PROJECT MANUAL

PHOENIX SKY HARBOR
INTERNATIONAL AIRPORT
TERMINAL 4 S-1 APRON

PHOENIX, Arizona

PREPARED FOR:

CITY OF PHOENIX

200 W. Washington Street, 5th Floor
Phoenix AZ 85003

VOLUME 1

TERMINAL 4 S-1 APRON

PROJECT NO.: AV08000083/FAA AIP No. 3-04-0029-0XX-20XX

ISSUE DATE: 31 JULY 2020

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**END OF DOCUMENT**
PART 1 - GENERAL

1. RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 1 Specification Sections, apply to this Section. This Section only
   applies to the construction of the Blast Fence foundation and Blast Wall as depicted in the
   Contract Documents, all else shall follow civil technical specifications.

1.2 SUMMARY

A. This section covers design, construction, treatment of formwork to confine and shape concrete
   to the required dimensions, and formwork accessories.

B. Related Sections:
   1. 032000 – Concrete Reinforcing
   2. 033000 – Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

A. The latest versions of the publications listed below form a part of this Specification; comply with
   provisions of these publications except as otherwise shown or specified.

   1. ACI 117 Standard Specification for Tolerances for Concrete
   2. ACI 301 Standard Specifications for Structural Concrete, including other
      standards referred to in ACI 301, such as ASTM, etc.

1.4 SUBMITTALS

A. Formwork Shop Drawings: Submit the following in accordance with Section 013300, "Submittal
   Procedures":

   1. Formwork shop drawings sealed by a professional Engineer licensed in the state where
      the Work will be done.
   2. Calculations for formwork, reshoring, and backshoring sealed by a professional Engineer
      licensed in the state where the Work will be done.
   3. Exposed Concrete Surfaces: Show the general construction of forms including jointing,
      formed joints or reveals, form tie locations, and pattern of form placement, and other
      items that affect the exposed concrete visually.
   4. Formwork Facing Materials: Data on form facing materials proposed for smooth-form
      finish.

B. Product Data: Include specifications and installation instructions for proprietary materials and
   items as required, including formwork release agents, form liners, manufactured form systems,
   form ties, and accessories.

C. Construction and Contraction Joints: Submit the location of construction and contraction joints
   proposed if different from those indicated in the Contract Documents.

D. Testing for Formwork Removal: Data on method for determining strength of concrete for
   removal of formwork when a method other than field-cured cylinders is proposed.
E. Formwork Removal Plans: Detail plans for formwork removal operations when removal of forms at concrete strengths lower than that specified is proposed.

F. Reshoring and Backshoring Plans: When reshoring or backshoring is required or permitted, submit procedures and plans of operations, before use, sealed by a professional Engineer licensed in the state where Work will be performed.

1.5 QUALITY ASSURANCE

A. Design and construction of concrete formwork is the responsibility of the Contractor. Design and construct formwork to furnish only those lines and shapes indicated on drawings, unless otherwise approved by Architect. Construct formwork for erection in satisfactory sequence and removal without damage to the resulting concrete surface.

B. Allowable Tolerances: Variations from plumb and designated building lines shall not exceed the tolerances specified in ACI 117.

C. Inspections: Refer to Section 014500, "Structural Testing, Inspection, and Quality Assurance," for inspection requirements performed by Owner's Testing Agency.

D. Embedded Items: Where items, such as embedded plates, reglets, anchors, fastenings, conduit, piping and other items are supplied by other trades and specified elsewhere in the Contract Documents, coordinate and obtain approval of their placement in the forms prior to placing any concrete.

E. Forms for Reuse: Where applicable, construct and erect forms for reuse; withdraw all projecting nails and other objects from contact surfaces before reusing; clean and completely recondition all forms prior to reuse. Obtain approval for form reuse from Owner's Inspector; formwork with patches and repairs affecting the appearance of concrete surfaces will not be allowed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Form-Facing Materials: Materials for form faces in contact with concrete shall meet the following requirements unless otherwise specified in the Contract Documents.

1. Rough Form Finish: No form-facing material is specified.

2. Smooth Form Finish: Use plywood, tempered concrete form-grade hardboard, metal, plastic, paper, or other acceptable materials capable of producing the desired finish. Form-facing materials shall produce a smooth, uniform texture on the concrete. Do not use form-facing materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects that will impair the texture of concrete surfaces. Set the facing materials in an orderly and symmetrical arrangement and keep the number of seams to a practical minimum.

B. Formwork Accessories: Use commercially manufactured formwork accessories that are partially or wholly embedded in concrete, including ties and hangers. Do not use non-fabricated wire form ties. Where noted in the Contract Documents, use form ties with integral water barrier plates in walls.

C. Formwork Release Agents: Use commercially manufactured formwork release agents that will prevent formwork absorption of moisture, prevent bond with concrete, and not stain the concrete surfaces.

E. Other Embedded Items: Use waterstops, sleeves, inserts, anchors, reglets, dovetail anchor slots, and other embedded items of the material and design indicated in the Contract Documents.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. Design and engineering of formwork shall be the responsibility of the Contractor.

B. Design formwork, shores, reshores, and backshores to carry all loads transmitted to them and to comply with the requirements of the applicable building code. Design formwork to withstand the pressure resulting from placement and vibration of concrete and to maintain specified tolerances.

C. Do not use earth cuts as forms for vertical or sloping surfaces unless required or permitted by Contract Documents.

D. Maximum deflection of facing materials reflected on concrete surfaces exposed to public view shall be L/240 of the span between structural members of the formwork.

E. Formed Construction: Locate and form construction joints that least impair the strength of the structure. Unless otherwise specified or permitted, locate and detail formed construction joints to the following requirements:

1. Locate construction joints within the middle third of the spans of slabs, beams, and girders. When a beam intersects a girder at this point, offset the joint in the girder a distance equal to or greater than twice the width of the beam.
2. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs.
3. Make joints perpendicular to the main reinforcement.
4. Provide keyways as indicated in the Contract Documents.

2.3 FABRICATION AND MANUFACTURE

A. Formwork shall be tight to prevent loss of mortar from concrete.

B. Place 3/4-inch minimum chamfer strips in the corners of formwork to produce beveled edges on permanently exposed surfaces unless otherwise specified. Do not bevel re-entrant corners or edges of formed joints of concrete unless specified in the Contract Documents.

C. Provide temporary openings at the base of column and wall formwork and at other points where necessary to facilitate cleaning and inspection. Arrange such openings in sides of forms where concrete surfaces will be concealed by other materials or construction. Clean and inspect immediately before concrete is placed.

D. Fabricate form ties so ends or end fasteners can be removed with minimum spalling at the faces of concrete.

E. Locate waterstops in joints where indicated in the Contract Documents. Use pieces of premolded waterstop with a maximum practical length to hold the number of end joints to a minimum. Make joints in waterstops in accordance with the manufacturer's recommendations.

2.4 WATERSTOPS
A. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   1. JP Specialties, Inc.; Earth Shield TPE-Rubber.
   2. Vinylex Corp.; PetroStop.
   3. WESTEC Barrier Technologies, Inc.; 600 Series TPE-R.

C. Dimensions: 6 inches by 3/16 inch, nontapered.

2.5 EXECUTION

2.6 CONSTRUCTION AND ERECTION OF FORMWORK

A. At construction joints, lap contact surface of the form sheathing for flush surfaces exposed to view over the hardened concrete in the previous placement by 1 inch minimum. Ensure formwork is held firmly against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface. Construct formwork so concrete surfaces conform to the tolerance limits of ACI 117.

B. Provide positive means of adjustment (wedges or jacks) for shores and struts. Make adjustments in the formwork prior to concrete placement. Fasten form wedges in place after final adjustment of forms. Brace formwork securely against lateral deflection and lateral instability.

C. Camber formwork to compensate for anticipated formwork deflections. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface. Ensure that edge forms and screed strips are sufficiently strong to support vibration screeds or roller pipe screeds when the finish specified requires the use of such equipment.

D. When formwork is cambered, set screeds to a like camber to maintain required concrete thickness.

E. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movements of the formwork system during concrete placement.

F. Construct formwork for wall openings to facilitate removal and to counteract swelling of wood formwork.

G. Place sleeves, inserts, anchors, and embedded items required for adjoining work or form support of adjoining work before concrete placement.

H. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.

I. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete is placed.

J. Cover surfaces of formwork with an acceptable material that will prevent bond with the concrete. A field-applied formwork release agent or a factory-applied liner may be used. If a formwork release agent is used, apply following these guidelines:
1. Apply to the surfaces of the formwork in accordance with the manufacturer's recommendations before placing reinforcing steel.
2. Do not allow formwork release agent to puddle in the forms.
3. Do not allow formwork release agent to make contact with reinforcing steel or hardened concrete against which fresh concrete is to be placed.

2.7 REMOVAL OF FORMWORK

A. When finishing is required, remove forms as soon as removal operations will not damage concrete.

B. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform needed repairs or required treatments at once and follow immediately with specified curing.

C. Loosen wood formwork for wall openings when this can be accomplished without causing damage to the concrete.

D. Leave formwork and shoring in place to support the weight of concrete in beams, slabs, and in-place structural members until concrete has reached the specified compressive strength. If a lower compressive strength is proposed for removal of formwork and shoring, submit detailed plans for review and acceptance. When shores and other vertical supports are arranged to allow the form-facing material to be removed without loosening or disturbing the shores and supports, the facing material may be removed at an earlier age.

E. Construct formwork to permit easy removal.

2.8 RESHORING AND BACKSHORING

A. While reshoring and backshoring is under way, do not permit any construction load on new construction.

B. During reshoring and backshoring, do not allow concrete in beam, slab, column, or any structural member to be loaded with combined dead and construction loads in excess of the design loads indicated in the Contract Documents at the specified concrete compressive strength.

C. Place reshores and backshores in sequence with stripping operations.

D. Tighten reshores and backshores to carry the required loads without overstressing the concrete members. Leave them in place until required tests indicate the concrete compressive strength has attained the minimum value specified.

2.9 STRENGTH OF CONCRETE REQUIRED FOR REMOVAL OF FORMWORK

A. Vertical formwork not supporting the weight of concrete may be removed 24 hours after concrete placement, provided the concrete is hard enough to not be damaged and curing and protection operations are continued.

B. When removal of formwork or reshoring is based on concrete reaching a specified compressive strength, concrete will be presumed to have reached this strength when test cylinders, field cured the same as the concrete they represent, have reached the compressive strength specified for removal of formwork and/or reshoring. Mold cylinders in accordance with
ASTM C31, and cure them under the same conditions for moisture and temperature as used for the concrete they represent. Test cylinders in accordance with ASTM C39.

C. Alternatively, one of the following methods for evaluating concrete strength for formwork removal may be used, provided sufficient data is submitted, using project materials, to demonstrate correlation of measurements on the structure with the compressive strength of laboratory-cured molded cylinders or drilled cores. Submit correlation data on the proposed alternative method for determining strength to the Architect/Engineer.

1. Tests of cast-in-place cylinders in accordance with ASTM C873 (limited to slabs with concrete depths from 5 to 12 inches)
2. Penetration resistance in accordance with ASTM C803
3. Pullout strength in accordance with ASTM C900
4. Acceptable maturity-factor procedure in accordance with ASTM C1074
5. Break-off number of concrete in accordance with ASTM C1150

END OF SECTION
SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers materials, fabrication, placement, and tolerances of reinforcement and reinforcement accessories. This Section only applies to the construction of the Blast Fence foundation and Blast Wall as depicted in the Contract Documents, all else shall follow civil technical specifications.

B. Related Sections:

1. 031000 – Concrete Forming and Accessories
2. 033000 – Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

A. The latest versions of the publications listed below form a part of this specification; comply with provisions of these publications except as otherwise shown or specified.

1. ACI 117 Standard Specification for Tolerances for Concrete
2. ACI 301 Standard Specifications for Structural Concrete, including other standards referred to in ACI 301, such as ASTM, AWS, etc.
3. CRSI MSP Manual of Standard Practice

1.4 SUBMITTALS

A. General: Submit the following data and drawings for review and acceptance before fabrication and execution in accordance with Section 013300, "Submitital Procedures."

B. Placing Drawings: Submit placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement supports. Indicate splicing, laps, details of reinforcing, and accessories.

1. Show embedded plates, bolts, etc., for purposes of checking for potential interferences.
2. Indicate locations of construction joints in the concrete construction.

C. Mechanical Splices: Submit the types of mechanical splices proposed for use. Include the latest ICC-ES (or IAPMO-ES equivalent) Reports for threaded or sleeve-type splices to verify compliance with specified requirements.

D. Headed Bars or Terminators: Submit the types of headed bars or terminators proposed for use. Include the latest ICC-ES (or IAPMO-ES equivalent) reports to verify compliance with the specified requirements.

E. Product Data: Include specifications and installation instructions for all proprietary materials and reinforcement accessories.
F. Welding Procedures and Qualifications: Submit description of reinforcement weld locations, welding procedures, and welder qualifications when welding is permitted.

G. Mill Certificates: Submit mill certificates for all reinforcing steel for information and record only.

1.5 QUALITY ASSURANCE

A. Allowable Tolerances: Fabrication and placement tolerances shall be in accordance with ACI 117.

B. Welder Qualifications: Welders shall be qualified in the last six months in accordance with the American Welding Society, AWS D1.4. Welding procedures qualified by others and welders qualified by another employer may be acceptable as permitted by AWS D1.4. If re-qualification is required, the cost of these qualification tests shall be borne by the Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Bundles of reinforcing bars shall be tagged showing quantity, grade, size, and suitable identification to allow checking, sorting, and placing. Identification of steel shall be maintained after bundles are broken.

1. Bundles of flat sheets and rolls of welded wire reinforcement shall be tagged showing quantity, style designation, width, and length.

B. Reinforcing steel shall be stored off the ground in a manner that will prevent bending and be protected from earth, oil, or any other material that might impair bond to concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, deformed, unless otherwise indicated on drawings.

B. Reinforcing Bars for Welding and Reinforcing Bars Specified as "Special Ductile Quality": ASTM A706, Grade 60, deformed. ASTM A615, Grade 60 reinforcement may be used in lieu of ASTM 706 if the following conditions apply:

1. The actual yield strength based on mill tests does not exceed the specified yield strength by more than 18,000 psi.
2. The ratio of the actual ultimate tensile strength to the actual tensile yield strength is not less than 1.25.

C. Column Spirals (where noted): Plain, cold-drawn wire conforming to ASTM A82 or hot-rolled rods for spirals conforming to ASTM A615.

D. Welded Wire Reinforcement: ASTM A185 or ASTM A497; mesh and wire sizes as noted on Structural drawings. When used in slabs, provide flat sheets, not rolls.

E. Bar Supports: In accordance with CRSI Manual of Standard Practice; types and sizes as required for the conditions of the installation.

1. For exposed to view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are hot-dipped, galvanized, plastic protected, or stainless steel, in accordance with CRSI Class 1 or Class 2 (Types A or B).
2. Provide precast concrete blocks not less than 4 inches square when supporting reinforcing steel on ground. Precast concrete blocks shall have a compressive strength equal to that of surrounding concrete.

F. Tie Wire: No. 16-gage minimum, annealed black wire.

G. Threaded Splices: See General Notes on Structural Drawings.

H. Headed Bars or Terminators: See General Notes on Structural Drawings.

I. Steel Stud Assemblies or Studrails: ASTM 1044; Size, length, and assembly configuration as noted on the Structural Drawings.

2.2 FABRICATION

A. Reinforcement: Bend reinforcement cold. Fabricate and detail to shapes and dimensions shown on drawings in accordance with CRSI Manual of Standard Practice and with fabricating tolerances in accordance with ACI 117.

B. Welding: Welding or tacking of reinforcing bars is not permitted unless specifically indicated in the Contract Documents. When welding of reinforcement is indicated and required, provide welds in accordance with AWS D1.4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: When concrete is placed, reinforcement shall be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory provided the minimum nominal dimensions, nominal weight, and the minimum average height of deformation of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

B. Reinforcement: Place, support, and fasten reinforcement as indicated in the Contract Documents. Do not exceed the placing tolerances specified in ACI 117 before concrete is placed. When necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement or embedded items, submit the resulting arrangement of reinforcement for acceptance.

C. Cover: Allowable concrete cover for reinforcement is indicated in the project drawings. Tolerances on concrete cover shall meet the requirements of ACI 117.

D. Tie Wires: After cutting tie wires, turn wires to the inside of section and bend so that concrete placement will not force ends to exposed concrete surfaces.

E. Welded Wire Reinforcement: Place, support, and fasten welded wire reinforcement as indicated in the Contract Documents. Do not exceed the placing tolerances specified in ACI 117 before concrete is placed.

   1. Slabs on Grade: Extend welded wire reinforcement to within 2 inches of the concrete edge. Lap edges and ends of reinforcement sheets a minimum of one mesh spacing plus 2 inches, not less than 6 inches. Support welded wire reinforcement during placing of concrete to ensure required position in the slab. Do not place welded wire reinforcement on grade and subsequently raise into position in concrete.
2. Slabs on Steel Deck: Extend welded wire reinforcement to within 2 inches of the concrete edge. Lap edges and ends of reinforcement sheets a minimum of one mesh spacing plus 2 inches, not less than 6 inches. Support welded wire reinforcement during placing of concrete to ensure required position in the slab. Do not place welded wire reinforcement on deck and subsequently raise into position in concrete.

F. Splicing: Make splices as indicated in the project drawings. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than 1/5 the required length of lap, and not to exceed 6 inches.

1. Mechanical Splices: Mechanical splices for reinforcement not shown on the project drawings shall be submitted for review and accepted prior to use. Mechanical splices shall be in accordance with the recommendations of the manufacturer of the mechanical splicing device.

G. Reinforcement shall not be field bent or straightened except when specifically permitted.

H. Reinforcement shall not be cut in the field except when specifically permitted.

3.2 DEFECTIVE WORK

A. General: The following reinforcing steel work will be considered defective and shall be removed and replaced by the Contractor at no additional cost to the Owner:

1. Bars with kinks or bends not shown on drawings.
2. Bars injured due to bending or straightening.
3. Bars heated for bending.
4. Reinforcement not placed in accordance with the drawings and/or specifications.
SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section only applies to the construction of the Blast Fence foundation and Blast Wall as depicted in the Contract Documents, all else shall follow civil technical specifications.

   Section Features:
   1. Cast-in-place structural concrete
   2. Concrete mix design
   3. Concrete placement procedures
   4. Concrete finishing
   5. Concrete curing
   6. Repair of surface defects

   B. Related Sections:
      1. 031000 – Concrete Forming and Accessories
      2. 032000 – Concrete Reinforcing

1.3 REFERENCE STANDARDS
   A. The latest versions of the publications listed below form a part of this specification; comply with provisions of these publications except as otherwise shown or specified.

      1. ACI 117 Standard Specification for Tolerances for Concrete
      2. ACI 301 Standard Specifications for Structural Concrete, including other standards referred to in ACI 301, such as ASTM, etc.
      3. ACI 305.1 Standard Specification for Hot Weather Concreting
      4. ACI 306.1 Standard Specification for Cold Weather Concreting
      5. ACI 308.1 Standard Specification for Curing Concrete
      6. ASTM C1116-03 Standard Specification for Fiber-Reinforced Concrete

1.4 SUBMITTALS
   A. General: Make submittals in accordance with Section 013300, "Submittal Procedures."

   B. Concrete Mix Design Proportions: Submit concrete mixture proportions and characteristics. Submit the concrete mix design to the local building officials where required. Do not begin concrete production until concrete mix designs have been reviewed and approved. Mix designs shall include proportions of all ingredients, including admixtures added at time of batching or at job site. Include the following:
1. Specify the locations for each mix design.
2. Specify the method used to determine proposed concrete mix design. Include field test records or trial mix test data used to establish the average compressive strength of the concrete mixture.
3. For aggregates, submit types, pit or quarry locations, producers’ names, gradings, specific gravities, certification, and evidence not more than 90 days old demonstrating compliance with this specification. Aggregate weights shall be based upon saturated surface dry conditions. Include concrete mix gradation of fine and coarse aggregates.
4. For admixtures, submit types, brand names, producers, manufacturer's technical data, and certification data.
5. Submit the cement type and certification, fly ash type and certification, water/cementitious materials ratio, and source of water supply.
6. Submit the slump.
7. Submit the air content of freshly mixed concrete.
8. Submit the concrete compressive strength at 7, 28, and 56 days. The 56-day strength is required only when specified in the Concrete Mix Specification Table in the General Notes.
9. Submit the chloride ion content of concrete.
10. For fibrous reinforcing, submit the type, fiber length, dosage rate, and dosage procedures.

C. Curing Methods: Submit written methods, procedures, and products for curing of all concrete.

D. Repair Methods: Submit the proposed methods of repair, along with repair material specification, manufacturer's data on the proposed patching material, and the proposed preparation and application procedure.

E. Construction Joints: Submit information for acceptance of proposed location and treatment of construction joints proposed but not indicated on the Construction Documents.

F. Qualification of Finishers: Submit qualifications of the finishing contractor and the finishers who will perform the Work.

G. Matching Sample Finish: When required by Contract Documents, submit sample finish.

H. Samples: For each of the following materials:
   1. Finish free form liners.
   2. Colored concrete for cylindrical columns.

I. Exposed-Aggregate Surface: When an exposed-aggregate surface is specified and a chemical retarder is proposed, submit specification and manufacturer's data for the retarder and the proposed method of use.

J. Records: Retain records of all concrete poured, including exact mix proportions, slumps, test strength, date, time, location of the placement, weather conditions at time of placement, and the source of concrete. Submit copy to Owner's Representative and Building Official.

1.5 QUALITY ASSURANCE

A. The Contractor is responsible for correcting Work that does not conform to the specified requirements, including strength, tolerances, and finishes. The Contractor shall submit the proposed solution for review and approval.
B. Unless otherwise noted, maintain the allowable tolerances in ACI 117.

C. Maintain records verifying materials used are of the specified and accepted types and sizes and are in conformance with the Contract Documents.

D. Special Inspection and Testing: Concrete work is subject to special inspection and testing as specified; notify the Testing Agency at least 48 hours before inspection is required.

E. Single Source Responsibility: Provide materials for concrete work made or produced from a single source of supply; no mixing of brands or types of cement will be allowed; no substitution of aggregate type or size from those approved will be permitted.

F. Concrete Contractor Qualifications: An experienced concrete contractor who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

G. Concrete Producer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C94. Producer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

H. Pre-Construction Conference: At least 30 days prior to start of concrete work, the Contractor shall hold a meeting to review the finish appearance requirements, reveal locations, joint spacings, concrete design mixes, requirements for submittals, construction procedures, schedules for testing, inspection, and certifications.

1. Notify attendees 10 days prior to the scheduled date of the meeting.
2. Required in attendance:
   a. Contractor and Subcontractors
   b. Testing Laboratory representative
   c. Concrete subcontractor
   d. Ready-mix producer
   e. Architect
   f. Engineer
   g. All subcontractors with work to be installed in or affected by concrete work
   h. Building official or appointed representative

1.6 DELIVERY, STORAGE, AND HANDLING

A. Cementitious Materials: Store cementitious materials in dry, weather-tight buildings, bins, or silos that will exclude contaminants.

B. Aggregates: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other materials or other sizes of aggregates. Store aggregates to drain freely. Do not use aggregates that contain frozen lumps.

C. Admixtures: Protect stored admixtures against contamination, evaporation, or damage. Protect liquid admixtures from freezing and from temperature changes that will adversely affect their characteristics. Store and handle products in a manner to retain original quality. Do not use products stored beyond the manufacturer's recommended shelf life.

D. Delivery of Materials: Deliver site applied materials, such as joint and curing materials, in original factory packaging and unopened containers and protect from damage and
E. Place concrete within the time limits specified. Concrete shall possess the specified characteristics in the freshly mixed state at the point of placing.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Portland cement shall conform to ASTM C150, Type I or Type II.

1. The cement shall be of the same brand and type and from the same plant of manufacture as the cement used in the concrete represented by the submitted field test records or used in the trial mixtures.
2. For architectural concrete, use one brand of cement throughout project, unless otherwise acceptable to the Architect.
3. Type III cement may be used for cold weather construction.

B. Aggregate: Aggregates and aggregate grading requirements shall conform to ASTM C33. Aggregates shall be free from any substance that may be deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete. Aggregates used in concrete shall be obtained from same sources and have the same size ranges as the aggregates used in the concrete represented by submitted historical data or used in trial mixtures.

C. Fly Ash: Pozzolanic mineral admixture conforming to ASTM C618. Maximum loss on ignition to be 3%. Use fly ash from one single source for the whole project. When fly ash is used, the maximum amount shall be 30% by weight of the total cementitious materials, unless otherwise noted in the Construction Documents.

D. Admixtures: The use of admixtures shall be the responsibility of the Contractor. When more than one admixture is used in the mix, furnish satisfactory evidence to the Architect that the admixtures to be used are compatible in combination with the cement and aggregates. Provide only one brand of each type of admixture. Admixtures shall be free of calcium chloride and thiocyanate (not more than 0.05% chloride ions). The following types of admixtures are approved:

4. Retarding Admixture: Master Builders "Pozzolith Series or Delvo Series," W. R. Grace & Co. "Daracet, Mira, or ADVA Series," Sika "Plastiment ES" or approved equal conforming to ASTM C494, Type B.
5. Accelerating Admixture: Master Builders "Pozzolith NC 534 or Pozzutec 20+," W. R. Grace & Co. "Daraset Series, DCI, PolarSet, or Lubricon NCA", Sika "SikaSet NC", or approved equal conforming to ASTM C494, Type C.
entrainable)", Sika "Sika Control 40", or approved equal conforming to ASTM C494, Type S.

7. Corrosion Inhibiting Admixture: Master Builders "Rheocrete CNI or Rheocrete 222+," W. R. Grace & Co. "DCI or DCI-S", Sika "Sika CNI", or approved equal conforming to ASTM C494, Type S. Calcium Nitrite based with solids content of 30 +/- 2%. Dosage rate varies between 2 and 4 gallons/cubic yards. Contact manufacturer's representative for corrosion-protection guidance based on chloride exposure level.

E. Water: Water shall be in conformance with ASTM C94.

2.2 RELATED MATERIALS

A. Dissipating Resin Curing Materials: Liquid type membrane-forming curing compound complying with ASTM C309, Type I. Curing compound must be of a type that does not inhibit subsequent moist curing operations. The film shall chemically break down in a 6- to 8-week period and shall not affect adhesion of coverings or membranes. Acceptable products are Dayton Superior "Burke Aqua Resin Cure or Day-Chem Rez Cure (J-11-W)," Euclid Chemical Co. "Kurez DR," or approved equal.

B. Cure and Seal Combination Materials (Exposed Interior Concrete Slabs, including Garage Slabs): Use curing and sealing compounds that conform to ASTM C309 (Types 1 and 1D, Class B) or ASTM C1315. Acceptable products are Master Builders "Acryseal or Kure-N-Seal," Euclid Chemical Co. "Rez-Seal," or approved equal. Cure and seal material for use in parking garages must resist de-icing chemicals.

C. Moisture Retaining Cover: Use waterproof sheet materials that conform to ASTM C171.

D. High Density Insulation Fillers: Extruded polystyrene foam insulation complying with ASTM D6817 as noted in the Construction Documents. Where no type is indicated use ASTM D6817 EPS22.

E. Commercial Bonding Grout and Repair Materials: Use products in accordance with manufacturer's recommendations. Products include, but are not limited to, the following:

1. Portland-cement mortar modified with a latex acrylic, non-re-emulsifiable bonding agent conforming to ASTM C1059 Type II. Acceptable products include Euclid Chemical Co. "Flex-Con," Dayton Superior "Day-Chem Ad Bond (J-40)," or approved equal.

2. Epoxy mortars and epoxy compounds that are moisture-insensitive during application and after curing and that embody an epoxy binder conforming to ASTM C881. The type, grade, and class shall be appropriate for the application as specified in ASTM C881.


F. Vapor Retarders – Sheet Vapor Retarder: ASTM E1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:

   b. Raven Industries, Inc.: Vapor Block 15.
   c. Stego Industries, LLC: Stego Wrap 15 mil Class A.
2.3 PROPORTIONING AND DESIGN REQUIREMENTS OF CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete by Field Experience Method or, if not available, by Laboratory Trial Batch Methods as specified in ACI 301. Mix proportions shall produce consistent and workable concrete that can be worked readily into forms and around reinforcement without segregation or excessive bleeding.

1. Field Experience Method: If field test data is available, in accordance with ACI 301, submit for acceptance the mixture proportions along with the field test data.
2. Trial Batch Method: Use an independent, qualified Testing Facility for preparing and reporting proposed mix designs. All expenses connected with such testing and submittals shall be borne by the Contractor.

B. Concrete Mixes: Provide concrete mixes conforming to the requirements as indicated in the Structural Drawing General Notes.

1. Strength Requirements: Compressive strength requirements are indicated on drawings and are based on cylinder tests at indicated age. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type III Portland cement.
2. Cement Content for Slabs: Not less than those indicated in ACI 301.
4. Air Entrainment: Use air-entraining admixture in exterior exposed concrete as indicated on the Structural Drawings.
5. Slump: The Contractor shall determine slump. Each concrete mix submitted shall have the slump specified. Slump tolerances shall meet the requirements of ACI 117.
6. Admixtures: Concrete may contain admixtures, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete. When admixtures are specified or required for workability for particular parts of the Work, use the types specified.
7. Chloride Ion: Maximum water-soluble chloride ion concentrations in hardened concrete at ages 28 to 42 days contributed from the ingredients, including water, aggregates, cementitious materials and admixtures, shall not exceed a maximum, by weight of cement, of 0.06% for prestressed concrete and 0.30% for other concrete.

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the Owner. New field data, data from new trial mixtures, or evidence that indicates that the change will not adversely affect the relevant properties of the concrete shall be submitted for acceptance before use.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not place concrete until the Architect approves all required submittals.

B. Remove snow, ice, frost, water, and other foreign materials from form surfaces, reinforcement, and embedded items against which concrete will be placed.

C. Place concrete on properly prepared and unfrozen sub-grade or forms and only in dewatered excavations and forms.
D. Do not allow mud or foreign materials into the concrete during placement operations.

E. When the ambient temperature necessitates the use of cold or hot weather concreting, make provisions in advance of concrete placement.

F. Do not begin placing concrete when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing.

G. Do not begin placing concrete while rain, sleet, or snow is falling unless adequate protection is provided. Do not allow rainwater to increase mixing water or to damage the surface of the concrete.

3.2 JOINTS

A. Construction Joints: Locate construction joints as indicated on the structural drawings or as approved by the Architect. Remove laitance and thoroughly clean and dampen construction joints prior to placement of fresh concrete.

B. Bonded Construction Joints: Coat concrete joined with new concrete, including topping, with a concrete bonding compound. Mix and apply in strict accordance with manufacturer’s recommendations for the conditions of the application. Concrete surfaces to which other concrete is to be bonded shall be roughened in an approved manner that will expose sound aggregate uniformly without damaging the concrete; remove all laitance and loose particles.

C. Control Joints in Slabs-on-Ground: Construct control joints in slabs-on-ground to form panels of patterns as approved. Use inserts 1/4-inch-wide by depth indicated on the drawings. Where saw-cut joints are required or permitted, start cutting as soon as concrete has hardened sufficiently to prevent dislodgment of aggregates. Saw a continuous slot to the depth indicated on the drawings. Complete sawing within the timeframe indicated on the drawings. The aspect ratio of the slab panels should be a maximum of 1.5:1. "L" and "T" shaped panels should be avoided. If an alternative method, timing, or depth is proposed for saw cutting, submit detailed procedure plans for review and acceptance.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

1. Embedded items include, but are not limited to, expansion joints, joint fillers, waterstops, anchor bolts, embedded plates, dovetail anchor slots, etc.

2. Items shall be free of oil, loose scale, rust, etc.

3. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent the entry of concrete into the voids.

4. Do not embed aluminum in concrete, except where the aluminum is protected from direct contact from the concrete.

3.4 CONCRETE DELIVERY

A. Ready-Mix Concrete: Comply with requirements of ASTM C94 and as herein specified.

1. Elapsed time from start of batching at plant to completed discharge at job site shall not exceed 90 minutes or more than 300 revolutions, whichever comes first after introducing mixing water.
2. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 90 minutes to 75 minutes. When air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.

3. The concrete temperature shall be monitored in the truck. A rise in temperature of 5°F within 10 minutes or less indicates concrete setting has started before discharge and the load shall be rejected.

4. Ready-Mix Concrete: Provide certificate signed by authorized official of supplier with each load of concrete, stating the following:
   a. Time truck left plant
   b. Mix of concrete
   c. Amount of water and cement in mix
   d. Amount and type of admixtures
   e. Time truck is unloaded at site
   f. Additional water amount allowed at the project site

5. A truck without batch tickets will be rejected.

B. Control of Mixing Water: Water may be added once to increase the slump of the concrete within the first 15 minutes after the truck arrives at the jobsite, provided the following requirements are adhered to:

1. The specified slump and maximum allowable water/cement ratio is not exceeded.
2. The Independent Testing Agency is present to monitor the amount of water added to compare with the amount of water added at the plant. Testing Agency shall keep written record of the amount of water added at the jobsite to each truckload delivered.
3. The drum shall be turned an additional 30 revolutions, or more if necessary, until the added water is uniformly mixed into the concrete.
4. Water shall not be added to the batch after the taking of test cylinders, unless new test cylinders are taken at the expense of the Contractor.
5. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

C. Admixtures: Add admixtures within an accuracy of 3%. Where two or more admixtures are used in the same batch, they shall be added separately and must be compatible. Approved admixtures must be added at the appropriate time in strict compliance with manufacturer's directions. Concrete that shows evidence of total collapse or segregation caused by the use of admixtures shall be removed from the site.

3.5 CONCRETE PLACEMENT

A. Pre-Placement Inspection: Before concrete placement operation begins, perform the following procedures:

1. Inspect and complete formwork installation and all reinforcing and embed items. Notify other crafts to permit installation of their work.
2. Ensure that the reinforcing will be maintained in the proper position during concrete placement operations.
3. Moisten wood forms immediately before placing concrete where form coatings are not used.
4. At topping slabs, thoroughly saturate base slab just prior to placing topping, but do not leave pools of water.
5. Verify all dimensions and elevations.

B. Conveying: Methods of conveying concrete is the responsibility of the Contractor. Convey concrete from mixer to the place of final deposit rapidly by methods that prevent segregation or
loss of ingredients and that will ensure the required quality of concrete. Do not use aluminum pipes or chutes. Use acceptable conveying equipment of a size and design that will prevent cold joints from occurring. Clean conveying equipment before each placement.

1. Provide runways or other means for wheeled equipment to convey concrete to deposit points. Do not run wheeled equipment used to deposit concrete over reinforcement; do not support runways on reinforcement.

2. Belt Conveyors: Use belt conveyors that are horizontal or at a slope that will not cause excessive segregation or loss of ingredients. Protect concrete to minimize drying and effects of temperature rise. Use an acceptable discharge baffle or hopper at the discharge end to prevent segregation. Do not allow mortar to adhere to the return length of the belt.

3. Chutes: Use metal or metal-lined chutes having rounded bottoms and a slope between 1:2 and 1:3 (vertical:horizontal). Chutes more than 20 feet long and those not meeting slope requirements may be used, provided they discharge into a hopper prior to distributing into the forms.

4. Pumping or Pneumatic Conveying: Use pumping conveying equipment that permits placement rates that avoid cold joints and prevent segregation in discharge of pumped concrete. In addition:
   
a. Pipeline shall be steel pipe or heavy-duty flexible hose.
   b. Inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate.
   c. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer.
   d. Provide continuous supply of concrete to the pump.
   e. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place.

5. Cleaning: Do not discharge rinse water into forms or areas to receive concrete.

C. Depositing: Deposit concrete continuously in one layer, or in multiple layers if the fresh concrete is deposited on in-place concrete that is still plastic. Do not deposit fresh concrete on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joint as specified. Deposit concrete as near to its final location as practicable to avoid segregation. In addition:

1. There shall be no vertical drop greater than 3 feet, except where suitable equipment is provided to prevent segregation and where specifically authorized.

2. Do not use concrete that has surface-dried or partially hardened or that contains foreign material.

3. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs.

D. Consolidating: Consolidate concrete by vibration. Thoroughly work concrete around reinforcement and embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.

1. Workers shall be experienced in use of the vibrators.

2. Vibrators shall have a frequency of not less than 8,000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the concrete mix being placed. A spare vibrator shall be kept at the job site during all concrete placing operations.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniform spacing over the area of placement; distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area
being vibrated will overlap the adjacent just vibrated area by a few inches. Do not place vibrators within 2-1/2 inches of form face.

4. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set; if there is a delay of more than 15 minutes, vibrate previous lift prior to placing the new concrete. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix. Withdraw vibrators slowly.

5. Consolidation of slabs shall be obtained with vibrating screeds, rolling pipe screeds, or internal vibrators.

E. Re-tamping of concrete that has taken its initial set is not allowed.

F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.1 and as specified herein.

   1. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.1 and as specified herein. Loss of slump, flash set, or cold joints due to temperature of concrete as placed are not acceptable.

   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.
   2. When temperature of steel reinforcement, embedments, or forms is greater than 120°F, fog steel reinforcement, embedments, and forms with water immediately before placing concrete. Remove standing water before placing concrete.
   3. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
   4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, if approved by the Architect.

3.6 FINISHES FOR FORMED SURFACES

A. General: After removal of forms, give each formed surface one or more of the finishes described below. When Contract Documents do not specify a finish, finish surfaces as required by Unspecified Finishes.

B. When the finish is required by the Contract Documents to match a sample panel furnished by the Contractor, reproduce the sample finish on an area at least 100 square feet in a location designated by the Architect. Obtain acceptance before proceeding with that finish in the specified locations.

C. As-Cast Finishes: Coordinate finishes of all "as-cast" concrete finishes with construction of formwork. Produce as-cast form finishes in accordance with the following requirements:

   1. Rough-Form Finish: Patch tie holes and defects. Chip or rub off fins exceeding 1/2 inch in height. Leave surfaces with the texture imparted by the forms.
2. Smooth-Form Finish: Patch tie holes and defects. Remove fins exceeding 1/8 inch in height. Leave surfaces with the texture imparted by the forms.


D. Rubbed Finishes: Remove forms as early as permitted, and produce one of the following finishes on concrete specified to have a smooth form finish:

1. Smooth-Rubbed Finish: Patch tie holes and defects and remove fins. Produce finish on newly hardened concrete no later than the day following formwork removal. Wet the surface and rub it with carborundum brick or other abrasive until uniform color and texture are produced. Use no cement grout other than the cement paste drawn from the concrete itself by the rubbing process.

2. Grout-Cleaned Finish: Patch tie holes and defects and remove fins. Begin cleaning operations after contiguous surfaces to be cleaned are completed and accessible. Do not clean surfaces as work progresses. Wet the surface and apply grout consisting of 1-part Portland cement and 1-1/2 parts fine sand with enough water to produce the consistency of thick paint. Add white cement as needed to match color of surrounding concrete. Scrub grout into voids and remove excess grout. When grout whitens, rub the surface. Keep the surface damp for 36 hours afterward.

3. Cork-Floated Finish: Patch tie holes and defects and remove fins. Wet the surface and apply stiff grout of 1-part Portland cement and 1-part fine sand, filling voids. Add white cement as needed to match color of surrounding concrete. Use enough water to produce a stiff consistency. Compress grout into voids by grinding the surface with a slow-speed grinder. Produce the final finish with cork float, using a swirling motion.

E. Sandblast Finish: After removal of forms and while concrete is still "green," apply a light abrasive blast finish to exposed-to-view surfaces to match approved sample. Perform abrasive blasting in a continuous operation, utilizing same work crew to maintain continuity of finish on each surface. Use wet sandblasting operations. Use same type and grading of abrasives as that used on approved sample. Continually wash off abraded mortar from sandblasted areas to prevent staining.

F. Unspecified Finishes: When a specific finish is not specified in Contract Documents for a concrete surface, apply the following finishes:

1. Rough form finish on concrete surfaces not exposed to public view.

2. Smooth form finish on concrete surfaces exposed to public view.

G. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent surfaces, unless otherwise indicated.

3.7 FINISHES FOR UNFORMED SURFACES

A. General: Finish slab surfaces in accordance with one of the finishes noted below, as designated in the Contract Documents. Finish all joints and edges with proper tools as approved.

B. Placement: Place concrete at a rate that allows spreading, straight edging, and darbying or bull floating before bleed water appears. Screed all slabs, topping fills to true levels and slopes. Work surfaces as required to produce specified finish. Do no finishing in areas where water has accumulated; drain and re-screed. In no case use a sprinkling of cement and sand to absorb moisture.
C. Tolerances: Measure floor slabs for suspended floors and slabs-on-grade to verify compliance with the tolerance requirements of ASTM E 1155 and ACI 117. Measure floor finish tolerances within 72 hours after slab finishing and before removal of supporting formwork or shoring.

D. Scratch Finish: Place, consolidate, strike off, and level concrete, eliminating high spots and low spots. Roughen the surface with stiff brushes or rakes before the final set. Produce a finish that will meet Moderately flat (Ff flatness = 25) requirements of ACI 117.

E. Float Finish: Place, consolidate, strike off, and level concrete, eliminating high spots and low spots. Do not work concrete further until it is ready for floating. Begin floating with a hand float, a bladed power float equipped with float shoes, or a powered disk float when the bleed water sheen has disappeared, and the surface has stiffened sufficiently to permit the operation. Produce a finish that will meet Moderately flat (Ff flatness = 25) requirements of ACI 117, then refloat the slab immediately to a uniform texture.

F. Light Steel Troweled Finish: Float concrete surface, then power trowel the surface. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until all "shine" has disappeared from surface; no final troweling is required. Tolerance for concrete floors shall be Moderately flat (Ff flatness = 25) in accordance with ACI 117.

G. Full Steel Trowel Finish: Float concrete surface, then power trowel the surface. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled. Finished surface shall be free of trowel marks, uniform in texture and appearance. Tolerance for concrete floors shall be Moderately flat (Ff flatness = 25) in accordance with ACI 117.

H. Broom or Belt Finish: Immediately after concrete has received a floated finish, give the concrete surface a coarse transverse scored texture by drawing a broom or burlap belt across the surface. Degree of texture shall be as approved by the Architect. Tolerance for concrete floors shall be Moderately flat (Ff flatness = 25) in accordance with ACI 117.

I. Raked Finish: Immediately after concrete has received a floated finish, draw closely spaced rake across surface with ribs perpendicular to traffic flow. Notify Architect at time of finishing so that they may be present to approve the final degree of texture required. Tolerance for concrete floors shall be Moderately flat (Ff flatness = 25) tolerance in accordance with ACI 117.

J. Dry-Shake Finish: Blend metallic or mineral aggregate specified in Contract Documents with Portland cement in the proportions recommended by the aggregate manufacturer, or use bagged, premixed material specified in Contract Documents as recommended by the aggregate manufacturer.

1. Float-finish the concrete surface.
2. Apply approximately 2/3 of the blended material required for coverage to the surface by a method that ensures even coverage without segregation. Float-finish the surface after application of the first dry-shake.
3. Apply the remaining dry-shake material at right angles to the first application and in locations necessary to provide the specified minimum thickness. Begin final floating and finishing immediately after application of the dry-shake.
4. After selected material is embedded by the two floatings, complete operation with a broomed, floated, or troweled finish, as specified in the Contract Documents.

K. Exposed-Aggregate Finish: Immediately after surface of the concrete has been leveled to meet the Moderately flat (Ff flatness = 25) tolerance requirements of ACI 117 and the bleed water sheen has disappeared, spread aggregate of the color and size specified in Contract Documents uniformly over the surface to provide complete coverage to a depth of one stone.
1. Tamp the aggregate lightly to embed aggregate in the surface. Float the surface until the embedded stone is fully coated with mortar and the surface has been finished to meet the Moderately flat (F/ flatness = 25) tolerance requirements of ACI 117.

2. After the matrix has hardened sufficiently to prevent dislodgment of the aggregate, apply water carefully and brush the surface with a fine-bristled brush to expose the aggregate without dislodging it.

3. An acceptable chemical retarder sprayed on freshly floated concrete surface may be used to extend the working time for the exposure of aggregate.

L. Non-specified Finish: When the type of finish is not specified in Contract Documents, use one of the following appropriate finishes and accompanying tolerances.

1. Scratched Finish: For surfaces intended to receive bonded cementitious mixtures.
2. Floated Finish: For walks, drives, steps, ramps, and for surfaces intended to receive waterproofing, roofing, insulation, or sand-bed terrazzo.
3. Full Steel Troweled Finish: For floors intended as walking surfaces, floors in manufacturing, storage, and warehousing areas, or for reception of floor coverings.

3.8 CONCRETE CURING AND PROTECTION

A. General: Cure concrete in accordance with the Curing Methods noted below for a minimum of 7 days after placement. Cure high-early strength concrete for a minimum of 3 days after placement. Alternatively, moisture retention measures may be terminated when any of the following criteria are met:

1. Tests made on at least two cylinders kept adjacent to the structure and cured by the same methods as the structure indicate 70% of f'c, as determined in accordance with ASTM C39, has been attained.
2. The compressive strength of laboratory-cured cylinders, representative of the in-place concrete, exceeds 85% f'c, provided the temperature of the in-place concrete has been maintained at 50°F or higher during curing.
3. Strength of concrete reaches f'c as determined by accepted nondestructive test methods.

B. Additional Curing Periods: When the 7-day compression test cylinders, representative of parts of a structure already placed, indicate that the 28-day strengths may be less than 85 percent of the design strengths, give those parts of the structure additional curing.

C. Protection: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

1. Protect concrete during the curing period such that the concrete temperature does not fall below requirements of ACI 306.1. The concrete shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and to ensure the necessary strength development for structural safety.

2. Maintain protection in such a manner that the maximum decrease in temperature measured at the surface of the concrete in a 24-hour period shall not exceed the following:

   a. 50°F for sections less than 12 inches in the least dimension.
   b. 40°F for sections from 12 to 36 inches in the least dimension.
   c. 30°F for sections 36 to 72 inches in the least dimension.
   d. 20°F for sections greater than 72 inches in the least dimension.

3. Measure and record concrete temperature using a method acceptable to the Architect/Engineer. When the surface temperature of the concrete is within 20°F of the
ambient temperature, protection measures may be removed.

D. Curing Unformed Concrete Surfaces: Apply one of the Curing Methods after completion of placement and finishing of concrete surfaces not in contact with forms.

E. Curing Formed Concrete Surfaces: Keep absorbent wood forms wet until they are removed. After formwork removal, cure concrete by one the Curing Methods.

F. Curing Methods: After placing and finishing, use one or more of the following methods to preserve moisture in concrete. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing, or as soon as marring of the concrete will not occur. When one of the curing procedures is used initially, the curing procedure may be replaced by one of the other procedures when concrete is 1 day old, provided the concrete is not permitted to become surface-dry at any time. Avoid rapid drying at end of final curing period.

1. Ponding, continuous fogging, or continuous sprinkling.
2. Application of mats or fabric kept continuously wet.
3. Continuous application of steam (under 150°F).
5. Application of a curing compound conforming to ASTM C309 or C1315.
   a. Apply the compound in accordance with manufacturer’s recommendation as soon as water sheen has disappeared from the concrete surface and after finishing operations.
   b. For rough surfaces, apply curing compound in two applications at right angles to each other.
   c. Do not use curing compound on any surface where concrete or other material will be bonded unless the curing compound will not prevent bond or unless measures are to be taken to completely remove the curing compound from areas to receive bonded applications.
   d. The Contractor shall be responsible for removing any traces of the dissipating curing compound that remains on the substrate prior to applying subsequent floor finish. This shall include, but is not limited to, removing the curing compound using power scrubbers and industrial strength detergents and using fresh water to remove the detergents. Comply with any additional instructions and recommendations of the manufacturer whose products are to be applied directly over concrete slab.
6. Application of other accepted moisture-retaining method.

3.9 CONCRETE SURFACE REPAIRS

A. General: All surface defects shall be reported to the Architect. Remove and replace concrete having defective surfaces if defects cannot be repaired to the satisfaction of the Architect.

B. Repair of Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, stains, and other discolorations that cannot be removed by cleaning.

1. Repair concealed formed surfaces that contain defects that affect the durability of concrete.
2. Repair tie holes and surface defects immediately after formwork removal. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surface defects before texturing.
C. Repair of Unformed Surfaces: Surface defects include crazing, cracks in excess of 0.01-inch-wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

1. Repair finished unformed surfaces that contain defects that affect durability of concrete.
2. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope.
3. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days. Depth or removal shall not exceed 1/4 inch without scanning the affected area to verify required concrete cover will be maintained over reinforcing, post-tensioning tendons, or other embedment.
4. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Architect.

D. Repair of Tie Holes: Plug tie holes except where stainless steel ties, non-corroding ties, or acceptably coated ties are used. When Portland cement patching mortar is used for plugging, clean and dampen tie holes before applying the mortar. When other materials are used, apply them in accordance with manufacturer's recommendations.

E. Repair of Surface Defects: Submit Method Statement of Repair that includes proposed repair product, surface preparation procedures, inspection schedule and application procedures prior to the commencement of work.

1. Surface Preparation: Unless otherwise directed by the repair product's manufacturer:
   a. Outline honeycombed or otherwise defective concrete with a 1/2- to 3/4-inch-deep saw cut and remove such concrete down to sound concrete.
   b. When chipping is necessary, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges.
   c. Dampen the area to be patched, plus 6 inches around the patch area perimeter.
   d. Prepare bonding grout and thoroughly brush grout into the surface.
   e. When the bond coat begins to lose water sheen, apply patching mortar and thoroughly consolidate mortar into place. Strike off mortar, leaving the patch slightly higher than the surrounding surface to permit initial shrinkage.
   f. Leave the patch undisturbed for 1 hour before finishing. Keep the patch damp for 7 days.

2. Partially Exposed Reinforcement: The surface of partially exposed reinforcement where exposed less than and equal to 3/8-inch shall be cleaned of detritus material. Where reinforcement is exposed more than 3/8-inch, concrete shall be removed around the entire circumference of the reinforcement for a minimum of 1/4 inch plus the maximum aggregate size and cleaned of detritus material.

F. Removal of Stains: Remove stains, rust, efflorescence, and surface deposits considered objectionable by the Architect by acceptable methods.

G. Crack Repair: The Contractor shall carry an allowance for concrete crack repair. Submit crack map and repair procedures for review and approval prior to commencing work.

1. Flexible Repair: Prepare, treat rout and fill cracks according to ASTM C1127 and the manufacturer's recommendations. Prior to coating surfaces, remove debris and dust according to ASTM D4258. Comply with the recommendations in ASTM C1193 for joint.
sealant installations.

2. Structural Repair: Cracks shall be repaired by epoxy injection conforming to ASTM C881.

3. Repair full length of cracks if any part of the crack exceeds the widths specified in this Article.

4. Actual crack repair required shall be based on crack width as measured a minimum of 28 days after crack appears. Repair cracks as follows:
   a. Permanently Exposed Walls: Repair all cracks greater than 0.035 inch in width.
   b. Exterior Elevated Slabs: All cracks greater than 0.035 inch in width.
   c. Slab on Grade: Repair all cracks greater than 0.0625 inch in width.
   d. Interior Elevated Slabs: Repair all cracks greater than 0.0625 inch in width.

H. Site-Mixed Repair Materials:

1. Bonding Grout: Mix approximately 1-part cement and 1-part fine sand with water to the consistency of thick cream.

2. Repair Mortar: Mix repair mortar using the same materials as concrete to be patched with no coarse aggregate. Do not use more than 1-part cement to 2-1/2 parts sand by damp loose volume.
   a. For repairs in exposed concrete, make a trial batch and check color compatibility of repair material with surrounding concrete. Blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding.
   b. Use repair mortar at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix repair mortar and manipulate the mortar frequently with a trowel without adding water.

I. Commercial Repair Products: Acceptable commercial repair products other than site-mixed repair materials may be used for repair, as specified in Part 2. Use repair products in accordance with manufacturer's recommendations.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations lightly rounded.

B. Equipment Bases and Foundations: Form bases for the mounting of equipment shown on drawings. Coordinate sizes and requirements for bases with trade requiring same; make bases a minimum of 4 inches high, unless otherwise noted on drawings, and finish to match adjacent floor finish. Set anchor bolts for machines and equipment to correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Screed, tamp, and finish concrete surfaces with light broom finish.

END OF SECTION
SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Section 00 73 26 Additional Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section only applies to the construction of the Blast Fence and Blast Wall as depicted in the Contract Documents, all else shall follow civil technical specifications.

B. Section Includes:
   1. Steel framing and supports for exterior blast wall hollow metal windows.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Miscellaneous steel trim including steel angle corner guards and steel edgings.
   4. Loose bearing and leveling plates for applications where they are not specified in other Sections.

C. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves,

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. LEED Submittals:
   1. Complete "LEED Credit Forms" for each material, product or assembly that contributes to LEED credit requirements that are used in the installation of the work of this section. Refer to Division 01 Section "Sustainable Design Requirements".
   2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from project to materials manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and fraction by weight that is considered regional.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
   1. Steel framing and supports for exterior blast wall hollow metal windows.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 75 percent.

C. Regional Materials: Preference shall be given to manufacturers for procuring recycled content material within 500 miles of the project site.
D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with "Section 09 91 13 "Exterior Painting," Section 09 91 23 Interior Painting," and Section 09 96 00 "High-Performance Coatings."

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
   1. VOC Content: Field applied repair paint shall have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.
2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.8 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer. Primer specified in Section 09 96 00 "High-Performance Coatings."

2.9 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
2.11 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

B. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
3.3 INSTALLING BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting."

END OF SECTION
SECTION 08 12 13 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes hollow-metal window frames. This Section only applies to the construction of the Blast Wall as depicted in the Contract Documents, all else shall follow civil technical specifications.

1.3 DEFINITIONS
   A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION
   A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material description and finishes.
   B. LEED Submittals:
      1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   C. Shop Drawings: Include the following:
      1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
      2. Details of anchorages, joints, field splices, and connections.
      3. Details of moldings, removable stops, and glazing.

1.7 DELIVERY, STORAGE, AND HANDLING
   A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
      1. Provide additional protection to prevent damage to factory-finished units.
   B. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each unit to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amweld International, LLC.
2. Ceco Door; ASSA ABLOY.
3. Curries Company; ASSA ABLOY.
4. Pioneer Industries, Inc.
5. Republic Doors and Frames.
6. Steelcraft; an Allegion brand

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 EXTERIOR HOLLOW-METAL FRAMES

A. Construct exterior frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Frames: SDI A250.8, Level 2.
   1. Physical Performance: Level B according to SDI A250.4.
   2. Materials: Metallic-coated steel sheet, minimum thickness of 0.053-inch (1.3 mm), with minimum A40 (ZF120) coating.

2.3 FRAME ANCHORS

A. Sill and Jamb Anchors:
   1. Full perimeter weld to steel framing provided.

2.4 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.5 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

C. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
   2. Provide fixed frame moldings on outside of exterior and on secure side of interior frames.
3. Provide loose stops and moldings on inside of hollow-metal work.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
B. Hollow-Metal Frames: Install hollow-metal window frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      b. Install frames with removable stops located on secure side of opening.
      c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   2. Jamb and Sill Anchoring: Weld full perimeter of window frames to steel embeds provided.
   3. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Squareness: Plus, or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus, or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus, or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus, or minus 1/16 inch (1.6 mm), measured at jambs at floor.
C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not
more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION
SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section only applies to the construction of the Blast Wall as depicted in the Contract Documents, all else shall follow civil technical specifications. This Section includes glazing for the following products and applications:
   1. Blast wall windows.

B. Related Requirements:
   1. Section 081213 "Hollow Metal Frames".

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, as defined in referenced glazing publications.

B. Glass Fabrication: Using primary glass in the production of single pane glass products such as coated, laminated, and heat-treated glass. Can be done by either the Glass Manufacturer or the Glazing Product Manufacturer.

C. Glazing Product Manufacturer: Firm that uses fabricated glass in the production of insulating glass (multiple panes of glass).

D. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

E. Large Glass Lites and Insulating Glass Units: over 55 SF.

F. Interspace: Space between lites of a conventional insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement, wind, and impact loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Shop Drawings:
   1. Submit Shop Drawings of glazing details. Draw details at least full size and indicate dimensions, tolerances, and materials.

C. LEED Submittals:
1. Product Data for Credit MR 4: Recycled content
2. Product Data for Credit MR 5: Regional Materials

D. Glass Samples: With each submittal, submit a list of all glass Styles required in the Project. On the list, indicate which Styles are included in the submittal.
   1. Each style of monolithic and laminated glass, except clear monolithic glass, no less than 75 by 150 mm (3 by 6 inches).

E. Product Certificates:
   1. For exterior glazing, Glass Fabrication manufacturer's statement that products meet the specified glass breakage probability requirements for indicated applied loads, that expected thermal stressing of products is acceptable and that glazing details (if required by Glass Fabrication manufacturer) have been reviewed and are approved.
   2. Submit statement from Glazing Product Manufacturer stating that glazing products meet the requirements of the specified standards, the project specifications, and there is no incompatibility of glazing materials with the insulating glass unit sealants.

F. Quality Assurance Program (QAP)
   1. Glass fabrication: Written QAP including but not limited to reference of applicable ASTM testing methodology, type, and frequency of in-line monitoring of glass fabrication and reporting and documentation. Test sample lite of glass, at GC's expense, for conformance to a) bow and warp, b) localized distortion / roller wave, c) concavity / convexity and d) compression strength.
   2. Installation: Written QAP to monitor quality of products such as cleaners, solvents, primers, and sealants; and sealant workmanship including, cleaning, priming, joint opening preparation, and sealant installation.
      a. Include as part of program random adhesion and compatibility testing of production run products.
      b. Do not install sealant work prior to review of program.
      c. Submit quality assurance program to glass and sealant manufacturers for review and approval prior to submission to Architect.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
   1. Level 1 minimum: all installers
   2. Level 2 minimum: on-site superintendents

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Source Limitations for Glass: Laminated glass from single source from single manufacturer using primary glass obtained from a single source for each glass type.

E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities.
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having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1. All permanent marks and/or labels should be placed in the vicinity of the glass where the label is not obscured by the glass bite, gasket, sealant, or other anchoring/glazing material. End text at least 3 mm from all site lines of the fenestration glazing to allow for readability.

H. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.9 WARRANTY

A. General: During the warranty period, restore defective Work to the standard of the Contract Documents, including all labor, materials, refinishing and other costs incidental to the Work. Restore Work found to be defective as defined in the Contract Documents.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Includes but not limited to opacified spandrel glass.
   2. Warranty Period: 10 years from date of Substantial Completion.

C. Installation: Glazing systems installation shall be warranted for a period of 5 years against defective materials and workmanship.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
   1. Minimum Glass Thickness for Exterior Lites: Not less than 8.0 mm.

B. Strength: ASTM C 1048, Kind FT (fully tempered).

C. Safety Glass
   1. CPSC 16 CFR part 1201, testing requirements of ANSI Z97.1, and listed in the SGCC Certified Products Directory with appropriate SGCC certification mark or label permanently affixed.
   2. Furnish safety glass for glass occurring in doors and sidelights, and where indicated and
further required by authorities having jurisdiction.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass:  ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process:  By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. Distortion Tolerances:
      a. Roller Wave:  Maximum 0.003 inch (0.076mm) from peak to valley within the main body of the sheet and maximum 0.008 inch (0.20mm) within 10.5 inches of a leading or trailing edge.
      b. Localized Warp:  Maximum 0.03-inch (0.80mm) over any 12-inch (305mm) span but limited to 0.31 inch (8.00mm).

B. Tempered Glass:  ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6.
   1. Products:  Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
      a. AFG Industries, Inc.
      b. Guardian Industries Corp.
      c. Oldcastle Building Envelope
      d. Pilkington North America.
      e. PPG Industries, Inc
      f. Viracon, Inc.

2.3 LAMINATED GLASS

A. Manufacturers:  Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFG Industries, Inc.
   b. Guardian Industries Corp.
   c. Oldcastle Building Envelope
   d. Pilkington North America.
   e. PPG Industries, Inc
   f. Viracon, Inc.

B. Laminated Glass:  ASTM C 1172 and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified.  Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction:  Laminate glass with SentryGlas polymer interlayer to comply with interlayer manufacturer's written recommendations.
   2. Interlayer Thickness:  Provide thickness not less than 0.60 mm and as needed to comply with requirements.
   3. Interlayer Color:  Translucent white.

C. Glass:  Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets:  Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
5. Compression wedge for dry glazing system: of shape and size to compress the exterior compression gasket a minimum of 25 percent, and as recommended by glazing and sealing systems manufacturer.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned [neoprene] [EPDM] [silicone] [or] [thermoplastic polyolefin rubber] gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Bed gasket for wet glazing system: continuous with pressure sensitive adhesive 1 side, designed to be compressed 25-40 percent in the opening.
2. Compression gasket for dry glazing system: shape as required to be compressed in place a minimum of 25 percent and of one-piece construction with factory-assembled frames with injection-molded, vulcanized corners; produced oversize in opening dimension, as determined by measurements, to insure compression at corners but within limits so that compression does not create a "pucker".
3. Channel gasket: continuous channel of shape and dimensions for application in the opening with specified glazing.

2.5 GLAZING SEALANTS

A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

C. For openings up to 1900 united mm (75 united inches), use unshimmed tape. For openings
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over 1900 united mm (75 united inches), use pre-shimmed tape.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
   1. Each block shall be properly sized for load, as wide or wider than glazing, no less than 100 mm (4 inches) long; profile to permit friction fit, dart insertion into metal chair, or pressure sensitive adhesive one side to fix block in glazing opening.

D. Spacers: Elastomeric blocks or continuous extrusions of 40 to 60 Shore "A" durometer hardness to maintain glass lites in place for installation indicated.
   1. Profile to permit friction fit, dart insertion or pressure sensitive adhesive one side to fix shim or spacer in location.

E. Edge Blocks: Elastomeric material of 40 to 60 Shore "A" durometer hardness to limit glass lateral movement (side walking).
   1. Each block shall be a minimum of 100 mm (4 inches) long, as wide as glazing, placed in the vertical glazing channel, and sized to allow a nominal 3-mm (1/8-inch) clearance between glass edge and installed block; profile to permit friction fit or pressure sensitive adhesive one side to fix block in glazing opening.

F. Bond breaker
   1. Heavy duty, 0.28-mm (11-mil) minimum thickness, colored, polyethylene or teflon, self-adhesive bond breaker of type recommended by sealant manufacturer and suitable for conditions of usage. Liquid bond breaker is not permitted.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.9 LAMINATED-GLASS TYPES

A. Glass Type: Clear laminated glass with two plies of fully tempered float glass.
   1. Thickness of Each Glass Ply: 5/16-inch (8.0 mm).
   2. Interlayer Thickness: 0.060 inch (1.52 mm).
   3. Interlayer color: Translucent white.
   4. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
1. Ensure approved Quality Assurance Program is implemented.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass, and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
1. Locate one quarter of glass width from each corner, but with block edge nearest corner no closer than 150 mm (6 inches) from corner, unless otherwise specified or required by glass manufacturer.
2. Insulating glass used in sloped glazing shall have both panes supported by setting blocks.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from...
natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION
SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section only applies to the construction of the Blast Wall as depicted in the Contract Documents, all else shall follow civil technical specifications. This Section includes surface preparation and the application of high-performance coating systems.

1. Exterior Substrates:
   a. Steel.

B. Related Requirements:
   1. Section 05 12 00 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.

1.3 DEFINITIONS

A. MPI Gloss Level 5 (Semi-Gloss Finish): 35 to 70 units at 60 degrees, according to ASTM D 523.
B. MPI Gloss Level 6 (Gloss Finish): 70 to 85 units at 60 degrees, according to ASTM D 523.
C. MPI Gloss Level 7 (High-Gloss Finish): More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.
B. Sustainable Design Submittals:
   1. Product Data: For paints and coatings, indicating VOC content.
   2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.
C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.
D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.
1.6 FIELD CONDITIONS
A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
C. Do not apply exterior coatings in snow, rain, fog, or mist.

1.7 WARRANTY
A. Applicator's Warranty: Provide coverage against failure of PVDF-based coating over improper pretreatment where coating was not applied in accordance with ASTM D 1730, Type B, Method 5, or ASTM B449, Section 5.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Benjamin Moore & Co.
   2. Devoe Paint Company; Akzo Nobel
   3. Dunn-Edwards Corporation.
   4. PPG Paints - PPG Architectural Coatings, Inc.
   5. Sherwin-Williams Company (The).
   6. Tnemec Company, Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL
A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
   1. Provide products from manufacturer's premium or professional product line.
B. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
   3. Products shall be of same manufacturer for each coat in a coating system.
C. VOC Content: For field applications[ that are inside the weatherproofing system], paints and coatings shall comply with VOC content limits of [authorities having jurisdiction][the South Coast Air Quality Management District (SCAQMD), Rule 1113, effective 07/01/2008][the Bay Air Quality Management District (BAAQMD), Reg. 8, Rule 3, effective 01/01/2004] and the following VOC content limits:
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 50 g/L.
   3. Primers, Sealers, and Undercoaters: 100 g/L.
   4. Rust-Preventive Coatings: 100 g/L.
   5. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
   6. Pretreatment Wash Primers: 420 g/L.
   7. Floor Coatings: 50 g/L.
   8. Dry-Fog coatings: 150 g/L.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMUs): 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer’s written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer’s written instructions.
   1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
   2. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer
   1. SSPC-SP 7/NACE No. 4.
   2. SSPC-SP 11.
   3. SSPC-SP 6/NACE No. 3.
   4. SSPC-SP 10/NACE No. 2.
   5. SSPC-SP 5/NACE No. 1.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
H. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
   1. Use applicators and techniques suited for coating and substrate indicated.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing; Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
   1. Contractor shall touch up and restore coated surfaces damaged by testing.
   2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:
   1. Acrylic Polyurethane over Epoxy System:
      a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
         1) Sherwin-Williams; Macropoxy 646, B58-600 Series.
      b. First and Second Topcoat: Polyurethane, semi-gloss.
         1) Sherwin-Williams; Acrolon 218 HS Semi-Gloss, B65-650 Series.
   2. Hi-solids Polyurethane over Epoxy System:
a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
   1) Sherwin-Williams; Macropoxy 646, B58-600 Series.

b. First and Second Topcoat: Hi-Solids Polyurethane, semi-gloss.
   1) Sherwin-Williams; Hi-Solids Polyurethane, B65-350 Series.

END OF SECTION

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## Section 10 Definition of Terms

When the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be defined as follows:

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<td>10-01</td>
<td>AASHTO</td>
<td>The American Association of State Highway and Transportation Officials.</td>
</tr>
<tr>
<td>10-02</td>
<td>Access Road</td>
<td>The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public roadway.</td>
</tr>
<tr>
<td>10-03</td>
<td>Advertisement</td>
<td>A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.</td>
</tr>
<tr>
<td>10-04</td>
<td>Airport</td>
<td>Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; airport buildings and facilities located in any of these areas, and a heliport.</td>
</tr>
<tr>
<td>10-05</td>
<td>Airport Improvement Program (AIP)</td>
<td>A grant-in-aid program, administered by the Federal Aviation Administration (FAA).</td>
</tr>
<tr>
<td>10-06</td>
<td>Air Operations Area (AOA)</td>
<td>The term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.</td>
</tr>
<tr>
<td>10-07</td>
<td>Apron</td>
<td>Area where aircraft are parked, unloaded or loaded, fueled and/or serviced.</td>
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<td>10-09</td>
<td>Award</td>
<td>The Owner’s notice to the successful bidder of the acceptance of the submitted bid.</td>
</tr>
<tr>
<td>10-10</td>
<td>Bidder</td>
<td>Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.</td>
</tr>
<tr>
<td>10-11</td>
<td>Building Area</td>
<td>An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.</td>
</tr>
<tr>
<td>10-12</td>
<td>Calendar Day</td>
<td>Every day shown on the calendar.</td>
</tr>
<tr>
<td>10-13</td>
<td>Certificate of Analysis (COA)</td>
<td>The COA is the manufacturer’s Certificate of Compliance (COC) including all applicable test results required by the specifications.</td>
</tr>
<tr>
<td>10-14</td>
<td>Certificate of Compliance (COC)</td>
<td>The manufacturer’s certification stating that materials or assemblies furnished fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer’s authorized representative.</td>
</tr>
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<td>10-15</td>
<td>Change Order</td>
<td>A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for work within the scope of the contract and necessary to complete the project.</td>
</tr>
<tr>
<td>10-16</td>
<td>Contract</td>
<td>A written agreement between the Owner and the Contractor that establishes the obligations of the parties including but not limited to performance of work, furnishing of labor, equipment and materials and the basis of payment. The awarded contract includes but may not be limited to: Advertisement, Contract form, Proposal, Performance Bond, Payment Bond, General Provisions, certifications and representations, Technical Specifications, Plans, Supplemental Provisions, standards incorporated by reference, and issued addenda.</td>
</tr>
<tr>
<td>10-17</td>
<td>Contract Item (Pay Item)</td>
<td>A specific unit of work for which a price is provided in the contract.</td>
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<tr>
<td>10-18</td>
<td><strong>Contract Time</strong></td>
<td>The number of calendar days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.</td>
</tr>
<tr>
<td>10-19</td>
<td><strong>Contractor</strong></td>
<td>The individual, partnership, firm, or corporation; or the Construction Manager at Risk (CMAR) providing the GMP; primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work. The words “Contractor” and “CMAR” in the General Provisions, Special Provisions, Technical Specifications, and plans shall be synonymous.</td>
</tr>
<tr>
<td>10-20</td>
<td><strong>Contractors Quality Control (QC) Facilities</strong></td>
<td>The Contractor’s QC facilities in accordance with the Contractor Quality Control Program (CQCP).</td>
</tr>
<tr>
<td>10-21</td>
<td><strong>Contractor Quality Control Program (CQCP)</strong></td>
<td>Details the methods and procedures that will be taken to assure that all materials and completed construction required by the contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors.</td>
</tr>
<tr>
<td>10-22</td>
<td><strong>Control Strip</strong></td>
<td>A demonstration by the Contractor that the materials, equipment, and construction processes results in a product meeting the requirements of the specification.</td>
</tr>
<tr>
<td>10-23</td>
<td><strong>Construction Safety and Phasing Plan (CSPP)</strong></td>
<td>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.</td>
</tr>
<tr>
<td>10-24</td>
<td><strong>Drainage System</strong></td>
<td>The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.</td>
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<tr>
<td>10-25</td>
<td>Engineer</td>
<td>The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.</td>
</tr>
<tr>
<td>10-26</td>
<td>Equipment</td>
<td>All machinery, together with the necessary supplies for upkeep and maintenance; and all tools and apparatus necessary for the proper construction and acceptable completion of the work.</td>
</tr>
<tr>
<td>10-27</td>
<td>Extra Work</td>
<td>An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Owner’s Engineer or Resident Project Representative (RPR) to be necessary to complete the work within the intended scope of the contract as previously modified.</td>
</tr>
<tr>
<td>10-28</td>
<td>FAA</td>
<td>The Federal Aviation Administration. When used to designate a person, FAA shall mean the Administrator or their duly authorized representative.</td>
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<tr>
<td>10-29</td>
<td>Federal Specifications</td>
<td>The federal specifications and standards, commercial item descriptions, and supplements, amendments, and indices prepared and issued by the General Services Administration.</td>
</tr>
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<td>10-30</td>
<td>Final Acceptance</td>
<td>Final acceptance of the work granted upon completion of all work including substantial completion punch list work.</td>
</tr>
<tr>
<td>10-31</td>
<td>Force Account</td>
<td><strong>a.</strong> Contract Force Account - A method of payment that addresses extra work performed by the Contractor on a time and material basis.</td>
</tr>
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<td></td>
<td></td>
<td><strong>b.</strong> Owner Force Account - Work performed for the project by the Owner's employees.</td>
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<tr>
<td>10-32</td>
<td>Intention of Terms</td>
<td>Whenever, in these specifications or on the plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer and/or Resident Project Representative (RPR) is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer and/or RPR, subject in each case to the final determination of the Owner. Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.</td>
</tr>
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<td>10-33</td>
<td>Laboratory</td>
<td>The official testing laboratories of the Contracting Agency or such other laboratories as may be designated by the RPR.</td>
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<td>10-34</td>
<td>Lighting</td>
<td>A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.</td>
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<td>10-35</td>
<td>Liquidated Damages</td>
<td>Specified amounts set forth in the contract as a reasonable estimate of the Contracting Agency’s damages caused by the contractor’s failure to substantially complete the contract within contract time. Liquidated damages may also be specified in the contract for the contractor’s failure to meet early completion milestones and/or the reopening of closed runways, taxiways, or aprons on time.</td>
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<td>10-36</td>
<td><strong>Lump Sum</strong></td>
<td>The price bid by a contractor as a single amount for a complete contract item as defined by the specifications, or a price proposed by a contractor as a single amount for the performance of extra work. Payment for the item is based on a percentage complete. When actual Cost of Work for an item identified as Lump Sum is less than the stated lump sum value in a GMP proposal, the unused value of the Lump Sum item shall move into the Owner Controlled Funds.</td>
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</table>
| 10-37 | **Major and Minor Contract Items** | Except for Construction Manager at Risk (CMAR) contracts, a major item is any bid item for work having an original dollar value equal to or greater than the amount shown below. On CMAR contracts a major contract item shall be any item that is listed in the GMP, the total of which is equal to or greater than twenty (20%) percent of the total amount of the GMP.

- **Major Item is defined as any item equal to or:**
  - **Contract Amount - Up to $1 million,** Major Item is Greater than $15,000 or 3%, whichever is greater
  - **Contract Amount - $1 million to $3 million,** Major Item is Greater than 3% or the original Contract amount to a maximum of $75,000.00
  - **Contract Amount - $3 million to $5 million,** Major Item is Greater than 2.5% of the original Contract amount to a maximum of $90,000.00
  - **Contract Amount - Over $5 million,** Major Item is Greater than 1.5% of the original Contract amount to a maximum of $125,000.00

- **All other items shall be considered minor contract items.** |
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<td>10-38</td>
<td>Materials</td>
<td>Any substance specified for use in the construction of the contract work.</td>
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<td>10-39</td>
<td>Modification of Standards (MOS)</td>
<td>Any deviation from standard specifications applicable to material and construction methods in accordance with FAA Order 5300.1.</td>
</tr>
<tr>
<td>10-40</td>
<td>Notice to Proceed (NTP)</td>
<td>A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.</td>
</tr>
<tr>
<td>10-41</td>
<td>Owner “City”</td>
<td>The term “Owner” shall mean the party of the first part or the contracting agency signatory to the contract. Where the term “Owner” is capitalized in this document, it shall mean airport Sponsor only. The Owner for this project is <strong>City of Phoenix Aviation Department</strong>.</td>
</tr>
<tr>
<td>10-42</td>
<td>Partial Acceptance</td>
<td>An agreed-upon portion of the Work is sufficiently complete so that the City can occupy and use that part for its intended purposes. To achieve Partial Acceptance, the Contractor/CMAR may be required to satisfy these conditions: (1) all systems in place, functional, and demonstrated to the City or its representative; (2) all materials and equipment installed; (3) all systems reviewed and accepted by the City; (4) draft O&amp;M manuals and record documents reviewed and accepted by the City; (5) site work complete; and (6) final cleaning.</td>
</tr>
<tr>
<td>Paragraph Number</td>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>10-43</td>
<td>Passenger Facility Charge (PFC)</td>
<td>Per 14 Code of Federal Regulations (CFR) Part 158 and 49 United States Code (USC) § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.</td>
</tr>
<tr>
<td>10-44</td>
<td>Pavement Structure</td>
<td>The combined surface course, base course(s), and subbase course(s), if any, considered as a single unit.</td>
</tr>
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<td>10-45</td>
<td>Payment bond</td>
<td>The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.</td>
</tr>
<tr>
<td>10-46</td>
<td>Performance bond</td>
<td>The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.</td>
</tr>
<tr>
<td>10-47</td>
<td>Plans</td>
<td>The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications. Plans may also be referred to as 'contract drawings.'</td>
</tr>
<tr>
<td>10-48</td>
<td>Project</td>
<td>The Work to be completed in the execution of this Agreement as amended and as described in the Recitals above and in Exhibits attached</td>
</tr>
<tr>
<td>10-49</td>
<td>Proposal</td>
<td>The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.</td>
</tr>
<tr>
<td>10-50</td>
<td>Proposal Guarantee</td>
<td>The security furnished with a proposal to guarantee that the bidder will enter into a contract if his/her proposal is accepted by the Owner.</td>
</tr>
<tr>
<td>10-51</td>
<td>Quality Assurance (QA)</td>
<td>Owner’s responsibility to assure that construction work completed complies with specifications for payment.</td>
</tr>
<tr>
<td>10-52</td>
<td>Quality Control (QC)</td>
<td>Contractor’s responsibility to control material(s) and construction processes to complete construction in accordance with project specifications.</td>
</tr>
<tr>
<td>Paragraph Number</td>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10-53</td>
<td>Quality Assurance (QA) Inspector</td>
<td>An authorized representative of the Engineer and/or Resident Project Representative (RPR) assigned to make all necessary inspections, observations, tests, and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.</td>
</tr>
<tr>
<td>10-54</td>
<td>Quality Assurance (QA) Laboratory</td>
<td>The official quality assurance testing laboratories of the Owner or such other laboratories as may be designated by the Engineer or RPR. May also be referred to as Engineer’s, Owner’s, or QA Laboratory.</td>
</tr>
<tr>
<td>10-55</td>
<td>Reasonably Close Conformity</td>
<td>Where working tolerances are specified, reasonably close conformity means compliance with such working tolerances. Where working tolerances are not specified, reasonably close conformity means compliance with reasonable and customary manufacturing and construction tolerances.</td>
</tr>
<tr>
<td>10-56</td>
<td>Resident Project Representative (RPR)</td>
<td>The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor, and acting directly or through an authorized representative.</td>
</tr>
<tr>
<td>10-57</td>
<td>Runway</td>
<td>The area on the airport prepared for the landing and takeoff of aircraft.</td>
</tr>
<tr>
<td>10-58</td>
<td>Runway Safety Area (RSA)</td>
<td>A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft. See the construction safety and phasing plan (CSPP) for limits of the RSA.</td>
</tr>
<tr>
<td>10-59</td>
<td>Safety Plan Compliance Document (SPCD)</td>
<td>Details how the Contractor will comply with the CSPP.</td>
</tr>
<tr>
<td>10-60</td>
<td>Specifications</td>
<td>A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.</td>
</tr>
<tr>
<td>Paragraph Number</td>
<td>Term</td>
<td>Definition</td>
</tr>
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</tr>
<tr>
<td>10-61</td>
<td>Sponsor</td>
<td>A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.</td>
</tr>
<tr>
<td>10-62</td>
<td>Structures</td>
<td>Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.</td>
</tr>
<tr>
<td>10-63</td>
<td>Subgrade</td>
<td>The soil that forms the pavement foundation.</td>
</tr>
<tr>
<td>10-64</td>
<td>Superintendent</td>
<td>The Contractor’s executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the RPR, and who shall supervise and direct the construction.</td>
</tr>
<tr>
<td>10-65</td>
<td>Supplemental Agreement</td>
<td>A written agreement between the Contractor and the Owner that establishes the basis of payment and contract time adjustment, if any, for the work affected by the supplemental agreement. A supplemental agreement is required if: (1) change in scope work would increase or decrease the total amount of the awarded contract by more than 25%; (2) change in scope of work would increase or decrease the total of any major contract item by more than 25%; (3) work that is not within the scope of the originally awarded contract; or (4) adding or deleting of a major contract item.</td>
</tr>
<tr>
<td>10-66</td>
<td>Surety</td>
<td>The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.</td>
</tr>
<tr>
<td>10-67</td>
<td>Taxilane</td>
<td>A taxiway designed for low speed movement of aircraft between aircraft parking areas and terminal areas.</td>
</tr>
<tr>
<td>Paragraph Number</td>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------</td>
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</tr>
<tr>
<td>10-68</td>
<td>Taxiway</td>
<td>The portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport’s runways, aircraft parking areas, and terminal areas.</td>
</tr>
<tr>
<td>10-69</td>
<td>Taxiway/Taxilane Safety Area (TSA)</td>
<td>A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft. See the construction safety and phasing plan (CSPP) for limits of the TSA.</td>
</tr>
<tr>
<td>10-70</td>
<td>Work</td>
<td>The procuring and furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor’s performance of all duties and obligations imposed, reasonably inferable by the contract, plans, and specifications.</td>
</tr>
<tr>
<td>10-71</td>
<td>Working day</td>
<td>A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor’s control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor’s forces engage in regular work will be considered as working days. Reference the Improving Phoenix Handbook at <a href="https://www.skyharbor.com/Business/TenantsAndContractors/ImprovingPhoenix">https://www.skyharbor.com/Business/TenantsAndContractors/ImprovingPhoenix</a> for additional site-specific work restrictions.</td>
</tr>
<tr>
<td>10-72</td>
<td>Controlled Funds and Allowance</td>
<td>This item of work is likely, but not certain, to occur during the course of the work. If the RPR or Owner determines that this work is required, the Contractor will accomplish the work, and payment for the work will be made at negotiated amounts or on a Time &amp; Material basis. Allowance or Controlled Fund items shall not be classified as major items regardless of the amount established in the Bid Schedule. All unused monies in the items will not be paid to the Contractor.</td>
</tr>
<tr>
<td>10-73</td>
<td>Bid Schedule</td>
<td>The prepared schedule, included as part of the proposal pamphlet, containing the estimated quantities of the pay items for which unit bid prices are invited.</td>
</tr>
<tr>
<td>Paragraph Number</td>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
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</tr>
<tr>
<td>10-74</td>
<td>City</td>
<td>A municipal corporation organized and existing under and by the virtue of the laws of the State of Arizona. The City may be the Contracting Agency for the executed Contract with the Contractor.</td>
</tr>
<tr>
<td>10-75</td>
<td>Complete in Place</td>
<td>Complete in place means that payment will be full compensation for all work necessary to complete that portion of the contract in its entirety to the satisfaction of the RPR/Owner, in accordance with the requirement of the contract. When the basis of payment states the work will be paid for complete in place it shall be the Contractor’s responsibility to determine the elements necessary to complete the work.</td>
</tr>
<tr>
<td>10-76</td>
<td>Council</td>
<td>The City Council which by law constitutes the Legislative Department of the City.</td>
</tr>
<tr>
<td>10-77</td>
<td>County</td>
<td>Maricopa County, organized and existing under and by virtue of the laws of the State of Arizona.</td>
</tr>
<tr>
<td>10-78</td>
<td>Inspector</td>
<td>An authorized representative of the RPR/Owner assigned to make all necessary inspections and/or tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.</td>
</tr>
<tr>
<td>10-79</td>
<td>Non-Pay Item</td>
<td>An item of work for which no separate payment will be made under the proposal, but which must be included as an incidental cost for payment on an associated item included in the proposal or bid schedule.</td>
</tr>
<tr>
<td>10-80</td>
<td>Site Representative</td>
<td>The Contractor’s authorized representative who is present on the work at all times during progress and is authorized to receive and fulfill instructions from the Engineer, and who shall supervise and direct the construction.</td>
</tr>
</tbody>
</table>

END OF SECTION 10
Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders). Refer to Call for Bids.

20-02 Qualification of bidders. Each bidder shall submit evidence of competency and evidence of financial responsibility to perform the work to the Owner at the time of bid opening.

Evidence of competency, unless otherwise specified, shall consist of statements covering the bidder’s past experience on similar work, and a list of equipment and a list of key personnel that would be available for the work.

Each bidder shall furnish the Owner satisfactory evidence of their financial responsibility. Evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder’s financial resources and liabilities as of the last calendar year or the bidder’s last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether their financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder’s financial responsibility has changed, the bidder shall qualify the public accountant’s statement or report to reflect the bidder’s true financial condition at the time such qualified statement or report is submitted to the Owner.

Unless otherwise specified, a bidder may submit evidence that they are prequalified with the State Highway Division and are on the current “bidder’s list” of the state in which the proposed work is located. Evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

20-03 Contents of proposal forms. The Owner’s proposal forms state the location and description of the proposed construction; the place, date, and time of opening of the proposals; and the estimated quantities of the various items of work to be performed and materials to be furnished for which unit bid prices are asked. The proposal form states the time in which the work must be completed, and the amount of the proposal guaranty that must accompany the proposal. The Owner will accept only those Proposals properly executed on physical forms or electronic forms provided by the Owner. Bidder actions that may cause the Owner to deem a proposal irregular are given in paragraph 20-09 Irregular proposals.

A prebid conference is required on this project to discuss as a minimum, the following items: material requirements; submittals; Quality Control/Quality Assurance requirements; the construction safety and phasing plan including airport access and staging areas; and unique airfield paving construction requirements. Refer to the Call for Bids for the Pre-bid conference time and location.

20-04 Issuance of proposal forms. The Owner reserves the right to refuse to issue a proposal form to a prospective bidder if the bidder is in default for any of the following reasons:

a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.

c. Documented record of Contractor default under previous contracts with the Owner.
d. Documented record of unsatisfactory work on previous contracts with the Owner.

20-05 Interpretation of estimated proposal quantities. An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as provided in the Section 40, paragraph 40-02, Alteration of Work and Quantities, without in any way invalidating the unit bid prices.

20-06 Examination of plans, specifications, and site. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves to the character, quality, and quantities of work to be performed, materials to be furnished, and to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and is satisfied to the conditions to be encountered in performing the work and the requirements of the proposed contract, plans, and specifications.

Boring logs and other records of subsurface investigations and tests are available for inspection of bidders. It is understood and agreed that such subsurface information, whether included in the plans, specifications, or otherwise made available to the bidder, was obtained and is intended for the Owner’s design and estimating purposes only. Such information has been made available for the convenience of all bidders. It is further understood and agreed that each bidder is solely responsible for all assumptions, deductions, or conclusions which the bidder may make or obtain from their own examination of the boring logs and other records of subsurface investigations and tests that are furnished by the Owner.

20-07 Preparation of proposal. The bidder shall submit their proposal on the forms furnished by the Owner. All blank spaces in the proposal forms, unless explicitly stated otherwise, must be correctly filled in where indicated for each and every item for which a quantity is given. The bidder shall state the price (written in ink or typed) in - numerals which they propose for each pay item furnished in the proposal.

Prices should generally be written in whole dollars and cents. The extended total amount of each item should not be rounded.

The bidder shall correctly sign the proposal in ink. If the proposal is made by an individual, their name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state where the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of their authority to do so and that the signature is binding upon the firm or corporation.

20-08 Responsive and responsible bidder. A responsive bid conforms to all significant terms and conditions contained in the Owner’s invitation for bid. It is the Owner’s responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.
A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 2 CFR § 200.318(h). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

20-09 Irregular proposals. Proposals shall be considered irregular for the following reasons:

   a. If the proposal is on a form other than that furnished by the Owner, or if the Owner’s form is altered, or if any part of the proposal form is detached.

   b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.

   c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.

   d. If the proposal contains unit prices that are obviously unbalanced.

   e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.

   f. If the applicable Disadvantaged Business Enterprise information is incomplete.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

20-10 Bid guarantee. Each separate proposal shall be accompanied by a bid bond, certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such bond, check, or collateral, shall be made payable to the Owner.

20-11 Delivery of proposal. Refer to Information For Bidders, Section 5.

20-12 Withdrawal or revision of proposals. Refer to Information For Bidders, Section 6.

20-13 Public opening of proposals. Refer to Information For Bidders.

20-14 Disqualification of bidders. A bidder shall be considered disqualified for any of the following reasons:

   a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

   b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

   c. If the bidder is considered to be in “default” for any reason specified in paragraph 20-04, Issuance of Proposal Forms, of this section.

20-15 Discrepancies and Omissions. A Bidder who discovers discrepancies or omissions with the project bid documents shall immediately notify the Owner’s Engineer of the matter. A bidder that has doubt as to the true meaning of a project requirement may submit to the Owner’s Engineer a written request for interpretation no later than 7 days prior to bid opening.
Any interpretation of the project bid documents by the Owner’s Engineer will be by written addendum issued by the Owner. The Owner will not consider any instructions, clarifications or interpretations of the bidding documents in any manner other than written addendum.

END OF SECTION 20
Section 30 Award and Execution of Contract

30-01 Consideration of proposals. After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a bidder’s proposal contains a discrepancy between unit bid prices written in words and unit bid prices written in numbers, the unit bid price written in words shall govern.

Until the award of a contract is made, the Owner reserves the right to reject a bidder’s proposal for any of the following reasons:

a. If the proposal is irregular as specified in Section 20, paragraph 20-09, Irregular Proposals.

b. If the bidder is disqualified for any of the reasons specified Section 20, paragraph 20-14, Disqualification of Bidders, or in the Information for Bidders.

In addition, until the award of a contract is made, the Owner reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the Owner’s best interests.

30-02 Award of contract. The award of a contract, if it is to be awarded, shall be made within 180 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

See also I.F.B. 10. CONTRACT AWARD.

30-03 Cancellation of award. The Owner reserves the right to cancel the award without liability to the bidder, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the Owner in accordance with paragraph 30-07 Approval of Contract.

30-04 Return of proposal guaranty. The successful bidder’s proposal guaranty will be returned as soon as the Owner receives the contract bonds as specified in paragraph 30-05, Requirements of Contract Bonds. See also I.F.B. 3. BID BOND.

30-05 Requirements of contract bonds. See I.F.B. 7. PERFORMANCE AND LABOR MATERIAL BOND.

30-06 Execution of contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety bond or bonds specified in paragraph 30-05, Requirements of Contract Bonds, of this section, within 30 calendar days from the date mailed or otherwise delivered to the successful bidder.

30-07 Approval of contract. Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the Owner shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the Owner’s approval to be bound by the successful bidder’s proposal and the terms of the contract.

30-08 Failure to execute contract. Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the period specified in paragraph 30-06, Execution of
Contract, of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidated damages to the Owner.

END OF SECTION 30
Section 40 Scope of Work

40-01 Intent of contract. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 Alteration of work and quantities. The Owner reserves the right to make such changes in quantities and work as may be necessary or desirable to complete, in a satisfactory manner, the original intended work. Unless otherwise specified in the Contract, the Owner’s Engineer or RPR shall be and is hereby authorized to make, in writing, such in-scope alterations in the work and variation of quantities as may be necessary to complete the work, provided such action does not represent a significant change in the character of the work.

When supported by a Contractor's Time Impact Analysis, supplement agreements (change orders or amendments) for altered work may include extensions of contract time.

For purpose of this section, a significant change in character of work means: any change that is outside the current contract scope of work; any change (increase or decrease) in the total contract cost by more than 25%; or any change in the total cost of a major contract item by more than 25%.

Work alterations and quantity variances that do not meet the definition of significant change in character of work shall not invalidate the contract nor release the surety. Contractor agrees to accept payment for such work alterations and quantity variances in accordance with Section 90, paragraph 90-03, Compensation for Altered Quantities.

Should the value of altered work or quantity variance meet the criteria for significant change in character of work, such altered work and quantity variance shall be covered by a supplemental agreement. Supplemental agreements shall also require consent of the Contractor’s surety and separate performance and payment bonds. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

40-03 Omitted items. The Owner, the Owner’s Engineer or the RPR may provide written notice to the Contractor to omit from the work any contract item that does not meet the definition of major contract item. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with Section 90, paragraph 90-04, Payment for Omitted Items.

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, Owner may issue a Change Order to cover the necessary extra work. Change orders for extra work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the
contract time that, in the RPR’s opinion supported by a Contractor’s Time Impact Analysis, is necessary for completion of the extra work.

When determined by the RPR to be in the Owner’s best interest, the RPR may order the Contractor to proceed with extra work as provided in Section 90, paragraph 90-05, Payment for Extra Work. Extra work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a supplemental agreement as defined in Section 10, paragraph 10-59, Supplemental Agreement.

If extra work is essential to maintaining the project critical path, RPR may order the Contractor to commence the extra work under a Time and Material contract method. Once sufficient detail is available to establish the level of effort necessary for the extra work, the Owner shall initiate a change order or supplemental agreement to cover the extra work.

Any claim for payment of extra work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 Maintenance of traffic. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor’s equipment and personnel, is the most important consideration. The Contractor shall maintain traffic in the manner detailed in the Construction Safety and Phasing Plan (CSPP). See also Special Provisions Para. 1.3 Aircraft Safety, 1.11 Vehicle Traffic Regulations, and 1.12 Aircraft Traffic Regulations.

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to their own operations and the operations of all subcontractors as specified in Section 80, paragraph 80-04, Limitation of Operations. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in Section 70, paragraph 70-15, Contractor’s Responsibility for Utility Service and Facilities of Others.

b. With respect to their own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport in accordance with the Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD).

c. When the contract requires the maintenance of an existing road, street, or highway during the Contractor’s performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep the road, street, or highway open to all traffic and shall provide maintenance as may be required to accommodate traffic. The Contractor, at their expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor’s equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (http://mutcd.fhwa.dot.gov/), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

40-06 Removal of existing structures. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are
otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Resident Project Representative (RPR) shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the RPR in accordance with the provisions of the contract.

Except as provided in Section 40, paragraph 40-07, Rights in and Use of Materials Found in the Work, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

40-07 Rights in and use of materials found in the work. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be embankment, the Contractor may at their own option either:

a. Use such material in another contract item, providing such use is approved by the RPR and is in conformance with the contract specifications applicable to such use; or,

b. Remove such material from the site, upon written approval of the RPR; or

c. Use such material for the Contractor’s own temporary construction on site; or,

d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the RPR's approval in advance of such use.

Should the RPR approve the Contractor’s request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at their expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the RPR approve the Contractor’s exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of their own exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 Final cleanup. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition.
Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of the property Owner.

END OF SECTION 40
Section 50 Control of Work

50-01 Authority of the Resident Project Representative (RPR). The RPR has final authority regarding the interpretation of project specification requirements. The RPR shall determine acceptability of the quality of materials furnished, method of performance of work performed, and the manner and rate of performance of the work. The RPR does not have the authority to accept work that does not conform to specification requirements.

The Owner or RPR may, at its discretion and without cause, order the Contractor in writing to stop and suspend the Work. Immediately after receiving such notice, the Contractor will discontinue advancing the work specified under this Agreement. Such suspension will not exceed one hundred and eighty (180) consecutive Days during the duration of the Project.

The Contractor may seek an adjustment of the Contract Price and Time, if its cost or time to perform the Work has been adversely impacted by any suspension or stoppage of work by Owner/RPR.

50-02 Conformity with plans and specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans, or specifications.

If the RPR finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications, but that the portion of the work affected will, in their opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the RPR will advise the Owner of their determination that the affected work be accepted and remain in place. The RPR will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. Changes in the contract price must be covered by contract change order or supplemental agreement as applicable.

If the RPR finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the RPR’s written orders.

The term “reasonably close conformity” shall not be construed as waiving the Contractor’s responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the RPR’s responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor’s execution of the work, when, in the RPR’s opinion, such compliance is essential to provide an acceptable finished portion of the work.

The term “reasonably close conformity” is also intended to provide the RPR with the authority, after consultation with the Sponsor and FAA, to use sound engineering judgment in their determinations to accept work that is not in strict conformity, but will provide a finished product equal to or better than that required by the requirements of the contract, plans and specifications.

The RPR will not be responsible for the Contractor’s means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.
50-03 Coordination of contract, plans, and specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. If electronic files are provided and used on the project and there is a conflict between the electronic files and hard copy plans, the hard copy plans shall govern. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. See Supplementary Conditions Para. 2. PRECEDENCE OF CONTRACT DOCUMENTS for precedence.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the RPR for an interpretation and decision, and such decision shall be final.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, Contractor shall immediately notify the Owner or the designated representative in writing requesting their written interpretation and decision.

50-04 List of Special Provisions. Refer to Special Provisions Section 1.

50-05 Cooperation of Contractor. The Contractor shall be supplied with five hard copies or an electronic PDF of the plans and specifications. The Contractor shall have available on the construction site at all times one hardcopy each of the plans and specifications. Additional hard copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof and shall cooperate with the RPR and their inspectors and with other Contractors in every way possible. The Contractor shall always have a competent superintendent on the work who is fully authorized as their agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the RPR or their authorized representative.

The Contractor shall file with the RPR, the names, addresses, and telephone numbers of their representatives, who can be contacted at any time, in case of emergency. These representatives must be fully authorized and equipped to correct unsafe or deficient work. When no work is being performed and during holiday non work periods, the representatives identified shall be available and report to the Airport within 60 minutes of notification.

Before starting the work, the Contactor shall designate, in writing, qualified superintendent(s) who shall have complete authority to act on behalf of the Contractor. These superintendents shall be qualified to perform the scope of the work. All qualified superintendents must have worked as a Project Superintendent for a minimum of two (2) years prior to this project, and the Contractor shall submit resumes of these individuals for the RPR’s review and approval.

At minimum one qualified superintendent shall be present at the work site whenever any work is in progress. Any communication given to the superintendent(s) on any work shift shall be deemed delivered to the Contractor. The qualified superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instruction from the RPR, or his/her authorized representative.

The RPR has the right to:
1. Disapprove any candidate named as the Contractor’s qualified superintendent who fails to meet the provisions set forth herein.

2. Remove the qualified superintendent(s) who in the opinion of the RPR has demonstrated incompetence, lack of ability, or other unsuitability to perform supervision of the work.

3. Remove superintendents who fail to follow orders or directives from the RPR.

If a qualified superintendent leaves the employ of the Contractor, the Contractors will be required to replace the individual(s) approved by the RPR within ten (10) days.

Failure to have a superintendent present at the site of the work at all times while work under the Contract is in progress shall constitute suspension of the work by the Contractor, until such time as a qualified superintendent is present at the site.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and he shall cooperate with the RPR and his/her inspectors and with other contractors in every way possible.

50-05.1 Daily Reports: The Contractor and each Subcontractor, not covered by the Contractor Report, shall provide the RPR, uploaded into Unifier, with a written Daily Report describing all project activities for each shift. Daily Reports are required from each project superintendent from each company, and these reports shall be submitted within 24 hours after the end of each work shift. These Daily Reports are in addition to any required report for Time and Materials work. As a minimum, the Daily Reports shall include the items specified below for each shift and associated with the Project, and shall provide an accurate, detailed daily report for each shift’s activities. Each Daily Report Shall Address:

1. Condition – Weather, temperature, moisture, wind, site conditions, etc.

2. Personnel – Number of workers by trade classification by employer, list all subcontractors and lower tier subcontractors, and the number of hours worked.

3. Equipment – List the equipment by type, model, serial number, and the hours the equipment was operational and the hours on standby for each shift.

4. Quantities – Identify the quantities of work performed on each shift.

5. Materials – List all materials received for that shift and the locations stored or where placed directly into the work and identify any defective or deficient materials and actions taken regarding the deficiencies.

6. The Daily Report shall identify the hours, in military time, the shift worked including start and end times.

7. Describe the overall general description of work being performed.

8. The Daily Reports shall be signed and dated by the superintendent. The name shall also be printed, or typed, legibly.

50-05.2 Construction Progress Photographs: The Contractor shall take at least thirty (30) progress photographs for each month and progress aerial photographs of sufficient quantity to show demolition and restoration progress or pertinent construction work until the work is completed. The Contractor shall upload the photographs monthly into Unifier.
50-06 Cooperation between Contractors. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with their own contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange their work and shall place and dispose of the materials being used to not interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join their work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-07 Construction layout and stakes. In addition to the requirements of the section, construction survey and record drawing survey will comply with the I.F.B Para. 13. SURVEY.

The Engineer/RPR shall establish necessary horizontal and vertical control. The establishment of Survey Control and/or reestablishment of survey control shall be by a state Licensed Land Surveyor. Contractor is responsible for preserving integrity of horizontal and vertical controls established by the Engineer/RPR. In case of negligence on the part of the Contractor or their employees, resulting in the destruction of any horizontal and vertical control, the resulting costs will be borne by the Contractor.

Prior to the start of construction, the Contractor shall check all control points for horizontal and vertical accuracy and certify in writing to the RPR that the Contractor concurs with survey control established for the project. If errors are discovered during this verification process, and the control points do not agree with the geometry shown on the plans, the Contractor shall notify the RPR in writing explaining the issue(s) in detail. The RPR will advise the Contractor of any corrective actions, which may be deemed necessary. All lines, grades, and measurements from control points necessary for the proper execution and control of the work on this project shall be provided to the RPR. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the RPR for each area of construction and for each placement of material as specified to allow the RPR to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the RPR prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in the following format(s): Horizontal datum is NAD83 (2011 Epoch, Arizona Central Zone and the vertical datum is NAVD88. Refer to the Survey Control Sheet, A.C-103 for Horizontal Adjustment criteria and the Project Benchmark.

Laser, GPS, String line, or other automatic control shall be checked with temporary control as necessary. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.
a. General Requirements. The Contractor shall set all construction stakes establishing lines, grades, and elevations to include necessary utilities and appurtenances and shall be responsible for their conformance with plans and specifications. The Contractor shall perform all calculations to establish horizontal and vertical controls on the project from the Project Plans. The Contractor shall not base his survey layout and calculations on CAD files. The Contractor shall furnish all materials, personnel and equipment necessary to perform all surveying, staking, and verification of the accuracy of all existing control points. The work shall include establishing and marking “Record Drawings” coordinates and elevations on survey monuments and other designated locations. The work shall be done under the direction of an Arizona registered land surveyor.

Materials and equipment shall include, but shall not be limited to, vehicles for transporting personnel and equipment, properly adjusted and accurate survey equipment, straightedges, stakes, flagging and all other devices necessary for checking, marking, establishing and maintaining lines, grades and layout to perform the work call for in the Contract. The Contractor shall furnish a sufficient quantity of competent personnel to perform the survey work and layout. The Contractor shall not employ nor engage the services of any person or persons in the employ of the RPR for the performance of any work as described herein.

b. Electronic Field Logs/Electronic Data Collector Cut Sheets/Field Books. The Contractor shall furnish and use electronic field logs and electronic data collector cut sheets or bound field books for recording survey data and field notes. Copies of these field books, electronic field logs, and electronic data collector cut sheets notes and corresponding grade sheets shall be provided when requested by the RPR. These records and all electronic data shall also become property of the Owner and submitted along with the Contractor’s as-built construction plans upon completion of the work.

c. Permanent Survey Markers. The Contractor shall be responsible for the preservation of survey monuments and benchmarks. Damaged or disturbed monuments shall be replaced at the Contractor’s expense by an Arizona registered land surveyor. Post construction monument ties shall be submitted to the RPR.

d. Existing or New Underground Utilities. The Contractor shall notify the RPR immediately in writing of any conflicts between the project work and any existing utility. Horizontal locations and elevations of existing underground utilities including new and exposed fuel lines shall be included in the Contractor’s as-built construction plans. Horizontal coordinates and elevations shall be taken at all field pipe connections, bends, etc., on all new and exposed existing piping. This data shall be included in the as-built drawings.

e. General Staking. The Contractor shall set all survey stakes. Staking include, but is not limited to: centerline stakes, offset stakes, reference point stakes, pavement lines, curb lines and grade stakes, airfield drainage, fuel system piping and structures, manholes and pull boxes, sign foundations, pipe, survey monuments, grade stakes for subgrade, base and pavement courses, paint striping layouts, supplemental bench marks, and permanent as-built elevation marks.

f. Survey staking shall be established and placed for the finished subgrade elevation and alignment at 50' maximum intervals, finished base elevations at the intersection of each paving joint for concrete paving, and at elevation and alignment intervals not exceeding 40’ for finished asphalt pavements, and at each concrete pavement joint intersection for P-501 pavement. As-built
survey elevations shall be provided to the RPR at the staking intervals specified herein for finished subgrade, finished base material, and finished asphalt and concrete surfaces that confirm that the work has been constructed within the allowable contractual tolerances, and shall be included in the as-built drawings.

g. Survey staking frequencies and procedures for structures, drainage facilities, underground piping, striping, and all other contract work, shall be approved by the RPR. All elevation and alignment variations from the project plans shall be included in the as-built drawings.

h. Preservation. The Contractor shall exercise care in the preservation of stakes, references and benchmarks and shall reset them whey any are damaged, lost, displaced, or removed.

i. Discrepancies. Any discrepancies in the grade, alignment, quantities, locations or dimensions detected by the Contractor shall immediately be brought to the attention of the Engineer. Changes to the project plans will not be allowed without the approval of the RPR.

j. Random Inspections. The RPR reserves the right to make inspections and random checks of any portion of the staking and layout work. If, in the RPR’s opinion, the work is not being performed in a manner that will assure proper controls and accuracy, he may order any or all of the staking and layout work re-done, or he can further order further staking to supplement the original work, both of which would be at no additional cost to the Owner.

k. Additional Work. If additional staking and layout are required as the result of additional work order by the RPR, such work will be paid at the respective predetermined unit prices specified herein. The amount per hour for a one (1) person survey crew, and a survey manager (registered land surveyor) includes the cost of all work necessary to complete the extra work. The predetermined rates are identified below and will be paid in accordance with the Bid Schedule.

a. 1-Person Survey Crew - $120/Hour and b. Survey Manager (RLS) $160/Hour.

**50-08 Authority and duties of Quality Assurance (QA) inspectors.** QA inspectors shall be authorized to inspect all work done and all material furnished. Such QA inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. QA inspectors are not authorized to revoke, alter, or waive any provision of the contract. QA inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

QA Inspectors are authorized to notify the Contractor or their representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the RPR for a decision.

**50-09 Inspection of the work.** All materials and each part or detail of the work shall be subject to inspection. The RPR shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the RPR requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or
examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor’s expense.

Provide advance written notice to the RPR of work the Contractor plans to perform each week and each day. Any work done or materials used without written notice and allowing opportunity for inspection by the RPR may be ordered removed and replaced at the Contractor’s expense.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 Removal of unacceptable and unauthorized work. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the RPR as provided in paragraph 50-02, Conformity with Plans and Specifications.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of Section 70, paragraph 70-14, Contractor’s Responsibility for Work.

No removal work made under provision of this paragraph shall be done without lines and grades having been established by the Contractors Surveyor. Work done contrary to the instructions of the RPR, work done beyond the lines shown on the plans or as established by the RPR, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor’s expense.

Upon failure on the part of the Contractor to comply with any order of the RPR made under the provisions of this subsection, the RPR will have authority to cause unacceptable work to be remedied or removed and replaced; and unauthorized work to be removed and recover the resulting costs as a liquidated damage against the Contractor.

50-11 Load restrictions. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment. See Special Provisions Para. 1.11 Vehicle Traffic Regulations for additional information.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. No hauling of materials over new base, surface pavements, or structures will be permitted until the expiration of the curing period, minimum strengths, and other criteria stipulated elsewhere in the plans and specifications, has been attained. The Contractor, at their own expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor’s equipment and personnel.

The Contractor shall restrict hauling on Sky Harbor Boulevard (SHB) to be night-time only as specified in the Special Provisions, Para. 1.11.4.

50-12 Maintenance during construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted
day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in paragraph 50-12, Maintenance during Construction, the RPR shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the RPR’s notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be recovered as a liquidated damage against the Contractor.

50-14 Partial acceptance. See Special Conditions Para. 4.B. Substantial Completion and Para. 4.C. Penalty for Failure to Complete Punch List Work Within Specified Time.

50-15 Final acceptance. See Special Conditions Para. 4.D. Contract Retention.

50-16 Claims for adjustment and disputes. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the RPR in writing of their intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the RPR is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the RPR has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the RPR who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor’s right to dispute final payment based on differences in measurements or computations.

50-17 Utility-Related Construction Delay Damages Claim Procedures. The Contractor shall immediately notify, in writing, the RPR of any potential utility-related delay claim. The Contractor shall also immediately notify the appropriate liaison of the affected utility verbally, followed by a written notification.

The Contractor shall coordinate an investigation of the situation with the affected utility, the RPR, and the Owner’s Project Manager. After resolution, the Contractor shall provide written notification of the settlement of the claim to all affected parties.
If the affected utility decides to handle negotiations for a claim, their personnel will be responsible for monitoring the project and all negotiations with the Contractor regarding the claim.

The Contractor shall determine to document requirements of the affected utility for their acceptance or responsibility for the claims. The Contractor shall provide four (4) copies of the required documentation to the utility involved and two (2) copies of this documentation to the RPR. The Contractor shall obtain written confirmation from the utility company involved of their documentation requirements.

**50-18 Restoration Of Damaged Utilities Found Within Pavement Structural Section.** Utilities may be encountered within the concrete pavement section and/or pavement structural section during demolition work. The Contractor shall immediately notify the RPR if any utility is damaged during demolition work and shall make all necessary provisions to shut down said utility. Restoration work shall be performed by the Contractor as directed by the RPR.

The Contractor shall mobilize and be on the project site within four (4) hours of notification to repair/restore any damage to power and control cables, conduit, duct banks, direct buried cable, conductor, or conduit; and be on site within two (2) hours to repair/restore conduit and conductors for the Emergency Fuel Shut Off System.

**50-19 Owner Controlled Funds.** During construction of the project, work that is not otherwise noted as a pay item within the bid schedule may be requested by the RPR. The Contractor shall coordinate this work with the RPR and shall provide documentation requested to substantiate the price for the work, or the work RPR may direct the work to be performed on a Time and Material basis. Compensation for this extra work will be made from the Owner Controlled Funds.

**50-20 Measurement.** Survey will be measured per lump sum. Travel time will not be measured for payment. Survey work for quality control surveys will not be measured for payment but shall be considered incidental to the Contractor Quality Control Program.

Measurement for additional survey for extra work direct by the RPR will be made on an hourly basis for the hours approved and accepted.

Extra work ordered by the RPR will be measured as Owner Controlled Funds as directed by the RPR based on the type of work items performed.

**50-21 Basis of Payment.** Payment for Survey Services shall be made at the contract lump sum price. This price shall constitute full compensation for furnishing all personnel, vehicles, survey equipment, all other equipment, all materials, tools and incidentals necessary as specified herein to accomplish and construct the work within the tolerances specified. Twenty (20%) percent of the lump sum amount will be retained until delivery of the original survey notes and the as-built drawings. The remaining eighty (80%) percent to be paid on a monthly basis shall be calculated by dividing the lump sum bid price less twenty percent by the contract time in months.

No direct quantity has been included in the bid schedule for extra survey work. If required, funds will be used from owner-controlled funds to cover.

Payment will be made under:

| Item GP-50-21.1 | Construction Survey and Layout – per Lump Sum |
END OF SECTION 50
Section 60 Control of Materials

60-01 Source of supply and quality requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed). Any materials used in the work that are damaged during the construction of the project and prior to final acceptance, shall be replaced by the Contractor with new material at no additional cost to the Owner.

In order to expedite the inspection and testing of materials, the Contractor shall furnish documentation to the RPR as to the origin, composition, and manufacture of all materials to be used in the work. Documentation shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the RPR’s option, materials may be approved at the source of supply before delivery. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that meets the requirements of the specifications; and is listed in AC 150/5345-53, Airport Lighting Equipment Certification Program and Addendum, that is in effect on the date of advertisement.

60-02 Samples, tests, and cited specifications. All materials used in the work shall be inspected, tested, and approved by the RPR before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the RPR shall be performed at the Contractor’s risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the RPR, shall be removed at the Contractor’s expense.

Unless otherwise designated, quality assurance tests will be made by and at the expense of the Owner in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), federal specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids.

The testing organizations performing on-site quality assurance and Contractor Quality Control inspections and field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the RPR. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor’s representative at their request after review and approval of the RPR.

A copy of all Contractor QC test data shall be provided to the RPR daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the RPR showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

The Contractor shall employ a Quality Control (QC) testing organization to perform all Contractor required QC tests in accordance with Item C-100 Contractor Quality Control Program (CQCP). All reports and test data shall be uploaded into the Owner’s Document Control “Unifier” system.

60-03 Certification of compliance/analysis (COC/COA). The RPR may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer’s COC stating that
such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by a person having legal authority to bind the supplier or manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified. The COA is the manufacturer’s COC and includes all applicable test results.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the RPR.

When a material or assembly is specified by “brand name or equal” and the Contractor elects to furnish the specified “or equal,” the Contractor shall be required to furnish the manufacturer’s certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

a. Conformance to the specified performance, testing, quality or dimensional requirements; and,

b. Suitability of the material or assembly for the use intended in the contract work.

The RPR shall be the sole judge as to whether the proposed “or equal” is suitable for use in the work. The RPR reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

Certificates of Compliance. A certificate of Compliance shall contain the following minimum information:

1. Identify the specific Contracting Agency project number, project location and description, and appropriate AIP and FAA project number whenever applicable.

2. A description of the material supplied.

3. Quantity of material represented by the Certificate.

4. Means of material identification, such as label, lot number, markings, etc.

5. Statement that material compiles in all respects with the requirements of the cited specifications.

6. The name, title, and signature of a person having legal authority to bind the manufacturer or supplier of the material shall be shown on the Certificate. A copy or an exact reproduction will be acceptable, provided the original Certificate shall be made available upon request. The person signing the Certificate shall be in one of the following categories:

   a. An officer of a corporation.

   b. A partner in a business partnership or an owner.

   c. A general manager.

   d. Any person having been given the authority in writing by either (a), (b), or (c) above. The supplier or manufacturer of the material shall provide documentation of the persons(s) in Paragraph d upon request of the RPR.

Certificates of Analysis. A Certificate of Analysis shall include all the information required in a Certificate of Compliance, and, in addition, shall include the results of all tests required by the specifications.
**60-04 Plant inspection.** The RPR or their authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the RPR conduct plant inspections, the following conditions shall exist:

   a. The RPR shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.

   b. The RPR shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

   c. If required by the RPR, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Place office or working space in a convenient location with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The RPR shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

**60-05 Engineer/Resident Project Representative (RPR) field office.** See Civil Technical Specifications C-105 Mobilization.

**60-06 Storage of materials.** Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the RPR. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans and/or CSPP, the storage of materials and the location of the Contractor’s plant and parked equipment or vehicles shall be as directed by the RPR. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the RPR a copy of the property Owner’s permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at their expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

**60-07 Unacceptable materials.** Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the RPR.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the RPR has approved its use in the work.
60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor’s handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor’s handling, storage, or use of Owner-furnished materials.

60-09 Trade Names and Substitutions. See Information For Bidders, Para. 2. REQUEST FOR SUBSTITUTIONS.

END OF SECTION 60
Section 70 Legal Regulations and Responsibility to Public

70-01 Laws to be observed. The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all their officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor’s employees.

70-02 Permits, licenses, and taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work. See I.F.B Para. 9. PERMITS for information.

70-03 Patented devices, materials, and processes. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 Restoration of surfaces disturbed by others. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) must be shown on the plans and is indicated as follows:

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the RPR.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the RPR, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal Participation. The United States Government has agreed to reimburse the Owner for some portion of the contract costs. The contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator. No requirement of this contract shall be construed
as making the United States a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-06 Sanitary, health, and safety provisions. The Contractor’s worksite and facilities shall comply with applicable federal, state, and local requirements for health, safety and sanitary provisions.

The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of their employees as may be necessary to comply with the requirements and regulations of the Arizona State Department of Health or as specified by the Maricopa County Health Department, Sanitary Code.

The Contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions, on his own responsibility or as the RPR may determine, reasonable necessary to protect the life and health of employees on the job, the safety of the public and to protect property in connection with the performance of the work as covered by the Contract.

Precaution shall be exercised by the Contractor at all times for the protections of persons (including employees) and property. The Contractor shall comply with the provisions of all applicable laws, pertaining to such protection.

Occupational Safety and Health Standards shall apply at all times. The Contractor shall have, in accordance with OSHA requirements, Safety Data Sheets (SDS) available for all applicable materials stored or utilized on the project. Should the Contractor fail to follow OSHA regulations, the RPR may suspend the work until compliance has been achieved. Any such failure to comply with OSHA regulations shall constitute waiver of any right to claim for such suspended work. If regulations are in conflict, the stricter regulation shall apply.

Prior to construction, the Owner will make a reasonable effort to locate, identify and remove potentially hazardous or contaminated materials within the project area. Despite these efforts, some of these materials may be found during the construction of the project. During construction operations, should material be encountered which the Contractor believes to be hazardous or contaminated, that has not been identified in the construction documents, the Contractor shall immediately cease work and notify the RPR.

The RPR will determine the extent and nature of the hazardous or contaminated areas and specify a clean-up plan, if necessary. Once the RPR determines the limits of the area affected by the contaminated materials, work may then be resumed for the remaining areas of the project where contaminated materials, work may then be resumed for the remaining areas of the project where contamination is determined not to present a significant hazard. The RPR will determine the Contractor’s qualifications to perform the work specified in the clean-up plan. If the Contractor is not qualified to do the work specified in the clean-up plan, the Owner will obtain a Contractor for cleanup.

70-07 Public convenience and safety. The Contractor shall control their operations and those of their subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to their own operations and those of their own subcontractors and all suppliers in accordance with Section 40, paragraph 40-05, Maintenance of Traffic, and shall limit such operations for the
convenience and safety of the traveling public as specified in Section 80, paragraph 80-04, Limitation of Operations.

The Contractor shall remove or control debris and rubbish resulting from its work operations at frequent intervals, and upon the order of the RPR. If the RPR determines the existence of Contractor debris in the work site represents a hazard to airport operations and the Contractor is unable to respond in a prompt and reasonable manner, the RPR reserves the right to assign the task of debris removal to a third party and recover the resulting costs as a liquidated damage against the Contractor.

70-08 Construction Safety and Phasing Plan (CSPP). The Contractor shall complete the work in accordance with the approved Construction Safety and Phasing Plan (CSPP) developed in accordance with AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP is included in the Project Specifications.

70-09 Use of explosives. The use of explosives is not permitted on this project.

70-10 Protection and restoration of property and landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer/RPR has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at their expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

70-11 Responsibility for damage claims. The Contractor shall indemnify and hold harmless the Engineer/RPR and the Owner and their officers, agents, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the “Workmen’s Compensation Act,” or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of their own contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, their own surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 Third party beneficiary clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any
member thereof, a third-party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 Opening sections of the work to traffic. If it is necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such “phasing” of the work must be specified below and indicated on the approved Construction Safety and Phasing Plan (CSPP) and the project plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified.

Upon completion of any portion of work listed above, such portion shall be accepted by the Owner in accordance with Section 50, paragraph 50-14, Partial Acceptance.

No portion of the work may be opened by the Contractor until directed by the Owner in writing. Should it become necessary to open a portion of the work to traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the RPR, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at their expense.

The Contractor shall make their own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

The Contractor must conform to safety standards contained AC 150/5370-2 and the approved CSPP.

Contractor shall refer to the plans, specifications, and the approved CSPP to identify barricade requirements, temporary and/or permanent markings, airfield lighting, guidance signs and other safety requirements prior to opening up sections of work to traffic.

70-14 Contractor’s responsibility for work. Until the RPR’s final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with Section 50, paragraph 50-14, Partial Acceptance, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at their own expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.
70-15 Contractor’s responsibility for utility service and facilities of others. As provided in paragraph 70-04, Restoration of Surfaces Disturbed by Others, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and/or in the contract documents.

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of their plan of operations. A copy of each notification shall be given to the RPR.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor’s opinion, the Owner’s assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner’s “Person to Contact” no later than two normal business days prior to the Contractor’s commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the RPR.

The Contractor’s failure to give the two days’ notice shall be cause for the Owner to suspend the Contractor’s operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet of such outside limits at such points as may be required to ensure protection from damage due to the Contractor’s operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the RPR and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the RPR continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or their own surety.
70-15.1 FAA facilities and cable runs. The Contractor is hereby advised that the construction limits of the project include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the execution of the project work, shall comply with the following:

a. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

b. The Contractor shall provide notice to the FAA Air Traffic Organization (ATO)/Technical Operations/System Support Center (SSC) Point-of-Contact through the airport through the Owner, RPR, or Operator a minimum of seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

c. If execution of the project work requires a facility outage, the Contractor shall contact the FAA Point-of-Contact a minimum of 72 hours prior to the time of the required outage.

d. Any damage to FAA cables, access roads, or FAA facilities during construction caused by the Contractor’s equipment or personnel whether by negligence or accident will require the Contractor to repair or replace the damaged cables, access road, or FAA facilities to FAA requirements. The Contractor shall not bear the cost to repair damage to underground facilities or utilities improperly located by the FAA.

e. If the project work requires the cutting or splicing of FAA owned cables, the FAA Point-of-Contact shall be contacted a minimum of 72 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA representative on site to observe the splicing of the cables as a condition of acceptance. All cable splices are to be accomplished in accordance with FAA specifications and require approval by the FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

70-16 Furnishing rights-of-way. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor’s operations.

70-17 Personal liability of public officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, RPR, their authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-18 No waiver of legal rights. Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or their surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill their obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.
The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner’s rights under any warranty or guaranty.

**70-19 Environmental protection.** The Contractor shall comply with all federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, asphalts, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

**70-20 Archaeological and historical findings.** Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during their operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the RPR. The RPR will immediately investigate the Contractor’s finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor’s operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in Section 40, paragraph 40-04, *Extra Work*, and Section 90, paragraph 90-05, *Payment for Extra Work*. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with Section 80, paragraph 80-07, *Determination and Extension of Contract Time*.

END OF SECTION 70
Section 80 Execution and Progress

80-01 Subletting of contract. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Resident Project Representative (RPR).

The Contractor shall perform, with his organization, an amount of work equal to at least 45 percent of the total contract cost.

A person who has been convicted of a violation of Arizona Revised Statutes Section 34-252 is not eligible to enter into any contract either as a contractor, subcontractor or supplier, for a period of up to three years, from the date of conviction, as determined by the court. A person means any individual, partnership, corporation, association or other entity formed for the purpose of doing business as a contractor, subcontractor or supplier.

Should the Contractor elect to assign their contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

The Contractor shall provide copies of all subcontracts to the RPR 7 days prior to being utilized on the project. As a minimum, the information shall include the following:

- Subcontractor's legal company name.
- Subcontractor's legal company address, including County name.
- Principal contact person's name, telephone and fax number.
- Complete narrative description, and dollar value of the work to be performed by the subcontractor.
- Copies of required insurance certificates in accordance with the specifications.
- Minority/ non-minority status.
- Verification that all required Federal Provisions; i.e., Federal Form 1273, Executive Order, and Wage Determination Decisions are attached to each subcontract in any federal aid funded contract.
- The Contractor shall certify to the Owner that all its subcontractors have all the required registrations.

Subcontractors performing contracting work subject to Arizona Revised Statutes Section 32-1101 et seq. shall be duly licensed in accordance with those statutes. Subcontractors providing other services shall be licensed in accordance with the requirements of Arizona law.

The Owner will not consent to subletting of any portion of the Contract if a copy of a subcontracts and lower tier subcontracts is not received. The Owner’s consent shall in no way be construed to be an endorsement of the subcontractor or its ability to complete the work in a satisfactory manner.

80-02 Notice to proceed (NTP). The Owners notice to proceed will state the date on which contract time commences. The Contractor is expected to commence project operations within 7 days of the NTP date.
The Contractor shall notify the RPR at least 24 hours in advance of the time contract operations begins. The Contractor shall not commence any actual operations prior to the date on which the notice to proceed is issued by the Owner.

Notices to the Contractor from the Owner or the RPR for the Notice to Proceed and all other written communications or data, will be considered delivered and the service thereof completed, when said communications have been mailed to the Contractors address, or delivered in person to any qualified representative of the Contractor.

**80-03 Execution and progress.** The RPR may require the Contractor to finish a section of work which is in progress before work is started on any additional sections if the opening of such section is essential to airfield operations and/or the public.

The Contractor shall not commence any actual construction prior to the date on which the NTP is issued by the Owner.

The project schedule shall be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or another format, or as otherwise specified. It shall include information on the sequence of work activities, milestone dates, and activity duration. The schedule shall show all work items identified in the project proposal for each work area and shall include the project start date and end date.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

**80-03.1 Unless otherwise specified or approved, the Contractor shall submit a one hundred twenty (120) Calendar Day CPM progress schedule at least 20 days prior to starting work.** The Contractors 120 Calendar Day CPM Progress schedule, when accepted by the RPR, will be used to establish construction operations and to monitor the progress of the work for the first one hundred twenty (120) calendar days. The remaining progress of work will be based on the accepted Baseline CPM Schedule. CPM Schedule requirements are contained elsewhere in the contract specifications. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the Contract.

Unless suspended, the work shall be diligently and continuously carried on to completion and the Contractor agrees to provide at all times an adequate force of labor and sufficient materials and equipment to ensure the completion of the Contract with the time allowed. The progress of the work.

**80-04 Limitation of operations.** The Contractor shall control their operations and the operations of their subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport. The RPR may require the Contractor to finish a section of work which is in progress before work is started on any additional sections if the opening of such section is essential to airfield operations and/or the public.

When the work requires the Contractor to conduct their operations within an AOA of the airport, the work shall be coordinated with airport operations (through the RPR) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the RPR and
until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, paragraph 70-08, Construction Safety and Phasing Plan (CSPP).

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; and immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor’s operations in the AOA until satisfactory conditions are provided. The areas of the AOA identified in the Construction Safety Phasing Plan (CSPP) and as listed below, cannot be closed to operating aircraft to permit the Contractor’s operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows:

The Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction and the approved CSPP.

80-04.1 Operational safety on airport during construction. All Contractors’ operations shall be conducted in accordance with the approved project Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD) and the provisions set forth within the current version of AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a SPCD that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and SPCD and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP and SPCD unless approved in writing by the Owner. The necessary coordination actions to review Contractor proposed modifications to an approved CSPP or approved SPCD can require a significant amount of time.

80-05 Character of workers, methods, and equipment. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the RPR, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the RPR, be removed immediately by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the RPR. The Contractor and any
Subcontractor shall hold the Owner and its agents harmless from any damages or claims for compensation that may occur in the enforcement of this subsection.

Should the Contractor fail to remove such person or persons, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the RPR may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall not cause injury to previously completed work, adjacent property, or existing airport facilities due to its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless otherwise authorized by the RPR. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the RPR to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the RPR determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the RPR may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this paragraph.

80-06 Temporary suspension of the work. The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods the Owner may deem necessary, due to unsuitable weather, or other conditions considered unfavorable for the execution of the work, or for such time necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the written order to suspend work to the effective date of the written order to resume the work. Claims for such compensation shall be filed with the RPR within the time period stated in the RPR’s order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The RPR will forward the Contractor’s claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather or for any other delay provided for in the contract, plans, or specifications.
If it becomes necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

**80-07 Determination and extension of contract time.** The number of calendar days shall be stated in the proposal and contract and shall be known as the Contract Time.

If the contract time requires extension for reasons beyond the Contractor’s control, it shall be adjusted as follows:

**80-07.1 Contract time based on calendar days.** Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-workdays. All calendar days elapsing between the effective dates of the Owner’s orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded. Contract time stops at substantial completion of the entire project.

The contract time is based on the originally estimated quantities. Should the satisfactory completion of the Contract require performance of work in greater quantities than those estimated in the proposal, the contract time may be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in contract time shall not consider either the cost of work or the extension of contract time that has been covered by change order or supplemental agreement, and the time extension for greater quantities shall be made at the time of final payment.

Requests for extension of time caused by inclement weather shall be supported with National Weather Bureau data showing the actual amount of inclement weather exceeded what could normally be expected during the period of the inclement weather event. Delays caused by inclement weather are excusable but non compensable.

If a nationwide shortage exists in basic materials or standard items which are necessary in the fabrication or manufacture of equipment, parts, or articles to meet the specific requirements of the project, a serious widespread shortage of such equipment, parts, or articles may be considered as a valid reason for the extension of contract time.

The Contractor’s plea that insufficient time was specified along with delivery delays or shortages caused by ordinary supply fluctuations and not nationwide shortages, are not valid reasons for extensions of time.

If the Contractor finds it impossible for reasons beyond his control to complete the work within contract time as specified or as extended, the Contractor shall immediately submit a written request supported by a Time Impact Analysis (TIA) to the RPR for an extension of time setting forth therein the reasons along with documentation to justify the granting of a time extension. If the RPR determines that the work was delayed because of conditions beyond the control and through no fault of the Contractor, he may extend the time for completion is such amount as the conditions justify. The extended time for completion shall then be in full force and effect the same as though it were the original time for completion.
80-08 Failure to complete on time. For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in paragraph 80-07, Determination and Extension of Contract Time) the sum specified in the contract and proposal as liquidated damages (LD), in Table 80-08.1, will be deducted from any money due or to become due the Contractor or their own surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract.

The maximum construction time allowed for all phases and subphases will be the sum of the time allowed for individual phases but not more than 247 days. Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the contract.

Permitting the Contractor to continue and finish the work or any part of it after the time established for substantial completion, or after the date to which the time for substantial completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the Contract.

If the Contractor fails to attain Substantial Completion within the Contract Time as adjusted, the Contractor shall pay the Owner One Thousand Five Hundred Dollars ($1,500) as liquidated damages (not as a penalty) for each Day that Substantial Completion is delayed beyond the Contract Time as adjusted.

<table>
<thead>
<tr>
<th>TABLE 80-08.1</th>
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<tr>
<td>SUBSTANTIAL COMPLETION LIQUIDATED DAMAGES</td>
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<td>Original Contract Amount</td>
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Liquidated damages may also be assessed for the Contractor’s failure to reopen runways, taxiways, taxilanes, and aprons within the allotted daily/shift approved closure hours as follows:

Runways – The Owner may assess liquidated damages of $1,000 per minute for each minute a runway is not reopened within the daily/shift allotted work hours in the Contract, or as approved by the RPR.

Taxiways, Taxilanes, and Aprons – The Owner may assess liquidated damages of $100 per minute for each minute that a taxiway, taxilane, or apron is not reopened within the daily/shift work hours allotted in the Contract or as approved by the RPR.

Liquidated damages may be assessed for the Contractor’s failure to complete construction phases within the allotted closure periods as follows:

Construction Phase Completion – The Owner may assess liquidated damages of $1,500 per calendar day that each specific construction phase or sub-phase (including Phases 3, 4A, 4B, 4C, 4D and 5) is not substantially completed within the time allotted in the Contract.

Construction Phase Completion – The Owner may assess liquidated damages of $1,500 per calendar day that each specific construction phase or sub-phase (including Phases 4A, 4B, 4C, and 4D) that involves the reopening of Taxiway D and Taxiway S is not substantially completed within the time allotted in the Contract.

All punch list work shall be completed, and the project final acceptance granted within thirty (30) calendar days from the date of substantial completion. The Owner may assess liquidated damages of $1,500 for each calendar day or fraction of a day thereof beyond the thirty (30) calendar days from substantial completion and deduct the total from the Contractor’s earned amounts regardless of liquidated damages previously assessed, if all work is not completed and final acceptance granted within thirty (30) calendar days following substantial completion.

**80-09 Default and termination of contract.** The Contractor shall be considered in default of their contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons, if the Contractor:

- a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or
- b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or
- c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- d. Discontinues the execution of the work, or
- e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or
- f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or
- h. Makes an assignment for the benefit of creditors, or
- i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.
Should the Owner consider the Contractor in default of the contract for any reason above, the Owner shall immediately give written notice to the Contractor and the Contractor’s surety as to the reasons for considering the Contractor in default and the Owner’s intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the RPR of the facts of such delay, neglect, or default and the Contractor’s failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the RPR will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

**80-10 Termination for national emergencies.** The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the RPR.

Termination of the contract or a portion thereof shall neither relieve the Contractor of their responsibilities for the completed work nor shall it relieve their surety of its obligation for and concerning any just claim arising out of the work performed.

**80-11 Work area, storage area and sequence of operations.** The Contractor shall obtain approval from the RPR prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate work in accordance with the approved CSPP and SPCD.

**80-12 No Waiver of Legal Rights.** Upon completion of the work, the Owner will expeditiously make final inspection and notify the contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the
Contractor or surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill its obligations under the Contract. A waiver on part of the Owner of any breach of any part of the Contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the Contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the rights under any warranty or guaranty.

80-13 Guarantee and Warranty Provisions. The Contractor shall guarantee the work against defective workmanship or materials for a period of one year from the date of final acceptance under the Contract, ordinary wear and teas and unusual abuse or neglect excepted.

Any omission on the part of the RPR to condemn defective work or materials at the time of construction shall not be deemed an acceptance, and the Contractor shall be required to correct defective work or materials at any time before final acceptance and within one year thereafter.

Should any defects develop within one year from the date of final acceptance due to faults in workmanship or materials the Contractor shall, within fourteen (14) calendar days of receipt of written notice from the RPR begin making the necessary repairs to the satisfaction of the RPR. Such work shall include the repair or replacement of other work or materials damaged or affected by making the above repairs or corrective work, all at no additional cost to the Owner.

If defects develop which are determined by the RPR to be an emergency, the RPR shall notify the Contractor, via the most expeditious means, regarding the nature and condition of the defects. In turn, the Contractor shall immediately dispatch necessary forces to correct the defect or the emergency condition. If the Contractor, in his initial action, resolves the emergency condition but not the defect, a letter as described herein will follow and normal procedures for corrections shall be employed. If immediate or appropriate action, satisfactory to the RPR, is not taken by the Contractor, or if the Contractor cannot be contacted, the RPR will deploy necessary forces to correct and/or secure the deficiency. Costs of the RPR’s action shall be paid by the Contractor and/or bonding agency. Should it later be determined that the defects requiring such emergency action are not the responsibility of the Contractor, the Contractor will be paid for all costs incurred as a result of these demands in accordance with Section 90. Such action by the RPR will not relieve the Contractor of the guarantees required in accordance with this Section or elsewhere in the Contract Documents.

In case of work, materials, or equipment for which written warranties are required in the contract documents, the Contractor shall provide or secure from the appropriate Subcontractor or supplier such warranties addressed and in favor of the Owner and deliver same to the RPR prior to final acceptance of the work. Delivery of such warranties shall not relieve the Contractor from any obligation assumed under any other provisions of the Contract.

The warranties and guarantees provided in this subsection of the contract documents shall be in addition to and not in limitation of any other warranties, guarantees or remedies required by law.

END OF SECTION 80
Section 90 Measurement and Payment

90-01 Measurement of quantities. All work completed under the contract will be measured by the RPR, or their authorized representatives, using United States Customary Units of Measurement.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the RPR.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

When requested by the Contractor and approved by the RPR in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the RPR and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>Excavation and Embankment Volume</td>
<td>In computing volumes of excavation, the average end area method will be used unless otherwise specified.</td>
</tr>
<tr>
<td>Measurement and Proportion by Weight</td>
<td>The term “ton” will mean the short ton consisting of 2,000 pounds (907 kg) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, independently certified scales by competent, qualified personnel at locations designated by the RPR. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the RPR directs, and each truck shall bear a plainly legible identification mark.</td>
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<tr>
<td>Measurement by Volume</td>
<td>Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.</td>
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<tr>
<td>Asphalt Material</td>
<td>Asphalt materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, will be used for computing quantities.</td>
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<tr>
<td>Cement</td>
<td>Cement will be measured by the ton (kg) or hundredweight (km).</td>
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<tr>
<td>Structure</td>
<td>Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.</td>
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<tr>
<td>Timber</td>
<td>Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.</td>
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<tr>
<td>Plates and Sheets</td>
<td>The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.</td>
</tr>
<tr>
<td>Miscellaneous Items</td>
<td>When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.</td>
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<td>Term</td>
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<tr>
<td>Scales</td>
<td>Scales must be tested for accuracy and serviced before use. Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end. Scales shall be accurate within 0.5% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the RPR before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed 0.1% of the nominal rated capacity of the scale, but not less than one pound (454 grams). The use of spring balances will not be permitted. In the event inspection reveals the scales have been “overweighing” (indicating more than correct weight) they will be immediately adjusted. All materials received subsequent to the last previous correct weighing-accuracy test will be reduced by the percentage of error in excess of 0.5%. In the event inspection reveals the scales have been under-weighing (indicating less than correct weight), they shall be immediately adjusted. No additional payment to the Contractor will be allowed for materials previously weighed and recorded. Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the RPR can safely and conveniently view them. Scale installations shall have available ten standard 50-pound (2.3 km) weights for testing the weighing equipment or suitable weights and devices for other approved equipment. All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project. Scales shall be tested and resealed as often as required to assure accurate weights and at intervals not exceeding 365 calendar days. Scales shall be sealed by the Arizona Department of Weights and Measures or a Licensed Service approved by the State of Arizona Department of Weights and Measures.</td>
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<tr>
<td>Rental Equipment</td>
<td>Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered in connection with extra work will be</td>
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<tr>
<td>measured as agreed</td>
<td>in the change order or supplemental agreement authorizing such work as provided in paragraph 90-05 Payment for Extra Work.</td>
</tr>
<tr>
<td>Pay Quantities</td>
<td>When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the RPR. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.</td>
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90-02 Scope of payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of Section 70, paragraph 70-18, No Waiver of Legal Rights.

When the “basis of payment” subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-02.1 Scope of Work. Measurement and payment for pay items in the contract will be as indicated in the applicable specifications.

When payment is specified to be made on the basis of weight, the weighing shall be done by a licensed public weighmaster or the weighmaster’s deputy of a device licensed or certified as defined by Arizona Revised Statutes Section 41-2091 and 41-2093. The Contractor shall furnish the RPR with duplicate Weighmaster’s Certificates showing the actual net weights together with the information required by the rules adopted by the Department ofWeights and Measures as authorized by Arizona Revised Statutes Section 41-2065. The Contractor shall furnish the RPR with duplicate Weighmaster’s Certificates at the time of delivery.

Payment for the various items in the contract will be made at the unit price in the Bid Schedule, and shall be compensation in full for furnishing all labor, materials, equipment, and appurtenances necessary to complete the work in a satisfactory manner as shown on the plans and as required in the specifications, with all connections, testing, and related work completed. Each item, fixture, piece of equipment, etc., shall be complete with all necessary connections and appurtenances, for the satisfactory use and operations of said item. This compensation shall also cover all risk, loss, damage or expense of whatever character arising out of the nature of the work or the prosecution thereof.

Payment will be made for only those items listed in the Bid Schedule. All materials and work necessary for completion of the project are included in the Bid Schedule items. Work or materials not specifically identified in the Bid Schedule are considered as included in the unit price of related contract items, and no additional direct measurement for payment will be made for such work.
No compensation will be made in any case for loss of anticipated profits. Unless otherwise specified, payment will not be made for unused materials.

Taxes are deemed to include all sales, use, consumer and other taxes that are legally enacted at the time of submittal of the or project fee proposal, whether or not they are yet effective or merely scheduled to go into effect. Any such taxes shall be paid by the Contractor and included in the contract bid amount.

The Contractor shall be responsible to contact all municipalities and other governmental agencies having jurisdictional authority over the project or the project area to determine if they will charge the Contractor other fees such as permit fees for the work. Unless otherwise specified in the construction documents, the Contractor shall include the cost of such fees in the Bid Schedule unit prices.

90-03 Compensation for altered quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in Section 40, paragraph 40-02, Alteration of Work and Quantities, will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from their own unbalanced allocation of overhead and profit among the contract items, or from any other cause.

All compensation due the Contractor for alteration or work shall be documented by a Change Order, or other approved Owner forms. The Contractor shall not proceed with work until directed by the RPR.

90-03.1 Increases and Decreased in Contract Amounts. For a decrease greater than twenty-five (25%) percent of either the total cost of the Contract or the total cost of a major item and when a reasonable cost analysis supports an increase in the pro rata share of fixed cost chargeable to this item in total, an increase adjustment in the monies due the Contractor may be made. This adjusted compensation shall not exceed seventy-five (75%) percent of the original extended unit amount (bid price multiplied by original quantity).

For an increase greater that twenty-five (25%) percent of either the total cost of the Contract or the total cost of a major item, any adjustment made will only apply to the cost in excess of one hundred twenty-five (125%) percent of the original total cost of the Contract or, in the case of a major item, in excess of one hundred twenty-five (125%) percent of the original proposed extended unit cost (bid price multiplied by original quantity). If either party presents a reasonable cost analysis that shows a change in the pro rata share of fixed costs chargeable to this item in total, an increase or decrease adjustment will be made. This increase or decrease adjustment will be made on such basis as necessary to cover a reasonable estimate of cost, plus an allowance, not to exceed twelve (12%) percent, for overhead and profit.

For either increases or decreases in cost, no claim shall be made by the Contractor for any loss of anticipated profits. Increases or decreased in quantities or amounts do not apply to Owner or CMAR controlled funds identified in the Bid Schedule.

90-03.2 Alterations Due to Physical Conditions. If the RPR, after his investigation of the site conditions, agrees that they materially differ from those indicated in the Contract and would cause an increase in the Contractor’s cost of accomplishing the work, new unit prices or a lump sum cost (for the additional work only) may be negotiated. If the parties are unable to reach an agreement on scope and prices, the
RPR has the authority to order this additional work accomplished on an actual cost basis as specified in subsection 90-05.

**90-03.3 Due to Extra Work.** If the Contractor can present valid, factual evidence, satisfactory to the RPR, that the work in question was not provided in the Contract, then a unit price or lump sum cost, for this extra work only, may be negotiated. If an agreement cannot be reached between the RPR and the Contractor, the RPR has the authority to order the extra work accomplished on an actual cost basis as specified in subsection 90-05.

**90-03.4 Contractor Requested Changes.** Any approved Contractor initiated changes shall be at no additional costs, a reduction in the contract amounts, or an increase in contract amount as determined by the RPR.

**90-03.5 Due to Failure of Contractor to Properly Maintain the Project.** For any suspension of work due to the Contractor’s failure to properly maintain the project, there will be no additional compensation or adjustments in contract time allowed.

**90-03.6 Allowable Markups.** Allowable Markups are defined in Supplementary Conditions Para. 17 CHANGE ORDER REQUEST MARKUPS AND WORKSHEET.

**90-04 Payment for omitted items.** As specified in Section 40, paragraph 40-03, *Omitted Items*, the RPR shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the RPR omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the RPR’s order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the RPR’s order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the RPR’s order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

**90-05 Payment for extra work.** Extra work, performed in accordance with Section 40, paragraph 40-04, *Extra Work*, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

An Owner and Contractor Controlled Funds Item is provided for the purpose of encumbering funds to cover possible additional work. The amount of the item is determined by the Project Manager and is not subjected to individual bid pricing. All bidders will incorporate the amount pre-entered in the bid proposal and will reflect the same in the total amount bid for this Project. This allowance item provides estimated funding to cover unforeseen conditions that may be encountered and correspond to extra work needed to complete the project per plan. Unforeseen extra work, if any, will be approved by the Project Manager.
It will be understood that this allowance is an estimate only and is based on the history of similar projects. It will not be utilized without the Project Manager’s approval. It is further understood that authorized extra work, if any, may be less than the allowance item.

90-05.1 Allowable Markups. Allowable Markups are defined in Supplementary Conditions Para. 17 CHANGE ORDER REQUEST MARKUPS AND WORKSHEET.

90-05.2 Actual Cost of Work – Time & Materials (T&M). The compensation for actual cost of work (T&M) performed by the Contractor and all Subcontractors shall be determined as follows:

90-05.2.1 Labor. For all labor and for the foremen, when he is in direct charge of the operation, the Contractor will be paid the actual wages plus the percentage thereof to cover the Contractor’s cost incurred as a result of payment imposed by State or Federal Law and payments that are made to, or on behalf of, the workman other than actual wage.

a. Regular Hour Pay (RP) which is determined as follows:
   \[ RP = (WR + FR) \times LB \times OP \]
   Where
   - WR = hourly wage rate as determined by payroll
   - FR = fringe benefit rate as determined by payroll
   - LB = labor burden at 50%
   - OP = overhead and profit percentage permitted by contract

   NOTE: OP is not included in the equation for CMAR contracts

b. Overtime Hour Pay (OT) which is determined as follows:
   \[ OT = (OR + FR) \times LB \times OP \]
Where

OR = overtime hourly wage rate as determined by payroll
FR = fringe benefit rate as determined by payroll
LB = labor burden at 50%
OP = overhead and profit percentage permitted by contract 90-05.1

NOTE: OP is not included in the equation for CMAR contracts

90-05.2.2 Materials. For all material, accepted by the RPR and used in the work, the Contractor will be paid the actual invoice cost of such approved and accepted material including transportation costs. An overhead profit rate of twelve (12%) percent will be added to the T&M invoiced amount.

The Owner reserves the right to furnish such materials as it deems appropriate, and the Contractor shall have no claims for any costs, overhead or profit on materials provided by the Owner.

90-05.2.3 Equipment. Equipment which the RPR has approved for the performance of T&M work will be eligible for payment at the established rates only during the hours that is operated except as otherwise allowed elsewhere in the specifications. Equipment hours will be recorded to the nearest one-half hour. The Contractor will be paid the rental rates as set forth in Equipment Watch. (https://equipmentwatch.com/) Blue book equipment rates, current edition. All rate determinations will be based on the rental rates applicable at the time the equipment is being used.

a. Hourly Rental Rates (Without Operator) (HR)

HR = (R/176 + HOC) * F * OP

Where

R = current Equipment Watch monthly rate
HOC = hourly operating cost
F = regional adjustment factor of 0.933
OP = overhead and profit percentage rate per 90-03.6A

NOTE: OP is not included in the equation for CMAR contracts

The hourly operating cost represents the major costs of equipment operation, such as fuel and oil, lubrication, field repairs, tires, expendable parts, and supplies.

For each piece of equipment used, whether owned or rented, the Contractor shall provide the RPR with the manufacturer’s name, equipment type, year of manufacture, model number, type of fuel used, horsepower rating, attachments required along with their size or capacity, and any further information necessary to ascertain the proper rental rate.

When multiple attachments are included with the rental equipment, only the attachment having the higher rental rate will be eligible for payment, provided the attachment has been approved by the RPR as being necessary for the T&M work.

Approved equipment eligible for payment shall be of modern design and in good working condition. The equipment shall be handled and used to provide normal output or production. Equipment that is not in good working condition or in not of proper size for efficient performance of the T&M work may be rejected by the RPR.
If it is deemed necessary by the RPR to use equipment not listed in Equipment Watch, a suitable rate for such equipment will be approved or established by the RPR. The Contractor may be required to furnish cost data to assist the RPR in the establishment of such rental rate. The rental rates shall be agreed to prior to the use of such equipment on T&M work or paid for by invoices if outside rental equipment is used.

b. **Stand By Time (SBR).** Equipment that is in operational condition and is standing by with the RPR’s approval for participation in T&M work shall be paid for in accordance to the following stand by rate.

\[
SBR = \left( \frac{R}{176} + \text{HOC} \right) \times F \times 0.5 \times OP
\]

Where

- \( R \) = current Equipment Watch monthly rate
- \( F \) = regional adjustment factor of 0.933
- \( OP \) = overhead and profit percentage rate per 90-03.6A

**NOTE:** \( OP \) is not included in the equation for CMAR Contracts

Payment for stand-by will be limited to not more than eight hours in a 24-hour day or 40 hours per week. No compensation will be allowed for equipment that is inoperable due to breakdown. No payment will be allowed for equipment that is not operation because of work suspended by the Contractor.

Rental time will be allowed for the time required to move needed equipment to the location of the T&M work and to return it to its original location. Loading and transportation costs will be allowed in lieu of moving times when equipment is moved by means other than its own power. Moving time back to the original location or loading and transportation costs will not be allowed if the equipment is used at the project site of the T&M work on other contract items or related work.

For use of equipment moved to the work exclusively for T&M work, the cost of transferring the equipment to the site of the work and returning it to the original location will be allowed as specified herein. The original location of the equipment to be hauled to the site of the T&M work shall be agreed by the RPR in advance.

Where the move of the equipment is made by common carrier, the payment will be the invoiced amount paid for the freight plus twelve (12%) percent. If the Contractor hauls the equipment with its own forces, rental will be allowed for the hauling unit plus the driver’s wages and time of loading and unloading the equipment.

The maximum rental period for the day that the equipment is moved on the work site and that the use of the equipment is discontinued shall be the actual time that the equipment is in operation on the T&M work.

**90-05.3 Superintendence.** No part of the salary or expense of anyone connected with the Contractor’s forces above the grade of foreman and having general supervision of the work will be included in the labor items as specified herein.
90-05.4 Actual Cost (T&M) Work by Subcontractors. If it is determined by the RPR that portions of the T&M work to be performed requires specialized labor or equipment not normally used by the Contractor and such work is then authorized to be performed by a Subcontractor(s), the Subcontractor(s) will be paid by the Contractor in accordance with the actual cost (T&M) work procedures outlined in subsection 90.05. The Contractor will be paid the full amount of the Subcontractor(s) approved plus an additional amount specified in subsection 90-05.1C (less markups for overhead and profit for Subcontractor and lower tier Subcontractor(s)). Subcontractor(s) will be paid the full amount of lower tier Subcontractor approved work plus an additional amount specified in subsection 90-05.1C (less markups for overhead and profit for lower tier Subcontractor work.)

90-05.5 Documentation. The Contractor and Subcontractor(s) shall submit an equipment list for all contractor owned equipment to be used during the Contract, along with Equipment Watch sheets for each piece of equipment, within thirty (30) calendars following Notice to Proceed, and prior to the start of any T&M work.

Except for emergency situations, the Owner will not be liable for any actual cost (T&M) work performed by the Contractor prior to authorization by the RPR.

Documentation shall include but not be limited to receipted invoices for all materials used and transportation charges. If materials used on the T&M work are not specifically purchased for such work but are taken from the Contractor’s stock, then in lieu of invoices, an affidavit of the Contractor certifying that such materials were taken from stock, that the quantity claimed was actually used, and the price and transportation claimed represent the actual cost to the Contractor.

Payment for work performed on a T&M basis will not be made until the Contractor and Subcontractor(s) have furnished the RPR, on Owner provided forms, itemized costs of work with backup invoices and receipts as follows:

- Name, classification date, daily hours, start and stop times, rates, and extension for each labor and foreman.
- Designation, dates, daily hours, total hours, start and stop times, rental rates, and extensions for each unit of equipment.
- Quantities of material, prices, extension and transportation cost on a daily basis supported by vendor invoices.

The RPR will compare his records of daily work sheets furnished by the Contractor, resolving any differences and making the required adjustments. Both the RPR’s representative and the Contractor foreman shall sign daily worksheets to track labor, equipment, and materials that are to be used and included in the development and submission of T&M work.

90-05.6 Authority of the RPR. The RPR has the authority to direct which labor and equipment will be used, to suspend operations, and to refuse to pay for any labor or equipment which he considers is not performing productive work.

90-05.7 Non-Allowable Charges. Regardless of whether extra work is paid using extension of existing unit bid prices, negotiated amounts, or actual cost (T&M) work, on change orders, Owner and CMAR Controlled funds, in no case will the Contractor be reimbursed for the following items:

1. Profit in excess of that provided herein;
2. Loss of profit;
3. Home office overhead;
4. Consequential damages, including loss of bonding capacity, loss of bidding opportunities, and insolvency;
5. Indirect costs or expenses of any nature;
6. Attorney fees, claims preparation expenses or costs of litigation;
7. Interest

90-06 Partial payments. Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the RPR, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with paragraph 90-07, Payment for Materials on Hand. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars. Also see Supplementary Conditions Para. 3 PARTIAL PAYMENTS and I.F.B. Para. 36. PAYMENT RETENTION.

a. The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 7 days after the Contractor has received a partial payment. Contractor must provide the Owner evidence of prompt and full payment of retainage held by the prime Contractor to the subcontractor within 30 days after the subcontractor’s work is satisfactorily completed. A subcontractor’s work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

b. When at least 95% of the work has been completed to the satisfaction of the RPR, the RPR shall, at the Owner’s discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done. The Owner may retain an amount up to two and one half (2.5) times the reasonable cost to complete all remaining or defective Work as noted in the Certificate of Substantial Completion or Partial Substantial Completion. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the RPR to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in paragraph 90-09, Acceptance and Final Payment.
The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

**90-07 Payment for materials on hand.** Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the RPR at or on an approved site.

b. The Contractor has furnished the RPR with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the RPR with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner’s payment for such stored or stockpiled materials shall in no way relieve the Contractor of their responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this paragraph.

Partial payments will not be made for materials or equipment until all required certificates of compliance, analysis, and bill of lading have been provided.

**90-08 Payment of withheld funds.** At the Contractor’s option, if an Owner withholding retainage in accordance with the methods described in paragraph 90-06 *Partial Payments*, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner’s deposit of retainage into an escrow account is subject to the following conditions:

a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.
b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 Acceptance and final payment. When the contract work has been accepted in accordance with the requirements of Section 50, paragraph 50-15, Final Acceptance, the RPR will prepare the final estimate of the items of work actually performed. The Contractor shall approve the RPR’s final estimate or advise the RPR of the Contractor’s objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the RPR shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor’s receipt of the RPR’s final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the RPR’s estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with Section 50, paragraph 50-16, Claims for Adjustment and Disputes.

After the Contractor has approved, or approved under protest, the RPR’s final estimate, and after the RPR’s receipt of the project closeout documentation required in paragraph 90-11, Contractor Final Project Documentation, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of Section 50, paragraph 50-16, Claims for Adjustments and Disputes, or under the provisions of this paragraph, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 Construction warranty.

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work, except as noted. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession.

c. The Contractor shall remedy at the Contractor’s expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor’s expense any damage to Owner real or personal property, when that damage is the result of the Contractor’s failure to conform to contract requirements; or any defect of equipment, material, workmanship, or design furnished by the Contractor.
d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor’s warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within 14 days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor’s expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner’s rights with respect to latent defects, gross mistakes, or fraud.

90-11 Contractor Final Project Documentation.

The Aviation Department requires all project related documents to be uploaded to UNIFIER. The following information provides a guideline for utilization. Any questions related to the requirements of UNIFIER should be directed to the Aviation Department Project Manager.

The Contractor will be required to maintain all project records in electronic format. The City provides an Application Service Provider (ASP) web-based project management database which the Contractor will be required to utilize in the fulfillment of the contract requirements. Although this electronic platform does not fulfill this requirement in its entirety, the Contractor will be required to utilize this platform as the basis for this work. The City will provide training to the Contractor’s designated staff members and will provide online access to the UNIFIER software.

The Contractor can expect to use this ASP to process all primary level tri-partite contract documents related to the construction phase of the Project including but not limited to: requests for interpretation/information, potential Change Orders, Change Orders, construction meeting minutes, Submittals, Design Professional’s supplemental instructions and Payment Requests.

The Contractor will be required to process information into electronic digital form. In order to fulfill this requirement, the Contractor will provide all necessary equipment to perform the functions necessary to generate, convert, store, maintain, connect to web-based ASP and transfer electronic data.

The Contractor will provide a computerized networked office platform with broadband internet connectivity. Wired or wireless is acceptable. This platform will function well in a web-based environment utilizing an internet browser compatible with the Aviation Department UNIFIER ASP system.

Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the RPR approves the Contractor’s final submittal. The Contractor shall:
a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with Section 40, paragraph 40-08, Final Cleanup.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer's certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.

j. Project Operation and Maintenance (O&M) Manual(s).


l. Equipment commissioning documentation submitted, if required.

END OF SECTION 90
Section 100 Site Specific Environmental Compliance

100-1 GENERAL. Contractor shall, at Contractor’s own expense, comply with all present and subsequently enacted Environmental Laws, and any amendments thereto, affecting Contractor’s occupation and use of the Premises.

100-2 DEFINITIONS

“Environmental Laws” means those laws promulgated for the protection of human health or the environment, including but not limited to, the following as the same are amended from time to time: the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA], 42 U.S.C. Sections 9601 et seq., as amended by the Superfund Amendment and Reauthorization Act [SARA]; the Solid Waste Disposal Act [SWDA], 42 U.S.C. Sections 6901 et seq., as amended by the Resource Conservation and Recovery Act [RCRA] including Subtitle I, Underground Storage Tanks; the Toxic Substances Control Act [TSCA], 15 U.S.C. Sections 2601 et seq.; the Public Health Service Act (Title XIV) [PHSA] a.k.a. the Safe Drinking Water Act [SDWA] and SDWA Amendments of 1996, 42 U.S.C. Sections 300f et seq.; the Federal Water Pollution Control Act [FWPCA], as amended by the Clean Water Act, 33 U.S.C. Sections 1251 et seq.; the Clean Air Act, 42 U.S.C. Sections 7401 et seq.; Title 49 of the Arizona Revised Statutes, including the Arizona Environmental Quality Act, A.R.S. Sections 49-101 et seq.; the Arizona Comprehensive Air Quality Act, A.R.S. Sections 49-401 et seq.; the Arizona Solid Waste Management Act, A.R.S. Section 49-701 et seq.; the Arizona Hazardous Waste Management Act, A.R.S. Sections 49-901 et seq.; the Arizona Underground Storage Tank Regulation Act, A.R.S. Sections 49-1001 et seq.; the Occupational Safety and Health Act of 1970 as amended, 29 U.S.C. Sections 651-678 and the regulations promulgated thereunder, and, any other laws, regulations and ordinances (whether enacted by local, state or federal government) now in effect or hereafter enacted, that provide for the regulation or protection of human health or the environment, including the ambient air, ground water, surface water, and land use, including substrata soils.

In this Contract, the term “regulated substances” means:

Those substances identified or listed as a hazardous substance, pollutant, hazardous material, and, petroleum, in CERCLA/SARA; the Hazardous Materials Transportation Act, 49 U.S.C. Sections 5101 et seq.; RCRA, Subtitle I, Regulation of Underground Storage Tanks, 42 U.S.C. Sections 6991 through 6991i; Clean Air Act, 42 U.S.C. Section 7412 et seq.; and in any rule or regulation adopted to implement said statutes.

Those substances identified or listed as a hazardous substance, pollutant, toxic pollutant, petroleum, or as a hazardous, special, or solid waste in the Arizona Environmental Quality Act, A.R.S. Sections 49-101 et seq., including but not limited to, the Water Quality Assurance Revolving Fund Act [WQARF], A.R.S. Sections 49-281 et seq.; the Arizona Comprehensive Air Quality Act, A.R.S. Sections 49-401 et seq.; the Arizona Solid Waste Management Act, A.R.S. Sections 49-701 et seq.; the Arizona Underground Storage Tank Regulation Act, A.R.S. Sections 49-1001 et seq.; A.R.S. Sections 49-851
through 49-868 pertaining to Management of Special Waste; the Arizona Hazardous Waste Management Act, A.R.S. Sections 49-921 et seq.; and in any rule or regulation adopted to implement said statutes.

All substances, materials and wastes that are, or that become, regulated, or that otherwise are classified as hazardous or toxic, under any Environmental Law during the term of this Contract.

The term “release” means any releasing, spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, disposing or dumping.

As used herein, the term “Premises” means Contractor’s leasehold and/or any part or portion of Phoenix Sky Harbor International Airport (PSHIA), Phoenix Deer Valley Airport (DVT), Phoenix Goodyear Airport (GYR) or City owned property where Contractor or its employees or agents causes to occur a release of a regulated substance.

As used herein, the term “Contractor” means every consultant, lessee, sublessee, licensee, permittee, concessionaire, tenant or other person, firm or corporation occupying or using the Premises pursuant to an agreement and includes Contractor’s heirs, personal representatives, successors-in-interest and assigns.

100-3 COMPLIANCE Contractor shall not cause or permit any regulated substance to be used, generated, manufactured, produced, stored, brought upon, or released on, or under the Premises, or transported to or from the Premises, by Contractor, its agents, employees, Contractor’s invitees or a third party in a manner that would constitute or result in a violation of any Environmental Law or that would give rise to liability under an Environmental Law.

100-3.1 Contractor may provide for the treatment of certain discharges regulated under the City of Phoenix pretreatment ordinances pursuant to Chapter 28 of the Phoenix City Code or such other ordinances as may be promulgated and the Federal Clean Water Act, 33 U.S.C. Section 1251 et seq.

Contractor shall indemnify, defend and hold harmless, on demand, City of Phoenix (“City”), its successors and assigns, its elected and appointed officials, employees, agents, boards, commissions, representatives, and attorneys, for, from and against any and all liabilities, obligations, damages, charges and expenses, penalties, suits, fines, claims, legal and investigation fees or costs, arising from or related to any claim or action for injury, liability, breach of warranty or representation, or damage to persons, the environment or Premises and any and all claims or actions brought by any person, entity or governmental body, alleging or arising in connection with contamination of, or adverse effects on, human health or the environment pursuant to any Environmental Law, the common law, or other statute, ordinance, rule, regulation, judgment or order of any governmental agency or judicial entity, which are incurred or assessed as a result, whether in part or in whole, of Contractor’s occupancy or use of the Premises during the term of this Contract or any previous contract or uses of the Premises by Contractor or its owners or affiliated entities, agents, employees, invitees, visitors or licensees. Regardless of the date of termination of this Contract, Contractor’s obligations and liabilities under this Section shall continue so long as City bears any liability or responsibility under
the Environmental Laws arising from Contractor’s occupancy or use of the Premises during the term of this Contract. This indemnification of City by Contractor includes, without limitation, costs incurred in connection with any investigation of site conditions or any cleanup, remedial actions, removal or restoration work required or conducted by any federal, state or local governmental agency or political subdivision because of regulated substances caused by Contractor to be present on or under the Premises or present in the soil or ground water on or under the Premises or present in surface waters on or adjacent to the Premises.

100-3.2 Without limiting the foregoing, if the release by Contractor of any regulated substance on or under the Premises, or to the air, groundwater or surface waters on or adjacent to the Premises results in any contamination of the Premises, air, groundwater or surface waters, Contractor shall promptly take all actions at its sole cost and expense that are necessary to mitigate any immediate threat to human health or the environment. Contractor shall then undertake any further action necessary to return the contaminated site to the condition existing prior to the introduction by Contractor of any regulated substance; provided that City’s approval of such actions shall first be obtained. Contractor shall undertake such actions without regard to the potential legal liability of any other person; however, any remedial activities by Contractor shall not be construed to impair Contractor’s rights, if any, to seek contribution or indemnity from another person.

100-3.3 Contractor shall, at Contractor’s own cost and expense, make all tests, reports, studies and provide all information to any appropriate governmental agency as may be required pursuant to the Environmental Laws pertaining to Contractor’s occupancy or use of the Premises. This obligation includes but is not limited to any requirements for a site characterization, site assessment and/or remediation plan that may be necessary due to any actual or potential spills or discharges of regulated substances on, under or from the Premises, or to the air, groundwater or surface waters on or adjacent to the Premises during the term of this Contract. At no cost or expense to City, Contractor shall promptly provide all information requested by City pertaining to the applicability of the Environmental Laws to the Premises, to respond to any governmental investigation, or to respond to any claim of liability by third parties which is related to environmental contamination.

In addition, City shall have the right to inspect, within ten (10) days of Contractor’s receipt of written request, and copy any and all records, test results, studies and/or other documentation, other than trade secrets and legally privileged documents, regarding environmental conditions relating to the use, storage, or treatment of regulated substances by Contractor on, under or from the Premises or to the air, groundwater or surface waters on or adjacent to the Premises.

100-3.4 Contractor shall notify the Aviation Director within twenty-four (24) hours upon learning of the following:

Any correspondence or communication from any governmental agency regarding the application of Environmental Laws to the Premises or Contractor’s occupancy or use of the Premises;

Any change in Contractor’s activities on the Premises that will change or have the potential to change Contractor’s or City’s obligations or liabilities under Environmental Laws;
Any assertion of a claim or other occurrence for which Contractor may incur an obligation under this Section.

100-3.5 Contractor shall at its own expense obtain and comply with any permits or approvals that are required or may become required as result of any occupancy or use of the Premises by Contractor, its agents, employees, invitees and assigns.

100-3.6 Contractor shall insert the provisions of this Exhibit in any agreement or contract by which it grants a right or privilege to any person, firm or corporation under this Contract.

100-3.7 Contractor shall obtain and maintain compliance with any applicable financial responsibility requirements of federal, state and/or local law regarding the ownership or operation of any underground storage tank(s) or any device used for the treatment or storage of a regulated substance and present evidence thereof to the City, as may be applicable.

100-3.8 Contractor shall take reasonable precautions to prevent other persons not acting under Contractor’s authority from conducting any activity that would result in the release of a regulated substance on, under or from the Premises or to the air, groundwater or surface waters on or adjacent to the Premises. Contractor shall also exercise due care with respect to any regulated substance that may come to be located on the Premises as a result of the actions of third parties who are not under Contractor’s authority.

100-3.9 Contractor shall make its best efforts to minimize its production of a waste stream that includes regulated substances, and shall minimize the storage of regulated substances on, in and around the Premises.

100-4. TERMINATION OF AGREEMENT Contractor’s failure or the failure of its agents, employees, contractors, invitees or of a third party to comply with any of the requirements and obligations of this Exhibit or applicable Environmental Law shall constitute a material breach of this Contract and shall permit the City to pursue the following remedies, in addition to all other rights and remedies provided by law or otherwise provided for in this Contract, to which the City may resort cumulatively, or in the alternative.

100-4.1 The City of Phoenix may, at the City’s election, keep this Contract in effect and enforce all of its rights and remedies under the Contract, including (1) the right to recover rent and other sums as they become due by appropriate legal action and/or (2) the right, upon ten (10) day’s written notice to Contractor, to make payments required of Contractor or perform Contractor’s obligations and be reimbursed by Contractor for the cost thereof, unless such payment is made or obligation performed by Contractor within such ten (10) day period.

100-4.2 The City of Phoenix may, at the City’s election, terminate this Contract upon written notice to Contractor. Upon the City’s termination, Contractor shall immediately pay to the City an amount equal to all accrued but unpaid rents plus interest thereon calculated from the date the rent is past
due at a rate equal to: (1) eighteen percent (18%) per annum or (2) the maximum interest rate permitted by state law, whichever is greater.

100-4.3 Notwithstanding any other provision in this Contract to the contrary, the City shall have the right of “self-help” or similar remedy in order to minimize any damages, expenses, penalties and related fees or costs, arising from or related to a violation of Environmental Laws on, under or from the Premises or in surface waters on or adjacent to the Premises, without waiving any of its rights under this Contract.

100-4.4 The exercise by the City of any of its rights under Section C of this Exhibit shall not release Contractor from any obligation it would otherwise have under this Exhibit.

100-4.5 The covenants of this Exhibit shall survive the termination of this Contract.

100-5 AZPDES STORMWATER GENERAL PERMIT COMPLIANCE SUPPLEMENT Contractor shall also comply with the attached AZPDES Stormwater General Permit Compliance Supplement to this Exhibit as if the Supplement is fully set forth herein.

With the exception of discharges on Indian Country, stormwater discharges in Arizona are regulated by the Arizona Department of Environmental Quality through the Arizona Pollutant Discharge Elimination System (AZPDES) program. An AZPDES permit is required for any point source discharge of pollutants to waters of the United States. Because stormwater runoff can transport pollutants to either a municipal separate storm sewer system (MS4) or to waters of the United States, AZPDES permits are required for stormwater discharges.

The City of Phoenix (the “City”) and its Contractors are required to obtain AZPDES permit coverage to the extent that stormwater is discharged from the Premises. Coverage under the AZPDES General Permit for Discharges from Construction Activities to Waters of the United States (AZG2020-001 CGP) (“AZPDES Construction General Permit”) is required for stormwater discharges generated by construction activities. Coverage under the AZPDES General Permit for Stormwater Discharges Associated with Industrial Activity from Non-Mining Facilities to Waters of the United States (AZMSG2019-001) (“AZPDES Multi-Sector General Permit”) is required for stormwater discharges generated by facilities and operations engaged in certain industrial activities. Among these industries are those engaged in “air transportation” and associated activities.

The City has obtained coverage under the AZPDES Multi-Sector General Permit for its “air transportation” facilities at Phoenix Sky Harbor International Airport, Phoenix Deer Valley Airport and Phoenix Goodyear Airport (collectively hereinafter referred to as the “Airports”). The City has adopted a Stormwater Quality Protection ordinance, Phoenix City Code Ch. 32C, and has in place an “Aviation Department Stormwater Enforcement Procedures and Civil Penalty Policy” (“Aviation Stormwater Policy”), both of which were developed to comply with federal and local laws governing stormwater pollution.
100-5.1 COMPLIANCE GENERALLY The City adopted the Aviation Stormwater Policy to achieve compliance with the AZPDES program requirements by the Aviation Department, its contractors and permittees. Contractor is subject to the policy as a condition of its activities, operations, and location at the Airports. The City shall have the right to monitor and require compliance with the Aviation Stormwater Policy.

Contractor agrees to comply with the Aviation Stormwater Policy and to implement at its sole expense, unless otherwise agreed to in writing between City and Contractor, those requirements of the Airports’ Stormwater Pollution Prevention Plans (SWPPP) and City ordinances that pertain to its operations and activities on the Premises at the Airports. Contractor warrants that it will use its best efforts to meet all deadlines that are established by statute, regulation, ordinance, and the Aviation Stormwater Policy, or that are agreed to by the parties. Contractor acknowledges that time is of the essence in the implementation of all City Permit requirements.

Full compliance with the AZPDES Permit Program as contained in 18 A.A.C. 9, Art. 9; Chapter 32(C) of the Phoenix City Code; and the Aviation Stormwater Policy is a material condition of this Contract, and for any breach thereof which exposes City to civil or criminal fine, penalty, sanction or remediation cost by any governmental entity, City may terminate this Contract. This remedy is in addition to any other remedies available to the City.

100-5.2 AZPDES CONSTRUCTION GENERAL PERMIT If Contractor elects to perform construction activities at the Airports, Contractor is required, prior to commencing those construction activities, to obtain stormwater discharge authorization from ADEQ under an AZPDES Construction General Permit. Contractor will obtain that authorization by preparing a SWPPP and filing for AZPDES Construction General Permit coverage in coordination with the City’s project manager. The City will consult with and assist Contractor with regard to the filing for AZPDES Construction General Permit coverage as time and personnel allow. Contractor will also work with the City’s project manager to develop pollution controls (e.g., Best Management Practices, Control Measures, schedules and procedures) for the SWPPP. Contractor is solely responsible for implementation of the pollution controls, all related costs and compliance with its AZPDES Construction General Permit obligations.

100-5.3 AZPDES MULTI-SECTOR GENERAL PERMIT Contractor is required, prior to commencing its operations and activities at the Airports, to obtain stormwater discharge authorization from the ADEQ under an AZPDES Multi-Sector General Permit. Contractor will obtain that authorization as a “Co-Permittee” with the City. As a Co-Permittee, the Contractor agrees to:

Provide the City with a copy of Contractor’s written Authorization to Discharge to the extent Contractor has received such from the Arizona Department of Environmental Quality; and

Implement the Airports’ SWPPP, including Best Management Practices, Control Measures, schedules, and procedures, as applicable to the Contractor’s operations.

In connection with its coverage under the AZPDES Multi-Sector General Permit, the City has developed a SWPPP for the Airports to minimize the contact of storm and other precipitation event
water with “significant materials” (as defined in the Regulations and City Ordinances) generated, stored, handled or otherwise used on Airport facilities. The City shall provide a copy of the SWPPP, including Best Management Practices, Control Measures, schedules, and procedures to Contractor, and Contractor shall implement that portion of the SWPPP applicable to its activities.

The City agrees that, to the extent allowed by law, Contractor shall have the right to be removed as a Co-Permittee from coverage under the AZPDES Multi-Sector General Permit should its Contract be canceled or terminated for other reasons, or due to Contractor’s relocation, noncompliance with the AZPDES Multi-Sector General Permit requirements or Contractor’s exercise of choice. In no event shall Contractor be relieved of its obligation to comply with the requirements of the AZPDES permit program with regard to its occupation and use of the Premises at the Airports, nor shall Contractor be excused from any obligations or indemnifications incurred and owed to City prior to Contractor’s removal as a Co-Permittee that result from a failure of Contractor to fulfill an obligation of a Co-Permittee.

100-5.4 POLLUTION CONTROLS City reserves the right to impose upon Contractor any Best Management Practices, Control Measures, schedules, and procedures, other action necessary to ensure City’s ability to comply with its AZPDES program requirements or applicable City ordinances; however, except in "extreme emergency" conditions, Contractor shall have ten (10) days from date of receipt of written notice imposing such pollution control measures or other requirements to notify City in writing if it objects to any action it is being directed to undertake. If Contractor does not provide the specified timely notice, it will be deemed to have assented to implementation of the pollution control measures or other requirements. If Contractor provides City with timely written notice of its objections, the parties agree to negotiate a prompt resolution of their differences. Contractor warrants that it will not serve a written notice of objections for purposes of delay or avoiding compliance.

As used herein, "extreme emergency conditions" means:

Conditions that impose an immediate impact on waters of the United States (e.g., Salt River) resulting from an emergency situation such as fire, spill, release or explosion, such that the facility responsible for the release must immediately begin appropriate response activities independently of City's direction or oversight;

An emergency such that a facility has to close because of a catastrophic event, where the facility can extend the ten (10) day notice period, but must implement pollution control measures before it reopens;

A collapse of the storm sewer system or other event which forecloses the Airports and/or City from performing its obligations under the City Permit due to lack of capacity.

100-5.5 COVENANT OF GOOD FAITH City and Contractor covenant to act in good faith to implement any AZPDES program requirements imposed on them pursuant to 18 A.A.C. 9, Art. 9. City and Contractor acknowledge that close cooperation will be necessary to ensure compliance with any
AZPDES Multi-Sector General Permit requirements to promote safety and minimize costs, and each party agrees to a candid exchange of information necessary to coordinate a stormwater management and monitoring plan.

100-5.6 INDEMNIFICATION The covenants of insurance and indemnification in favor of City imposed by other provisions of the Contract shall extend to, and are incorporated into, the provisions of this Supplement to Exhibit 3.

100-5.7 COVENANT OF GOOD FAITH City and Contractor covenant to act in good faith to implement any AZPDES program requirements imposed on them pursuant to 18 A.A.C. 9, Art. 9. City and Contractor acknowledge that close cooperation will be necessary to ensure compliance with any AZPDES Multi-Sector General Permit requirements to promote safety and minimize costs, and each party agrees to a candid exchange of information necessary to coordinate a stormwater management and monitoring plan.

100-6 DISPOSAL OF SURPLUS MATERIAL All surplus and/or waste material must be disposed of off the Airport property at the Contractor's discretion, subject to the following conditions:

If the City landfills are used, the Contractor will pay the normal dumping fee.

If private property within the City limits is used, the Contractor will obtain written permission from the property owner and deliver a copy of this agreement to the City prior to any hauling dumping. If the surplus material is disposed of outside City limits, the Contractor will comply with all applicable laws/ordinances of the agency concerned and be responsible for all costs incurred.

100-7 ASBESTOS/LEAD BASED PAINT IDENTIFICATION AND REMEDIATION Asbestos and lead based paint identification and/or remediation will be performed by the Contractor unless otherwise indicated in the contract documents. Prior to starting Work, the Contractor should obtain a copy of the asbestos and lead based paint survey of the affected area and contact the City of Phoenix Aviation Environmental Division Manager prior to the disturbance of any building materials that contain or potentially contain asbestos or lead based paint. Building materials that could potentially contain asbestos include any materials that are not wood, metal or glass. Any building materials that will be disturbed during renovation or demolition projects that have not been previously inspected will be inspected by an Asbestos Hazard Emergency Response Act (AHERA) certified building inspector approved by the City of Phoenix. Any asbestos and lead based paint remediation activities will be conducted by contractors licensed to perform asbestos and lead based paint remedial activities and will be approved by the City of Phoenix. All asbestos and lead based paint inspection and remedial work will be performed in compliance with all applicable local, state and federal regulations regarding asbestos, lead based paint and general construction.

100-8 Method of Measurement.
100-8.1 Removal and Abatement of Foreign Substances/Contaminates shall be measured by and paid on a time and material basis as outlined in Section 90, paragraph 90-05, Payment for Extra Work.
100-9 Basis of Payment.

100-9.1 Payment for Removal and Abatement of Foreign Substances/Contaminates shall be paid up to the maximum of the contract price based on the requirements of Section 90, paragraph 90-05, *Payment for Extra Work*. This price shall constitute full compensation for furnishing all personnel, vehicles, survey, equipment, all other equipment, all materials, tools and incidentals necessary as specified herein to accomplish and construct the work within the tolerances specified herein.

END OF SECTION 100
Section 110 Airport Operations and Security

110-1 DESCRIPTION

110-1.1 GENERAL. The Contractor shall carry out his operations in a manner that will cause a minimum of interference with air traffic, and shall cooperate with the FAA, the City, the Phoenix Sky Harbor International Airport (PHX) airlines, tenants, flight schools and Fixed Base Operators, and other contractors working in the area.

All work shall be completed in accordance with the Construction Safety and Phasing Plan (CSPP) adopted for the project, the Contractor prepared Safety Plan Compliance Document (SPCD), FAA Advisory Circular 150/5370-2, that is in effect on the date of advertisement, and the City of Phoenix Department of Aviation’s Airport Construction Safety Manual and Technical Specifications of these Contract Documents.

Phasing of the work will be necessary to minimize impacts on airport operations during construction. The priorities for phasing of the work are shown in the CSPP.

All work within the Runway Safety Area will require that the runway be closed.

The preparation of a Safety Plan Compliance Document (SPCD) by the Contractor to indicate how it will comply with the CSPP, and the project Civil Technical Specification 1 Airport Safety and Security is included in the Contractor’s scope of work.

Any conflicts between the CSPP, the Contract Documents and General Technical Provision Section 20, Airport Barricading, Safety and Security, shall be reported to the RPR, Aviation Department Project Manager, PHX Aviation Supervisor and the Engineer of Record for resolution. Until resolved, the Contractor shall comply with the most stringent requirement.

The Contractor shall hold weekly airfield coordination meetings with PHX Airport Operations. Additionally, the Contractor shall meet with Airport Operations prior to the start of each shift to discuss the day’s anticipated work activities.

All vehicles shall have flashing amber lights in accordance with the CSPP and Section 20.

The Contractor shall be required to supply, place, maintain, move and store the items listed herein, as appropriate, to facilitate construction and protect air traffic. The Contractor shall keep on site an adequate extra supply of these items.

All work within the Runway Safety Area will require all personnel to be PHX SIDA badged.
110-2 MATERIALS

110-2.1 RED WARNING LIGHTS. Red warning lights shall be flashing lights meeting the requirements of the “Manual on Uniform Traffic Control Devices for Streets and Highways” for Type A and Type B flashers or as shown in the Airport Construction Safety Manual. All warning lights used on the airfield shall be RED only.

110-2.2 WARNING MARKERS. (For use on roadways and service roads only) Warning markers shall be the type and size detailed on the plans or shown in the CSPP. Markers shall be equipped with a red warning light per paragraph 110-2.1.

110-2.3 TEMPORARY RUNWAY/TAXIWAY CLOSED DEVICES AND SYMBOL. The airport operations personnel will provide “Lighted X’s” to mark all runway closures. The closed devices shall be portable lighted “X”, SWEEPSTER Model LX Runway Closure Marker conforming to FAA AC 150/5345-55 Specification for L-893 Lighted Visual Aid to Indicate Temporary Runway Closure, that is in effect on the date of advertisement or approved equal.

All other temporary closure symbols, including vinyl “X’s”, shall be painted or applied on the pavement surface in accordance with the CSPP, plans and Civil Technical Specification Item P-620.

110-2.4 LOW AND MEDIUM LEVEL BARRIER SYSTEMS. Medium and low-level barriers shall be the Airport Runway Safety Barricade Model AR-1 and AR-2 Multi-BARRIER as manufactured by Off The Wall Products, LLC, or approved equal. The AR-1 barrier medium level sections shall be eight (8) feet long and two (2) feet high and the AR-2 low level barrier sections shall be eight (8) feet long and ten (10) inches high and shall have reflective sheeting on the side facing the active airfield. Both sections shall be interlocking and shall be ballasted with water to prevent damage from jet blast. Each barricade section shall be equipped with a Model: SL-H867R Solar Powered Safety lights as manufactured by Leotek Electronics USA Corp. or approved equal. The barriers shall be furnished, maintained and relocated during each phase by the Contractor, and at the completion of the Contract they shall become property of the City.

110-2.5 VACUUM SWEEPER. Vacuum Sweeper shall be Tymco, Model HSP-600 or Elgin Model Crosswind, or approved equal. A sweeper and operator shall always be available during construction activities if requested by Owner or RPR.

110-2.6 SAFETY AREA SUPPORT. Reinforced structural steel plates, precast slabs or other approved material necessary to cover open excavation in the Runway Safety Area shall conform to Paragraph 110-5.1(1)(c)(i). Excavations that cannot be covered to provide the required protection shall be backfilled.

110-2.7 SECURITY CHECK POINTS AND CONTROLLED CROSSINGS. Provide as shown on the plans, in the CSPP, in Appendix A of the SPCD, and as detailed within this specification, the items necessary to control access to the Air Operations Area (AOA) through Entry Gate #220 and control crossings at active taxiways. These items include, but are not limited to the following:

1) Flaggers equipped for daytime and nighttime operations.
2) Marking, symbols, barrier systems and warning markers in accordance with the CSPP and this specification.

110-3 RESPONSIBILITIES

110-3.1 CONTROL REQUIREMENTS. 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. The Contractor is required to submit a Safety Plan Compliance Document (SPCD) to indicate how he/she will comply with the Construction Safety and Phasing Plan (CSPP) and how he/she will safely operate within the AOA. This SPCD shall conform to Chapter 2, Safety Plans, Operational Safety on Airports During Construction, AC 150/5370-2 that is in effect on the date of advertisement and the Aviation Department Airport Construction Safety Manual, June 2006. It shall be submitted and approved by the Airside Operations Manager before the commencement of any construction. Information needed for preparation of the SPCD is located in AC 150/5370-2 that is in effect on the date of advertisement, the CSPP and at the end of this section.

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 RPR in writing a detailed work plan for each construction phase. The work plan shall include, but not be limited to, paving sequence, marking sequence, 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 RPR in writing a plan, by construction phase, for controlling construction equipment and vehicular movements, including material haul roads, in the Air Operations Area (AOA). This plan shall be submitted at the Pre-Construction Meeting and prior to each construction phase. No work may commence until this plan is approved by PHX Airport Operations. The plan must include material haul roads.

5) Paved surfaces shall be kept clear at all times and specifically must be kept free from all Foreign Object Debris (FOD) which could potentially damage aircraft.

6) The Contractor shall ensure that no personnel or equipment enters the active movement areas or their associated Object Free Areas without the appropriate Airport Operations escort. Access into movement areas or Object Free Areas without an Airport Operations escort is prohibited!

7) The Contractor will be required to coordinate his work so as to satisfy clearance requirements for arrival and departure of aircraft in compliance with the CSPP and in
compliance with FAA Advisory Circular 150/5370-2 that is in effect on the date of advertisement, concerning Operational Safety on Airports during Construction.

110-3.2 VEHICLE AND PEDESTRIAN CONTROL. Vehicle and access routes for airport construction shall be controlled as necessary to prevent inadvertent or unauthorized entry of persons, vehicles or animals onto Air Operation areas. No vehicle shall enter the AOA except at predetermined locations. The amount of construction traffic may require a flag person to control traffic in aircraft movement areas. Contractor personnel who operate vehicles in the AOA shall comply with the Airport Operations rules and regulations for vehicle marking, lighting, and operation. Failure to comply may result in contract non-compliance costs and Notice of Violation assessments, per paragraph 110-3.10.

110-3.3 CONTROL AND WARNING DEVICES. During construction operations near active taxiways or runways the Contractor shall furnish and maintain medium and low level barricades equipped with red warning lights along the edges of the runway and taxiway safety areas to warn construction equipment to stay clear of the active airfield pavement as well as warn pilots of areas having construction hazards. Per paragraph 110-2.4 barricades shall be equipped with red lights acceptable to the Airport Operations. The Contractor shall furnish and maintain warning markers with red warning lights along the edges of the runway safety area as designated and detailed on the plans. The Contractor shall maintain red warning lights and warning flags around all equipment, stockpiles, or other areas as directed by the RPR and Airport Operations.

The Contractor shall provide the phone numbers of five (5) of its responsible personnel, including the project superintendent, and responsible personnel, from the paving and safety subcontractors, each of whom may be contacted in an emergency. Personnel shall be on call 24 hours per day for maintaining construction hazard lighting and barricades. The Contractor shall employ watchmen to maintain and service all traffic control equipment.

110-3.4 VEHICLE MARKING AND IDENTIFICATION. All permitted vehicles operating in the AOA shall display in full view above the vehicle a 3’ x 3’ or larger, orange and white checkerboard flag, each checkerboard color being 1’ square. Any vehicle operating on the AOA shall be equipped with a flashing amber dome-type light, mounted on top of the vehicle and of such intensity to conform to local codes for maintenance and emergency vehicles. All vehicles operating within the airfield boundary which are approved for unescorted access shall be identified with a painted or magnetic sign on each side of the vehicle bearing the name and/or logo of the company. If with magnetic signage, an Airside Vehicle Permit, obtained through the airports Security Badging Office, must be displayed on the vehicle’s dashboard at all time while operating in the AOA. The sign (painted or magnetic) shall conform to the requirements below:

Rented or leased vehicles cannot be granted unescorted access unless the above signage is placed on it. All vehicles with unescorted access must have available for inspection, when entering the Restricted area or while in the Restricted area, the current registration and proof of insurance for the vehicle.

Vehicles making only occasional visits to the job site are exempt from the identification requirements contained above provided that the Airside Operations Manager is notified and a properly identified vehicle escorts them into, throughout, and out of the airport secured area. These and other vehicles
needing intermittent identification may be marked with tape or with magnetically attached markers that are commercially available to meet identification size and content requirements.

110-3.5 VEHICLE TRAFFIC AND OPERATIONS. When any vehicle other than those approved for use in the AOA is required to travel to or from the work area or over any portion of the work area, shall be escorted by a vehicle properly identified to operate in the area and be provided with a flag on a staff attached to the vehicle. All construction vehicles/equipment shall have automatic signaling devices to sound an alarm when moving in reverse. All equipment shall be operated within the approved speed limits.

All vehicles and/or construction equipment operating inside the active AOA movement area shall be escorted by Airport Operations, who will maintain radio contact with the ATCT. Crossing the active runway shall not be permitted. Vehicular traffic routes which need to cross an active taxiway shall be coordinated in advance (at least 72 hours) with Airport Operations to ensure that proper Notices to Airmen (NOTAMs) are in place. These prearranged traffic routes must be controlled by flag-persons as detailed on the plans. Aircraft always have the right-of-way. Construction equipment shall always yield to aircraft. Construction vehicle traffic shall never cross an active taxiway unless escorted by Airport Operations or at the pre-approved crossing points while crossing guards are stationed.

The Flag-persons shall be equipped with handheld signs or flags to assist in directing construction traffic. For nighttime construction operations, the flag-person shall also be equipped with lighted wands and light plants. In addition, one vacuum sweeper and one water truck shall be dedicated to and stationed full time along the haul route to maintain the surface of the AOA be free from construction traffic debris. Mud and other material tracked onto taxiway surfaces shall be removed by hand if necessary, to achieve its complete removal.

Prior to entering any work site within the AOA, the Contractor will physically meet with Airport Operations to brief each other on the intended activities. The Contractor must also arrange a physical inspection of the work area with Airport Operations prior to leaving any area that has been closed for work, or that has been used for a crossing point or haul route by the Contractor.

110-3.6 VEHICLE PARKING. All vehicles shall be parked and serviced in the designated staging and employee parking areas shown on the plans. The Contractor is responsible for transporting his/her employees from these areas to the jobsite.

110-3.7 RADIO COMMUNICATIONS. The control of vehicular activity on the AOA is of the highest importance. This requires coordination with airport users and Air Traffic Control Tower (ATCT). The Contractor shall have no direct contact with the ATCT. All communications with the ATCT shall be coordinated through Airport Operations. However, the Contractor shall properly train his/her personnel, particularly flag-persons, on the proper procedures for monitoring radio frequencies.

110-3.8 AIRPORT SECURITY REQUIREMENTS. The Contractor will be required to coordinate work to satisfy clearance requirements for arrival and departure of scheduled aircraft, and in compliance with the latest version FAA Advisory Circular 150/5370-2 concerning operational safety on airports during construction activity.
The airport is operated in strict compliance with Federal, State and local rules and regulations, which prohibits unauthorized persons or vehicles in the AOA. Equipment and personnel will be restricted to the work areas defined on the plans. Any violations by Contractor’s personnel will subject the Contractor to the contract non-compliance assessments imposed by FAA and the Aviation Department.

Airport restricted areas are fenced and must always remain fenced. No temporary airport perimeter security fencing is required for this project. If, as the project progresses, any temporary security fences and/or gates are required they shall be constructed by the Contractor according to specifications set by Airport Operations. The temporary fence and gate must be approved by Airport Operations before any of the regulated perimeter security fence may be altered. The gates will remain closed and locked, or if used continuously for ingress and egress, the Contractor will provide approved guards trained by Airport Operations to monitor access to the Airport. The Contractor shall provide guards with a roster of his personnel and ensure that each individual has adequate identification. Contractor locks are not permitted on any airport gate. Gates will be staffed during shift working hours and will be secured when there is no activity at that location with a Security approved control device. The Contractor will be responsible for at a minimum a 24-hour advance notification to Airport Operations regarding the scheduling of the use of the various security check point gates. There will be a communications system for emergency responses, security breaches, etc.

Entrance to the airfield is subject to strict security regulations. All personnel entering the airfield must obtain and display Airport security identification badges (PHX SIDA) and all vehicles must meet minimum identification requirements and have proof of insurance on file with the Airport Security Office. All vehicles will be searched upon entering the AOA. All vehicles will be searched each time prior to passing the security check points and may be subject to random searches while operating in the AOA. Due to these TSA mandatory searches, throughput of vehicles entering the AOA at these check points may be severely reduced, thereby possibly affecting the execution of some construction activity. The Contractor must account for the possible loss of time associated with these vehicle searches in his/her bid. No additional time or compensation will be permitted for actions resulting from these vehicle searches.

The Contractor shall maintain the security integrity between the public and AOA. All barrier designs and their phasing shall be submitted to the Aviation Department and approved by them in writing prior to erection.

All construction personnel assigned to the project, except for escorted in-transit material suppliers, shall make application for and wear security badges. The term of the badge will be no more than six months or up to the contract completion date, whichever is first. If the prime contract is for more than six months, a renewal badge application will be required at no cost to the company making the application. The Contractor and the subcontractor can make application for these items by contacting Phoenix Aviation Department Airport Security Office at (602) 273-2036 to make arrangements. Airport badges will be issued for each employee contingent on the successful completion of the airport’s badging process. Each employee shall be responsible for paying the current fee schedule. Badges must be surrendered upon termination of the employee or contract. The Contractor must notify the Airport Security Office (273-2036) immediately to report any badges that are lost or stolen. The Contractor’s employees, the subcontractor’s employees and others taking
the Airfield Drivers Training class and the Security class should anticipate that the duration to wait in line, and submit to fingerprinting, may take one to two hours per person. Required classes will be scheduled upon completion of the federal background check and may take two to five days to schedule and two to three hours to complete.

The Contractor shall maintain an up-to-date record of all badge holders showing name, address, social security number and Immigration form I-9 (eligibility to work in the United States). The Contractor will be required to furnish this information to the Airport upon request.

The Contractor shall restrict passage into the Security Area to badged persons, vehicles and equipment displaying his identification or that of the Airport. Should the Contractor wish to allow visitors, vendors or delivery through his access point, he shall provide an escort in accordance with escort procedures.

The Contractor shall be responsible to provide at his own cost a badged escort for all vehicles that do not operate daily within the AOA. Escorted vehicles shall not be left unattended. The badged escort shall always remain with the escorted vehicle while on the AOA and shall be escorted back and forth to the point of entry. One badged escort vehicle shall be required for EACH unbadged vehicle. One badged escort vehicle is permitted to escort up to two (2) material delivery trucks and transit mix trucks. There will be no exceptions to this requirement.

The Contractor is required to submit a plan on how he/she will safely operate within the AOA. This plan shall be submitted and approved by the Airside Operations Manager before the commencement of any construction. The Contractor is required to prepare, submit for approval and maintain during construction a plan for managing Airport Security Badges of his/her employees, subcontractors or any other party recommended by the Contractor for badging. This plan shall be submitted to Airport Operations prior to the Pre-Construction Meeting.

The Contractor will contact the Airside Operations Manager, telephone (602) 273-3490 ten (10) days prior to start of construction to submit the necessary airport security information for all vehicles and personnel required inside the restricted area during construction.

**110-3.9 VEHICLE OPERATIONS IN RESTRICTED AREAS:** In addition to other Contract insurance requirements vehicle insurance coverage is applicable for any vehicle operations that is required in the airport's Restricted Areas and must be submitted in the proper format to the airport's Security Badging Office before vehicle operations will be permitted on any Restricted Areas. The certificate holder of this certification will be The City of Phoenix Aviation Department. Contractor or its subcontractors must provide their own coverage in the amounts as required by the airport's Security Badging Office. All vehicles that will be used in the Restricted Area must be covered by this certificate. Certificate of insurance must be in the amount of five million dollars ($5,000,000) dollars with at least one million dollars ($1,000,000) of the combined limit listed in automobile liability. The City must be named as certificate holder and additional insured with respect to liability arising out of the activities and operations performed by or on behalf of the Contractor. Coverage is to be primary and non-contributory. All personnel must be in possession of a valid unexpired driver’s license when operating a vehicle in the airport's Restricted Area.
110-3.10 CONTRACTOR AND SUBCONTRACTOR WORKER BACKGROUND SCREENING:
Contractor agrees that all Contract Workers that Contractor allows to perform work under this Contract shall be subject to background and security checks and screening (Background Screening). Contractor must pay for the cost of all Background Screenings, unless otherwise provided in the Scope of Work. Contractor agrees that Background Screenings required by this Section is necessary to preserve and protect public health, safety, and welfare. The Background Screening requirements set forth in this Section are the minimum requirements for this Contract. The City does not warrant or represent that the minimum requirements are sufficient to protect Contractor from any liability that may arise out of Contractor’s work under this Contract or Contractor’s failure to comply with this Section. Therefore, in addition to the Background Screening measures set forth below, Contractor and its Contract Workers shall take such other reasonable, prudent, and necessary measures to further preserve and protect public health, safety, and welfare when providing work under this Contract.

As used in this Section, “Contract Worker” means a person performing work for the City, including (1) a person or entity that has a contract with the City, (2) a worker of a person or entity that has a contract with the City, (3) a worker of a subcontractor of a person or entity that has a contract with the City, and (4) a worker of a tenant of the City. (City of Phoenix A.R. 4.45)

1. Legal Worker Background Check
Pursuant to Arizona Revised Statutes (A.R.S.) § 41-4401, Contractor must verify the legal Arizona worker status of each Contract Worker. Contractor must conduct and all Contract Workers must pass a background check for their real identity and legal name prior to performing any work under this Contract.

2. City Rights Regarding Security Inquiries
In addition to a Legal Worker Background Check, the City reserves the right to require Contractor to:
   a) Have a Contract Worker provide fingerprints and execute any document that is necessary to obtain criminal justice information pursuant to A.R.S. § 41-1750(G)(4) or Phoenix City Code § 4-22 or both;
   b) Act on newly acquired information, whether or not the information should have been previously discovered;
   c) Unilaterally change its standards and criteria related to the acceptability of Contract Workers; and
   d) Object, at any time and for any reason, to a Contract Worker performing work under this Contract, including supervision and oversight services.

3. Contractor Certification
By entering into this Contract, Contractor certifies that Contractor has read the Background Screening requirements and criteria in this Section, understands them, and that all Background Screening information furnished to the City is accurate, complete, and current. A Contract Worker that is rejected for work under this...
4. Contractor’s Contracts and Subcontracts
Contractor shall include the terms of this Section for Contract Worker Background Screening in all contracts and subcontracts for work performed under this Contract, including supervision and oversight services.

5. Materiality of Background Screening Requirements and Indemnity
The Background Screening requirements of this Section are material to the City’s decision to enter into this Contract. Any breach of this Section by Contractor shall be deemed a material breach of this Contract. In addition to any other indemnification provision in this Contract, Contractor shall defend, indemnify, and hold harmless the City from and against any and all claims, actions, liabilities, damages, losses, and expenses (Claims) arising out of this Background Screening Section, including the Contractor’s disqualification of any Contract Worker or the City’s failure to enforce this Section.

6. Continuing Duty and Audit
Contractor’s obligation to ensure that all Contract Workers pass a Background Screening pursuant to Section shall continue throughout the entire term of this Contract. Contractor shall immediately notify the City of any change to a Contract Worker’s Background Screening. Contractor shall maintain all records and documents related to all Background Screenings and the City reserves the right to audit Contractor’s compliance with this Section.

110-3.11 CONTRACT WORKER ACCESS CONTROLS AND AIRPORT SECURITY BADGE REQUIREMENTS.
Contractor shall not allow a Contract Worker to begin work under this Contract until Contractor has completed the Background Screening required by the City and the City has issued the appropriate airport security badge to the Contract Worker. The airport security badge will grant the Contract Worker unescorted access authority only to the area or areas of the Airport that the Contract Worker must enter in order to perform work under this Contract. When a Contract Worker’s work in any area ends, the Contract Worker’s access authority to that area ends. Any Contract Worker that attempts to enter a restricted area or sterile area, as those terms are defined below, of the Airport without proper authority is an immediate breach of this Contract.

110-3.12 SECURITY IDENTIFICATION DISPLAY AREA (SIDA) BADGE PROCESS.
Each Contract Worker that needs unescorted access authority to a restricted or sterile area of the Airport in order to perform work under this Contract must receive a security identification display area (SIDA) badge from the Aviation Department’s Public Safety and Security Division’s Badging Office. Contractor must make arrangements with the City to have each Contract Worker proceed to the Badging Office for processing. The Badging Office will not issue a SIDA badge until the Contract Worker passes a fingerprint-based criminal history background check (CHRC) required by federal law (49 C.F.R. § 1542.209) and § 4-22(C) of the Phoenix City Code and passes a security threat assessment as mandated by the TSA through a security directive (49 C.F.R. § 1542.303). The Contract Worker shall
comply with all requirements of and furnish all information requested by the Badging Office. Contractor shall pay for all fees associated with SIDA badging process, unless otherwise provided in the Scope of Work. Fees will be assessed according to § 4-22(D) of the Phoenix City Code. Current badging procedures and fees are available for review at https://www.skyharbor.com/security/BadgingInformation.

As used in this Section, “restricted area” means the secured area and SIDA area of the Airport. “Secured area” means the part of the Airport in which certain federal security measures are implemented and where airlines enplane and deplane passengers and load baggage. “SIDA area” means the secured area and other areas designated by the Aviation Department, which include air operation areas, ground transportation areas, and the Rental Car Center security doors. “Sterile area” means the part of the Airport that provides passengers access to board aircraft and is controlled by the TSA or the airline by screening of persons and property. See § 4-22 of the Phoenix City Code and Rules 05-01 and 05-09 of the Aviation Department Rules and Regulations for a complete definition of the foregoing terms.

**110-3.13 RISK-BASED BACKGROUND CHECK PROCESS** The City has established two levels of risk for Contract Worker background checks: standard risk and maximum risk. If the Scope of Work changes, the City may change the level of risk, which may require Contractor conduct additional investigations and incur additional costs in order to process a background check and obtain the required airport security badge. Contract Workers who receive a SIDA badge are exempt from a standard and maximum risk background check.

A MAXIMUM RISK BACKGROUND CHECK is required for all non-exempt Contract Workers performing work under this Contract.

As used in this Section, “background check” means the fact-gathering process described in City of Phoenix A.R. 4.45 that is conducted to obtain information regarding a Contractor’s legal Arizona eligibility, criminal history, driving history, certifications, and other matters that may affect the Contractor’s ability or fitness to perform work under this Contract.

1. Before any work is performed under this Contract, Contractor shall provide the City with a list of its Contract Workers.

2. If any dispute arises related to a background check process or criminal history check information, then Contractor and the affected Contract Worker will resolve the dispute. The City will not get involved in resolving any such dispute.

3. In making the determination whether information in a background check renders the Contract Worker disqualified, Contractor should be guided by the following principles and guidelines:

   a. Disqualification should not be based solely on a criminal conviction, unless the conviction related to performance under this Contract.

   b. Arrests that did not result in a conviction being entered or charges being filed may not be considered.
c. Not all criminal convictions or other negative information obtained in a background check will disqualify a Contract Worker from working under this Contract.

d. Contractor must evaluate the relevance of the information to the work the Contract Worker will perform under this Contract.

e. Contractor must consider the following factors in determining whether negative background information disqualifies a Contract Worker:
   - Duties of the position
   - Time, nature, and number of negative events and convictions
   - Attempts and extent of rehabilitation efforts
   - The relation between the duties of the position and the nature of the crime committed

4. The analysis of whether any information in a background check is a potentially disqualifying factor involves looking at the requirements of the Contract, the Scope of Work, where the work will be performed, the need for access to restricted areas, and the type of persons or places the Contract Worker will encounter. Contractor should review the background check results and determine whether the nature of the conviction or crime reported would create a risk to the City based on the Contract’s requirements.
   a. For a Contract Worker requiring a standard risk background check, potentially disqualifying convictions include a record of theft, identity theft, computer fraud or abuse, burglary, arson, crimes against property, violent crimes, or other crimes involving dishonesty, or embezzlement.
   b. For a Contract Worker requiring a maximum risk background check, potentially disqualifying convictions include a record of child molestation, assault, sexual assault, crimes against a person, public indecency, drug offenses, forgery, theft, burglary, arson, crimes against property, violent crimes, crimes for financial gain, identity theft, computer fraud or abuse, and embezzlement.

5. If a background check shows that the disposition of an arrest is unknown, then Contractor must determine the disposition of the arrest.

6. Contractor will obtain a Contract Worker disclosure from each Contract Worker who will perform work under this Contract. Contractor will provide the Contract Worker disclosures to the City upon request. “Contract Worker disclosure” means an affidavit by a Contract Worker disclosing his or her prior criminal record. The Contract Worker disclosure must list all criminal convictions, including the nature of the crime, the date of the conviction, and the location where the crime and conviction occurred. The Contract Worker disclosure also grants to the City the right to review the background check results. (City of Phoenix A.R. 4.45)
7. In a standard risk background check, Contractor must review the results of the background check and decide if a Contract Worker should be disqualified for work under this Contract. Contractor must engage in whatever due diligence is necessary to make the decision on whether to disqualify a Contract Worker. After Contractor has made its decisions, a list of names of qualified Contract Workers will be provided to the City.

8. In a maximum risk background check, Contractor must conduct the same review as in a standard risk background check. However, when submitting its list of qualified Contract Workers, Contractor must also submit the results of the background checks to the City for review. After its review, the City will either approve or deny each Contract Worker.

   a. If the City approves a Contract Worker, then the City will notify Contractor of that fact and the Aviation Department will issue the appropriate airport security badge to the Contract Worker.

   b. If the City denies a Contract Worker, then the City will notify Contractor of that fact and Contractor will reevaluate the Contract Worker to determine whether the person should be disqualified. If Contractor believes there are extenuating circumstances that suggest that the Contract Worker should not be disqualified, then Contractor will discuss those circumstances with the City. The City will review the matter and its decision on disqualification is final.

   c. The City may set up a secure folder or drop box for confidential materials related to maximum risk background checks. The City will not keep records related to maximum risk background checks after they are reviewed.

9. If Contractor is a sole proprietor, Contractor must submit to the City a copy of his or her own background check and a background check for all business partners, member, and employees that will work under this Contract and for whom the background check requirements of City of Phoenix A.R. 4.45 apply.

10. Contractor shall determine whether a Contract Worker is disqualified from performing work under this Contract.

STANDARD RISK BACKGROUND CHECK A standard risk background check must be conducted for the term of this Contract or five (5) years, whichever is shorter. Contractor shall conduct a standard risk background check on all Contract Workers whose work under this Contract requires:

   ● An airport security badge or key for access to City facilities,
   ● Access to sensitive information, confidential records, personal identifying information, or restricted City information, or
   ● Unescorted access to City facilities during normal and non-business hours.

“Personal identifying information” is defined by City of Phoenix A.R. 4.45.

1. Scope of the Standard Risk Background Check
The standard risk background check conducted by Contractor must be based on the real identity and legal name of the Contract Worker and include felony and misdemeanor records checks from any county in the United States, the state of Arizona, and any other jurisdiction where the Contractor Worker has lived at any time in the last seven (7) years.

MAXIMUM RISK BACKGROUND CHECK A maximum risk background check must be conducted for the term of this Contract or five (5) years, whichever is shorter. Contractor shall conduct a maximum risk background check on all Contract Workers whose work under this Contract requires:

- Working directly with a vulnerable adult or child under age 18,
- Any responsibility for the receipt of payment of City funds or control of inventories, assets, or records that are at risk of misappropriation,
- Unescorted access to City data centers, money rooms, high-value equipment rooms,
- Access to a private residence,
- Access to Homeland Defense Bureau-identified critical infrastructure sites or facilities, or
- Responsibility or access to City-identified critical infrastructure sites, City networks or data, cyber/IT/network assets, digital or cyber assets, workstations, or servers, by either remote or direct access.

1. **Scope of the Maximum Risk Background Check**
   The maximum risk background check conducted by Contractor must include the search criteria conducted under a standard risk background check in addition to a search for all felony and misdemeanor convictions (not including traffic or parking violations), a sex offender check, and a search for all outstanding warrants. Based on the Scope of Work, Contractor shall also conduct a credit check (for cash handling, accounting, and compliance positions only), driving records check (for driving positions only), and fingerprint verification when the Contract Worker is working directly with a child under age 18 or a vulnerable adult or the work under the Contract will take the Contract Worker to a criminal justice information system (CJIS) location.

   Maximum risk background checks are valid for the term of this Contract or three (3) years, whichever is shorter.

2. **Maximum Risk Background Check for Child Care Staff Members**
   If the Scope of Work of this Contract involves work as a childcare staff member, then Contractor will conduct a maximum risk background check.

3. **Criminal Justice Information System (CJIS) Maximum Risk Background Check**
   If the Scope of Work of this Contract requires unescorted access to a CJIS location or if Contractor will have access to a CJIS infrastructure or information, then a CJIS maximum risk background check will be conducted, reviewed, and approved by the Phoenix Police Department or the Arizona Department of Public Safety.
4. Maximum Risk Background Check for Children or Vulnerable Adults
If the Scope of Work of this Contract involves work with a child under age 18 or a vulnerable adult, then Contractor will conduct a maximum risk background check.

As used in this Section, “vulnerable adult” means an individual who is 18 years of age or older who is unable to protect himself or herself from abuse, neglect, or exploitation by others because of a mental or physical impairment. (A.R.S. § 13-3623(F)(6) and City of Phoenix A.R. 4.45)

110-3.14 AIRPORT SECURITY BADGE HANDLING PROCEDURES
Contractor will comply with the following airport security badge handling procedures:

1. Key Access Procedures.
If a Contract Worker requires keyed access to enter a City facility, then a separate key will be issued, and Contractor must complete a return form and submit it to the City for each key issued.

2. Stolen or Lost Badges or Keys.
Contractor shall immediately report any lost or stolen airport security badge or key to the City. A new airport security badge application or key issue form must be completed and submitted along with payment of the applicable fee prior to issuance of a new airport security badge or key.

3. Return of Badges or Keys.
All airport security badges and keys are the property of the City and must be returned to the Badging Office within one (1) business day after the Contract Worker’s access to a City facility is no longer required under this Contract. Contractor shall collect a Contract Worker’s airport security badge and all keys (1) when the Contract Worker’s employment is terminated, (2) when the Contract Worker’s services are no longer required at a City facility, or (3) when this Contract terminates, is cancelled, or expires, whichever occurs first.

4. Return of Badges or Keys.
Contract Workers must always have an airport security badge and some form of verifiable company identification in their possession while working under this Contract, unless otherwise provided in the Scope of Work. Contract Workers are strictly prohibited from entering any area of the Airport that is not authorized by the airport security badge or key issued to them by the Badging Office. The Aviation Department will determine who will have access to the Airport. Contract Workers access authority is only valid during their scheduled hours. Contractor shall provide the City with updates and changes in personnel as they occur.

5. Badge Fees
Contractor shall pay the airport security badge fees set forth in § 4-11(D) of the Phoenix City Code.
110-3.15 CONTRACTOR’S BREACH. Contractor agrees that the access control, airport security badge, and key requirements in this Section are necessary to preserve and protect public health, safety, and welfare. Therefore, Contractor shall be deemed in immediate breach of this Section upon the occurrence of any of the following:

● A Contract Worker gains access to a City facility or a restricted or secured area of the Airport without the proper airport security badge or key;
● A Contract Worker uses another person’s airport security badge or key to gain or attempt to gain access to a City facility or a restricted or secured area of the Airport;
● A Contract Worker begins work under this Contract without passing the appropriate Background Screening and being issued the proper airport security badge or key;
● A Contract Worker or Contractor submits false, incomplete, or misleading Background Screening information or submits any false, incomplete, or misleading information in an attempt to improperly obtain an airport security badge or key;
● Contractor fails to collect and timely return a Contract Worker’s airport security badge or key to the City within three days of the (1) date the Contract Worker’s employment terminates, (2) the date the Contract Worker is assigned to another City facility, or (3) when this Contract terminates, is cancelled, or expires, whichever occurs first.

110-3.16 LIQUIDATED DAMAGES AND REMEDIES FOR BREACH. In addition to any other remedy available to the City at law or in equity, including the right to terminate this Contract, Contractor shall be liable for and shall pay to the City a stipulated damage in the amount of $1,000.00 for each breach of this Section and for each time a Contract Worker entered a restricted or secured area of the Airport without proper authority. Contractor agrees that the stipulated damage amount is not a penalty but is a reasonable estimate of the actual harm to the City caused by a breach and that the harm was very difficult to estimate at the time this Contract was executed.

110-3.17 CONTRACTOR CERTIFICATION. Contractor certifies to the City that Contractor has read the foregoing Background Screening requirements and that all Background Screening information Contractor furnished to the City is accurate, complete, and current. Contractor further certifies to the City that Contractor has satisfied all Background Screening requirements and verified the legal worker status of each Contract Worker as required under this Section.

110-3.18 VIOLATION OF RESPONSIBILITIES. Any violation of 110-3.1 - 110-3.17 shall be considered a violation of the Contract itself and shall be sufficient cause for halting the work without extending the time limit of the job.

110-3.19 CONTRACT NON-COMPLIANCE. Due to both the safety and security precautions necessary at Phoenix Sky Harbor International Airport, failure of the Contractor to adhere to the prescribed requirements/regulations has consequences that may jeopardize the health, welfare and lives of the customers and employees at Phoenix Sky Harbor International Airport, as well as the Contractor’s own employees. Therefore, if the Contractor is found to be in non-compliance with the security, airfield badging/licensing and airfield safety requirements by either Airside Operation’s Personnel or the RPR or his representatives, the Airside Operations Division will issue Notices of Violation (NOV). The Contractor may appeal the NOV, however appeals must be made in writing, and within four (4) calendar days of the offending incident, to the City of Phoenix’s Project Manager. The appeal would
need to state, in sufficient detail, why the NOV/circumstances is unwarranted. A final and binding decision on the appeal will be made by the City of Phoenix's Project Management Team within ten (10) working days of receipt of the appeal, the Contractor will then be notified of this decision in writing. No further appeals to the specific NOV will be considered or accepted.

The City of Phoenix Airside Operations has the option to issue warnings on the first offense if the incident justifies it. Individuals involved in a non-compliance violation may be required to surrender their security badge and airfield driver's license pending investigations of the matter and the outcome of the possible appeal.

1) Should any violation caused by the Contractor result in an expense to the City of Phoenix, the City shall recover the total of those expenses from the Contractor. The expenses will be determined by the Aviation Department and will consist of the following:
   a) Labor hours of City staff or consultants which were devoted to investigating and resolve the violation, including overhead and labor burden mark-ups.
   b) Expenses for materials or equipment necessary to make the situation temporarily or permanently safe.
   c) Work by others, either contracts, or services, or by airlines, which were performed in order to rectify the situation.
   d) Any monetary sanctions assessed by the FAA, TSA or others.

Incursions are defined as "any entrance onto an active runway, taxiway, taxi lane or apron that may or may not subject any aircraft or crash fire rescue vehicle to yield, stop or change direction to avoid the sudden entrance."

The Airport's Notice of Violation (NOV) program also applies to all security badge holders and the companies they work for. Airport NOVs can result in the suspension or revocation of a company's or individual's privilege to do work at the airport. Responsibilities for security badge holders and their companies are communicated through the badge application process.

110-4 COORDINATION OF CONSTRUCTION ACTIVITIES

110-4.1 WORK SCHEDULING AND ACCOMPLISHMENT. The Contractor shall contact PHX Airport Operations each day before beginning work to coordinate the status and nature of work to be done that day. Access to work sites within the AOA will require daily coordination with Airport Operations prior to gaining access. The Contractor shall also report to Airport Operations at the end of each day to schedule the work he plans to do on the following day.

Violations of any coordination requirements shall be considered a violation of the Contract itself and shall be sufficient cause for halting the work without extending the time limit of the job.

110-5 OPERATIONAL SAFETY REQUIREMENTS

110-5.1 GENERAL. Before entering or crossing any runway or taxiway, or aircraft movement area, the Contractor shall receive proper clearance from PHX Airport Operations. Emergencies and operating conditions may necessitate sudden changes, both in airport operations and in the
operations of the Contractor. Aircraft operations shall always have priority over any and all of the Contractor’s operations. Should runways or taxiways be required for the use of aircraft and should Airport Operations deem the Contractor to be too close to active runways or taxiways the Contractor shall suspend his operations, remove his personnel, plant, equipment, and materials to a safe distance and stand by until the runways and taxiways are no longer required for use by aircraft. There will be no compensation for delays or inefficiencies due to these changes.

The Contractor shall ensure that no personnel or equipment enters into the active movement areas or their associated Object Free Area without the appropriate Airport Operations escort. Access into movement areas or Object Free Areas without an Airport Operations escort is prohibited!

Throughout the duration of the job, any practice or situation that Airport Operations or the RPR determines to be unsafe or a hindrance to regular airport operations shall be immediately rectified.

Any violation of these or the following safety requirements shall be considered a violation of the Contract itself and shall be sufficient cause for halting the work without extending the time limit of the job.

1. The following publications contain definitions/descriptions of critical airport operating areas. The areas defined below pertain to airfield safety requirements and are referenced throughout the Contract Documents. Copies of Advisory Circulars may be found at the FAA website:

   http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

   and, Federal Aviation Regulations (FARs) can be found at:

   http://www.faa.gov/regulations_policies/faa_regulations

   The Contractor is always to use the latest version of each AC or regulation that is in effect on the date of advertisement.

   (a) Advisory Circular 150/5370-2G, “Operational Safety on Airports During Construction” sets forth guidelines to assist airport operators in with the requirements of federally funded construction projects, or version that is in effect on the date of advertisement.

   (b) FAR Part 77, “Objects Affecting Navigable Airspace,” Current Edition: Establishes standards for determining obstructions to navigable airspace. Civil airport imaginary surfaces are defined in the publication. It also sets forth requirements for notice of certain proposed construction or alteration. Notice of construction provides a basis for recommendations for identifying the construction or alteration in accordance with AC 70/7460-1, “Obstruction Marking and Lighting,” Current Edition.

   (c) AC 150/5300-13A Change 1, “Airport Design” Current Edition: Establishes design, operational and maintenance standards for airports, or that is in effect on the
date of advertisement. Standard terms used in the contract plans and specifications are defined below:

(i) Runway Safety Area (RSA) - The defined surface surrounding the runway over which aircraft should, in dry weather, be able to cross at normal operating speeds without incurring significant damage. A safety area is graded, drained and compacted. It is free of any holes, trenches, humps or other significant surface variations or objects, other than those which must be there because of their essential aeronautical function. The safety area requires the capability of supporting maintenance, firefighting, and rescue vehicles under normal (dry) conditions.

Prior to re-opening the runway each morning, the RSA must comply with the following:

(1) The area(s) shall be able to support an aircraft at normal operating speeds without the aircraft incurring significant damage.

(2) For the first 200 feet beyond the runway ends, the longitudinal grade of the RSA is between 0% and 3%, with any slope being downward from the runway ends. For the remainder of the RSA, the maximum allowable downward grade is 5% and the maximum allowable upward grade shall not penetrate the 20:1 approach surface from the end of the runway, as defined in FAR Part 77. However, limitations on longitudinal grade changes are plus or minus 2% per 100 feet.

(3) For the RSA during construction (200 feet from runway centerline and up to 200 feet from the runway ends), the transverse grade from the edge of the runway pavement is 1.5% to 5% downward. For areas beyond 200 feet from the runway ends, the maximum allowable transverse grade shall be 5%, upward or downward. Transverse grade changes should be warped smoothly.

(4) The maximum permissible drop-off at the edge of the runway pavement is 1.5 inches.

(a) Object Free Area (OFA) – An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigations or aircraft ground maneuvering purposes.

(b) Obstacle Free Zone (OFZ) – The OFZ is the airspace below 150 feet 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:

(i) Runway OFZ. The airspace above a surface centered on the runway centerline.
(ii) Inner-approach OFZ. The airspace above a surface centered on the extended runway centerline. It applies to runways with an approach lighting system.

(iii) Inner-transitional OFZ. The airspace above the surfaces located on the outer edges of the runway OFZ and the inner-approach OFZ. It applies to runways with approach visibility minimums lower than ¾-statute mile.

(c) Taxiway Safety Area (TSA) – A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

(d) The dimensioning of RSA’s, OFA’s and OFZ’s are determined by the type of aircraft utilizing the runways and taxiways. AC 150/5300-13A or that is in effect on the date of advertisement. provides detailed information for determining the required dimensioning for various safety areas. For the Phoenix Sky Harbor International Airport, the following are the locations of Runway and Taxiway Safety Areas, Object Free Areas and Obstacle Free Zones.

(i) Group IV aircraft is the Design Aircraft for Phoenix Sky Harbor International Airport. Workers and equipment are to provide 25’ wingtip clearance during taxiing operations if Taxiway remains open to traffic.

Group IV – 171’ Wingspan
(a) TSA 85.5’ from Taxiway Centerline
(b) OFA 129.5’ from Taxiway Centerline

(5) The Contractor shall acquaint his supervisors and employees with the airport and operations that are inherent to Phoenix Sky Harbor International Airport and shall conduct his/her construction activities to conform to all routine and emergency air traffic requirements and guidelines for safety specified herein. The Contractor shall be responsible for providing all safety devices as required for the protection of his personnel.

(6) Protection of all persons shall be provided throughout the progress of the work. The work shall proceed in such a manner as to provide safe conditions for all workers and personnel. The sequence of operations shall be such that maximum protection is afforded to ensure that personnel and workers in the work area are not subject to any dangerous conditions. The Contractor must provide safety measures to guard against injury.

(7) During the performance of this contract, the airport facility shall remain in use to the maximum extent possible. Use of areas near the Contractor’s work will be controlled to minimize disturbance to the Airport’s operation. The Contractor shall not allow employees, subcontractors, suppliers, or any other unauthorized person to enter or remain in any airport area which would be hazardous to persons.

(8) All work to be performed which is too close to an active runway, taxiway or apron under operational conditions shall be performed when the runway, taxiway or apron is not in use. Such work shall not be accomplished without prior permission from Airport Operations.
Requested closings shall be directed to the Airport Operations in writing at least 72 hours in advance so that the proper Notice-to-Airmen (NOTAM) may be issued. Only Airport Operations have the authority to open or close runways or taxiways.

(9) The Contractor shall be aware of the following types of safety problems and/or hazards. These problems or hazards shall not be permitted. Should any of these problems or hazards arise during construction, the Contractor shall immediately rectify/correct the problem or hazard to the satisfaction of the RPR and Airport Operations Personnel:

(a) Trenches, holes, or excavations on or adjacent to any open runway or in safety areas.

(b) Unmarked/unlighted holes or excavation in any apron, open taxiway, open taxilane, or related safety area.

(c) Mounds or piles of earth, construction materials, temporary structures, or other objects in the vicinity of any open runway, taxiway, taxilane, or in a related safety, approach, or departure area.

(d) Vehicles or equipment (whether operating or idle) on any open runway, taxiway, taxilane, or in any related safety, approach, or departure area.

(e) Vehicles, equipment, excavations, stockpiles, or other materials which could degrade or otherwise interfere with electronic signals from radios or electronic navigational aids (NAVAIDS).

(f) Runway surfacing projects resulting in excessive lips greater than 1 inch for runways and exceeding 3 inches for edges between the old shoulder and new surfaces at runway edges and ends.

(g) Unmarked utility, NAVAID, weather service, runway lighting, or other power or signal cables that could be damaged during construction.

(h) Objects (whether or not marked or flagged) or activities anywhere on or in the vicinity of the airport which could be distracting, confusing, or alarming to pilots during aircraft operations.

(i) Unflagged/unlighted low visibility items (such as tall cranes, drills, and the like) anywhere in the vicinity of active runways, or in any approach or departure area.

(j) Misleading or malfunctioning obstruction lights or unlighted/unmarked obstructions in an approach to any open runway.

(k) Inadequate approach/departure surfaces needed to assure adequate landing/takeoff clearance over obstructions or work or storage areas.
(l) Inadequate, confusing or misleading (to user pilots) marking/lighting of runways, taxiways, or taxilanes, including displaced or relocated thresholds.

(m) Water, dirt, debris, or other transient accumulation which temporarily obscures pavement marking, pavement edges, or derogates visibility of runway/taxiway marking or lighting.

(n) Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA.

(o) Trash or other materials with foreign object damage (FOD) potential, whether on runways, taxiways, or aprons, or in related safety areas.

(p) Inadequate barricading or other marking which is placed to separate construction or maintenance areas from open aircraft operating areas.

(q) Failure to control vehicle and human access to open aircraft operating areas.

(r) Construction/maintenance activities or materials which could hamper the response of aircraft rescue and firefighting (ARFF) equipment from reaching all aircraft or any part of the runway/taxiway system, runway approach and departure areas, and aircraft parking locations.

(s) Bird attractants on airport, such as edibles (food scraps, etc.), miscellaneous trash, or ponded water.

(10) The Contractor shall conduct activities so as not to violate any safety standards contained herein. The Contractor shall inspect all construction and storage areas as often as necessary and promptly take all steps needed to prevent/remedy any unsafe or potentially unsafe conditions/activities discovered.

(11) Before actual commencement of construction activity, the Contractor shall notify Airport Operations and the RPR in writing of his intentions to begin construction, stating the proposed time, date, and work area in order for the appropriate Notice-to-Airmen (NOTAM) to be issued. Only PHX Airport Operations have the authority to open or close runways or taxiways and to issue NOTAMs. In order to properly communicate these closures Airport Operation must receive these requests 72 hours prior to the scheduled closure. Upon completion of work and return of all related areas to standard conditions, the Contractor shall again notify Airport Operations and the RPR in writing and describe the area that is complete and available for normal airport operations.

(12) Debris. Debris, waste and loose material or any other FOD (including dust and dirt) capable of causing damage to aircraft landing gear, propellers or being ingested in jet engines shall not be allowed on active aircraft movement areas or adjacent infield areas. Materials observed to be within these areas shall be removed immediately and/or continuously by the Contractor. The Contractor shall be required to have a sweeping machine and operator on
site, ready always during construction activity. Where travel on or across runways, ramp areas, taxiways, or aircraft aprons is required, the Contractor shall provide adequate personnel and equipment to keep such surfaces clear of debris at the discretion of the RPR. Closed pavements shall be swept clean prior to reopening to aircraft traffic. Exposed earth in excavation areas within 75 feet of the centerline immediately adjacent to active taxiways shall be covered to prevent dust from jet blast. Cover material shall be weighted to prevent movement from jet blast.

(13) Flag persons. In accordance with the specifications, the Contractor shall furnish flag persons as necessary to control his traffic unless otherwise directed by the RPR.

(14) Trenches, Excavations and Stockpiled Material. Open trenches or excavations exceeding 3" in depth and 3" in width or stockpiled material will not be permitted within the limits of restricted areas of operational runways or taxiways. Covering for open trenches or excavations shall be of sufficient strength to support the weight of the heaviest aircraft operating on the runway or taxiway. Trenches and excavations that cannot be protected by covering shall be backfilled, and re-excavated if necessary, at the end of each day or before opening the restricted area to operational use of the runway or taxiway. Open storm drain trenches, electrical duct or conduit trenches, utility trenches or any other trench shall be limited to 500-feet accumulative in length at any time. Open trenches in the runway safety area shall be properly and completely backfilled and compacted in sufficient time before the end of the work shift.

(15) Construction in Proximity to Active Runways and Taxiways.

Runway Sides: If appropriate construction/maintenance NOTAM has been issued, construction is permissible as close as 250 feet from the centerline of the active runway provided that all Airport Operations and FAA criteria are met. The 250 feet shall be clearly marked in the infield areas with approved barricades at 10-foot intervals. Runway Ends: No work will be permitted within 1,000 feet of the active runway threshold.

Taxiway Sides: If appropriate construction/maintenance NOTAM has been issued, construction is permissible as close as the dimensions shown on the Construction Safety and Phasing Plan (CSPP) provided that all Airport Operations and FAA criteria are met. This dimension(s) shall be clearly marked in the infield areas using approved barricades at 10-foot intervals. Personnel and equipment working within taxiway Object Free Areas (OFA) must at all times be able to give way to taxiing aircraft.

(16) Equipment Height Restrictions.

Maximum permissible equipment height varies by location and by construction phase. Maximum equipment height requirements are shown in the CSPP and shall not be exceeded unless prior approval is obtained from the RPR and Airport Operations. Atop all equipment booms shall be mounted the white and orange checkered flag described in Paragraph 110-3.4. The top ten feet (10’) of these booms shall be painted fluorescent orange and they shall
be equipped with a red obstruction light. Any crane erections shall be coordinated with Airport Operations and the RPR during every shift.

(17) Miscellaneous.

(a) Open flame, welding or torch cutting are prohibited unless adequate fire and safety precautions have been taken and the procedure has been approved by the RPR.

(b) All materials and equipment when not in use shall be placed in approved areas where they will not constitute a hazard to aircraft and not penetrate clearance height restrictions as shown in the CSPP. All equipment shall be parked in the appropriate area(s) when not in use.

(c) The Contractor shall provide the Safety/Security Manager with a current list of all subcontractors and suppliers working on the airport. The list shall be maintained current by the Contractor and Subcontractors.

(d) For emergencies involving life safety (injuries, fires, security breaches, etc.), the Contractor shall immediately call 602-273-3311, the Sky Harbor Emergency number, and simultaneously or as soon as possible contact PHX Airport Operations followed by notification to the Project Manager.

110-5.2 CLOSED RUNWAY AND TAXIWAY MARKING AND LIGHTING. Closed runway and taxiway markings shall be as shown in the CSPP. Closed runway and taxiway marking, and lighting materials shall be approved for use by the RPR prior to placement. Construction activities shall not begin until the layout of such marking and lighting has been approved by the RPR.

110-5.3 HAZARD MARKING. Hazard-marking barricades, flashers, etc. should be used: to identify and define the limits of construction making them visible to aircraft, personnel, or vehicles; to identify hazards such as open manholes, small areas under repair, stockpiled material, waste areas, etc.; to prevent aircraft from taxiing onto a closed runway for takeoff; and to identify FAA, airport, and National Weather Service facilities, cables, power lines and other sensitive areas to prevent damage, interference, and facility shutdown.

Traffic Cones shall not be used at any time on the Air Operations Area.

Hazardous areas, in which no part of an aircraft may enter, should be indicated using barricades marked with diagonal, alternating orange and white reflective stripes. During reduced visibility or night hours, the barricades should be supplemented with flashing red lights. The intensity of the lights and spacing for barricades, flags, and lights should be adequate to delineate the hazardous area without ambiguity. The Contractor shall have a designated person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades.

110-5.4 CONSTRUCTION AREA MARKING AND LIGHTING. Low profile lights, retroreflective taxiway edge markers, low level barriers, and warning flags shall be provided and erected by the Contractor as shown in the CSPP or as directed by the RPR. All construction areas, including closed runways and
taxiways, should be clearly and visibly separated from active air operation areas. Hazard areas, facilities, cables, and power lines should also be clearly identified by the Contractor. The Contractor is responsible for maintaining the condition and visibility of all markers identifying above-mentioned areas and that marking, and lighting aids remain in place. Appropriate barriers, lights and signs should be used as necessary to clearly separate all construction/maintenance areas from other parts of the AOA. All barricades, temporary markers, flag line supports, and other objects placed and left in safety areas on any open runway, taxiway, or taxilane should be: as low as possible to the ground; of low mass; easily collapsible upon contact with an aircraft or any of its components; weighted down or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, or other surface wind currents; and if affixed to the surface, frangible at ground level.

110-5.5 CONSTRUCTION NEAR NAVIGATIONAL AIDS. Construction materials and equipment shall not be placed or parked where they may interfere with the line-of-sight of the ATCT and navigational aids in operation. PHX Operations shall determine if any materials or equipment will cause any type of interference.

110-5.6 CONSTRUCTION SITE ACCESS AND HAUL ROADS. The Contractor will not be permitted to use any access or haul roads other than those designated on the contract drawings. The Contractor should submit specific proposed ingress and egress routes associated with specific construction activities to the RPR for evaluation and approval prior to commencing construction activities. Aircraft Rescue and Firefighting (ARFF) right-of-way on access roads, haul roads, taxiways, and runways shall not be impeded at any time.

110-5.7 TRENCHES AND EXCAVATIONS. Gaps or holes between paving lanes, open trenches or excavations are not permitted within an operational runway safety area. Coverings for open trenches or excavations such as reinforced structural steel plates, precast slabs or other methods should be of sufficient strength to meet the requirements of the RSA found in Paragraph 110-5.1(1)(c). Open trenches and excavations at the construction site outside of the RSA should be prominently marked with red or orange flags, as approved by the RPR, and lighted with red light units during hours of restricted visibility or darkness.

Excavations and open trenches may be permitted up to the edge of structural taxiways provided the drop-off is adequately signed, marked, and lighted and the appropriate NOTAM is issued.

110-5.8 CONSTRUCTION MATERIALS STOCKPILING AND EQUIPMENT STORAGE. There shall not be any equipment storage in the active runway and active taxiway safety areas or in the infield areas. The Contractor shall remove pavers and other equipment from the active Runway and Taxiway Object Free Areas (OFA) including the infield(s) (staging on apron areas will be allowed with prior approval) before re-opening the runway or taxiway. Stockpiled material or equipment should not be stored near aircraft turning areas or operational movement areas, aprons, or excavations and trenches. Stockpiled materials shall not be stored near NAVAIDs, visual or approach aids, nor shall they obstruct the ATCT’s line of sight to any runway or taxiway. The Contractor shall ensure that stockpiled construction materials and equipment do not cause degraded or hazardous conditions to airport operations safety. This includes determining and verifying that stockpiled materials and equipment are stored or parked at an approved location, that they are properly stowed to prevent foreign object
debris (FOD), attraction by wildlife, or obstruction of air operations either by their proximity to NAVAIDs or to aircraft movement areas.

Unless otherwise specified elsewhere in the contract documents, there will be no direct measurement and payment for providing sanitary facilities.

110-5.9 OTHER LIMITATIONS ON CONSTRUCTION. Open flame welding or torch cutting operations are prohibited unless adequate fire and safety precautions are provided and have been approved for use by the RPR. Under no circumstances should flare pots be used near aircraft turning areas.

110-5.10 FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT. Waste and loose materials capable of causing damage to aircraft landing gear or propellers or capable of being ingested in jet engines should not be left or placed on or near active aircraft movement areas. Materials tracked onto these areas should be continuously removed during the construction project. It is also recommended that waste or loose materials which would attract wildlife be carefully controlled and removed on a continuous basis.

110-5.11 RUNWAYS AND TAXIWAYS. Nothing shall be placed upon runways, taxiways, taxilanes, or aprons without authorization from Airport Operations.

METHOD OF MEASUREMENT
110-6 All items specified in this section will be measured as lump sum.

110-6.1 Measurement and payment for “Landside Traffic Control” and for Uniform Off-Duty Officer as specified in Section III-2 Technical Special Provision Section 1.1 (if included) is incidental this Item.

BASIS OF PAYMENT
110-7.1 Airport safety and security shall be paid for at the contract lump sum price in a proportionate manner, on the basis of current estimates. This price shall constitute full compensation for furnishing material and equipment, including but not limited to flagpersons, temporary gates, warning markers, temporary drainage items, low level barriers, other traffic control devices and necessary equipment, safety area support material, and other material and equipment list herein, and the maintenance thereof and all other labor, materials, equipment, tools and incidentals including Landside Traffic Control and Uniform off-duty Officers necessary to accomplish this item.

Payment will be made under:

Item GP-110-7.1 Airfield Safety and Security – per Lump Sum

REFERENCES

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

City of Phoenix Public Transit Department
AR 4.45 Security, Access, Controls and Badging Information

FAA Advisory Circular (AC)

AC 150/5345-55A Specification for L-893 Lighted Visual Aid to Indicate Temporary Runway Closure

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

AC 150/5300-13A Airport Design With Change 1

AC 70-7460-1L Obstruction Marking and Lighting

Code of Federal Regulations (CFR)

CFR 49 Part 1542 Airport Security

OSHA CFR 29 Occupational Safety and Health Parts 1900-1999

FAR Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace

END OF SECTION 110
Section 120 Coordination, Notifications, And Compliance

120-1 DESCRIPTION

120-1.1 GENERAL. The Contractor shall utilize information and requirements provided in the most current Improving PHX Program and Contractor Packet. Information on project schedules, impacts, and coordination shall be supplied to the Improving PHX Program daily or as required by the Contractor.

120-1.2 BACKGROUND The Improving PHX Program coordinates activities and communicates information to all airport stakeholders on behalf of the City of Phoenix Aviation Department construction and maintenance projects. The program’s mission is to generate clear, concise, recognizable communication and support services to all City of Phoenix Aviation Department Staff, Business Partners, Consultants and Contractors.

120-2 RESPONSIBILITIES.

Activity Coordination – Submit all construction project activities to affected Aviation Department division designees to gain approval for contractors to proceed with work activities and associated impacts.

Attend Meetings – Attend various meetings to sift through project details to tailor and adapt communication tools for effective information dissemination.

Dissemination of Information – Communication regarding Aviation Department construction and maintenance activities via the following venues within the minimum notice required:

- Emails
- Flyers
- Website www.Improvingphx.com
- Hotline Phone (602) 553-0005
- Graphic Maps
- Summaries & Reports

Stanchions & Temporary Partition Walls – Provision of interior stanchions and temporary partition walls utilized by contractors during construction to maintain a consistent look and feel.

Temporary Sign Plans & Sign Production – Development of plans that encompasses all wayfinding, regulatory and project identification needs that may be disrupted with construction activities. Plans are routed through designated representatives from various Aviation Divisions for approval prior to implementation. Once approved, the Program produces the signs, manages installation and maintains sign quality.

120-3 CONTRACTOR MANDATORY PARTICIPATION ITEMS. The City of Phoenix Aviation Department established the Improving PHX Program to handle internal and external construction communication and stakeholder coordination. The contractor shall be expected to fully cooperate with program regulations and guidelines. Contractor participation includes:
- Comply with Improving PHX Program Activity Scheduling (see Activity Scheduling Special Considerations in Improving PHX Contractor Packet for scheduling details on various activities)
- Ensure the Improving PHX Project Manager is provided with the date, time and location of all weekly construction progress meetings and any meetings addressing issues affecting stakeholders or other construction impacts
- Provide up-to-date construction schedules (including revisions and weekly "look ahead summaries") to allow the required notifications to stakeholders and identification of possible conflicts or necessary coordination items
- Provide a current 24-hour emergency contact list
- Provide plans to the Improving PHX Project Manager a minimum of one week prior to the start of construction to assist in identifying all work areas that will be visible to the public or that will impact Passenger, Tenant, Air Carrier or Employee movement
- Notify Improving PHX Project Manager of any change in schedule/activities no later than 24-hours prior to allow for proper dissemination of information
- Comply with the Improving PHX Program specifications for non-traffic barriers (See Temporary Construction Wall Specifications Page 19) and signage. Such barriers and any necessary signage shall be coordinated with the Improving PHX Program and approved by the Aviation Project Manager prior to installation
- Provide a minimum of 72-hours’ notice to Improving PHX Project Manager on requests for all Improving PHX provided signage and barriers
- Install and place all temporary construction signage furnished by the Improving PHX Program as necessary. Contractor shall provide labor to make necessary placement adjustments to existing signage as requested by the Improving PHX Project Manager
- All signs, stanchions and other barricades provided by the Improving PHX Program shall remain the property of the Improving PHX Program and shall be returned in good condition upon completion of the work by the contractor

All other temporary closure symbols, including vinyl “X’s”, shall be painted or applied on the pavement surface in accordance with the CSPP, plans and Civil Technical Specification Item P-620.

**120-3.1 WORK ACTIVITY NOTIFICATIONS.** Improving PHX is responsible for producing work activity notices. This a critical tool is necessary for tracking construction and maintenance activities taking place throughout City of Phoenix managed Airports. When scheduling activities please be sure to include all pertinent information described below:

1. Where:
   - Describe in detail all locations that activities will occur
   - Example: Terminal 4, S4 Concourse (Gates C11-C20), Passenger Level – Panera Bread

2. Date & Time:
   - Differentiate between Day & Night shifts
3. What:
   - Ensure shift hours are correctly noted
   - Provide different activities that will take place
   - Define work activities – for example concrete placement must include cubic yards, how many trucks will be necessary to facilitate placement and designated (and approved) haul routes

4. Impacts & Necessary Coordination:
   See Approval Process Section 120-4.1 for further detail on below listed activities:
   - Impacts to Airport tenants – necessary access coordination
   - Water/Electrical/Fire System Shutdowns
   - Lane Restrictions/Road Closures
   - Gate/Restroom Closures
   - Crane/Boom Lift/Scissor Lift Activity

5. Why & Corresponding Project:
   - Describe why this work is taking place
   - Specify the corresponding project name and/or number associated with work
   - Name the assigned City of Phoenix Aviation Department Project Manager in charge

6. Who:
   - Provide name of primary contractor as well as subcontractors performing work

7. Other Considerations:
   - All work MUST BE APPROVED by the City of Phoenix Aviation Department Project Manager and Airport Operations prior to beginning any activities
   - Available project equipment such as signage, stanchions, and flex screens will be provided as necessary

120-3.2 WORK ACTIVITY MINIMUM REQUIREMENTS. The City of Phoenix Aviation Department has an established Improving PHX Program which is responsible for all internal and external construction coordination and notification. To facilitate proper scheduling and mitigation of impacts to airport stakeholders, the contractor shall be expected to fully cooperate with the notification requirements listed below. Notification for the work activities must be submitted to the Aviation Design and Construction Services Project Manager and the Improving PHX Program Project Manager prior to the minimum notice timeframes. Please reference the most current version of the Improving PHX Contractor packet regarding minimum notification timelines.

120-4 NOTIFICATION APPROVAL PROCESS The Improving PHX Program approval process defines the expectations and actions necessary for the Contractor to receive approval from the City of Phoenix
Aviation Department and all stakeholders in a timely manner. The Contractor shall initiate Work Activity Notification for approval routing by PHX Stakeholders. The Contractor shall not proceed with work activities prior to receiving approval of the Work Activity request.

Internally Initiate Work Activity & Analyze Impacts

- Contractor shall initiate work, gather information and analyze impacts internally by identifying stakeholders and determining level of impact as it pertains to public and tenants.
- The Contractor shall request work that meets or exceeds Work Activities Minimum Notice Requirements (Page 6) to the Aviation Design & Construction Services Project Manager and Improving PHX Project Manager.

Specific activities require special considerations to allow for a more streamlined approval process. Please refer to Improving PHX Contractor Packet “Activity Scheduling Special Considerations” for more details regarding these considerations during contractor work activity initiation and impact analysis process.

After all information has been gathered, the contractor shall send request via email to the Improving PHX Project Manager with the following information:

- See Work Activity Notifications Section 120-3.2
- Normal workdays are Monday-Friday. Activities that are scheduled to begin between Friday at 2:30 PM through and including Sunday at 9:00 PM require an approved Weekend Work Form Request. (See Improving PHX Contractor Packet for specific form instructions)

Re-analyze & Confirm Impacts

- The Improving PHX Project Manager will re-analyze/confirm impacts and address special requirements from stakeholder(s) as necessary prior to routing to City of Phoenix Aviation Staff for final approval.

Route Schedule & Impacts/Review Feedback & Track Responses

- Improving PHX Project Manager will route schedule and previously identified impacts to City of Phoenix in a formal “Request” via email and will review feedback, track responses and follow up on pending items as necessary.

Communication Execution

- The contractor and Improving PHX Project Manager share mutual responsibility to maintain bilateral communication throughout the project.
- The Improving PHX Project Manager is responsible for sending work activity notifications to all applicable stakeholders concerning activities that have been coordinated between the Contractor and City of Phoenix.

120-5 CONSTRUCTION AND MAINTENANCE WORK MORATORIUMS The City of Phoenix issues moratoriums on construction and maintenance activities during times of increased passenger traffic. The activities below are prohibited during designated work moratorium dates. Restrictions of these activities should be considered during project planning and incorporated into the project schedule. Specific moratorium dates are issued by the City of Phoenix annually. Additional dates can and will
be added for high profile events and security stand downs issued locally or federally. Each additional restriction of work will be evaluated on a case by case basis. Current moratorium dates can be resourced at www.ImprovingPHX.com/Moratorium.pdf

Blackout Dates: No work will be permitted under any circumstances during the following periods

- Independence Day: Approximately July 3 – July 5
- Thanksgiving: Approximately Nov 25 – Nov 27
- Fiesta Bowl

Hard Moratoriums: Work MAY be permitted on a Case by Case Basis as listed below during the approximate timeframes following the restrictions listed.

- Independence Day: Approximately Jul 1 – Jul 7
- Thanksgiving: Approximately Nov 22 – Nov 30
- Winter Holidays: Approximately Dec 20–Jan 4
- Fiesta Bowl

Soft Moratoriums: The following event dates will potentially increase passenger traffic therefore restricted work hours may be enforced. Work MAY be permitted on a Case by Case Basis as listed below during the approximate timeframes following the restrictions listed.

- NASCAR Spring: Approximately 4 Day Period in March
- Memorial Day: Approximately May 21 – May 25
- Labor Day: Approximately Sept 4 – Sep 7
- NASCAR Fall: Approximately 4 Day Period in November

Moratorium Work Restrictions:

Work will NOT be Permitted During Dates Listed in the Moratorium:

- No Road Closures or Lane Restrictions
- No Trenching Excavating, Pot Holing, Drilling, Boring or Like Activities
- No Work During Holiday Weekends
- No Utility Outages (power, water, gas, etc.)
- No System Shutdowns (PIPS, AVI, Fire Protection etc.)
- No Work in Passenger Areas

The Following Work MAY be Permitted on a Case by Case Basis Pending Required Approval:

- Hauling Operations
- Demolition Activities
- Closure of Airport Facilities
• **Restriction of Access**

If the Contractor plans to work during the moratorium you must submit a Completed Moratorium Work Exception Request Form at a minimum, 1 week prior to the start date of the moratorium to Aviation Design and Construction (DCS) Project Management Team, Improving PHX Program and Aviation Operations. All exceptions will be on a case-by-case basis. Times and dates are subject to change at any time.

No extension of time will be granted to the Contractor for work dates identified in the most current moratorium. The dates specified should be considered when developing and proposing the construction Project Schedule.

**120-6 IMPAIRMENT** During the course of the project if the Contractor requires impairment to the electrical, fire or communication at PHX, the Contractor must submit for approval an Impairment Request Form, with approval prior to any impairment being constructed. An impairment is defined as any interruption to normal service or operation of the airport utilities including but not limited to fire, security, electrical, communications, water, etc.

Forms are located in the most current version of the Improving PHX Contractor Packet with detailed instructions for dispersant. The form must be sent by the Contractor a minimum of 72-hours prior to impairment to the DCS Project Manager for review. The primary project inspector and Improving PHX representative should also be included in this correspondence.

The DCS Project Manager will then respond to the Contractor and provide notification if the request is approved. If denied, no notification will be sent, and contractor will need to submit another request.

**120-7 CONSTRUCTION WALL STANDARDS** If temporary construction walls or barricading is required by the Contract Documents or deemed necessary by the DCS Project Manager the following specifications shall apply: Additional modular walls or wall types may be submitted for approval in lieu of the below at no additional cost to the Owner. Approval is discretionary and will be evaluated on a case by case basis.

1. **Wall Height:** The wall will be constructed to the top of the ceiling within the area whenever applicable. Due to the full height wall, fire sprinkler modifications may be required per the Aviation Fire Marshall.

2. **Wall Protrusion:** The wall will protrude a maximum of 6-Foot from the leasehold construction area when installed within a passenger area and protrusion is deemed necessary by the DCS Project Manager. Temporary walls used during remodel of concession and retail spaces will protrude a maximum of 1-Foot upon approval from the DCS Project Manager.

3. **Wall Bracing:** Bracing shall be sufficient to withstand a five pound per square foot force. Penetrations on terrazzo flooring are NOT permitted. High strength double-sided tape must be used when securing the bottom of temporary walls to terrazzo flooring. Penetrations into the ceiling grid or tiles are NOT permitted. The top of the temporary walls must be secured to the Unistrut or beams with similar strength within the ceiling. When installing a temporary wall in a carpeted area, penetrations into the carpet is permitted. Upon removal of the temporary wall the carpet must be restored to preexisting condition.

4. **Framing:** 4” Metal Studs spaced out 16” on center.
5. Drywall (Gypsum) Thickness: 1 Layer/1/2” (Drywall is only required on the exterior face of the wall).

6. Drywall (Gypsum) Finish:
   a. Metal drywall corner bead will be utilized for all outside and inside corners
   b. L-Metal trim will be utilized on the tops and sides of the walls
   c. Level 4 Drywall Finish Required: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes.

7. Wall Base: 4 Inch rubber cove base molding (Black or Grey) will be installed at the bottom of the full length of the wall

8. Construction Doors:
   a. All construction doors are required to be installed with case trim and must be self-closing and locking.
   b. All construction doors will swing open into construction areas to avoid protrusion into passenger areas.
   c. All construction doors will require the placement of “Construction Area Do Not Enter” signage.

9. Painting:
   a. Gypsum board shall be painted within 48-hours of installation with two coats of semi-gloss

10. Temporary Wall Maintenance: Temporary walls will be patched and painted as deemed necessary by the Aviation Department to maintain the wall condition of when it was first constructed.

11. Construction Area Walk-Off/Tack Paper: Tack paper will be installed on the floor in front of the construction door within the construction area to mitigate debris from entering passenger areas

12. Fire/Life Safety System Obstruction: Construction walls are prohibited from obstructing the devices below per the Aviation Fire Marshall. Relocations of these devices will be determined on a case by case basis by the Aviation Fire Marshall and Project Manager.
   • Fire Sprinklers
• Smoke Detectors
• Audible & Visual Alarms
• Automated External Defibrillator's (AEDs)

13. Security Camera Obstruction: Construction walls are prohibited from obstructing the view of security cameras. If obstruction of security cameras is deemed necessary for construction, the contractor will work with Aviation staff for the relocation of the camera(s).

14. HVAC Registers/Vents Obstruction: Construction walls are prohibited from obstructing HVAC registers and vents. If obstruction of the registers or vents is deemed necessary for construction, modifications to the temporary wall to extend the registers or vents through the wall may be required.

15. Light Fixture Obstruction: Construction walls are prohibited from obstructing light fixtures whenever possible.

16. Signage Obstruction: Construction walls are prohibited from obstructing existing signage whenever possible. If obstruction of signage is deemed necessary for construction, the Improving PHX Program will develop a temporary signage plan that will be submitted for Aviation review prior to implementation. Contractors are responsible for notifying the Aviation Department Design & Construction Services Project Manager and the Improving PHX Program when/if signs will be obstructed.

120-8 TEMPORARY CONSTRUCTION SIGN STANDARDS. All signage placed at Phoenix Sky Harbor International Airport associated with a construction project must follow the following specifications maintained by the Improving PHX Program in collaboration with Aviation Design and Construction Services.

1) When Signage is Required: Improving PHX Program fabricated signage is required at all non-traffic construction areas and facility closures/detours as decided by the contractor, Aviation Project Manager, Aviation Inspector and/or Improving PHX Project Manager.

2) Roadway Traffic Control Signage: The Improving PHX Program does NOT provide signage for vehicle traffic control on the public roadways. The signage required by the approved traffic control plan will be provided by the Contractor.

3) Paper Signage: No handwritten or paper signage is permitted.

4) Company Identifying/Branding Signage: No company-identifying or branding signage or materials is permitted.

5) Exterior Project Identification Signage:
   • Signs will be furnished by the Improving PHX Program, upon request from the Contractor
   • Signs will only be provided for exterior (Not within any building, concourse or terminal) projects.
• Sign will be installed by the contractor prior to the start of construction.

• The contractor will be responsible for all mounting hardware and drilling of holes unless otherwise specified by the Improving PHX Project Manager.

• Sign will be fabricated on 1/8” thick aluminum composite material.

• Sign will have a white background with black letter and will contain the Improving PHX Program branding.

6) Exterior Construction Jobsite Signage:

• Signs will be furnished by the Improving PHX Program

• Sign will only be provided for exterior (Not within any building, concourse or terminal) projects.

• Sign will be installed by the contractor prior to the start of construction.

• The contractor will be responsible for all mounting hardware and drilling of holes unless otherwise specified by the Improving PHX Project Manager.

• Sign will be fabricated on 1/8” thick aluminum composite material.

• Sign will have a white background with black letter and will contain the Improving PHX Program branding.

7) Dust Control & Storm Water Pollution Prevention Plan (SWPP) Permit Signage:

All projects are required to obtain a Maricopa County Dust Permit with a jobsite of one acre or larger must have a Dust Permit Sign. The sign can also include the SWPPP permit number is applicable and will be fabricated to meet the Maricopa Country Standards. All projects required to obtain a Maricopa County SWPPP Permit with a jobsite of 1 acre or larger must have a SWPPP Permit Sign.

• The Improving PHX Program will provide the Dust Permit Sign for the contractor to post at the permitted jobsite.

• Sign will be installed by the contractor prior to the start of construction and will be located on the exterior of the project limits (Not within any building, concourse or terminal).

• The contractor will be responsible for all mounting hardware and drilling of holes unless otherwise specified by the Improving PHX Project Manager.

• Sign will be fabricated on 1/8” thick aluminum composite material or 9oz vinyl mesh banner.
• The contractor will be solely responsible for requesting a new sign or vinyl patches prior to the permit expiration date.

8) The Contractor will be required to coordinate his work to satisfy clearance requirements for arrival and departure of aircraft in compliance with the CSPP and in compliance with FAA Advisory Circular 150/5370-2G concerning Operational Safety on Airports during Construction, or that is in effect on the date of advertisement.

METHOD OF MEASUREMENT

120-9 All items specified in this section are considered incidental to the project.

BASIS OF PAYMENT

120-10 All items specified in this section are to be considered as incidental to the Contract. No additional payment will be made for conformance to the specifications

REFERENCES

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

Sky Harbor International Airport

Current Version Improving PHX Contractor Information Packet

Current Version Construction & Maintenance Work Moratoriums

END OF SECTION 120
Section 130 Airport Site Safety Requirements

130-1 CONTRACTOR GENERAL AIRPORT SAFETY REQUIREMENTS. PHX is committed to providing a safe work environment and requires contractors ensure the health and safety of its employees and the employees of its subcontractors. Hazards include but are not limited to harmful dusts, fumes, and vapors, strong acids, molten or hot metal, metal with sharp or jagged edges, electrical hazards, overhead hazards and moving vehicles. PHX requires contractors comply with all federal, state and local laws, codes and regulations as applicable to the area and type of work conducted on the airport.

130-2 SAFETY COORDINATOR All Contracts will require the Contractor to designate a Safety Coordinator(s) as the point of contact for the Project regarding Safety. Contractor shall work with the Airport’s Safety section in meeting the pre-requisites to establish the Safety Coordinator. The Safety Coordinator(s) will represent the company having oversight of the project activities and the person(s) with a direct relationship with the Airport’s Safety section. The Safety Coordinator(s) should at minimum be responsible for planning, implementing and overseeing company’s employee safety at work. Their main duty is to ensure that the company complies and adheres to Occupational Health and Safety (OHSA) guidelines to reduce work-related injuries and provide a direct point of contact for the Airport’s Safety section.

The Safety Coordinator(s) is responsible for implementing and maintaining the safety program for areas pertaining to the project. Responsibilities may include administration and coordination of the following activities:

- Thoroughly reviewing accident investigations and initiating corrective action.
- In the event of an accident, preparing and submitting a written report, and assisting in the investigation according to requirements.
- Holding safety meetings.
- Reviewing safety performance and acting as necessary within the areas of responsibility.
- Maintaining effective and prompt communication of safety matters.
- Monitoring compliance with established safety standards and regulations.
- Assigning duties to subcontractors, checking work areas, making housekeeping inspections, and keeping records of conditions found and corrective actions taken.
- Requiring employees to use personal protective equipment such as safety glasses, body harnesses, respiratory protection equipment and head and eyewear protection.
- Maintaining effective communication of safety matters to employees.
- Assisting in the development and communication of safe work procedures for unusual or hazardous operations.
- Maintaining compliance with the requirements of federal, state, local, and other agencies, and with the requirements of the Contractor’s safety programs.

130-3 HAZARD IDENTIFICATION AND JOB HAZARD ANALYSIS (JHA) To ensure that safety risks are assessed, understood and controlled to reduce operational risks and exposures Contractor shall
develop and maintain a procedure for the identification of hazards and effective management of risk for activities and tasks conducted within the scope of project activity. There shall be a system, based on hazard identification and risk assessment, which ensures effective controls are in place to minimize exposure to hazards.

Contractor risk assessment process will use risk matrix and include at minimum the following elements:

- hazard identification;
- credible worst-case consequence;
- risk ranking;
- risk control treatments; and
- monitoring and review of controls.

A JHA shall be undertaken for each activity and shall at minimum:

- consider the tasks to be performed;
- identify and document the hazards;
- identify control measures;
- develop and implement hazard controls and regulatory compliance;
- perform the work and monitor the effectiveness of the hazard controls;
- consider emergency response procedures;
- provide feedback to improve the process (e.g. routine workplace inspections, auditing compliance during work performance, job briefing postings, lessons learned, etc); and
- provide for hazard assessments on new equipment or equipment where conditions change.

130-4 SAFETY VIOLATIONS Safety violations by Contractor employees constitute non-compliance with provisions of the contract and may result in immediate removal of the employee from airport premises. The Contractor’s manager, supervisor, or other person in charge who directs or allows employees to perform unsafe acts or to work in or around unsafe conditions will be immediately removed from the airport premises.

130-5 SAFETY TRAINING Contractor are responsible for ensuring that employees under their supervision, direct and/or indirect, are competent, trained, understand, and comply with the requirements of OSHA and applicable ADOSH standards. Upon request and/or as applicable, contractors must show proof of training for their employees prior to commencing any work activities associated with OSHA/ADOSH regulations.

Contractor are to train their employees on the safety, health, environmental, and fire prevention requirements for the work they are to perform and enforce adherence to safe work practices and procedures.

130-6 SAFETY EQUIPMENT Contractor is responsible for providing their employees with the proper tools and equipment to perform the job safely, including any required personal protective equipment. Contractor must ensure that their subcontractors do the same.
Personal protective equipment shall be worn according to the hazards associated with various types of exposure (e.g. Safety glasses, ear plugs, gloves, chemical gloves, respirators, aprons, harnesses, etc.)

Contractor must supply their own equipment necessary for their employees to perform the work safely and in compliance with rules, regulations. Contractor are to arrange for the proper use, maintenance, and repair of work equipment.

130-7 REGULATORY COMPLIANCE Contractor shall perform all work in a manner that complies with all applicable federal, state, and local laws, rules, and regulations and complies with safety best practices (e.g., 29 CFR 1900 through 1999, Federal Aviation Administration, Transportation Security Administration, National Fire Protection Association, Arizona Department of Environmental Quality) while performing work and/or in support, direct or indirect, of the airport project.

In addition, contractors are obligated to:

- obtain/provide information on OSHA/ADOSH safety plans/procedures when affecting airport employees;
- coordinate operations with the appropriate PHX supervisor(s) should both PHX employees and Contractor personnel be working in a work area simultaneously;
- inform the Aviation Project Manager and/or Aviation Safety of any hazards encountered or created either through a debriefing or during the operation;
- the requirements are in addition to any other requirements or obligations set forth herein the Contract documents or applicable federal, state, and local laws, rules, regulations, and permits;

130-8 WORK PERMITS Contractor shall obtain, at their expense, all applicable work permits required to perform their work to ensure that any potential hazard takes into consideration the reduction of risk and includes safety precaution measures in place.

Work Permits shall:

- be approved for use prior to commencing the task;
- clearly define the work to be completed under the Work Permit;
- show on the permit the duration of the work.

Examples of where Work Permits are required (but not limited to):

- electrical or equipment isolations;
- confined space work;
- surface excavations;
- working at heights;
- work performed near x-ray or radioactive sources;
- high voltage work or working in proximity to high voltage;
- hot work (excluding hot work conducted in workshops).
130-9 SAFETY PROGRAM Contractor are responsible for establishing and implementing a safety program. This program will include maintaining and auditing safety performance for compliance with applicable federal, state, local regulations and with established safety and environmental requirements.

Contractor are responsible for planning and executing work according to the stated objectives of their safety program.

At minimum, such programs are to provide employees with information on the following topics (as applicable to the type of work required and/or exposed to):

- Construction Safety Phasing Plan
- Site Specific Safety Plan
- Hazards present in their work assignment and surrounding area.
- Personnel protective equipment requirements.
- Proper procedures for safe work and reporting unsafe job conditions.
- Hazardous Energy control (lockout/tagout).
- Confined space and powered industrial trucks.
- Fire prevention and fire extinguishers.
- Waste disposal and environmental release requirements.
- Respiratory Protection
- Hot Work
- Fall protection / Working at Heights
- Electrical safety
- Hazardous Materials / Hazard Communication
- Evacuation
- Traffic Control
- Emergency Procedures and Contacts
- Lifting and Crane Works
- Machine and Equipment Guarding
- Extreme Weather
- Work Permits
- Personal Protective Equipment (PPE)
- Hearing Conservation
- Scaffolding
- Bloodborne Pathogens
- Spill Prevention Control, and Countermeasures
• Trenching and Excavation

The Contractor shall provide, when applicable or upon request, a written safety program(s)/plan(s) to the Aviation Project Manager and/or Aviation Safety.

As it pertains to their work responsibility, the Contractor’s written safety program(s)/plan(s) must meet the requirements set forth in federal (e.g., of OSHA 29 CFR 1900 through 1999, Federal Aviation Administration), state, and local regulatory entities.

Procedures used by the Contractor for intended/proposed work in a controlled area must be discussed with the Aviation Project Manager and/or Aviation Safety prior to commence of work.

130-10 SAFETY INSPECTIONS Contractor are to conduct regularly scheduled safety inspections of the work being conducted by the contract and/or subcontract personnel. The scope or duration of work may regulate the frequency of these inspections.

The inspection program may include but not be limited to:

• Housekeeping;
• correct use of work permits, JHAs;
• appropriate workplace behaviors;
• equipment condition;
• hazard identification;
• task observations; and
• work and environmental conditions.

Inspections must be carried out by line management to verify that employees are competent, trained, equipped and if required, certified to carry out their work in accordance with statutory and company requirements.

All inspection findings must be actioned using a formal corrective action plan that addresses identified issues.

Contractor must take immediate corrective action when a violation of job safety, fire, or environmental safety hazard is observed. Contractor are to regularly review their safety performance. Agreed corrective and preventative actions must be tracked to completion, closed out and verified as being effective. Failure to correct a problem may result in work stoppage in the related area, and work will not be permitted to resume until the problem is corrected.

Work stoppages need to be communicated to the Aviation Project Manager immediately and/or the Airport Duty Manager. Contractor are required to administer their own safety activities and are responsible for the safety of their employees.

If required by the project, Contractor and their Safety Coordinator or designee must attend a pre-work safety conference with the Aviation Project Manager and Aviation Safety (et.al as required) prior to beginning work. The conference is to review procedures, forms, record keeping and reporting, and to ensure a clear understanding of the safety program relevant to the work to be performed.

130-11 SAFETY RIGHTS Contractor agrees that, in addition to any other right under the Contract, the Aviation Project Manager, shall have the right to take any or all the following actions:
• Review and approve all Contractor work plans and work specific safety requirements;
• Designate safety precautions in addition to those in use or proposed by Contractor;
• Verify Contractor have effectively planned for eliminating or controlling work hazards that may impact the safety or health of the Airports and Contractor personnel or the general public;
• Require Contractor to provide additional safeguards beyond what Contractor plans to utilize;
• Conduct and document field safety observations and inspections to verify Contractor compliance with the Contractor Safety Program, the Contract requirements, applicable federal, state, and local laws, rules, regulations, and permits;
• Stop work to ensure compliance with safe work practices and applicable federal, state and local laws, rules, and regulations;
• Suspend, terminate, or place on probationary status Contractor in the event of a safety incident or failure to comply with these program requirements; and
• Evaluate Contractor safety performance at periodically during performance of the work and at conclusion of the work.

130-12 SAFETY INCIDENT REPORTING Contractor shall have a formal process implemented to report, investigate, record and follow-up incidents, injuries and occupational illnesses. This must include the determination of underlying causes and to minimize the potential for the future occurrence of similar events.

All incidents including, safety, environmental, process loss, property damage, injuries, near misses and occupational illnesses that occur within the project scope must be reported by Contractor’s employees to their immediate supervisor as soon as possible and recorded on Contractor’s Incident Report form.

All incidents, injuries, near misses and occupational illnesses shall be assessed within 24 hours for actual consequence and potential risk and corrective and preventative actions planned to reduce the likelihood and potential consequence of the event.

All high potential incidents and incidents that result in recordable injuries shall be formally investigated to determine causal and contributing factors and the appropriate corrective and preventative actions.

Incident investigations shall be led by an appropriately trained person and reviewed by Contractor, Aviation Project Manager, and Aviation Safety to verify the thoroughness of the investigations, completeness of findings and suitability of the recommended actions.

Contractor shall maintain records of all project related incidents, including all investigations and associated corrective and preventative actions.

Contractor is to immediately provide such information with complete copies of all documents, photographs, witness statements, another evidence related to any of the above to the Aviation Project Manager and Aviation Safety during the course of the incident, investigation, and/or upon
request. All records and documentation for Safety Incident Reporting, when finalized, shall be uploaded into Unifier.

130-13 SAFETY MEETINGS Contractor should hold regularly scheduled safety meetings and require attendance by employees. Accident prevention should have a prominent place on the agenda, and the meeting records should state the specific items discussed. Each supervisor should hold safety and training meetings in their work area with their on-site staff and review specific procedures pertinent to the work activity.

Safety meetings provide an opportunity to point out hazardous conditions or unsafe work practices, and discuss safety and environmental rules and regulations, safe working procedures, analysis of accidents, and potential hazards.

All meeting notes with attendees shall be documented and uploaded into Unifier.

130-14 GENERAL HOUSEKEEPING Good housekeeping shall be maintained during all operations and clean up should occur at the end of work each day.

Maintaining a clean work environment is the responsibility of the contractor. The Contractor is responsible for properly managing all waste generated in the course of the project in accordance with federal, state, and local regulations. Passageways, exits, and firefighting equipment must not be blocked or obstructed.

130-15 INDEMINIFICATION Contractor shall indemnify and hold harmless PHX from and against any and all losses, liabilities, damages, costs, fines, expenses, deficiencies, taxes and reasonable fees and expenses of counsel and agents, including any costs incurred in enforcing this contract, that PHX may sustain, suffer or incur arising from

(i) Contractor’s failure or alleged failure to comply, in whole or in part, with any of its obligations hereunder the contract;
(ii) any loss of or damage to Contractor’s equipment throughout the course of construction activity(ies);
(iii) any violation of laws;
(iv) any damage to any property of PHX caused by the maintenance or operation of any Contractor employees, direct or indirect;
(v) any claims by any third person with respect to death, injury or property damage caused, in whole or in part, by the maintenance or operation of any Contractor employee, direct or indirect; and
(vi) any claims resulting from or arising out of injury or death of any employee, agent of Contractor, direct or indirect, including claims alleging that PHX failed to provide a safe place to work.

METHOD OF MEASUREMENT

005-16.1 All items specified in this section are considered incidental to the project.
BASIS OF PAYMENT

005-17.1 All items specified in this section are to be considered as incidental to the Contract. No additional payment will be made for conformance to the specifications

REFERENCES

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

Code of Federal Regulations (CFR)
- CFR 49 Part 1542 Airport Security
- OSHA CFR 29 Occupational Safety and Health Parts 1900-1999

FAR Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace

END OF SECTION 130
## CIVIL TECHNICAL PROVISIONS AND SPECIFICATIONS

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#### CIVIL TECHNICAL SPECIFICATIONS

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ITEM 10 GENERAL SPECIFICATIONS

10.01 UTILITIES AND EXISTING FACILITIES

This item shall govern the field location of all underground existing utilities in areas to be improved, to avoid conflicts with proposed surface or underground improvement. Work under this section shall include, but not be limited to, the location of all underground facilities. Underground facilities means any item that is buried or placed below ground for use in connection with the storage or conveyance of water, sewage, electronic, telephone or telegraphic communications, electric energy, oil, gas or other substances, and shall include, but not be limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, attachments and those portions of poles and their attachments below ground, including electrical and communication ducts, airfield lighting and control cables, fiber optic lines, storm drains, electrical and telephone lines. The Contractor shall employ a private utility location service to locate the existing Owner and non-Owner utilities prior to starting the work. The Contractor shall pothole and use prudent care when excavating and locating said utilities. See also Supplementary Conditions Para. 15. UNDERGROUND FACILITIES.

The Contractor shall, after October 1, 1988, comply with the State requirements regarding excavation and underground utilities per A.R.S., Chapter 2, Article 6.3. and Sections 40.360.31 and other pertinent Sections of the Blue Stake Law. The Airport is not a member, but has distribution systems for gas, electrical, water, and sewer on the site. The Contractor shall be responsible for locating all Owner and non-Owner utilities.

The Contractor’s attention is directed to the following Arizona Revised Statutes:

- a. ARS 40-360.22. Excavations, determining location of underground facilities; providing information. This statute requires that no person shall begin excavation before the location and marking are complete or the excavator is notified that marking is unnecessary and requires that upon notification, the Owner of the facility shall respond as promptly as practical, but in no event later than two (2) working days. This section is not applicable to an excavation made during an emergency that involves danger to life, health or property if reasonable precautions are taken to protect underground facilities.

- b. ARS 40-360.23. Making excavations in careful, prudent manner; liability for negligence. This statute states that obtaining information as required does not excuse any person making any excavation from doing so in a careful and prudent manner, nor shall it excuse such persons from liability for any damage or injury resulting from his negligence.

- c. ARS 40-360.28. Civil penalty; liability. If the Owner or operator fails to locate, or incorrectly locates the underground facility, pursuant to this article, the Owner or operator becomes liable for resulting damages, costs and expenses to the injured party.

The Contractor is hereby advised that the location of all utilities, as shown on the Plans, may not be complete nor exact and the Contractor shall satisfy himself as to the exact location of the utilities. The Contractor shall be responsible for any damage done to public or private property and such damage shall be repaired at the Contractor’s expense.

Location of any underground telephone lines may be field verified by calling the Blue Stake Center telephone number 263-1100 or 1-800-STAKE-IT (Outside Maricopa County). The Contractor is required by Blue Stake Center to call at least two (2) working days before digging. The Contractor shall locate all utilities that Blue Stake will not locate.
The Contractor is to protect all existing facilities during construction. The Contractor shall notify the appropriate Utility Company or agency of any construction that may affect their facilities.

Measurement for “Location of Underground Utilities” shall be by the actual cost of the work. Cost for work for Contractor and subcontractors (i.e., Utility Designation/Potholing contractor) will be based upon invoiced cost from the Contractor and subcontractor.

Payment for location of underground utilities, measured as prescribed above, shall be paid from the lump sum based on approved actual costs. Such payment shall be full compensation for furnishing all labor, equipment, tools and materials and for all designation, preparation, excavation, backfilling and placing of materials; and for all incidentals necessary. Payment for the cost of each utility location will not be made until satisfactory survey data has been submitted to the RPR.

Payment shall be made under:

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10.01.02 WATER FOR CONSTRUCTION PURPOSES

The Contractor, at his expense, shall provide all water required for, and in connection with, the work to be performed. The Contractor shall remove all temporary waterlines installed by him, after completion of the work, if directed to do so by the RPR.

It is the Contractor's responsibility to identify the water source and its compatibility, storage, and costs for all water requirements for this project. The Contractor must submit a water source and its intended use to the RPR for approval. No direct payment will be made for construction water. The cost thereof shall be included in other items for which direct payment is made.

10.01.03 ELECTRICAL POWER

All power for lighting, operation of Contractor's plant or equipment, or for any other use as may be required in the execution of the work to be performed under the provision of these Contract Documents shall be provided by the Contractor at his expense. The Contractor shall remove all temporary electrical facilities installed by him, after completion of the work, if ordered to do so by the RPR.

10.01.04 TELEPHONE SERVICE

If required by PSHIA, the Contractor shall make all necessary arrangements with the telephone utility for telephones in his offices at the site and separate telephones, fax and a direct service line in the office of the RPR and shall pay all monthly charges therefore including long distance calls from the office of the RPR. All contractors and others performing work or furnishing services at the site shall be permitted to use the Contractor's telephone without charge for calls pertaining to the work.

10.01.05 SANITARY FACILITIES

Contractor shall furnish temporary sanitary facilities at the site, as provided herein, for the needs of all construction workers and other performing work or furnishing services on the Project. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 men. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.
END SECTION 10
ITEM 20 AIRFIELD BARRICADING, SAFETY, AND SECURITY

20.01 DESCRIPTION AND SCOPE

The information contained within this Section is supplemental to General Provision Section 110, Airfield Safety and Security. The Contractor shall also reference that specification for airfield safety requirements for construction operations at the Phoenix Sky Harbor International Airport (PSHIA).

This item shall consist of furnishing and implementing an Airfield Traffic Control and Barricade Plan for the Terminal 4 S1 Apron project.

The Barricade and Traffic Control Plans must be submitted by the Contractor at the Pre-Construction Conference.

The Contractor shall submit an Airfield Traffic Control and Barricade Plan for approval by the RPR to be followed during construction. The Plan shall specifically identify all work to be performed for each Phase of construction identified on the plans. The Plan shall also include the requirement of the Contractor and Airport to perform a site walk of the entire affected area of construction a minimum of 2-hours before that area is scheduled to be re-opened to aircraft traffic to assure that it has been cleaned and cleared of all equipment and Foreign Object Debris (FOD).

The Contractor shall be responsible for providing, the installation of, and the maintenance of barricades, lights, and traffic control devices necessary for the control of vehicular and pedestrian traffic, (24-hours a day) within their work zone. The overall site perimeter low-profile barricades and fencing, as shown on Drawing A.C-106, will be installed and maintained by the Terminal 4 S1 Concourse Contractor. The Contractor shall provide and maintain barricades and temporary fence delineating the boundary of this contract’s work zone and the Terminal 4 S1 Apron work zone as shown on the Phasing plans. Any requests to modify the approved barricading and phasing plans must be submitted to the Airport for review and approval.

20.02 BARRICADE REQUIREMENTS

All construction areas shall be delineated with low-profile barricades that meet FAA standards to prevent intrusion by taxiing aircraft, vehicles, or pedestrians, (FAA AC 150/5370-2, latest edition). Low-profile barricades shall be orange in color with white reflective tape on both sides of the barricade and shall be a minimum of eight (8) feet in length and a maximum of ten (10) inches in height, (not including required flagging or lights).

All barricades must be equipped with RED omni-directional lights, either flashing or steady burning, to provide additional visual warning whether during normal daytime and night-time operations or during periods of reduced visibility due to weather conditions. Lights may be either battery-powered or solar powered, however, the intensity of the lights must be sufficient to adequately and without ambiguity delineate the construction area. The Contractor is responsible to maintain all barricade lights in working condition to the approval of the Airport 24 hours a day.

20.03 SIGNAGE REQUIREMENTS

The Contractor shall use temporary directional or way-finding signage for all access and haul routes, open trenching or other hazards. The temporary signage shall be clear, concise, reflective, and large enough so as to minimize safety-related issues. All temporary signage shall be placed and maintained in a manner to withstand the particular elements it could experience, (i.e. monsoon winds, jet blast, etc.). All temporary signing shall meet the requirements of the most current version of the MUTCD and shall be frangible.
20.04 SAFETY PLAN COMPLIANCE

The Contractor shall be responsible to provide a Safety Plan Compliance Document at the Preconstruction Conference. 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 SPCD is a subset of the CSPP, similar to how a shop drawing review is a subset to the technical specifications. The effort required to prepare and submit a SPCD acceptable to airport operations shall be considered incidental to the Airfield Safety and Security line item provided in the bid, (GP-110-7.1).

20.05 METHOD OF MEASUREMENT AND PAYMENT

Measurement and payment for the items identified herein shall be considered incidental to Bid Item GP-110-7.1.

END SECTION 20
ITEM 30 MISCELLANEOUS CONSTRUCTION ITEMS

30.01 ADJUST WATER VALVE FRAME & COVER TO GRADE

Description
This work shall include the adjustment of any water valve frame and cover to grade, as well as incidental removals, as shown in City of Phoenix Detail P1270, P-1270-1, P1391, and P1165.

Method of Measurement
Measurement for adjust water valve frame and cover to grade shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport. The concrete collar around the frame shall be constructed in accordance with Technical Specification P-610.

Method of Payment
Payment for adjust water valve frame and cover to grade shall be made at the contract unit price per each.

Payment shall be made under:

Item GTP-30.01.1 Adjust Water Valve Frame & Cover to Grade (COP DET P1270, P1391 MOD & P1165) – per Each

30.02 ADJUST EXISTING MANHOLE FRAME & COVER TO GRADE (MAG STD DET 422)

Description
This work shall include the adjustment of any sanitary sewer manhole frame and cover to grade, as well as incidental removals, as shown in MAG Standard Detail 422 and City of Phoenix Detail P1424, modified with a bolted lid.

Method of Measurement
The measurement for adjust sanitary sewer manhole frame and cover to grade shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport. The concrete collar around the frame shall be constructed in accordance with Technical Specification P-610.

Method of Payment
Payment for adjust sanitary sewer manhole frame and cover to grade shall be made at the contract unit price per each.

Payment shall be made under:

Item GTP-30.02.1 Adjust Existing Manhole Frame & Cover to Grade (MAG STD DET 422, Modified) – per Each
30.03 ADJUST DRAIN BASIN TO GRADE

Description
This work shall include the adjustment of any roof drain basin, frame and cover to grade, as well as incidental removals.

Method of Measurement
The measurement for adjust drain basin to grade shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport including excavation, forming, concrete, and all incidentals.

Method of Payment
Payment for adjust drain basin to grade shall be made at the contract unit price per each.

 Payment shall be made under:

 Item GTP-30.03.1  Adjust Drain Basin to Grade – per Each

30.04 VALLEY GUTTER (MAG STD DET 240)

Description
This work shall include the installation of concrete valley gutter per MAG STD DET 240, modified to 3-feet wide, as well as incidental removals.

Method of Measurement
The measurement for valley gutter shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport including excavation, forming, concrete, and all incidentals.

Method of Payment
Payment for Valley Gutter shall be made at the contract unit price per square yard.

 Payment shall be made under:

 Item GTP-30.04.1  Valley Gutter (MAG STD DET 240, Modified to 3-feet Wide) – per Square Yard

30.05 JET BLAST DEFLECTION FENCE

PART 1 – GENERAL

1.1 Related Documents

 Drawings and General Provisions of the Contract apply to this Section.

1.2 SUMMARY
A. This Section includes the design, fabrication, erection, and certification for a complete Jet Blast Deflector (hereafter referred to as JBD).

B. The JBD manufacturer shall furnish the final design, material, labor, and equipment to fabricate and erect the JBD.

C. At project closeout, the JBD manufacturer shall furnish As-Built Drawings of the installation, Operation and Maintenance Guidelines, and a Performance Guarantee/Warranty Certificate approving the materials and installation.

D. All civil work, including paving and foundations, is specified in other sections.

E. Electrical work, including any required grounding, lightning protection, or lighting, is specified in other sections.

1.3 SUBMITTALS

F. General: Submit each item in this section according to the conditions of the Contract Plans and Specifications.

G. Quality Assurance Documents: The JBD manufacturer shall submit all quality assurance requirements listed in Sections 1.4-B and 1.4-C (Quality Assurance) for approval.

H. Upon execution of contract, the approved JBD manufacturer shall submit the following:
   1. Shop Drawings: Provide assembly and installation drawings detailing location and overall dimensional information, materials, and finish details of the JBD. Drawings shall include details of the structural frame members and major assembly/subassembly details for the JBD structure, including plans, elevations, and sections. Show anchorage and accessory items. Drawings shall be stamped by a qualified Professional Engineer (Structural) licensed in the State of Arizona.
   2. Foundation Design Criteria: JBD manufacturer shall furnish the anchor loads and locations, as well as all miscellaneous requirements for foundation design.
   3. Structural Calculations: Provide structural design calculations for the JBD structure, including structural connections, deflecting surfaces, and anchors, prepared and stamped by a qualified Professional Engineer (Structural) licensed in the State of Arizona. Calculations shall be submitted for each major frame system and shall comply with current IBC standards.
   4. Professional Engineer Qualifications: Documentation of past experience in accordance with Section 1.4-B (Quality Assurance) shall be provided with the submittal package.

I. At project closeout, the approved JBD manufacturer shall submit the following:
   1. Mill Certificates: Provide mill certificates for all steel used in the manufacturing of the JBD.
   2. Performance Guarantee/Warranty Certificate: Provide a written copy of the manufacturer’s guarantee or warranty certifying the workmanship, materials, installation, and performance of the JBD for a period of two (2) years from the date of final acceptance. See Section 3.3 (Erection) for JBD manufacturer supervision requirements.
   3. As-Built Drawings: Submit as-built drawings of completed work in accordance with requirements of the specifications.
1.4 QUALITY ASSURANCE

J. The JBD structural members, fasteners, deflecting surfaces, and anchorage shall be procured from a responsible source for design, manufacture, supply, and issuance of performance guarantee/warranty certificate in accordance with Section 1.3-D (Submittals) of this specification.

K. Professional Engineer Qualifications: Drawings and calculations shall be stamped by a Professional Engineer (Structural) with experience of at least five (5) past jet blast deflector projects rated for taxi/breakaway operations.

L. Alternate Manufacturers: To be approved as an alternate manufacturer, the following information shall be submitted to and approved by the Owner prior to submitting a bid (see Section 1.3-B).

1. Results of full-scale field proof tests in which the proposed JBD was subjected to the specified aircraft operating at taxi/breakaway power settings. Computer simulations are not an acceptable alternative to full-scale field tests.

2. Results of full-scale smoke dispersion tests demonstrating that smoke and gases are deflected in an upward direction, with evidence of no smoke dispersal behind the deflector. Video footage and test report shall be provided.

3. Evidence of satisfactory operation of at least five (5) installations of the proposed model, each with at least five (5) years of actual field service of continued use with similar aircraft, power settings, and engines.

4. Detailed structural design analysis of the proposed JBD showing loads and stresses in structural members, bolted connections, deflecting surfaces, and anchorage, using the worst-case aircraft velocity profiles as the calculated pressure for load calculations. Structural calculations shall comply with current IBC standards.

5. Design drawings of the proposed JBD demonstrating that the deflector meets all design and material specifications listed in Parts 1 and 2 of this specification.


7. Evidence that the JBD designer/manufacturer has a combined commercial general liability and excess coverage of $10 Million (minimum) with products/completed operations coverage. The JBD designer/manufacturer shall also provide evidence of professional liability coverage of $1 Million (minimum).

1.5 DESIGN CRITERIA

M. Aircraft

This JBD shall be designed specifically for commercial aircraft operating at taxi/breakaway power settings. Design exhaust velocity is 140 mph and shall be converted to pressure using standard day conditions. The JBD shall be designed to allow operation of specified aircraft, with no aircraft tail closer than 35 feet from the JBD leading edge and no engine nozzle closer than 60 feet from the JBD leading edge. The JBD shall take into account the effects of high-bypass engines and the effects of high-centerline engines typical of wide-body aircraft.
N. JBD Description

The JBD deflecting surface shall be a curved, corrugated type with corrugations running in the horizontal direction. Deflecting surfaces may not use concrete or perforated (or expanded) metal. Deflecting surfaces shall be rigidly supported by bolted structural steel frame assemblies spaced at 6’ (maximum) centers. Deflecting surface panels shall be supported by single-piece, curved steel members with a continuous radius. Welds at joints subjected to tension and/or vibration shall not be used. The JBD shall be LYNNSCO Type G12NB-6 or an approved equal. Any alternatives shall comply with all of Section 1.4 (Quality Assurance) conditions in order to qualify as an approved equal.

O. JBD Performance: The JBD shall reduce jet blast velocities at ground level behind the JBD to a maximum of 25 mph. The jet blast envelope shall be deflected upward at a minimum angle of 50° under no wind conditions.

P. Layout: As shown on Drawing A.CG-101 and A.C-104

Q. Height: Nominal 14 feet.

R. Foundation: The foundation design shall be a shallow slab (raft/mat) type with shear key(s), as necessary, designed to withstand the anchor loads provided by the JBD manufacturer and taking into consideration the minimum specified anchor bolt clearances. The foundation shall be constructed as a single-plane surface with no breaks in grade unless otherwise arranged with the JBD manufacturer.

S. Connections: For ease of assembly and to minimize construction time on the active airfield, all field connections shall be bolted. Field-welding is not permitted. The design of the structure shall maintain a reasonable degree of modularity should components require future repair or replacement.

T. FOD Considerations: Fastener assemblies used in the construction of the JBD shall include adequate locking mechanism(s) to prevent from working loose during continued, normal use of the structure (subject to JBD manufacturer maintenance guidelines).

U. Loading: The JBD shall be designed to withstand taxi/breakaway exhaust velocities from all aircraft specified in Section 1.5-A. Engine exhaust velocity shall be converted into pressure using standard day conditions and shall be applied normal to all deflecting surfaces. Code-level wind conditions shall also be assessed to identify governing design criteria for all JBD structural components.

PART 2 - PRODUCTS

2.1 STRUCTURE

A. Frames: Structural steel shapes shall consist of ASTM A36 (minimum strength) steel and shall be cut, rolled, and punched, as required. All field connections shall be bolted (no field-welding permitted). After shop fabrication, all individual structural steel members shall be hot-dip galvanized to a minimum of 2 oz/ft² per ASTM A123.
B. Deflecting Surface Sheets: Corrugated steel sheets shall be formed from 16-gauge (minimum) ASTM A924 sheet steel with 2 oz/ft² hot-dip galvanized coating per ASTM A653. Section modulus of formed sheets shall be a minimum of 0.196 in³/ft and shall be attached to frames with 3/8”-diameter bolts using half oval washers.

C. Fastener assemblies shall include adequate locking properties and shall be designed to withstand direct jet blast. Where applicable, the following shall be used as a minimum for strength, locking, and anti-corrosion characteristics:

<table>
<thead>
<tr>
<th>Fastener Component</th>
<th>Bolt Nom. Diameter ≥ ½”</th>
<th>Bolt Nom. Diameter &lt; ½”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolts:</td>
<td>ASTM A449 or SAE J429 Grade 5</td>
<td>SAE J429 Grade 5</td>
</tr>
<tr>
<td>Flat Washers:</td>
<td>ASTM F436 (Where Applicable)</td>
<td>Carbon Steel</td>
</tr>
<tr>
<td>Nuts:</td>
<td>ASTM A563*</td>
<td>ASTM A563*</td>
</tr>
<tr>
<td>Finish:</td>
<td>ASTM A153 or ASTM F2329</td>
<td>ASTM A153 or ASTM F2329</td>
</tr>
<tr>
<td>Half Oval Washers:</td>
<td>ASTM A36 steel, hot-dip galvanized per ASTM A123 to 2 oz/ft²</td>
<td></td>
</tr>
</tbody>
</table>

*Nuts and/or washers shall incorporate locking component to withstand vibrations induced by direct jet blast, thus preventing FOD; configuration shall be determined by the supplier using proven methods. Technical details of locking component shall be submitted within item 1.3-C.3 of these specifications.

D. Anchor Bolts: Load capacities for post-installed anchors in concrete shall be based on testing in accordance with ACI 355.2 or ASTM E488. Anchors shall be zinc-plated LYNNCO type AB34M mechanical anchors or approved equal. Anchors shall be supplied by the JBD manufacturer and shall not be installed in concrete that has cured for less than 7 days.

E. Galvanizing Repair Paint: Re-galvanizing damaged areas on hot-dip galvanized steel shall be finished using high-zinc-content paint—greater than 93 percent pure zinc by weight—complying with Mil-P- 21035 and Mil-P-26915.

2.2 FABRICATION, GENERAL

F. Produce metal fabrications from materials of approved size, thickness, and shapes as required. Work to dimensions indicated on approved shop drawings using proven details of fabrication and support.

G. All fabrications shall be produced with precise angles and straight, sharp edges.

H. Material shall be cut, sheared, drilled, and/or punched cleanly and accurately. Remove all burrs from edges and holes.

I. Remove any remaining sharp or rough areas on exposed surfaces prior to galvanizing.
2.3 PRODUCT MARKING

JBD manufacturer shall provide signage indicating manufacturer name, model number, power rating, usage restrictions, and project information/identifier. Sign(s) shall be securely-bolted to the back of the completed structure.

PART 3 - INSTALLATION

3.1 SITE CONDITION

The JBD manufacturer shall inspect the site prior to beginning work and notify the Owner of any deficiencies. Installation may not proceed until unsatisfactory conditions have been corrected.

3.2 MATERIAL STORAGE AND HANDLING

A. Store all JBD materials in approved areas, protected from the elements, and in a manner that prevents any damage, distortion, or deterioration. Keep deflecting surface sheets and steel members off ground using pallets, dunnage, platforms, or similar supports. Do not expose materials to water or moisture.

B. Surfaces showing iron stain or red rust shall be retouched or re-galvanized to the satisfaction of the contracting officer. See Section 2.2-E (Structure) for details for the galvanizing repair paint.

3.3 ERECTION

C. The JBD manufacturer shall observe and supervise the construction of the JBD and, upon satisfactory completion, the JBD manufacturer shall issue the performance guarantee/warranty (see Section 1.3-D).

D. Install all post-installed concrete anchors in accordance with anchor manufacturer’s written instructions. Use steel templates during drilling/setting of anchors to ensure accurate positions.

E. Set steel frames accurately at the locations provided on approved shop drawings, and in accordance with applicable American Institute of Steel Construction (AISC) standards.

F. Provide temporary guys and/or braces, as required, to support structural elements during erection.

G. Tighten all fasteners to the torques specified by the JBD manufacturer.

H. Field-executed thermal cutting or welding is not permitted.

I. Touch up any damaged galvanized surfaces with galvanizing repair paint (see Section 2.2-E for galvanizing repair paint product requirements). Follow paint manufacturer’s written instructions for surface preparation and application.

3.4 PERMITS

The general contractor shall be responsible for obtaining approval for the design of the JBD structure and associated foundation, and any required building permits.
3.5 INSPECTION

J. The JBD manufacturer and the Owner, or designated representatives thereof, shall visually inspect the completed installation to ensure that all work has been completed in an acceptable manner. Special care shall be given to the inspection of the JBD for loose material and missing fasteners.

K. Once any noted issues are corrected to the satisfaction of both parties, an acceptance letter or certificate of completion shall be signed by the representatives of the JBD manufacturer and the Owner who participate in the inspection. Final acceptance/certification by the JBD manufacturer and Owner shall be obtained in order to validate the performance guarantee/warranty for the JBD structure.

3.6 CLEANUP

L. Following completion of construction and related inspections, and prior to any aircraft operation, the JBD manufacturer representative(s) shall remove all associated construction materials, equipment, and debris from the jobsite.

M. Prior to aircraft operation, the Owner is responsible for thoroughly sweeping the surrounding areas and inspecting for FOD.

3.7 TESTING

Proof testing of taxi/breakaway fences is not required.

Method of Measurement
The measurement for blast fence and foundation shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport including footing excavation, demolition, reinforcing steel structural concrete, delivery, fabrication, and installation of the blast fence along with all other incidentals. Obstruction lighting and conduits shall be paid under their respective bid items.

Method of Payment
Payment for blast fence and foundation shall be made at the contract unit price per lump sum.

Payment shall be made under:

Item GTP-30.05.1 Jet Blast Deflection Fence and Foundation – per Lump Sum
30.06 BLAST WALL

The work under this section shall consist of the installation of the Blast Wall in accordance with plans and details including the following specification sections;

Division 3 - Concrete
- 03 10 00 Concrete Forming and Accessories
- 03 20 00 Concrete Reinforcing
- 03 30 00 Cast in Place Concrete

Division 5 – Metals
- 05 50 00 Metal Fabrications

Division 8 – Openings
- 08 11 13 Hollow Metal Doors and Frames
- 08 80 00 Glazing

Division 9 – Finishes
- 09 96 00 High Performance Coatings

Measurement and payment for this item shall be made at the contract unit price per lump sum of Blast Wall furnished and installed in accordance with the plans, details, and specifications, and as accepted by the Owner/Engineer. The price per lump sum shall include all foundations to support the blast wall. All required materials identified in the plans and specifications including reinforcement, curing compound, etc., shall be considered incidental to this item. This price shall include full compensation for all labor, materials, equipment, Quality Control, and special inspections necessary to complete this item.

Payment shall be made under:

Item GTP-30.06.1  Blast Wall – per Lump Sum

30.07 4,800 GALLON STORMWATER INTERCEPTOR

Description
This work shall include the installation of the 4,800 gallon stormwater interceptor as shown in Detail 2, Sheet A.CG-106.

Method of Measurement
The measurement for 4,800 gallon stormwater interceptor shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport including fabricating and delivering of the precast manhole sections, excavation, backfill in accordance with P-152, and all other incidentals to complete the work.

Method of Payment
Payment for 4,800 Gallon Stormwater Interceptor in accordance with the details in the plans shall be made at the contract unit price per lump sum.
Payment shall be made under:

Item GTP-30.07.1  4,800 Gallon Stormwater Interceptor – per Lump Sum

**30.08 ADJUST MANHOLE TO GRADE – REMOVE MANHOLE FLAT-TOP, EXTEND RISER**

**Description**
This work shall include the adjustment of any manhole frame and cover to grade, removing the manhole flat-top and extending the riser as shown in Detail 1, Sheet A.CG-106. This item includes any incidental removals.

**Method of Measurement**
The measurement for adjust manhole to grade - remove manhole flat-top and extend riser shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport. Items include the reinforced slab, ring and cover. The concrete collar around the frame shall be constructed in accordance with Technical Specification P-610.

**Method of Payment**
Payment for adjust manhole to grade – remove manhole flat-top and extend riser to grade shall be made at the contract unit price per each.

Payment shall be made under:

Item GTP-30.08.1  Adjust Manhole to Grade – Remove Manhole Flat-Top, Extend Riser – Each

**30.09 BOLLARD (DETAIL 2, SHEET A.C-104)**

**Description**
This work shall include the installation of 8” cast in place (CIP) bollards in new asphalt concrete pavement as shown in Detail 2, Sheet A.C-104. This item includes any incidental removals, yellow HDPE bollard protective sleeve with 1-2” wide red reflective tape placed 12” from sleeve top and 1-2” wide retroreflective tape 18” below the top and around the sleeve circumference.

**Method of Measurement**
The measurement for Bollard (Detail 2, Sheet A.C-104) shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport. Bollards are to be installed after the concrete pavement is placed by means of coring and vacuum excavation. Any removals of existing/new items is incidental to the bollard bid item. The concrete base around the bollard shall be constructed in accordance with Technical Specification P-610.

**Method of Payment**
Payment for bollard (Detail 2, Sheet A.C-104) shall be made at the contract unit price per each.
Payment shall be made under:

Item GTP-30.09.1 Bollard (Detail 2, Sheet A.C-104) – per Each

30.10 HAZARD MARKER (MAG STD DET 141, TYPE 1)

Description
This work shall include the installation of hazard markers per MAG STD DET 141, Type 1 Surface Mount, and any incidental removals.

Method of Measurement
The measurement for Hazard Marker (MAG STD DET 141, Type 1) shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport.

Method of Payment
Payment for hazard marker (MAG STD DET 141, Type 1) shall be made at the contract unit price per each.

Payment shall be made under:

Item GTP-30.10.1 Hazard Marker (MAG STD DET 141, Type 1) – per Each

30.11 CONCRETE SIDEWALK (COP STD DET P1230)

Description
This work shall include the installation of concrete sidewalk per MAG STD DET 1230 and any incidental removals as shown in the plans.

Method of Measurement
The measurement for concrete sidewalk per COP STD DET P1230 shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport.

Method of Payment
Payment for Concrete Sidewalk shall be made at the contract unit price per square yard.

Payment shall be made under:

Item GTP-30.11.1 Concrete Sidewalk (COP STD DET 1230) – per Square Yard

30.12 SINGLE CURB (MAG STD DET 222, TYPE A)

Description
This work shall include the installation of concrete single curb per MAG STD DET 222, Type A and any incidental removals as shown in the plans.
Method of Measurement
The measurement for single curb per MAG STD DET 222, Type A shall be as identified below and shall include all labor, equipment, tools, and incidentals necessary to complete the work as identified on the plans and accepted by the Airport.

Method of Payment
Payment for Single Curb shall be made at the contract unit price per linear foot.

Payment shall be made under:

   Item GTP-30.12.1 Single Curb (MAG STD DET 222) – per Linear Foot

END SECTION 30
Item C-100 Contractor Quality Control Program (CQCP)

100-1 General. Quality is more than test results. Quality is the combination of proper materials, testing, workmanship, equipment, inspection, and documentation of the project. Establishing and maintaining a culture of quality is key to achieving a quality project. The Contractor shall establish, provide, and maintain an effective Contractor Quality Control Program (CQCP) that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The Contractor shall establish a CQCP that will:

a. Provide qualified personnel to develop and implement the CQCP.
b. Provide for the production of acceptable quality materials.
c. Provide sufficient information to assure that the specification requirements can be met.
d. Document the CQCP process.

The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the CQCP has been reviewed and approved by the Resident Project Representative (RPR). No partial payment will be made for materials subject to specific quality control (QC) requirements until the CQCP has been reviewed and approved.

The QC requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the quality assurance (QA) testing requirements. QA testing requirements are the responsibility of the RPR or Contractor as specified in the specifications.

A Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Resident Project Representative (RPR), Contractor, subcontractors, testing laboratories, and Owner’s representative must be held prior to start of construction. The QC/QA workshop will be facilitated by the Contractor. The Contractor shall coordinate with the Airport and the RPR on time and location of the QC/QA workshop. Items to be addressed, at a minimum, will include:

b. Discussion of the QA program.
c. Discussion of the QC and QA Organization and authority including coordination and information exchange between QC and QA.
d. Establish regular meetings to discuss control of materials, methods and testing.
e. Establishment of the overall QC culture.
100-2 Description of program.

a. General description. The Contractor shall establish a CQCP to perform QC inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. The CQCP shall ensure conformance to applicable specifications and plans with respect to materials, off-site fabrication, workmanship, construction, finish, and functional performance. The CQCP shall be effective for control of all construction work performed under this Contract and shall specifically include inspections and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of QC.

b. Contractor Quality Control Program (CQCP). The Contractor shall describe the CQCP in a written document that shall be reviewed and approved by the RPR prior to the start of any production, construction, or off-site fabrication. The written CQCP shall be submitted to the RPR for review and approval at least five (5) calendar days before the CQCP Workshop. The Contractor’s CQCP and QC testing laboratory must be approved in writing by the RPR prior to the Notice to Proceed (NTP).

The CQCP shall be organized to address, as a minimum, the following:

1. QC organization and resumes of key staff
2. Project progress schedule
3. Submittals schedule
4. Inspection requirements
5. QC testing plan
6. Documentation of QC activities and distribution of QC reports
7. Requirements for corrective action when QC and/or QA acceptance criteria are not met
8. Material quality and construction means and methods. Address all elements applicable to the project that affect the quality of the pavement structure including subgrade, subbase, base, and surface course. Some elements that must be addressed include, but is not limited to mix design, aggregate grading, stockpile management, mixing and transporting, placing and finishing, quality control testing and inspection, smoothness, laydown plan, equipment, and temperature management plan.

The Contractor must add any additional elements to the CQCP that is necessary to adequately control all production and/or construction processes required by this contract.

100-3 CQCP organization. The CQCP shall be implemented by the establishment of a QC organization. An organizational chart shall be developed to show all QC personnel, their authority, and how these personnel integrate with other management/production and construction functions and personnel.

The organizational chart shall identify all QC staff by name and function, and shall indicate the total staff required to implement all elements of the CQCP, including inspection and testing for each item of work. If necessary, different technicians can be used for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for
implementation of all or part of the CQCP, the personnel assigned shall be subject to the qualification requirements of paragraphs 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The QC organization shall, as a minimum, consist of the following personnel:

- **Program Administrator.** The Contractor Quality Control Program Administrator (CQCPA) must be a full-time employee of the Contractor, or a consultant engaged by the Contractor. The CQCPA must have a minimum of five (5) years of experience in QC pavement construction with prior QC experience on a project of comparable size and scope as the contract.

  Included in the five (5) years of paving/QC experience, the CQCPA must meet at least one of the following requirements:

  1. Professional Engineer with one (1) year of airport paving experience.
  2. Engineer-in-training with two (2) years of airport paving experience.
  3. National Institute for Certification in Engineering Technologies (NICET) Civil Engineering Technology Level IV with three (3) years of airport paving experience.
  4. An individual with four (4) years of airport paving experience, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.
  5. An individual who currently is a Program Administrator on a similar project, or who has successfully performed as a Program Administrator on other similar type projects.

The CQCPA must have full authority to institute any and all actions necessary for the successful implementation of the CQCP to ensure compliance with the contract plans and technical specifications. The CQCPA authority must include the ability to immediately stop production until materials and/or processes are in compliance with contract specifications. The CQCPA must report directly to a principal officer of the construction firm. The CQCPA may supervise the Quality Control Program on more than one project provided that person can be at the job site within two (2) hours after being notified of a problem.

- **QC technicians.** A sufficient number of QC technicians necessary to adequately implement the CQCP must be provided. These personnel must be either Engineers, engineering technicians, or experienced craftsmen with qualifications in the appropriate field equivalent to NICET Level II in Civil Engineering Technology or higher, and shall have a minimum of two (2) years of experience in their area of expertise.

  The QC technicians must report directly to the CQCPA and shall perform the following functions:

  1. Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by paragraph 100-6.
  2. Performance of all QC tests as required by the technical specifications and paragraph100-8.
  3. Performance of tests for the RPR when required by the technical specifications.

  Certification at an equivalent level of qualification and experience by a state or nationally recognized organization will be acceptable in lieu of NICET certification.
c. Staffing levels. The Contractor shall provide sufficient qualified QC personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The CQCP shall state where different technicians will be required for different work elements.

100-4 Project progress schedule. Critical QC activities must be shown on the project schedule as required by Section 80, paragraph 80-03, Execution and Progress.

100-5 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include as a minimum:

a. Specification item number
b. Item description
c. Description of submittal
d. Specification paragraph requiring submittal
e. Scheduled date of submittal

100-6 Inspection requirements. QC inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by paragraph 100-9.

Inspections shall be performed each shift to ensure continuing compliance with contract requirements until completion of the particular feature of work. Inspections shall include the following minimum requirements:

a. During plant operation for material production, QC test results and periodic inspections shall be used to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment used in proportioning and mixing shall be inspected to ensure its proper operating condition. The CQCP shall detail how these and other QC functions will be accomplished and used.

b. During field operations, QC test results and inspections shall be used to ensure the quality of all materials and workmanship. All equipment used in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The CQCP shall document how these and other QC functions will be accomplished and used.

QC technicians shall not perform any production engineering or management functions. Their sole role and responsibility is inspection, testing, and documenting the actual work performed. QC technicians shall report directly to the Program Administrator, regardless of which company they are employed.
100-7 Contractor QC testing facility.

a. For projects that include Item P-401, Item P-403, and Item P-404, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM D3666, *Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*:

   8.1.3 Equipment Calibration and Checks;
   8.1.9 Equipment Calibration, Standardization, and Check Records;
   8.1.12 Test Methods and Procedures

b. For projects that include P-501, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM C1077, *Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation*:

   7 Test Methods and Procedures
   8 Facilities, Equipment, and Supplemental Procedures

100-8 QC testing plan. As a part of the overall CQCP, the Contractor shall implement a QC testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional QC tests that the Contractor deems necessary to adequately control production and/or construction processes.

The QC testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

a. Specification item number (e.g., P-401)
b. Item description (e.g., Hot Mix Asphalt Pavements)c. Test type (e.g., gradation, grade, asphalt content)d. Test standard (e.g., ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated)f. Responsibility (e.g., plant technician)g. Control requirements (e.g., target, permissible deviations)

The QC testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The RPR shall be provided the opportunity to witness QC sampling and testing.

All QC test results shall be documented by the Contractor as required by paragraph 100-9.

100-9 Documentation. The Contractor shall maintain current QC records of all inspections and tests performed. These records shall include factual evidence that the required QC inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial
action; and corrective actions taken. All records and reports shall be uploaded into the City’s Unifier document management system.

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the RPR daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the CQCPA.

Contractor QC records required for the contract shall include, but are not necessarily limited to, the following records:

a. **Daily inspection reports.** Each Contractor QC technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician’s daily reports shall provide factual evidence that continuous QC inspections have been performed and shall, as a minimum, include the following:

   1. Technical specification item number and description
   2. Compliance with approved submittals
   3. Proper storage of materials and equipment
   4. Proper operation of all equipment
   5. Adherence to plans and technical specifications
   6. Summary of any necessary corrective actions
   7. Safety inspection.
   8. Photographs and/or video

The daily inspection reports shall identify all QC inspections and QC tests conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible QC technician and the CQCPA. The RPR shall be provided at least one copy of each daily inspection report on the work day following the day of record. When QC inspection and test results are recorded and transmitted electronically, the results must be archived.

b. **Daily test reports.** The Contractor shall be responsible for establishing a system that will record all QC test results. Daily test reports shall document the following information:

   1. Technical specification item number and description
   2. Test designation
   3. Location
   4. Date of test
   5. Control requirements
   6. Test results
   7. Causes for rejection
   8. Recommended remedial actions
   9. Retests
Test results from each day’s work period shall be submitted to the RPR prior to the start of the next day’s work period. When required by the technical specifications, the Contractor shall maintain statistical QC charts. When QC daily test results are recorded and transmitted electronically, the results must be archived.

100-10 Corrective action requirements. The CQCP shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the CQCP as a whole, and for individual items of work contained in the technical specifications.

The CQCP shall detail how the results of QC inspections and tests will be used for determining the need for corrective action and shall contain clear rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and use statistical QC charts for individual QC tests. The requirements for corrective action shall be linked to the control charts.

100-11 Inspection and/or observations by the RPR. All items of material and equipment are subject to inspection and/or observation by the RPR at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate QC system in conformance with the requirements detailed here and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to inspection and/or observation by the RPR at the site for the same purpose.

Inspection and/or observations by the RPR does not relieve the Contractor of performing QC inspections of either on-site or off-site Contractor’s or subcontractor’s work.

100-12 Noncompliance.

a. The Resident Project Representative (RPR) will provide written notice to the Contractor of any noncompliance with their CQCP. After receipt of such notice, the Contractor must take corrective action.

b. When QC activities do not comply with either the CQCP or the contract provisions or when the Contractor fails to properly operate and maintain an effective CQCP, and no effective corrective actions have been taken after notification of non-compliance, the RPR will recommend the Owner take the following actions:

   (1) Order the Contractor to replace ineffective or unqualified QC personnel or subcontractors and/or
   (2) Order the Contractor to stop operations until appropriate corrective actions are taken.

100-13 Method of Measurement. Contractor Quality Control Program (CQCP) is for all personnel, tests, equipment, facilities, and documentation required to implement the CQCP and will be measured as follows:

a. 100-13.1 – The CQCP Administrator will be measured on a lump sum basis.

b. 100-13.2 – Contractor Quality Control Inspectors will be measured on a per hour basis for Contractor Quality Control Inspectors.
c. 100-13.3 – Contractor Quality Control Field and Laboratory Testing will be measured on a lump sum basis for Contractor Quality Control Testing.

100-14 Basis of Payment:

   a. 100-14.1 – Payment will be made at the contract lump sum price for the CQCP Administrator. The price shall be full compensation for furnishing all labor, equipment, materials, and incidentals to implement and manage the CQCP.

   b. 100-14.2 – Payment will be made at the contract unit price per hour for Quality Control Inspectors. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals to perform onsite inspection of the work.

   c. 100-14.3 – Payment will be made at the contract lump sum price for the Field and Laboratory sampling and testing. This price shall be full compensation for furnishing all labor, equipment, materials, and incidentals to perform testing of all onsite and offsite contract items of work, regardless of the number of testing technicians provided for each work shift.

Payment will be made under:

Item C-100-14.1      Contractor Quality Control Program Administrator – per Lump Sum
Item C-100-14.2      Contractor Quality Control Inspectors – per Hour
Item C-100-14.3      Contractor Quality Control Testing – per Lump Sum

REFERENCES

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

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

   ASTM C1077      Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

   ASTM D3665      Standard Practice for Random Sampling of Construction Materials

   ASTM D3666      Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

END OF ITEM C-100
Item C-102 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

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

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

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

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

See also ENV AZPDES Stormwater General Permit Compliance.

MATERIALS

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

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

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

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

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

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

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

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

Contractor shall be responsible for the day-to-day operational control of those activities at a project which are necessary to ensure compliance with a Stormwater Pollution Prevention Plan (SWPPP) for the site and other permit conditions. The Contractor is responsible for preparing, in a manner acceptable to the ADEQ and the EPA, all documents required by regulation, which shall include but not necessarily be limited to the following:

- Notice of Intent (NOI)
- Stormwater Pollution Prevention Plan (SWPPP)
- Notice of Termination (NOT)

102-3.1a NOI Submittal. The Contractor shall submit a Notice of Intent in accordance with the AZCGP. The Contractor shall identify on the NOI all non-stormwater discharges that are expected to be associated with the project’s construction activities as required by AZCGP.

Copies of the NOI and the SWPPP shall be submitted to the RPR.

The Contractor shall ensure the completed and duly signed NOI form(s) are submitted in a timely manner to prevent a delay to project construction.

A copy of all submitted NOI forms shall be posted at the construction site.

102-3.1b SWPPP. The Contractor shall develop, sign and certify, implement, update, amend, and revise the SWPPP as necessary, to assure compliance with permit requirements. The Contractor shall address in the SWPPP, all non-stormwater discharges that are expected to be associated with the project’s construction activities as required by the AZCGP.

The contractor shall ensure that:

- The SWPPP indicates the areas of the project where the City, County, or other entity has operational control over the project specifications, including the ability to make modifications in specifications.
- All other operators implementing portions of the SWPPP impacted by changes made to the SWPPP are notified of such modifications in a timely manner.
- The SWPPP indicates the parties with day-to-day operational control and parties responsible for implementation of the BMP’s identified in the SWPPP.

The Contractor and subconsultants shall ensure that construction activities do not render another party’s BMP(s) ineffective.

102-3.1c Inspections. Contractor shall perform inspections, by qualified personnel, of all stormwater pollution control devises on the project at least once every fourteen (14) days and within twenty-four (24) hours of each 0.5-inch or greater storm event, as required under the provisions of the AZCGP. Contractor shall prepare reports, in accordance with AZCGP, on such inspections and shall retain the reports for a period of at least three (3) years following the completion of the project. The Contractor
shall maintain all stormwater pollution control devices on the project in proper working order, which shall include cleaning, repair, and/or replacement during the duration of the project.

102-3.1d NOT Submittal. Upon project completion, acceptance and demobilization, Contractor shall submit to ADEQ a completed, duly executed Notice of Termination form for each NOI issued, with a copy of the NOT acknowledgement letter to appropriate authorities, thereby terminating all AZPDES permit coverage for the project. Contractor shall then provide to the County copies of the SWPPP, inspection information and all other documents prepared and maintained by the Contractor in compliance with the AZPDES Construction General Permit.

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

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

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

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

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

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

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

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

**METHOD OF MEASUREMENT**

**102-4.1** Measurement for developing and implementing a Temporary Erosion and Pollution Control Plan shall be made on a lump sum basis.

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

**BASIS OF PAYMENT**

**102-5.1** Payment will be made at the contract lump sum price for Temporary Erosion and Pollution Control. This price shall be full compensation for development of the plan along with furnishing all materials and labor, equipment, tools and incidentals necessary to develop, amended, obtain approval of, implement and maintain erosion control elements for the duration of the project. The Temporary Erosion Control will be paid as a lump sum with the following schedule of partial payments:

- A. With first pay request, 25% with approval of and completion of the required Environmental Documents and Submittals.
- B. When 25% or more of the original contract is earned, an additional 25%.
- C. When 50% or more of the original contract is earned, an additional 25%.
- D. When 75% or more of the original contract is earned, the final 25%.

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

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

Payment will be made under:

- Item C-102-5.1 Temporary Air and Water Pollution, Soil Erosion and Siltation Control – per Lump Sum
REFERENCES

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

Advisory Circulars (AC)

AC 150/5200-33  Hazardous Wildlife Attractants on or Near Airports
AC 150/5370-2  Operational Safety on Airports During Construction

ASTM International (ASTM)

ASTM D6461  Standard Specification for Silt Fence Materials

United States Department of Agriculture (USDA)

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

END OF ITEM C-102
Item C-104 Project Specific Special Provisions

104-1 Description of the Work. This project consists of removal of concrete and asphalt pavement, earthwork and base courses, placing new asphalt and concrete pavements, drainage system installations including trench drains, blast fence, blast wall, VSR and other pavement markings, airfield electrical modifications, and other associated work for the Terminal 4 S1 Concourse Apron Construction at the Phoenix Sky Harbor International Airport (PHX).

104-2 Compliance With Advisory Circulars. All work shall be in accordance with FAA Advisory Circulars except as modified herein. The Contractor’s attention is specifically directed to Advisory Circular 150/5370-2G (or current revision update) Operational Safety on Airports During Construction, the Contractor shall adhere to.

104-3 Phases of the Work

104-3.1 General. Unless otherwise approved by the RPR, the Contractor shall perform all work in accordance with the construction sequencing as shown on the plans and as described herein. The plans and descriptions are intended to provide a general outline of the order in which the work is to be accomplished, and the operating restrictions which will be in effect for each Phase of Work. Neither the phasing plans, nor the descriptions contained in this section, are intended to be a comprehensive list of all work items, nor are they intended to control the Contractor’s means or methods of construction.

The Contractor shall conduct its operation in such a manner so as to maintain a smooth, safe, uninterrupted flow of aircraft and vehicular traffic adjacent to or through each Phase boundary. Phases that are not under construction shall be accessible and remain operational at all times. The construction sequences and schedule shown on the plans has been developed to minimize the impact of construction activities on airfield operations.

Existing taxiway lighting systems, manholes, pull boxes, and other utility systems shall be protected and maintained at all times unless otherwise noted on the plans.

The Contractor shall perform improvements within each Phase in the sequential order as identified herein, or as approved, and shall complete each Phase within the durations of time shown on the Plans. Each phase shall be partially accepted in accordance with Section 50 prior to starting the subsequent phase.

The limits of work for each Phase of construction are shown on the construction phasing plans. For each phase, the boundaries of the phases show the limits of the work area in which the Contractor may have workers, equipment, and materials, and in which the Contractor may conduct work for that Phase.

Construction activity may be accomplished closer to a taxiway without taxiway closure, subject to the Airport Operation’s approval and meeting the criteria specified in the AC 150/5370-2G.
Existing taxiway lighting systems, manholes, fuel system, pull boxes and other utility systems shall be protected and maintained at all times unless noted in the project plans.

All Airport Service Roads and air carrier access to all open gates shall remain in operation at all times, along with airside access points, and truck fueling racks.

104-3.1A Notice to Proceed to start construction is anticipated for March 1, 2021. The entire project shall be substantially complete no later than November 3, 2021.

104-3.1B Phase Conditions

Phase 3 – Work on the west and south sides of the Concourse, identified on the plans, shall commence on construction Notice to Proceed. Work on the east side of the Concourse will not be available until March 26, 2011. Gate D1 will be closed for the construction of the Blast Wall and surrounding pavement. The maximum duration during Phase 3 for a Gate D1 closure is thirty (30) calendar days.

During Phase 3, there will be no shift or calendar day work restrictions, other than listed in the moratoriums in Section 120-5, Construction and Maintenance Work Moratoriums. The Contractor shall maintain access to the Concourse during the entirety of Phase 3.

Joint widening and sealing along and punch list work along the outer fifty (50’) of Phase 3 concrete pavement shall be substantially completed no later than August 1, 2021. The Contractor shall notify the RPR a minimum of four (4) weeks prior to the intended start of Phase 4A to enable the Concourse Contractor to install and obtain TSA approval for a new Temporary AOA fence installation adjacent the perimeter of Phase 3.

All of Phase 3 shall be substantially completed no later than August 24, 2021. Liquidated Damages in accordance with Section 80 will be assessed for failure to complete the work by August 24, 2021.

Phase 3A – Work identified on the plans as Phase 3A cannot start until the trash compactor has been installed by the Concourse Contractor and is functional. This Concourse work should be completed no later than August 1, 2021. AOA fencing must also be relocated to permit construction of Phase 3A. The Contractor shall notify the RPR a minimum of four (4) week notice prior to their intended start date of Phase 3A to permit time for the AOA fence relocation along with TSA approvals to be completed. The Contractor shall always maintain tenant access to the Trash Compactor.

During Phase 3A, there will be no shift or calendar day work restrictions, other than listed in the moratoriums in Section 120-5, Construction and Maintenance Work Moratoriums.

Phase 3A shall be substantially completed no later than November 3, 2021. Liquidated Damages in accordance with Section 80 will be assessed for failure to complete the work by November 3, 2021.
Phase 4A – Phase 4A shall consists of closing Taxiway S between Taxiway C and Taxiway D along with the relocation of the airside VSR road along the outer perimeter of Phase 3. This one (1) night shift operation to shift VSR traffic shall not commence until the new temporary AOA fencing installed by the Concourse Contractor near the end of Phase 3, is acceptable to the RPR.

Phase 4B – Phase 4B consists of pavement demolition, grading, drainage, and new pavement construction within the Object Free Area of Taxiway S. A VSR crossing through Phase 4B must always remain operational. During Phase 4B, there will be no shift or calendar day work restrictions, other than listed in the moratoriums in Section 120-5, Construction and Maintenance Work Moratoriums.

The maximum allowable time permitted for a Taxiway S full closure will be sixty (60) calendar days for combined Phase 4B and Phase 4C.

Phase 4C – Phase 4C consists of removal and construction of the VSR crossing left in place during Phase 4B construction. VSR traffic will be shifted to Phase 4B. During Phase 4C there will be no shift or calendar day work restrictions, other than listed in the moratoriums in Section 120-5, Construction and Maintenance Work Moratoriums.

The maximum allowable time permitted for a Taxiway S full closure will be sixty (60) calendar days for combined Phase 4B and Phase 4C durations. Liquidated damages will be assessed in accordance with Section 80 for failure to complete combined Phases 4B and 4C within sixty (60) calendar days from the start of Phase 4B.

Phase 4D – Phase 4D restricts Taxiway D to ADG Group III. Phase 4D work consists of the apron construction within Taxiway D Object Free Area. Phase 4D does not contain any shift or calendar day restrictions, except for work within 65’ to 93’ of Taxiway D centerline which shall be constructed at night between 2200 hours and 0600 hours daily. Phase 4D may be constructed concurrently with Phases 4B and 4C.

All of Phase 4D work shall be substantially completed by November 3, 2021. Liquidated damages will be assessed in accordance with Section 80 for failure to complete Phase 4D by November 3, 2021.

Phase 5 - Phase 5 construction shall start no earlier than the start of Phase 4. Unless otherwise approved by the RPR, Phase 5 shall be constructed during night hours only (2100 hours – 0600 hours). Phase 5 is anticipated to be concurrent with Phase 4.

All of Phase 5 work shall be substantially completed by November 3, 2021. Liquidated damages will be assessed in accordance with Section 80 for failure to complete Phase 4D by November 3, 2021.

Overall Project Completion – Following the restrictions herein along with those located elsewhere in the contract documents, all work shall be substantially complete no later than November 3, 2021. Liquidated damages will be assessed in accordance with Section 80 for failure to substantially complete the entire project by November 3, 2021.
104-3.2 Work Schedule. The Contractor shall submit a detailed Primavera P6 CPM schedule which indicates the specifics of the Contractor’s proposed Sequence of Work to comply with the requirements of this Section. The plan shall be comprehensive and shall indicate when, where and what work will occur in the daytime, and when, where and what work will occur at nighttime. This plan shall be prepared meeting the Construction Safety and Phasing Plans and the detailed requirements of Specification Item C-107 Construction Schedules, and shall be reviewed with the RPR prior to the Preconstruction Conference. The Contactor shall describe this plan to the assembled stakeholders at the Preconstruction Conference.

The Contractor shall also plan the work considering shifts will be cancelled during inclement weather. The Contractor shall plan for seven (7) lost work days per each calendar year or fraction thereof.

The Contractor shall submit a detailed paving and detour plan to indicate the methods for providing continuous access for service vehicles and Aircraft Rescue and Fire Fighting (ARFF) vehicle and equipment during construction of the project. This plan will require approval by the Airport prior to construction.

104-4 Traffic Control. The Contractor shall comply with all traffic control safety provisions as required by FAA AC 150/5370-2H, the CSPP, and other information located in the Contract documents.

The project will require the Contractor to maintain, relocate, and remove temporary airside perimeter security fence for the completion of all work activities, unless denoted otherwise in the project phasing plans. The Contractor will maintain at all times a clear zone of at minimum ten (10) feet adjacent to any temporary or permanent airside perimeter security fence.

When working airside the Contractor shall delineate the working area as shown on the plans adjacent to the taxiways and ramps with either low or high profile barricades as indicated and equipped with red flashing lights spaced at 10 foot intervals maximum with no spaces. Spaces will be permitted for ingress and egress points approved by the RPR. The Contractor shall remove the barricades from the active taxiways/taxilanes before the taxiways/taxilanes become operational at the end of each approved closure.

Additional high or low profile barricades, with or without lights that are not shown on the Plans may be requested by the RPR or Airport Operations during construction. The Contractor shall install, maintain, and remove the additional barricades ad directed.

When hauling materials to the staging area and the work areas, and when hauling materials off site, the Contractor shall also provide flagger(s) and appropriate warning signs and barricades along westbound Sky Harbor Boulevard to conform to the City of Phoenix permit requirements and the City of Phoenix Traffic Barricade Manual.

Escorts and sweeping shall be provided to or from the work area during all airside hauling operations. All trucks hauling materials into or out of the work site shall be escorted by an Airport approved Escort, regardless if the drivers of the trucks possess Airport badges. The Contractor shall provide the Escorts and the escort vehicle. The maximum convoy length shall not exceed two trucks plus the one escort vehicle (total of three) and escorted vehicles shall be in the immediate control of the vehicle conducting the Escort.
Hauling of aggregates, earthwork and base materials, redi-mix concrete, along with cement, fly ash, and aggregates to an on-site batch plant, if provided by the Contractor, shall be restricted to night time hours only. The night hours (8-hour window) for hauling shall be approved by the RPR.

The Contractor shall restrict hauling on Sky Harbor Boulevard (SHB) to be night-time only as specified in the Special Provisions, Para. 1.11.4.

104-5 Haul Roads, Vehicle Service Roads and Work Areas. The Contractor will be allowed to use portions of the Airport Proper for hauling as indicated on the plans. The Contractor shall schedule any required haul such that no damage occurs to the service roads. Any damage to the service roads caused by the Contractor’s operations shall be repaired by the Contractor at Contractor expense.

Access to all existing airport operations will be maintained at all times, unless noted otherwise in the Contract Documents.

The Contractor shall submit a detailed haul route traffic control plan to demonstrate the methods for providing access for aircraft operations and access for vehicular traffic at all times. This plan shall be submitted a minimum of 15 calendar days prior to the start of haul road use. This plan will require approval by the Airport prior to haul road use by the Contractor.

The Contractor shall obtain at the Contractor’s own expense any haul permits needed from the City of Phoenix for use of public streets for haul routes. Traffic control and cleaning shall comply with agency requirements. As a minimum, the Contractor shall provide sufficient traffic control measures to protect the public and the Contractor’s personnel.

104-6 Pre-Construction Conference. Following award, and prior to the start of construction work, the Contractor shall conduct a Pre- Construction Conference at a time and place designated by the RPR. The purpose of the Pre- Construction Conference shall be to discuss various items including operational safety, testing, quality control, security, safety, labor requirements and environmental factors. As a minimum, the following items will be discussed:

- Introduction of Parties Attending
- Award of the Contract
- Description of the Work
- Contractor Quality Control Program
- Environmental Issues
- Permits
- Utility Company Input
- Assignment of Authorized Site Representative(s) and Emergency Phone Numbers
- Discussion of Construction Schedule (at this meeting the Contractor shall describe the proposed sequence of work in detail)
- Liquidated Damages
- Safety and Security
- Certified Payrolls, Progress Payment System, Prevailing Wage Rates
- Concerns of FAA
- Concerns of the City/Airport
- Concerns of Adjacent Projects and Stakeholders
- Additional Comments
The Contractor shall be prepared to fully describe the proposed construction organization, operations and schedule at this meeting.

104-7 **Portable Construction Lighting.** The Contractor is responsible for providing work area lighting of sufficient quality and quantity to construct the work to the quality standards required in the Plans and Specifications.

As a minimum the construction lighting shall meet the following requirements:

- a. For any work to be performed during the night time hours the Contractor shall ensure that the work areas are adequately illuminated. A minimum of 10 foot-candles of illumination shall be provided in the work areas using maneuverable light plants with 1000-watt metal halide floodlights, mounted as high as practicality allowed. The Contractor shall determine the number of light plants and their required spacing to achieve the illumination levels specified herein.

- b. The Contractor shall coordinate with Airport Operations prior to placing light plants to ensure that light placements do not interfere with the visibility of pilots or Air Traffic Control Tower personnel.

104-8 **Standby Equipment.** The Contractor shall provide and maintain stand-by equipment as the Contractor deems necessary to prevent delays to the work in the event of breakdown of the primary equipment.

104-9 **Scheduling and Daily Operation.** All work hours shall be subject to the written approval of the RPR, Owner and Airport Operations, and shall be in accordance with the approved work schedule. The Contractor shall have personnel and equipment staged and ready to occupy the work site at the start times listed.

The Contractor shall attend daily briefings and weekly construction meetings with the RPR and Owner. Appropriate staff from the Airport and the Contractor shall attend as required. Topics shall include but not be limited to safety issues, schedule updates, current issues, quality control, utility issues, fuel coordination, adjacent project and stakeholder coordination, environmental concerns, submittal status, RFI status, coordination with other contracts, and potential disputes.

104-10 **Paving Plan.** Within 15 calendar days of the written Notice to Proceed with the work, the Contractor shall submit a preliminary paving plan for the review and approval of the RPR. The paving plan shall include the following features:

- Drawings to identify the locations of paving lanes and the sequence of paving for each night
- Volumes and areas anticipated each night for each concrete paving lane placement

In addition, the Contactor shall also furnish the RPR with paving drawings at each weekly construction meeting for the following work week. The drawings shall include a three week look-ahead paving schedule.

104-11 **Pre-Activity Planning Meetings.** Prior to the start of work, and prior to the start of any new phases or new activities of Work, the Contractor shall conduct a Pre-Activity Planning Meeting. At these
meetings the Contractor shall describe in detail the approach to be taken for the subject work. The Contractor shall include any sketches required to describe the work approach. The Contractor shall describe in detail the equipment to be used, security requirements, haul routes, traffic control, backup equipment and contingency planning should equipment or material delivery problems occur, etc.

104-12 Access to Airport Property. Contractor shall verify from the RPR and the Airport Authority, prior to the start of construction, approved access and haul routes. Access to construction zones shall be as shown on the project plans. Contractor shall be responsible for all damage to pavement, lighting and facilities resulting from his/her operations. For haul routes that cross taxiways and taxilanes, the active taxiway and taxilanes portion shall be kept clean and free of debris and dust at all times on a continual basis. Taxiways, taxilanes, and aprons shall be left in usable condition at the close of each work shift.

104-13 Security

a. General. The information contained in this section is intended to highlight and summarize requirements and responsibilities of the Contractor and is not intended to be used as a comprehensive list of the requirements. Efforts of the contractor in meeting PSHIA’s security requirements described herein shall be considered incidental to the project and no separate payment shall be made.

b. Gate Security. The Contracting Agency or their authorized representatives shall maintain control at all construction entrances to prevent unauthorized Airport Operations Area (AOA) access onto Phoenix Sky Harbor International Airport’s (PSHIA). The gate security guards will assure that driver and vehicles entering the project have the required identifications, warning flags or flashing beacons. At each Weekly Meeting, the Contractor shall provide the estimated number of vehicles and equipment expected for the following week.

c. Security Fences. All Airport perimeter fences and gates are part of PHX Security.

d. Airport Security and Badging. Air operational requirements at PHX require background screening of contractor’s employees, sub-contractor employees, and suppliers. Personnel will be required to obtain and wear PSHIA Picture I.D. Badges for access to AOA (Air Operations Area).

Additional security/badging requirements are stipulated elsewhere in the Contract Documents.

104-14 Partnering. In order to foster cooperation, understanding, and communication between all parties of the contract, consultants, sub-consultants, airlines, FAA, and other stakeholders on the project, partnering is encouraged for this project. Partnering is not a legal partnership but is intended to create cohesive working relationships and coordination between all stakeholders.

104-15 Sustainability.

104-15.1 General. The Contractor shall take all necessary measures to comply with the City of Phoenix Aviation Department’s Design and Construction Green Guide (Sustainable Horizontal Design and Construction Green Guide) located at: https://skyharbor.co/pdf/DsgnConst Green Guide.pdf

104-15.2 Sustainability Plan. Prior to the start of construction activities and the Preconstruction
Conference, the Contractor shall submit a “Sustainability Plan” outlining all the procedures and measures that will be implemented to comply with the intent of the Green Guide.

At a minimum, the Contractor shall outline procedures to satisfy the following initiatives:

1. Recycling/reuse of all waste and debris including but not limited to: concrete and asphalt pavements, whether these materials will be reused on the project or be processed and recycled for other specific purposes; and the recycling of paper, plastic, glass, electronics and metals, either from the job site or construction trailer. Recycling/Diversion Plan forms are attached. The Contractor’s attention is also directed to the DCS Green Guide Performance standards HC-MR-1 through 4.


3. Measures and procedures that will be implemented to minimize dust and particulates and a Maricopa County Dust Control Permit and Plan.

4. Measures and procedures that will be used to minimize noise outside the AOA. See DCS Green Guide performance standard HC-EQ-1.


8. A plan to provide sustainability training on the project initiatives to all employees and subcontractors and follow up training of employees. See DCS Green Guide HC-IM-3.

9. A Storm Water Pollution Prevention Plan (SWPPP) and permit and procedures that will be enacted on the project.

104-15.3 Required Submittals. The Contractor shall submit a monthly Checklist of the above-referenced and any other efforts undertaken during the month to meet the requirements stipulated herein. The Contractor shall address specific individual improvements that will be undertaken that will enhance sustainability in areas needing improvement. The Checklist form shall be approved by the Engineer. The Engineer will not process the monthly Contractor payment request in the absence of an acceptable sustainability Checklist of activities undertaken during the monthly progress payment period.

104-15.4 Payment. Submittals and measures to comply with the Green Guide will not be paid separately but will be considered incidental to the work.

END OF ITEM C-104
Item C-105 Mobilization

105-1 Description. This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items. Temporary construction fencing along with obtaining airport security badges and airport driving permission, and demobilization are included in this item of work.

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

105-3 Posted notices. Prior to commencement of construction activities, the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster “Equal Employment Opportunity is the Law” in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL “Notice to All Employees” Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

105-4 Engineer/RPR field office. The Contractor shall provide dedicated space for the use of the field RPR and inspectors, as a field office for the duration of the project. This space shall be located conveniently near the construction and shall be separate from any space used by the Contractor. The Contractor shall furnish water, sanitary facilities, heat, air conditioning, highspeed internet and electricity in accordance with local building codes, and applicable furnishings. The Contractor shall also supply a high speed copy machine capable of color printing in 8-1/2” and 11”x17”. Unless otherwise approved by the RPR, the RPR’s Field Office shall not be removed until thirty (30) calendar days after Final Project Acceptance.

The Contractor shall provide the RPR and Owner Representatives mobile devices, with internet connectivity, for the sole use of connection to the Contractors planned document control internal system. Contractor shall at minimum provide two (2) devices for the use of the RPR and two (2) devices for use by the Owner and representatives.

105-5 Contractor Area. The Contractor will be afforded the use of areas designated on the drawings or approved by the RPR for laydown and other storage areas. These spaces shall be provided without charge to the Contractor for their use throughout the contract period. These areas may be used by the Contractor for storage of material and equipment to be used in the work, and the location of the Contractor’s field laboratory and curing facilities, along with on-site batch plants.

As part of the yard set-up activities, the Contractor shall investigate the availability of and adequate supply of power, communications and other utilities, and make all arrangements, including permits, for the purchase of necessary utilities. The Contractor shall install temporary 6-foot high chain link fencing and gates to enclose the Contractor’s laydown areas to secure the area. The fencing and gates shall be removed at the completion of the work and will remain the property of the Contractor.
METHOD OF MEASUREMENT

105-5.1 Mobilization including all Work associated therewith, shall be measured for payment by the lump sum as a single complete unit of Work. No additional measurement will be made for Mobilization.

105-5.2 Contractor Laydown Yard Setup including all Work associated therewith, shall be measured for payment by the lump sum as a single complete unit of Work. No additional measurement will be made for Laydown Yard Setup.

105-5.3 Measurement for furnishing and maintaining an “Engineer/RPR’s Field Office” will be made on a lump sum basis.

105-5.4 Demobilization including all Work associated therewith including the Contractor Laydown Yard, shall be measured for payment by the lump sum as a single complete unit of Work. No additional measurement will be made for Demobilization.

BASIS OF PAYMENT

105-6.1 Payment for mobilization will be made at the lump sum price bid for mobilization. The total price shall be paid in partial payments as described in subsection 105-6.1.1. The price bid shall be full compensation for furnishing all materials, labor, airport security and badging requirements, drivers, training, phones and equipment and tools necessary to complete mobilization.

105-6.1.1 Partial Payments for Mobilization under this item will be made in accordance with the following provisions:

The first partial payment for Mobilization will be made at 50% of the lump sum price bid at such time that the project submittals have been provided to the satisfaction of the RPR; the Contractor’s baseline CPM schedule has been submitted and approved by the RPR; the required survey control, work has been completed.

The remaining 50% be prorated and paid monthly over the contract duration.

105-6.2 Payment for Contractor Laydown Yard Setup will be made at the lump sum price bid. The price bid shall be full compensation for furnishing all materials, labor, airport security and badging requirements, and equipment and tools necessary to complete Contractor Laydown and Batch Plant Yard.

105-6.3 Payment for RPR’s Field Office will be made at the contract lump sum price. This price shall constitute full compensation for furnishing and maintaining all equipment, providing internet service. Thirty (30%) percent of the lump sum amount will be paid once the RPR’s Field Office is set up with all equipment, services, and supplies. The remaining seventy (70%) will be paid on a monthly basis calculated by dividing the lump sum bid price less thirty percent by the Contract Time in months.

105-6.4 Payment for Demobilization will be paid at the contract lump sum amount after removing all materials and equipment, Contractor’s yards, storage areas, and have been cleaned and restored.
to original condition, along with delivery of all project closeout materials as required in the Contract.

**Payment will be made under:**

- **Item C-105-6.1** Mobilization (Maximum 2% of Total Bid) – per Lump Sum
- **Item C-105.6.2** Contractor Laydown Yard Setup – per Lump Sum
- **Item C-105.6.3** RPR Field Office – per Lump Sum
- **Item C-105.6.4** Demobilization (Maximum 2% of Total Bid) – per Lump Sum

**REFERENCES**

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

**Office of Federal Contract Compliance Programs (OFCCP)**

- Executive Order 11246, as amended
- EEOC-P/E-1 – Equal Employment Opportunity is the Law Poster

**United States Department of Labor, Wage and Hour Division (WHD)**

- WH 1321 – Employee Rights under the Davis-Bacon Act Poster

**END OF ITEM C-105**
Item C-106 Time Related Overhead

106-1 GENERAL. This item of time related overhead shall consist of those overhead costs, including field and home office overhead that are in proportion to the time and effort required to support the construction work. Time related overhead shall not include costs that are not related to time, including but not limited to, mobilization, demobilization, insurance, bonds, licenses, permits, and other charges incurred only once during the contract.

Time related overhead shall not apply to subcontractors of any tier, suppliers, fabricators, manufacturers, or other parties associated with the Contract.

106-2 FIELD AND HOME OFFICE OVERHEAD. Field office overhead expenses include time related costs associated with the normal and recurring operation of the construction project. These time related costs of field office overhead include, but are not limited to: salaries, benefits, and equipment costs of the project manager, field office managers, office engineers, and other field office staff assigned to the project. Other specific time related overhead costs include field office, utilities, sanitary facilities, water, maintenance, security, office supplies, cell phones, dumpster for field office, and equipment costs to support the Contractor’s project field offices. This item shall not include costs directly attributable to the work and supervision provided by superintendents, foreman, and trades including vehicles and construction equipment.

Home office overhead expenses are for the project costs specifically related to the contract. These labor costs include, Construction Managers, payroll clerks, accountant, estimator, and subcontract administration. Home office overhead costs shall exclude expenses specifically related to other contracts or other business of the Contractor.

106-3 QUANTITY INCREASES AND AUDITS. There shall be no final price adjustments if the final quantity for time related overhead is less than the original quantity or does not exceed the bid quantity by more than 149 percent. If the final quantity equals or exceed 150 percent of the original quantity, the RPR may request the Contractor to perform an audit of the home office overhead costs. This home office overhead audit costs shall be equally shared by the Owner and the Contractor and shall be performed by an independent Certified Public Accountant approved by the RPR. The home office overhead audit shall be in conformance with the requirements of the appropriate Federal Acquisition Regulations. The audit shall be adequately supported by reliable documentation and shall be related solely to the project under examination.

A unit price adjustment will be made only on the quantity that exceeds 150 percent of the original quantity. The unit price for this quantity increase may be greater or less than the original bid price.

106-4 MEASUREMENT. The quantity of time related overhead to be paid will be measured by the calendar day. Measurement for payment will begin on the date of Notice to Proceed for construction. Measurement will end after the date of substantial completion, but in no case shall measurement for payment be made beyond the required completion date of calendar days listed in the contract.
In the event the Contractor submits a CPM Baseline Construction Schedule showing an early completion of the work in accordance with these specifications that is accepted by the RPR, the amount of time related overhead eligible for payment will be based on the total number of contract days established for the project, rather than the Contractor’s early completion date shown on the Baseline CPM Schedule.

106-5 BASIS OF PAYMENT. The contract unit price paid per calendar day for time related overhead, measured as provided above, shall be made at the contract unit price. This price includes full compensation for the time related overhead, including the Contractor’s share of costs of any Independent Certified Public accountant audit and report of overhead costs requested by the RPR.

Full compensation for overhead costs incurred during days of inclement weather shall be considered included in the time related overhead paid during the calendar days, and no additional compensation will be allowed.

Overhead costs incurred by subcontractors of any tier, suppliers, fabricators, manufacturers, and other parties associated with the Contractor shall be considered as included in the various items of work.

Payment will be made under:

- Item C-106-5.1 Time Related Overhead – per Calendar Day

END OF ITEM C-106
Item C-107 Construction Schedules

107-1 Contractor will be required to adhere to all of the Project special provisions including Section 120 Coordination and Notification. In order to fully satisfy this goal the Contractor will submit a detailed CPM schedule which indicates the specifics of the Contractor’s proposed Sequence of Work to comply with the requirements of this Section. The plan shall be comprehensive and shall indicate when, where and what work will occur in the daytime, and when, where and what work will occur at nighttime. This plan shall be prepared meeting the Construction Safety and Phasing Plan and will be reviewed with the RPR prior to the Preconstruction Conference. The Contractor shall describe this plan to the assembled stakeholders at the Preconstruction Conference.

107-2 Work Restrictions. Restrictions of Work moratoriums are outlined in Section 120.

107-3 Inclement Weather. Weather-related schedule issues are outlined in Specification Item C-104, Section 104-3.2 Work Schedule.

107-4 Hauling of Materials. Restrictions on hauling are identified in Specification Item C-104, Section 104-4 Traffic Control.

107-5 Approval of Hours. All work hours shall be subject to the written approval of the RPR, Owner and Airport Operations, and shall be in accordance with the approved work schedule. The Contractor shall have personnel and equipment staged and ready to occupy the work site at the start times listed.

107-6 Critical Path Method Schedule. Contractor’s Construction Scheduler – Contractor shall employ or retain the services of a Construction Scheduler, an individual who is part of the Contractor’s management staff and solely dedicated to developing and maintaining the project construction schedule.

Unless otherwise approved, the Construction Scheduler shall have at least two (2) year of verifiable experience as the person primarily responsible for preparing and maintaining detailed project schedules on projects of the same or similar size and nature as this Project. The Contractor shall submit the Construction Scheduler’s background data to the RPR within ten (10) days after the Notice of Award date. The Construction Scheduler is required to attend all meetings pertaining to scheduling and progress of the Work. If the Construction Scheduler leaves the employ of the Contractor, the Contractor will be required to fulfill the requirements of this subsection within 14 calendar days of the departure of the Contractor’s Construction Scheduler. A resume shall be submitted for approval along with other supporting documentation regarding the proposed Scheduler’s qualifications which includes but is not limited to:
1) Identification, qualifications, and experience of the Contractor’s Construction Scheduler.

2) References of not less than two (2) previous projects on which the Contractor’s Construction Scheduler has utilized Primavera P3 or P6.

3) References: not less than two (2) names and telephone numbers of Officials who can verify the Construction Scheduler’s work product on two (2) previous projects within the past seven (7) years on which he utilized either Primavera P3 or P6 scheduling software.

The RPR reserves the right to disapprove any candidate proposed for the Project. The RPR reserves the right to request the Contractor remove the Scheduler, if, in the RPR’s opinion, is not performing scheduling work in accordance with the scheduling requirements.

107-6.1 General. The scheduling method to be used shall be a Critical Path Method schedule in the form of an activity on Precedence Diagram Network (PDN) with capabilities of identifying the critical path. The principles and definitions of the terms used herein shall be as set forth in the Associated General Contractors of America’s publication “The Use of CPM in Construction,” latest edition or “CPM in Construction Management”, latest edition (O’Brien and Plotnick). To the extent there are any conflicts between the Associated General Contractors of America's publication and “CPM in Construction Management”, the current textbook in publication governs. Finally, any conflict between any publications and the Contract Documents, the Contract Documents shall govern. The Contractor shall submit to the RPR for review, at the Pre-Construction Scheduling Conference, all of the following:

1) 120 day Preliminary Contract Schedule (4-month CPM Schedule)
2) A Work Breakdown Structure (WBS).
3) The associated alphanumeric coding structure to implement the WBS.
4) The activity identification system for labeling all Work activities.

The Contractor shall use the latest version of Primavera (P6) software or approved equal. This shall be referred to as the Scheduling System. The system shall be capable of handling, processing, printing, and plotting data to satisfy all requirements of these Contract Documents. The Contractor shall maintain the Scheduling System, the schedule, and the scheduling staff on Site or at a location approved by the RPR.

Within five (5) days after the Notice to Proceed, the Contractor shall submit a separate submittal schedule listing all submittals required under the Contract. This schedule (list of submittals) shall show when each submittal will be submitted. For the Preliminary and Baseline Schedules, all Submittals shall be shown, and match this “list of submittals” including activities for submittal preparation, reviews/acceptances, and procurement times shall be tied to their corresponding construction activities.

107-6.2 Preconstruction Scheduling Conference: The RPR will schedule and conduct a Preconstruction Scheduling Conference with the Contractor’s Project Manager, and Construction Scheduler within twenty (20) days after the Notice of Award date, to commence development of
the required 120-day Preliminary and Baseline Construction Schedule. The Contractor shall be prepared to review and discuss methodology for the schedule and sequence of operations.

107-6.3 Contractors 120 Day Preliminary Construction Schedule: Five (5) days after the Preconstruction Scheduling Conference, the Contractor shall submit a 120-day Preliminary Construction Schedule conforming to all the requirements of the Baseline Construction Schedule, but only for the duration of 4 months (120 calendar days).

After receipt of Contractor’s Preliminary Schedule, the RPR will review and provide comment(s) within fifteen (15) days. Within five (5) days after receipt of the RPR’s review comments, the Contractor shall re-submit the Preliminary Schedule and Narrative, addressing all of the RPR comments.

Submittal and acceptance of the Preliminary Construction Schedule is a condition precedent to the issuance of any Contractor’s progress payment.

107-6.4 Contractor’s Baseline Construction Schedule (Baseline Schedule): The Contractor shall prepare and submit to the RPR the Baseline Schedule within thirty (30) calendar days after acceptance of the 120 Day Preliminary Construction Schedule.

The Baseline Schedule shall show the sequence and interdependence of activities required for complete performance of the Work, and concluding with the Contract Completion Date shown in the Contract Documents. The first 120 calendar days of the Baseline Schedule shall match the Preliminary Schedule.

The schedule shall reflect the Contractor’s plans for progressing and performing the work. The Contractor shall be responsible for the means, methods, and activity durations, and shall certify that the schedule durations and contract period is achievable. At a minimum, each concrete placement day or concrete pour day shall be a uniquely identified activity. Drawings shall be provided with the Baseline Schedule to identify concrete paving lanes that coincide with each paving day activity in the Schedule.

Pursuant to the float sharing requirements of the Contract, use of float suppression techniques such as preferential sequencing, special lead/lag logic constraints, extended activity times or imposed dates shall be cause for rejection of the Preliminary/Baseline Schedule and any revisions or updates. The use of float time disclosed or implied by the use of alternative float suppression techniques shall be shared.

Any accepted Baseline Schedule, Baseline Schedule Revision(s), or Schedule update(s) having an early completion date shall show the time between the early completion date and the current Contract Completion Date as "Project Float." For the accepted Baseline or Baseline Revision(s), “Project Float” activity with appropriate duration (greater than 21 working days or 30 calendar days) shall be inserted as the last construction activity prior to Substantial Completion Milestone. The “Project Float” activity duration shall be “drawn down” as needed for project shared float.
The Contractor shall include inclement weather delay days as weather related excusable but non-compensable delays. These inclement weather activities shall be added after the last construction activity and prior to project phase substantial completion milestones.

The RPR will review and make comments on the Baseline Schedule. Meetings will be held between the RPR, the Contractor, Construction Scheduler to resolve any conflicts between the Baseline Schedule and the intent of the Contract.

Comments made by the RPR on the Baseline Construction Schedule, during reviews, will not relieve the Contractor from compliance with requirements of the Contract Documents. To the extent that there are any conflicts between the approved schedule and the requirements of the Contract Documents, the Contract Documents shall govern.

107-6.5 Network Details: The Baseline Schedule shall include time-scaled network diagrams, as well as computer tabulations. It shall be constructed to show the order in which the Contractor proposes to carry out the work, to indicate restrictions of access and to show availability of work areas, and availability and use of labor, materials and equipment. The Contractor shall utilize the Baseline Schedule in planning, scheduling, coordinating, and performing the work under the Contract (including all activities of subcontractors, equipment vendors, and suppliers).

The following criteria shall form the basis for assembly of the schedule logic:

1) Which activity must be completed before a subsequent activity can be started?
2) Which activities can be done concurrently?

The Baseline Schedule shall provide the RPR with a tool to monitor and follow the progress of all phases of the work. The Baseline Schedule submitted to the RPR shall comply with all limits imposed by the scope of work, with all contractually specified intermediate milestone and completion dates, and with all constraints or sequences included in the Contract. The degree of detail shall include factors to the satisfaction of the RPR, including, but not limited to each of the following:

1) Physical and structural breakdown of the Project.
2) Contract milestones and completion dates for each subphase, substantial completion dates, constraints, and the Contract completion date.
3) Activities of work to be performed and the sequences of work.
4) All purchases, submittal, submittal review, manufacturing, test, delivery, and installation activities for all major materials and equipment.
5) Preparation, submittal, and approval of shop and/or working drawings, and material samples showing a 15 day minimum time specified for the RPR ‘s review of all submittals, or longer as identified in the Contract. The same time frame shall be allowed for at least one (1) resubmittal on all submittals identified in the Contract Documents.
6) Approvals required by regulatory agencies or other third parties.
7) Plans for all subcontract work.
8) Assignment of responsibility for performing specific activities.
9) Access to and availability of work areas including all anticipated shutdowns.
10) Identification of interfaces and dependencies with preceding, concurrent and follow-on Contractors and utilities.
11) Punch list and final cleanup.
12) Written Narrative describing Critical Path, near Critical Path(s), basis of assumptions.
13) Identify as an Activity each individual concrete placement in the schedule

The activities included in the Baseline Schedule shall be analyzed in detail to determine activity time durations in units of days. Durations shall be based on the labor (crafts), equipment, and materials required performing each activity on a normal workday basis. No activity shall have duration over 15 days except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment. All durations shall be the result of definitive labor and resource planning by the Contractor to perform the work according to the Contract Documents.

The network diagram shall be prepared on 11” x 17” sheets, shall have a title block in the lower righthand corner, and a timeline on each page. Exceptions to the size of the network sheets and the use of computer graphics to generate the networks shall be subject to the approval of the RPR.

All networks shall be drafted time scaled to show a continuous flow of information from left to right. The primary path(s) of criticality shall be clearly and graphically identified on the network(s).

107-6.6 Baseline Construction Schedule: The Baseline Schedule submitted to the RPR shall include the time scaled network diagram (for the full network of activities as well as the Master Summary Schedule described below). Network diagrams shall be based on early start and early finish dates of activities shown. The network diagrams submitted to the RPR shall also be accompanied by a computer-generated mathematical computation reports (retained logic) for each activity included in the Baseline Schedule. Such mathematical reports shall be submitted to the RPR and shall include at a minimum, all of the following:

1) Activity number and description.
2) Predecessor and successor activity numbers and descriptions.
3) Activity code(s).
4) Schedule and actual/remaining duration for each activity.
5) Earliest start date (by calendar date).
6) Earliest finish date (by calendar date).
7) Actual start date (by calendar date).
8) Actual finish date (by calendar date).
9) Latest start date (by calendar date).
10) Latest finish date (by calendar date).
11) Float days.
12) Quantities for each activity.
13) Inclement weather delay time

Each of the following computer outputs/reports shall be required as part of the Baseline Schedule submittal and each revision or Monthly Updated Schedule.

1) All activities sorted by activity number from lowest to highest.
2) All activities sorted by the amount of total float, then in order of preceding event or activity number.
3) Each activity shall show as minimum: ID, Name, Calendar, Original Duration, Remaining Duration, Early Start, Early Finish, and Total Float (TF).
4) Activities completed in the previous month and Activities in the current month.
5) Activity sort by early start, for the next 60 days, then in order of preceding event or Activity number.
6) Activity sort(s) by organizational responsibility including submittals to the RPR for all items of material and equipment, the number of shifts to accomplish the activity.
7) Percentage of activity completed and remaining duration for incomplete activities.

The Contractor shall also prepare and submit a time-scaled Master Summary Schedule on a single sheet that shows the total Project in approximately 15 to 60 activities, as agreed to by the Contractor and the RPR. This schedule will summarize the accepted Baseline Schedule with all subsequent monthly Schedule Updates and shall have common events for correlating the two levels of schedule indenture. All Contract milestones along with substantial and final completion dates shall be shown.

The Master Summary Schedule shall be updated monthly.

When submitting the Baseline Construction Schedule for acceptance, the Contractor shall include in its letter of transmittal, any variances from the requirements of the Contract Documents. Otherwise, the Contractor will not be relieved of the responsibility for executing the work in strict accordance with the requirements of the Contract Documents.
The Contractor shall submit electronic and hard copy of each of the Baseline Schedule for review and acceptance:

1) Baseline Schedule network diagram and Master Summary Schedules (with retained logic).
2) Computer tabulations/reports (copies 8 ½” x 11” in size) including Primavera schedule diagnostics and Schedule Analyzer Pro (SA Pro) report of all item comparison of previous Schedule Update to current Schedule Update, or as directed by the RPR.
3) All required reports specified herein.
4) PDF files (latest version) containing items 1 through 4, above.

The Contractor shall also provide to the RPR an electronic copy of all schedules and schedule reports.

107-6.7 Acceptance of Baseline Schedule: The RPR shall accept or disapprove, in writing, the Contractor's Baseline Schedule submission within 14 days after receipt of all required information. The Baseline Schedule, once accepted, shall be used for monitoring and evaluating all facets of Contract performance, including, but not limited to progress, changes, and delays.

If the Contractor fails to submit the initial/final Baseline Schedule, the Master Summary Schedule, or the computer diskettes, within the time prescribed, or revisions thereof within the required time, it is within the RPR's discretion to stop the Contractor's work at no additional cost to the City.

107-6.8 Revisions to Accepted Baseline Schedule: The Contractor shall prosecute the Work in accordance with the accepted Baseline Schedule. No change to the accepted Baseline Schedule shall be made without the prior written approval of the RPR. If the Contractor desires to make a change to the accepted Baseline Schedule, the Contractor shall request permission from the RPR in writing, stating the reasons for the change as well as the specifics, such as revisions to activities, logic, durations, etc.

If the RPR considers a schedule change to be of a major nature, the RPR may require the Contractor to revise and submit for acceptance all of the affected portion(s) as a “fragnet” inside the Baseline Schedule/current Schedule Update and an analysis shall show the “before fragnet” and “after fragnet” effect (impact) on the entire Project. The proposed revision and analysis shall be submitted to the RPR within 15 days after the RPR notifies the Contractor the revision is of a major nature.

Analysis shall be in the form of a fragnet schedule inserted into Baseline Schedule/current Schedule Update and description or justification of item submitted. A change will be considered to be of a major nature if the time estimated for an activity or sequence of activities is varied from the original plan to the degree that there is reasonable doubt that the Contract Completion Date
will not be met, or if the change, impacts the work of other contractors and/or equipment installers at the site. Changes to activities having adequate float shall be considered as minor changes, except that an accumulation of minor changes may be considered a major change when such changes affect the Contract Completion Date. (Activities that have adequate float are activities that are not critical after the change is made.)

Only upon approval of a change by the RPR shall it be reflected in the next schedule update submitted by the Contractor.

**107-6.9 Schedule Updates.** The initial Monthly Schedule Update shall be submitted within the first week after acceptance of the Baseline Schedule. The Contractor shall submit subsequent Monthly Schedule Update(s) to the RPR for review and acceptance, five (5) Days after the end of each month throughout the duration of the Project. All updated schedules shall be submitted in the same detail as the Baseline Schedule, unless modified in writing by the RPR.

As part of each update submission, the status of work in progress shall also be similarly identified and the reported percent complete graphically indicated for each activity remaining in progress as of the last report period.

The Monthly Schedule Update and computer tabulations/reports shall be reviewed jointly by the Contractor’s Project Manager and Construction Scheduler at a joint monthly update meeting with the RPR for the purpose of verifying all of the following:

1) Actual start dates (actual start dates should be determined from Contractor’s daily field reports and confirmed inspection reports).

2) Actual completion dates (when an activity is verified complete by the RPR).

3) Activity percent completion (when an activity is verified complete by the RPR).

4) Incorporation of accepted changes, and accepted time extensions.

5) Status of outstanding Notices of Non-Compliance.

6) Correspondence with Job Memos/Field Memos/Field Directives

7) Primavera schedule diagnostic and SA Pro reports for comparison of previous Schedule Update/Baseline to current Schedule Update.

8) Complete narrative of work performed, issues, delays.

The Schedule Update shall include all information available as of the end of month cutoff date. A detailed list of all proposed schedule changes (logic, duration, status, additions, and deletions) shall be submitted with the update. A proposed Monthly Schedule Update containing all of the information set forth below shall be available for review at the meeting:

1) For activities started and/or completed during the previous period: Actual start and actual completion dates, number of shifts.

2) For activities begun but not yet complete to date: actual start date, number of shifts, remaining duration of the work, and percent of work complete.
3) For activities not yet started: Estimated early start/early finish dates, number of shifts, durations, and estimated completion dates, as necessary.

4) For authorized changes, and Change Orders: Inserted change order activities, number of shifts, and durations, where required.

5) The Monthly Schedule Update shall be for the month preceding and for the remainder of the Project. The previous month's activities shall be reported as they actually took place and designated as actual complete with Actual Start/Finish dates on the Schedule Update.

6) The Monthly Schedule Update and the electronic disk file of the submitted Monthly

7) Updated Construction Schedule Update and the related reports shall constitute a clear record of progress of the work from the Notice to Proceed date to final completion.

8) The Contractor shall provide to the RPR, printed copies of the Predecessor/Successor Report, Diagnostic report, SA Pro report, a printed list of all changes made to the previously accepted Monthly Schedule Update, and the Schedule Update Narrative Report. For Diagnostic report, includes a list all out-of-sequencing correction(s).

9) Narrative Report shall describe in detail, Critical Path Activities, Near-Critical Path activities, assumptions made for current month, potential difficulties, and potential delays.

10) The monthly submittal to the RPR shall be accompanied by copies of the Update Schedule Narrative Report. The Update Schedule Narrative Report shall describe the physical progress during the report period, plans for continuing the Work during the forthcoming report period, actions planned to correct any negative float predictions, and an explanation of potential delays and/or problems and their estimated impact on performance and the Contract Completion Date. In addition, alternatives for possible Recovery Schedule to mitigate any potential delay and/or cost increases shall be included for consideration by the RPR. The report shall follow the outline set forth below.

**107-6.10 Contractor’s Schedule Narrative Report Outline:**

A. Contract Completion and Item Date(s) status
   1) Ahead of schedule and number of Days
   2) Behind schedule and number of Days

B. Description of problem areas

C. Current and anticipated potential delays
   1) Cause of the potential delay
   2) Corrective action and schedule adjustments to correct the potential delay
   3) Impact of the potential delay on other activities, milestones, and completion dates
D. Changes in construction sequences

E. Pending items and status thereof
   1) Permits
   2) Field/Job Memos
   3) Time extensions
   4) Non-Compliance Notices, RFIs, proposed Change Order(s) with potential delays

F. Other Project or scheduling concerns

G. Include reviewed and corrected, if any, Monthly Schedule Update and Reports

For major network changes, independent of the monthly updates, the Contractor shall submit, in writing, such revisions for the RPR’s approval prior to inserting such changes into the Monthly Schedule Update. Submissions may be in the form of marked-up networks, fragments, or schedule abstracts provided they are submitted with a letter of transmittal. The submission and acceptance procedures for this information shall follow the same timetable described herein. Predicated on the results of the RPR’s review of monthly submissions of schedules/reports, the Contractor may be required to revise the Baseline Schedule.

Required revisions of the Monthly Schedule Updates are due within five (5) days of notice by the RPR that a revision is required. All revisions and additions to the Baseline Schedule are subject to the review of the RPR. No changes are to be implemented in the schedule by the Contractor without the prior acceptance of the RPR. When the proposed Monthly Schedule Update or its required revision is accepted by the RPR, it then becomes the Monthly Schedule Update.

The number of color copies will be determined by the RPR for the Schedule Narrative Update Report (networks and computer computations), the Master Summary Schedule, the accepted Monthly Schedule Update, and one (1) computer disk copy, reflecting the status of the Project agreed to at the updating meeting, and Summary shall be submitted to the RPR within five (5) days after each updating meeting as described herein.

107-6.11 Weekly Progress Reports: During weekly progress meetings, the Contractor shall submit a progress schedule listing the activities in progress for the current week and the activities schedule for the succeeding two (2) weeks. The activity designations shall be consistent with the activity designations in the Monthly Updated Construction Schedule.

107-6.12 Responsibility of Completion – Recovery Schedule: Whenever it becomes apparent from a schedule review progress meeting or the current Monthly Schedule Update that any milestone date(s) or the Contract Completion Date will not be met, the Contractor shall take some or all of the following actions for Recovery Schedule:

   1) Increase construction labor in such quantities and crafts as shall substantially eliminate the backlog of work and meet the current Contract completion date.
2) Increase the number of working hours per shift, the number of shifts per day, the number of working days or shifts per week, or the amount of construction equipment, or any combination of the foregoing sufficient to substantially eliminate the backlog of work.

3) Reschedule work items to achieve concurrent accomplishment of work activities.

Unreasonable and/or impossible “Stacking of Trades” is prohibited.

Prior to implementing any of the above actions, the Contractor shall notify and obtain approval from the RPR. If such actions are approved, the Contractor shall incorporate the revisions into the next Monthly Schedule Update.

Under no circumstances will the addition of equipment or construction forces, increasing the working hours or any other method, manner, or procedure to return to the Contract Completion Date be considered justification for a Change Order or be treated as acceleration where the need for a Recovery Schedule has been caused by the Contractor and/or its Subcontractors or Suppliers, at any tier.

The RPR may elect to withhold progress payments until the Contractor’s progress indicates that the milestone date(s) and/or the Contract Completion Date will be met.

107-6.13 Schedule Time Extensions and Time Impact Analysis: When a time extension is requested, the Contractor shall submit to the RPR, a written Time Impact Analysis (TIA) illustrating the influence of each change or delay on the current Contract schedule Completion Date utilizing the current accepted Monthly Schedule Update. Each TIA shall include a fragnet demonstrating how the Contractor proposes to incorporate the extra work or delay into the current accepted Monthly Schedule Update. A fragnet is defined as a sequence of new and/or revised activities that are proposed to be added to the accepted Baseline Schedule or current accepted Monthly Schedule Update in effect at the time the change or delay is encountered to demonstrate the influence of the delay and the method for incorporating the delay and its impact into the schedule as they are encountered.

Each TIA package shall contain three (3) things:

1) Narrative that includes;
   a) Description of whether the delay is excusable, non-compensable or compensable.
   b) Description of the merit of the delay
   c) When was the delay first encountered, including “Notice of Delay” document(s),
   d) Why the delay cannot be mitigated and what the approximate costs would be to mitigate the delay.
   e) How this delay affects the critical path
   f) How the Contractor plans to construct/perform the additional work
   g) How the Contractor determined the durations for delay activities.
2) Electronic file of the delay inserted; and adjusted/shown “Before and After” delay

3) Plot of the critical path with delay fragment.

Each TIA shall demonstrate the estimated time impact based on the date of the event, the date the proposed change and Change Order(s) were given to the Contractor, the status of construction at that point in time, and the event time computation of all activities affected by the change or delay and its impact on the Schedule. The event times used in the TIA shall be those included in the latest update of the Monthly Schedule Update, in effect at the time the change or delay was encountered.

Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total or remaining float along the critical path of activities at the time of actual delay, or at the time the proposed extra work changes were issued. Float or slack time is not for the exclusive use or benefit of the Owner or the Contractor but is an expiring resource available to all parties as needed to meet Contract milestones and the Contract Completion Date. Time extensions shall not be granted nor delay damages paid until both of the following occur:

1) A delay occurs which is beyond the control and without the fault or negligence of the Contractor and its Subcontractors or Suppliers, at any tier.

2) The delay extends actual performance of the Work beyond the applicable current Contract Completion Date and the most recent date predicted for completion of the Project on the current accepted Schedule Update as of the time of the delay or as of the time of issuance of the proposed change and Change Order(s).

Each TIA shall be submitted within 15 days after a delay occurs, or issuance of an Owner initiated change.

If the Contractor does not submit a TIA within the specified period of time, the Contractor shall be deemed to have irrevocably waived any rights to additional time and cost.

Since float time within the Baseline Schedule and Monthly Schedule Update is jointly owned it is acknowledged and agreed by the Contractor that Owner-caused delays on the Project may be offset by Owner-caused time savings (including, but not limited to: submittals returned in less time than allowed for in the Contract, approval of Substitution requests which result in a savings of time along the critical path for the Contractor, etc.). In such an event the Contractor shall not be entitled to receive an extension of time or delay damages until all Owner-caused time savings are exceeded and the Contract Completion Date also exceeded.

Approval or rejection of each TIA by the RPR shall be made within thirty (30) Days after receipt of each TIA submittal, unless subsequent meetings and negotiations are necessary. Upon approval, a copy of a TIA signed by the RPR shall be returned to the Contractor for incorporation into the schedule.
Upon mutual agreement by both parties, fragnets illustrating the influence of Change Orders and delays shall be incorporated into the Baseline Schedule or the current accepted Monthly Schedule Update, during the succeeding update after agreement is reached.

107-6.14 Project Milestones and Intermediate Milestones: The Baseline Schedule, revised Baseline Schedule and Schedule Updates shall include all project milestones and intermediate milestones in addition to substantial and final completion milestones.

METHOD OF MEASUREMENT

107-7.1 Measurement for “CPM Schedule and Updates” shall be on a lump sum basis.

BASIS OF PAYMENT

107-7.2. Payment for “CPM Schedule and Updates” shall be made at the lump sum contract price. This price shall be full compensation for submitting and maintaining the construction schedule and reports. Partial payments will be made in accordance with the following schedule:

a. Acceptance of Preliminary 120 day Schedule: 10% of the lump sum amount
b. Acceptance of Baseline Schedule: 20% of the lump sum amount
c. Updated Monthly Schedule Updates: 70% of the lump sum amount
   (evenly distributed for the Months of contract time following acceptance of the Baseline Schedule)

Payment will be made under:

Item C-107-7.1 CPM Schedule and Updates – per lump sum

END OF ITEM C-107
Item C-110 Method of Estimating Percentage of Material Within Specification Limits (PWL)

110-1 General. When the specifications provide for acceptance of material based on the method of estimating percentage of material within specification limits (PWL), the PWL will be determined in accordance with this section. All test results for a lot will be analyzed statistically to determine the total estimated percent of the lot that is within specification limits. The PWL is computed using the sample average (X) and sample standard deviation (S_n) of the specified number (n) of sublots for the lot and the specification tolerance limits, L for lower and U for upper, for the particular acceptance parameter. From these values, the respective Quality index, Q_L for Lower Quality Index and/or Q_U for Upper Quality Index, is computed and the PWL for the lot for the specified n is determined from Table 1. All specification limits specified in the technical sections shall be absolute values. Test results used in the calculations shall be to the significant figure given in the test procedure.

There is some degree of uncertainty (risk) in the measurement for acceptance because only a small fraction of production material (the population) is sampled and tested. This uncertainty exists because all portions of the production material have the same probability to be randomly sampled. The Contractor’s risk is the probability that material produced at the acceptable quality level is rejected or subjected to a pay adjustment. The Owner’s risk is the probability that material produced at the rejectable quality level is accepted.

It is the intent of this section to inform the Contractor that, in order to consistently offset the Contractor’s risk for material evaluated, production quality (using population average and population standard deviation) must be maintained at the acceptable quality specified or higher. In all cases, it is the responsibility of the Contractor to produce at quality levels that will meet the specified acceptance criteria when sampled and tested at the frequencies specified.

110-2 Method for computing PWL. The computational sequence for computing PWL is as follows:

a. Divide the lot into n sublots in accordance with the acceptance requirements of the specification.

b. Locate the random sampling position within the sublot in accordance with the requirements of the specification.

c. Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.

d. Find the sample average (X) for all subplot test values within the lot by using the following formula:

\[ X = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n} \]

Where: \( X = \) Sample average of all subplot test values within a lot
x₁, x₂, ..., xₙ = Individual sublot test values
n = Number of sublot test values

e. Find the sample standard deviation (Sₙ) by use of the following formula:

\[ S_n = \left[ \frac{(d_1^2 + d_2^2 + d_3^2 + \ldots + d_n^2)}{(n-1)} \right]^{1/2} \]

Where: Sₙ = Sample standard deviation of the number of sublot test values in the set
d₁, d₂, ..., dₙ = Deviations of the individual sublot test values x₁, x₂, ..., from the average value X
that is: d₁ = (x₁ - X), d₂ = (x₂ - X) ..., dₙ = (xₙ - X)
n = Number of sublot test values

f. For single sided specification limits (i.e., L only), compute the Lower Quality Index Qₜ by use of the following formula:

\[ Q_L = \frac{(X - L)}{S_n} \]

Where: L = specification lower tolerance limit

Estimate the percentage of material within limits (PWL) by entering Table 1 with Qₜ, using the column appropriate to the total number (n) of measurements. If the value of Qₜ falls between values shown on the table, use the next higher value of PWL.

g. For double-sided specification limits (i.e., L and U), compute the Quality Indexes Qₜ and Qᵤ by use of the following formulas:

\[ Q_L = \frac{(X - L)}{S_n} \]

and

\[ Q_U = \frac{(U - X)}{S_n} \]

Where: L and U = specification lower and upper tolerance limits

Estimate the percentage of material between the lower (L) and upper (U) tolerance limits (PWL) by entering Table 1 separately with Qₜ and Qᵤ, using the column appropriate to the total number (n) of measurements, and determining the percent of material above Pᵤ and percent of material below Pₜ for each tolerance limit. If the values of Qₜ fall between values shown on the table, use the next higher value of Pₓ or Pᵤ. Determine the PWL by use of the following formula:

\[ PWL = (P_U + P_L) - 100 \]

Where: Pₜ = percent within lower specification limit
Pᵤ = percent within upper specification limit
EXAMPLE OF PWL CALCULATION

Project: Example Project
Test Item: Item P-401, Lot A.

A. PWL Determination for Mat Density.
   1. Density of four random cores taken from Lot A.
      
      A-1 = 96.60
      A-2 = 97.55
      A-3 = 99.30
      A-4 = 98.35
      n = 4

   2. Calculate average density for the lot.
      
      \[ X = \frac{(x_1 + x_2 + x_3 + \ldots + x_n)}{n} \]
      
      \[ X = \frac{(96.60 + 97.55 + 99.30 + 98.35)}{4} \]
      
      \[ X = 97.95\% \text{ density} \]

   3. Calculate the standard deviation for the lot.
      
      \[ S_n = \sqrt{\left(\frac{(96.60 - 97.95)^2 + (97.55 - 97.95)^2 + (99.30 - 97.95)^2 + (98.35 - 97.95)^2)}{(4 - 1)}\right)^{1/2}} \]
      
      \[ S_n = \sqrt{\frac{(1.82 + 0.16 + 1.82 + 0.16)}{3}} \]
      
      \[ S_n = 1.15 \]

   4. Calculate the Lower Quality Index \( Q_L \) for the lot. (L=96.3)
      
      \[ Q_L = \frac{(X - L)}{S_n} \]
      
      \[ Q_L = \frac{(97.95 - 96.30)}{1.15} \]
      
      \[ Q_L = 1.4348 \]

   5. Determine PWL by entering Table 1 with \( Q_L = 1.44 \) and \( n = 4 \).
      
      PWL = 98

B. PWL Determination for Air Voids.

   1. Air Voids of four random samples taken from Lot A.
      
      A-1 = 5.00
      A-2 = 3.74
      A-3 = 2.30
      A-4 = 3.25

   2. Calculate the average air voids for the lot.
      
      \[ X = \frac{(x_1 + x_2 + x_3 + \ldots + x_n)}{n} \]
      
      \[ X = \frac{(5.00 + 3.74 + 2.30 + 3.25)}{4} \]
      
      \[ X = 3.57\% \]
3. Calculate the standard deviation $S_n$ for the lot.

$$S_n = \left[ \frac{(3.57 - 5.00)^2 + (3.57 - 3.74)^2 + (3.57 - 2.30)^2 + (3.57 - 3.25)^2}{(4 - 1)} \right]^{1/2}$$

$$S_n = \left[ \frac{(2.04 + 0.03 + 1.62 + 0.10)}{3} \right]^{1/2}$$

$$S_n = 1.12$$

4. Calculate the Lower Quality Index $Q_L$ for the lot. ($L = 2.0$)

$$Q_L = \frac{(X - L)}{S_n}$$

$$Q_L = \frac{(3.57 - 2.00)}{1.12}$$

$$Q_L = 1.3992$$

5. Determine $P_L$ by entering Table 1 with $Q_L = 1.41$ and $n = 4$.

$$P_L = 97$$

6. Calculate the Upper Quality Index $Q_U$ for the lot. ($U = 5.0$)

$$Q_U = \frac{(U - X)}{S_n}$$

$$Q_U = \frac{(5.00 - 3.57)}{1.12}$$

$$Q_U = 1.2702$$

7. Determine $P_U$ by entering Table 1 with $Q_U = 1.29$ and $n = 4$.

$$P_U = 93$$

8. Calculate Air Voids PWL

$$PWL = (P_L + P_U) - 100$$

$$PWL = (97 + 93) - 100 = 90$$

**EXAMPLE OF OUTLIER CALCULATION (REFERENCE ASTM E178)**

**Project:** Example Project  
**Test Item:** Item P-401, Lot A.  

**A. Outlier Determination for Mat Density.**

1. Density of four random cores taken from Lot A arranged in descending order.

$$A-3 = 99.30$$

$$A-4 = 98.35$$

$$A-2 = 97.55$$

$$A-1 = 96.60$$

2. From ASTM E178, Table 1, for $n=4$ an upper 5% significance level, the critical value for test criterion $= 1.463$.

3. Use average density, standard deviation, and test criterion value to evaluate density measurements.

   a. For measurements greater than the average:
If \((\text{measurement} - \text{average})/(\text{standard deviation})\) is less than test criterion, then the measurement is not considered an outlier.

For A-3, check if \((99.30 - 97.95)/1.15\) is greater than 1.463.

Since 1.174 is less than 1.463, the value is not an outlier.

b. For measurements less than the average:

If \((\text{average} - \text{measurement})/(\text{standard deviation})\) is less than test criterion, then the measurement is not considered an outlier.

For A-1, check if \((97.95 - 96.60)/1.15\) is greater than 1.463.

Since 1.435 is less than 1.463, the value is not an outlier.

**Note:** In this example, a measurement would be considered an outlier if the density were:

Greater than \((97.95 + 1.463 \times 1.15) = 99.63\%\)

OR

less than \((97.95 - 1.463 \times 1.15) = 96.27\%\).
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<th>Positive Values of Q (Q_L and Q_U)</th>
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Method of Estimating Percentage of Material Within Specification Limits (PWL)
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Method of Estimating Percentage of Material Within Specification Limits (PWL)
REFERENCES

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

ASTM International (ASTM)

ASTM E178 Standard Practice for Dealing with Outlying Observations

END OF ITEM C-110
Item P-101 Preparation/Removal of Existing Pavements

DESCRIPTION

101-1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable plans.

All items shown on the Plans to be removed shall become the property of the Contractor except the salvageable items identified in the construction documents. All items shall be immediately removed from the work area as soon as demolition occurs. The Contractor shall dispose of all items that are not to be salvaged at his own disposal area outside the Airport property. The COP Aviation Planning and Environmental Division and the RPR must approve all offsite disposal or stockpile locations prior to hauling and stockpiling materials and/or disposal of materials. Items to be salvaged and turned over to the Owner shall be delivered to the Airport Maintenance yard and stacked in a near and orderly fashion and approved by the RPR.

EQUIPMENT AND MATERIALS

101-2 All equipment and materials shall be specified here and in the following paragraphs or approved by the Resident Project Representative (RPR). The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of existing pavement.

The Contractor’s removal operation shall be controlled to not damage adjacent pavement structure, and base material, cables, utility ducts, pipelines, or drainage structures which are to remain under the pavement.

The Contractor shall thoroughly survey the boundaries of the demolition limits to assess the condition of the pavement and other facilities to remain. Any deficiencies or defects of existing surfaces to remain shall be photographed and documented and submitted to the RPR prior to demolition.

a. Concrete pavement removal. An initial full depth saw cut shall be made perpendicular to the slab surface. When the section of pavement to be removed is concrete, a second full depth relief saw cut shall also be made at a distance to prevent damage determined by the contractor from the perimeter. The Contractor shall submit the methods and equipment proposed to remove the relief cut pavement to the RPR for approval.

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Spalls or underbreaks created during demolition of existing pavement to
remain in place, if allowed by the RPR to remain in place, shall be repaired by methods and materials proposed by the Contractor and approved by the RPR. Adjacent areas damaged during repair shall be repaired or replaced at the Contractor’s expense.

At fuel pits, low point drain pits, high point vent pits, fuel isolation vault structures, manholes, catch basins, cathodic protection covers, monitoring wells, etc., the Contractor shall provide full depth saw cuts to minimize the impact and damage to existing facilities to remain. The location of the full depth saw cut at the fuel structures shall be coordinated with the Owner of the facility prior to any demolition of the concrete pavement surrounding these structures. The concrete around these structures may contain reinforcing steel. The Contractor shall use appropriate tools, demolition equipment, and procedures to avoid damage to the structures. Any damage to the structures to remain shall be removed and replaced, unless otherwise approved by the RPR to be repaired. Fuel structures damaged during demolition shall be removed and replaced or repaired by an approved hydrant fueling system specialty contractor, at no additional cost to the Owner.

b. Asphalt pavement removal. Asphalt pavement to be removed shall be cut to the full depth of the asphalt pavement around the perimeter of the area to be removed. The pavement shall be removed so the joint for each layer of pavement replacement is offset 1 foot (30 cm) from the joint in the preceding layer. This does not apply if the removed pavement is to be replaced with concrete or soil.

c. Repair or removal of Base, Subbase, and/or Subgrade. All failed material including surface, base course, subbase course, and subgrade shall be removed and repaired as shown on the plans or as directed by the RPR. Materials and methods of construction shall comply with the applicable sections of these specifications. Any damage caused by Contractor’s removal process shall be repaired at the Contractor’s expense.

101-3.2 Preparation of joints and cracks prior to overlay/surface treatment. Remove all vegetation and debris from cracks to a minimum depth of 1 inch. If extensive vegetation exists, treat the specific area with a concentrated solution of a water-based herbicide approved by the RPR. Fill all cracks (greater than 1/4 inch wide) with a crack sealant per ASTM D6690. The crack sealant, preparation, and application shall be compatible with the surface treatment/overlay to be used. To minimize contamination of the asphalt with the crack sealant, underfill the crack sealant a minimum of 1/8 inch, not to exceed ¼ inch. Any excess joint or crack sealer shall be removed from the pavement surface.

Wider cracks (over 1-1/2 inch wide), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as stated below.

Cracks and joints may be filled with a mixture of emulsified asphalt and aggregate. The aggregate shall consist of limestone, volcanic ash, sand, or other material that will cure to form a hard substance. The combined gradation shall be as shown in the following table.
**Gradation**

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Up to 3% cement can be added to accelerate the set time. The mixture shall not contain more than 20% natural sand without approval in writing from the RPR.

The proportions of asphalt emulsion and aggregate shall be determined in the field and may be varied to facilitate construction requirements. Normally, these proportions will be approximately one part asphalt emulsion to five parts aggregate by volume. The material shall be poured or placed into the joints or cracks and compacted to form a voidless mass. The joint or crack shall be filled to within +0 to -1/8 inches of the surface. Any material spilled outside the width of the joint shall be removed from the pavement surface prior to constructing the overlay. Where concrete overlays are to be constructed, only the excess joint material on the pavement surface and vegetation in the joints need to be removed.

**101-3.3 Removal of Foreign Substances/contaminates prior to overlay and remarking.** Removal of foreign substances/contaminates from existing pavement that will affect the bond of the new treatment shall consist of removal of rubber, fuel spills, oil, crack sealer, at least 90% of paint, and other foreign substances from the surface of the pavement. Areas that require removal are designated on the plans and as directed by the RPR in the field during construction.

Chemicals, high-pressure water, heater scarifier (asphaltic concrete only, cold milling or waterblasting may be used. If chemicals are used, they shall comply with the state’s environmental protection regulations. Removal methods used shall not cause major damage to the pavement, or to any structure or utility within or adjacent to the work area. Major damage is defined as changing the properties of the pavement, removal of asphalt causing the aggregate to ravel, or removing pavement over 1/8 inch deep. If it is deemed by the RPR that damage to the existing pavement is caused by operational error, such as permitting the application method to dwell in one location for too long, the Contractor shall repair the damaged area without compensation and as directed by the RPR.

Removal of foreign substances shall not proceed until approved by the RPR. Water used for high-pressure water equipment shall be provided by the Contractor at the Contractor’s expense. No material shall be deposited on the pavement shoulders. All wastes shall be disposed of in areas indicated in this specification or shown on the plans.
This specification shall not be used for removal of rubber deposits to improve skid resistance or obliterate traffic markings where a new overlay is not constructed.

101-3.4 Concrete spall or failed asphaltic concrete pavement repair.

a. Repair of concrete spalls in areas to be overlaid with asphalt. The Contractor shall repair all spalled concrete as shown on the plans or as directed by the RPR. The perimeter of the repair shall be saw cut a minimum of 2 inches outside the affected area and 2 inches deep. The deteriorated material shall be removed to a depth where the existing material is firm or cannot be easily removed with a geologist pick. The removed area shall be filled with asphalt mixture with aggregate sized appropriately for the depth of the patch. The material shall be compacted with equipment approved by the RPR until the material is dense and no movement or marks are visible. The material shall not be placed in lifts over 4 inches in depth. This method of repair applies only to pavement to be overlaid. Asphalt mix pavement repair of concrete pavement should only be allowed to depths less than 1/3 of the PCC pavement thickness.

b. Asphalt pavement repair. The Contractor shall repair all spalled concrete as shown on the plans or as directed by the RPR. The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. Materials and methods of construction shall comply with the applicable sections of these specifications.

101-3.5 Cold milling. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a uniform finished surface. The milling machine or grinder shall operate without tearing or gouging the underlaying surface. The milling machine or grinder shall be equipped with grade and slope controls, and a positive means of dust control. All millings shall be removed and disposed off Airport property. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material removed with new material at the Contractor’s Expense.

a. Patching. The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The RPR shall layout the area to be milled with a straightedge in increments of 1-foot widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn’t have the appropriate milling machine, or areas that are damaged because of his negligence, shall be repaired by the Contractor at the Contractor’s Expense.

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of 7 feet and it shall be equipped with electronic grade control devices that will cut the surface to the grade specified. The tolerances shall be maintained within +0 inch and -1/4 inch of the specified grade. The machine must cut vertical edges and have a positive method of dust control. The machine must have the ability to remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of off the airport.

c. Clean-up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual materials are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow the surface to remove loose residual material. Waste materials shall be collected and removed from the pavement.
surface and adjacent areas by sweeping or vacuuming. Waste materials shall be removed and disposed off Airport property.

101-3.6. Preparation of asphalt pavement surfaces prior to surface treatment. Existing asphalt pavements to be treated with a surface treatment shall be prepared as follows:

a. Patch asphalt pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new asphalt pavement similar to that of the existing pavement in accordance with paragraph 101-3.4b.

b. Repair joints and cracks in accordance with paragraph 101-3.2.

c. Remove oil or grease that has not penetrated the asphalt pavement by scrubbing with a detergent and washing thoroughly with clean water. After cleaning, treat these areas with an oil spot primer.

d. Clean pavement surface immediately prior to placing the surface treatment so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.

101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the RPR. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor’s expense.

101-3.8 Preparation of Joints in Rigid Pavement prior to resealing. Prior to application of sealant material, clean and dry the joints of all scale, dirt, dust, old sealant, curing compound, moisture and other foreign matter. The Contractor shall demonstrate, in the presence of the RPR, that the method used cleans the joint and does not damage the joint.

101-3.8.1 Removal of Existing Joint Sealant. All existing joint sealants will be removed by plowing or use of hand tools. Any remaining sealant and or debris will be removed by use of wire brushes or other tools as necessary. Resaw joints removing no more than 1/16 inch from each joint face. Immediately after sawing, flush out joint with water and other tools as necessary to completely remove the slurry.

101-3.8.2 Cleaning prior to sealing. Immediately before sealing, joints shall be cleaned by removing any remaining laitance and other foreign material. Allow sufficient time to dry out joints prior to sealing. Joint surfaces will be surface-dry prior to installation of sealant.

101-3.8.3 Joint sealant. Joint material and installation will be in accordance with Item P-604.

101-3.9 Preparation of Cracks in Flexible Pavement prior to sealing. Prior to application of sealant material, clean and dry the joints of all scale, dirt, dust, old sealant, curing compound, moisture and other foreign matter. The Contractor shall demonstrate, in the presence of the RPR, that the method used cleans the cracks and does not damage the pavement.

101-3.9.1 Preparation of Crack. Widen crack with router by removing a minimum of 1/16 inch from each side of crack. Immediately before sealing, cracks will be blown out with a hot air lance combined with oil and water-free compressed air.
101-3.9.2 Removal of Existing Crack Sealant. Existing sealants will be removed by routing. Following routing any remaining debris will be removed by use of a hot lance combined with oil and water-free compressed air.

101-3.9.3 Crack Sealant. Crack sealant material and installation will be in accordance with Item P-605.

101-3.9.4 Removal of Pipe and other Buried Structures.
   
a. Removal of Existing Pipe Material. Remove the types of pipe as indicated on the plans. The pipe material shall be legally disposed of off-site in a timely manner following removal. Trenches shall be backfilled with material meeting the requirements of P-152. Trenches under paved areas must be compacted to 95% of ASTM D1557. Unless otherwise specified, the trench shall be backfilled to original ground surface or to the top of subgrade elevation.

b. Removal of Inlets/Manholes. Where indicated on the plans or as directed by the RPR, inlets and/or manholes shall be removed and legally disposed of off-site in a timely fashion after removal. Excavations after removal shall be backfilled with material meeting the requirements of P-152. When under paved areas must be compacted to 95% of ASTM D1557, when outside of paved areas must be compacted to 95% of ASTM D698. Unless otherwise specified, the trench shall be backfilled to original ground surface or to the top of subgrade elevation.

c. Concrete Foundations. Removal of foundations shall be as designated on the plans. Unless otherwise noted, concrete foundations shall be removed to six (6') feet below the final grade as shown on the plans and hardstands removed in its entirety. The Contractor's removal operation shall not cause damage to existing pavement or facilities to remain. Unless directed by the RPR to remove and replace damaged pavement or facilities, all damage shall be repaired by the Contractor to the satisfaction of the RPR at no additional expense to the Owner.

d. Utilities. The Contractor shall coordinate with the owners of the utilities to be removed to determine the termination, plugging or capping requirements, or for complete removal of the utility. All utility piping and conduits shall be completely removed prior to the construction of the new improvements unless noted otherwise on the plans or in the specifications.

METHOD OF MEASUREMENT

101-4.1 PAVEMENT SAWCUTTING. The unit of measurement for sawcutting existing Portland Cement Concrete Pavement (Full Depth) or Asphalt Concrete Pavement (Full Depth) and full depth sidewalk shall be made by the number of linear feet, completed in conformance with these specifications. Measurement for any variation in depth or thickness shall not be considered. Measurement shall be made to the nearest foot. No additional payments will be measured for additional relief cuts required by the contract documents, or as an aid to the Contractor for removal of pavements.

101-4.2 Pavement removal. The unit of measurement for pavement removal shall be the number of square yards removed by the Contractor. Any pavement removed outside the limits of removal because the pavement was damaged by negligence on the part of the Contractor shall not be included in the measurement for payment. Removal of concrete sidewalk and obliteration of pavement markings will be measured by the square foot.
101-4.3 Removal of Foreign Substances/contaminates. The unit of measurement for foreign substances/contaminates removal shall be the square foot.

101-4.4 Removal of Pipe and other Buried Structures. Removal of existing storm drain pipe, regardless of pipe diameters, and removal of temporary fencing, shall be measured by the linear foot. Removal of catch basins, manholes or other structures shall be measured at the contract unit price for each.

101-4.5 Preparation of pavement to remove existing markings. Existing pavement markings shall be removed by water blasting or by the RPR minimizing damage to the pavement surface. The removal area may need to be larger than the area of the markings to eliminate ghost markings. After removal of markings on asphalt pavements, apply a fog seal or seal coat to ‘block out’ the removal area to eliminate ‘ghost’ markings.

101-4.6 Removal of Temporary Fence. Removal of Temporary fence shall be the number of feet, as measured along the base of fence, removed by the contractor.

101-4.7 Removal of Existing Electrical Items. Removal of existing electrical items shall be measured by lump sum. Removal and salvage of existing light fixtures along taxiway delta shall be measured at the contract unit price of each.

**BASIS OF PAYMENT**

101-5.1 Payment. Payment shall be made at contract unit price for the unit of measurement as specified above. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item.

101-5.2 Removal of Temporary Fence. Payment shall be made at the contract unit price for the removal and relocation of temporary fence and return of the fence to a storage area, as designated by the RPR, on PHX property. Care shall be taken not to create additional damage to the fence, concrete barrier, and obstruction lights. Obstruction lights shall be gathered, salvaged and returned to the RPR for distribution to the Concourse contractor. This unit price shall be full compensation for furnishing all materials and for the preparation, removal, hauling, and placing of the material for all labor, equipment, tools, and incidentals necessary to complete this item.

101-5.3 Removal of Existing Electrical Items. Payment shall be made at the contract lump sum price for the preparation and removal of existing electrical items as depicted in the contract documents. The payment shall be made to include all existing above and below ground electrical items including taxiway edge lights, concrete and slurry encased conduits, canisters and cannister structures, and preparation of electrical for safe removal. This unit price shall be full compensation for furnishing all materials and for the preparation, removal, hauling, and placing of the material for all labor, equipment, tools, and incidentals necessary to complete this item.

101-5.4 Removal and Salvage of Existing Taxiway D Edge Lights of Existing Electrical Items. Payment shall be made at the contract unit price per each for the removal and salvage of the existing taxiway edge lights and installation of a aircraft rated blank cover plate. Taxiway Edge Lights shall be returned to a storage area, as designated by the RPR, on PHX property. This unit price shall be full compensation for furnishing and salvaging all materials and for the preparation, removal, return, and placing of the material for all labor, equipment, tools, and incidentals necessary to complete this item.
Item P-101-5.1  Obliterate Pavement Markings – per Square Foot
Item P-101-5.2  Sawcut Concrete Sidewalk – per Linear Foot
Item P-101-5.3  Sawcut Asphalt Concrete Pavement – per Linear Foot
Item P-101-5.4  Remove Asphalt Concrete Pavement (Full Depth) – per Square Yard
Item P-101-5.5  Remove 6” Temporary Service Road Asphalt Concrete Pavement – per Square Yard
Item P-101-5.6  Remove Concrete Sidewalk – per Square Foot
Item P-101-5.7  Remove Storm Drain Pipe – per Linear Foot
Item P-101-5.8  Remove Catch Basin – per Each
Item P-101-5.9  Cut & Plug Storm Drain – per Each
Item P-101-5.10 Remove Temporary Fence – Linear Foot
Item P-101-5.11 Remove Existing Plug – per Each
Item P-101-5.12 Remove PCCP (Full Depth) – per Square Yard
Item P-101-5.13 Sawcut PCCP (Full Depth) – per Linear Foot
Item P-101-5.14 Demolition of Existing Electrical Items = per Lump Sum
Item P-101-5.15 Remove and Salvage Existing Light Fixtures along Taxiway D, Install Blank Cover Plate - per Each

REFERENCES

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

Advisory Circulars (AC)

ASTM International (ASTM)
   ASTM D6690  Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

END OF ITEM P-101
Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

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

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

   a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature or as classified as jet fuel impacted soil as defined by Item P-160 or classified as contaminated soil as defined by Item P-161.

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

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared or cleared and grubbed in accordance with Item P-151. Following clearing and grubbing, Contractor shall conduct a pre-construction earthwork as-built survey, acceptable to the RPR, that will be used in calculating final earthwork quantities.

Samples of all embankment for quality control and quality acceptance (proctor, gradation, plasticity index, etc.) shall be taken whenever the RPR determines there has been a change in the material characteristics, or for each 5,000 cubic yards of embankment. Material quality samples shall be taken for testing of the top 6” of subgrade for each 10,000 square yards or fraction thereof of subgrade, or whenever the RPR determines there has been a change in the material characteristics.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed of in waste areas as shown on the plans or hauled off site if not shown on the plans. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or disposed off site as approved by the RPR.

When the Contractor’s excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the RPR notified per Section 70, paragraph 70-20. At the direction of the RPR, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.
Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches, to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade.

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


152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the RPR has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface, refer to Section 152-2.1 for the pre-construction earthwork as-built survey.

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

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

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

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

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed off the airport. The cost is incidental to this item. This excavated material shall be paid for at the contract unit price per lump sum for the “Subgrade Preparation/Unclassified Excavation” bid item provided herein. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment.
Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans. Undercutting will be paid as unclassified excavation.

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

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor as indicated on the plans. All existing foundations shall be excavated at least 6 feet below finish grade or as indicated on the plans, and the material disposed of as directed by the RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

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

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

152-2.5 Preparation of cut areas or areas where existing pavement has been removed. In those areas on which a subbase or base course is to be placed, the top 8 inches of subgrade shall be compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D 1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

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

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

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.
152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor’s demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

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

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

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

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

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

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

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

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

Density tests will be taken by the RPR for every 3,000 square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the RPR.

If the material has greater than 30% retained on the 3/4-inch sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.
Rolling operations shall be continued until the embankment is compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D 1557. Under all areas to be paved, the embankments shall be compacted to a depth of 8 inches and to a density of not less than 100 percent of the maximum density as determined by ASTM D 1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

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

The in-place field density shall be determined in accordance with ASTM D1556 and ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Contractor’s laboratory shall perform all density tests in the RPR’s presence and provide the test results upon completion to the RPR for acceptance. If the specified density is not attained, the area represented by the test or as designated by the RPR shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

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

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

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

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

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

152-2.9 Proof rolling. The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. After compaction is completed, the subgrade
area shall be proof rolled with a Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to 100 psi or a fully loaded 4,000 gallon water truck in the presence of the RPR. Apply a minimum of 1 coverage, or as specified by the RPR, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch or show permanent deformation greater than 1 inch shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

152-2.10 Compaction requirements. The subgrade under areas to be paved shall be compacted to a depth of 8 inches and to a density of not less than 100 percent of the maximum dry density as determined by ASTM D1557. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of 8 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D698.

The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). When the material has greater than 30 percent retained on the ¾ inch sieve, follow the methods in ASTM D1557 or procedures in AASHTO T180 Annex for correction of maximum dry density and optimum moisture for oversized particles. Tests for moisture content and compaction will be taken at a minimum of 1,000 S.Y. of subgrade. All quality control shall be done by the Contractor’s laboratory in the presence of the RPR, and density test results shall be furnished upon completion to the RPR for acceptance determination.

The in-place field density shall be determined in accordance with ASTM D1556 and ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938 within 12 months prior to its use on this contract. The gage shall be field standardized daily.

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

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

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

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

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.
**152-2.12 Haul.** All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

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

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

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

a. **Smoothness.** The finished surface shall not vary more than +/- ½ inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

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

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

**METHOD OF MEASUREMENT**

**152-3.1** Measurement for “Subgrade Preparation” shall be measured by the square yard and shall include furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item including excavation, hauling, construction of embankment, and removal of waste excavation to a site off Airport property.

**152-3.2** Measurement for “Unclassified Excavation” shall be measured by the cubic yard and shall furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item including the excavation from the Contractor-acquired pre-construction as-built earthwork survey (where there is no existing pavement or bottom of existing pavement to be removed), to the top of finished subgrade.

Excavation and backfilling for trenches and structures will not be measured for payment under this item. Compensation for excavation and backfilling of trenches and structures shall be included in the contract price for the associated bid items.
Removal of unsuitable or unstable subgrade material as directed by the RPR will be measured by the computed cubic yard volume of material excavated. Measurement for P-152 material, if any used to replace the unsuitable/unstable material will also be measured by computed cubic yard volume of the in-place material placed and compacted.

152-3.3 There will be no separate measurement or payment for Clearing and Grubbing. For removal and haul off of Unsuitable/Unstable Subgrade, payment will be measured at the unit price per cubic yard of the in-place material removed.

**BASIS OF PAYMENT**

152-4.1 Payment for “Subgrade Preparation” shall be by the square yard and shall include furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item including excavation, hauling, and removal of waste excavation from the Airport.

Payment will be made under:

- Item P-152-4.1 Subgrade Preparation - per Square Yard

152-4.2 Payment for “Unclassified Excavation” shall be by the cubic yard and shall include furnishing/removal all materials, labor, equipment, tools, and incidentals necessary to complete the item including excavation, hauling, construction of embankment, and removal of waste excavation from the Airport. Unclassified Excavation shall include the excavation from the Contractor-acquired pre-construction as-built earthwork survey (where there is no existing pavement or bottom of existing pavement to be removed), to the top of finished subgrade.

Payment will be made under:

- Item P-152-4.2 Unclassified Excavation – per Cubic Yard

152-4.3 For removal and haul off of Unsuitable/Unstable Subgrade, payment will be measured at the unit price per cubic yard volume of the in-place material removed. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item. If P-152 material is also directed to be used for replacement backfill of the unsuitable/unstable subgrade removed, payment will also be based on the Contractor’s unit bid price for Item P-152 multiplied by the computed volume of material replaced. If P-209 or P-219 material is used for replacement backfill, the payment will be in accordance with either Section P-209 or P-219. If a material other than P-152, P-209, or P-219 is directed by the RPR for replacement backfill the work will be paid on a time and material basis.

Payment will be made under:

- Item P-152-4.3 Removal/Replacement of Unsuitable/Unstable Subgrade – per Cubic Yard

**REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
American Association of State Highway and Transportation Officials (AASHTO)
AASHTO T-180 Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

ASTM International (ASTM)
ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
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/ft³ (2700 kN-m/m³))
ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Advisory Circulars (AC)
AC 150/5370-2 Operational Safety on Airports During Construction Software

Software
FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design

U.S. Department of Transportation
FAA RD-76-66 Design and Construction of Airport Pavements on Expansive Soils

END OF ITEM P-152
Item P-153 Controlled Low-Strength Material (CLSM)

DESCRIPTION

153-1.1 This item shall consist of furnishing, transporting, and placing a controlled low-strength material (CLSM) as flowable backfill in trenches or at other locations shown on the plans or as directed by the Resident Project Representative (RPR).

MATERIALS

153-2.1 Materials.

   a. Cement. Cement shall conform to the requirements of ASTM C150 Type II

   b. Fly ash. Fly ash shall conform to ASTM C618, Class C or F.

   c. Fine aggregate (sand). Fine aggregate shall conform to the requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces the specified performance characteristics of the CLSM and meets the following requirements, will be accepted.

<table>
<thead>
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<th>Sieve Size</th>
<th>Percent Passing by weight</th>
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<td>100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 - 12</td>
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</tbody>
</table>

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

MIX DESIGN

153-3.1 Proportions. The Contractor shall submit, to the RPR, a mix design including the proportions and source of aggregate, fly ash, cement, water, and approved admixtures. No CLSM mixture shall be produced for payment until the RPR has given written approval of the proportions. The proportions shall be prepared by a laboratory and shall remain in effect for the duration of the project. The proportions shall establish a single percentage or weight for aggregate, fly ash, cement, water, and any admixtures proposed. Laboratory costs are incidental to this item.

   a. Compressive strength. CLSM shall be designed to achieve a 28-day compressive strength of 100 to 200 psi when tested in accordance with ASTM D4832, with no significant strength gain after 28 days.

   b. Consistency. Design CLSM to achieve a consistency that will produce an approximate 8-inch diameter circular-type spread without segregation. CLSM consistency shall be determined per ASTM D6103.
CONSTRUCTION METHODS

153-4.1 Placement.

a. Placement. CLSM may be placed by any reasonable means from the mixing unit into the space to be filled. Agitation is required during transportation and waiting time. Placement shall be performed so structures or pipes are not displaced from their final position and intrusion of CLSM into unwanted areas is avoided. The material shall be brought up uniformly to the fill line shown on the plans or as directed by the RPR. Each placement of CLSM shall be as continuous an operation as possible. If CLSM is placed in more than one lift, the base lift shall be free of surface water and loose foreign material prior to placement of the next lift.

b. Contractor Quality Control. The Contractor shall collect all batch tickets to verify the CLSM delivered to the project conforms to the mix design. The Contractor shall verify daily that the CLSM is consistent with 153-3.1a and 153-3.1b. Adjustments shall be made as necessary to the proportions and materials as needed. The Contractor shall provide all batch tickets to the RPR.

c. Limitations of placement. CLSM shall not be placed on frozen ground. Mixing and placing may begin when the air or ground temperature is 40 degrees and rising. Mixing and placement shall stop when the air temperature is and falling or when the anticipated air or ground temperature will be 35°F or less in the 24-hour period following proposed placement. At the time of placement, CLSM shall have a temperature of at least 40°F.

153-4.2 Curing and protection

a. Curing. The air in contact with the CLSM shall be maintained at temperatures above freezing for a minimum of 72 hours. If the CLSM is subjected to temperatures below 32°F, the material may be rejected by the RPR if damage to the material is observed.

b. Protection. The CLSM shall not be subject to loads and shall remain undisturbed by construction activities for a period of 24 hours or until the material will not be displaced by subsequent equipment or materials placed on the CLSM. The Contractor shall be responsible for providing evidence to the RPR that the material has reached the desired strength. Acceptable evidence shall be based upon compressive tests made in accordance with paragraph 153-3.1a.

153-4.3 Quality Assurance (QA) Acceptance. CLSM QA acceptance shall be based upon batch tickets provided by the Contractor to the RPR to confirm that the delivered material conforms to the mix design.

METHOD OF MEASUREMENT

153-5.1 Measurement.

No separate measurement for payment shall be made for controlled low strength material (CLSM). CLSM shall be considered necessary and incidental to the work of this Contract.

BASIS OF PAYMENT

153-6.1 Payment.

No payment will be made separately or directly for controlled low strength material (CLSM). CLSM shall be considered necessary and incidental to the work of this Contract.
REFERENCES

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

ASTM International (ASTM)

ASTM C33 Standard Specification for Concrete Aggregates
ASTM C150 Standard Specification for Portland Cement
ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C595 Standard Specification for Blended Hydraulic Cements
ASTM C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D4832 Standard Test Method for Preparation and Testing of Controlled Low-Strength Material (CLSM) Test Cylinders
ASTM D6103 Flow Consistency of Controlled Low Strength Material (CLSM)

END OF ITEM P-153
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ITEM P-160 REMOVAL AND DISPOSAL OF JET FUEL IMPACTED SOIL

Description
This item covers excavation, handling, and transportation of Jet Fuel Impacted Soil. Excavation, handling, and transportation of clean soil is not applicable to this specification section.

Definition
Soil: Soil, as applicable to this specification section (Item) only, is defined as any material beneath the concrete pavement, including aggregate base course and utility/pipe bedding materials.

Jet Fuel Impacted Soil: Jet Fuel Impacted Soil is defined as soil within a twenty (20) foot radius of existing hydrant pits, low-point drains, and high-point vents associated with the AFFC Jet-A Hydrant System, and including areas where modifications to the hydrant system will occur.

AFFC Environmental Representative: Environmental Representative provided and paid for by the Arizona Fueling Facility Corporation (AFFC) to be onsite when excavation work is performed within a 20-foot radius of the AFFC Jet-A Hydrant System. The AFFC Environmental Representative will evaluate the soil and determine if it is impacted by jet fuel.

Classification
Jet Fuel Impacted Soil Excavation: Jet Fuel Impacted Soil Excavation shall consist of the excavation, handling, and delivery of all Jet Fuel Impacted Soil to the Waste Management Butterfield Station Landfill.

Replacement Backfill: Replacement Backfill shall consist of the delivery, placement, and compaction of backfill material required to replace the volume of excavated Jet Fuel Impacted Soil. Replacement Backfill excludes the quantity of aggregate base course as required per Item P-209 to be placed below the concrete pavement, any fuel system Replacement Bedding Material as required per Item P-152.

Replacement Bedding Material: Replacement Bedding Material shall consist of the delivery, placement, and compaction of bedding material required to replace any bedding material around any existing utilities or hydrant system components that is excavated and disposed of as Jet Fuel Impacted Soil.

Qualifications
Based on PSHIA requirements for excavation of Jet Fuel Impacted Soil and AFFC requirements for excavation in the vicinity of the AFFC Jet-A Hydrant System, the companies listed below are the only...
companies approved to perform the work described in this Item. The Contractor shall subcontract one of these companies to perform the work described in this Item.

KEAR Civil Corporation
22041 N. 23rd Ave
Phoenix, AZ 85027
(623) 580-1100
www.kearcorp.com

SE Pipeline Construction
11832 S. Bloomfield Ave.
Santa Fe Springs, CA 90670
(562) 868-9771
www.sepipeline.com

Underground Construction Co., Inc.
5145 Industrial Way
Benicia, CA 94510
(707) 746-8800
www.undergrnd.com

Construction Methods

General
If soil is determined by the AFFC Environmental Representative to be impacted by jet fuel, the AFFC Environmental Representative will recommend to the RPR that two (2) vertical feet of soil be removed by the Contractor.

Upon removing two vertical feet of Jet Fuel Impacted Soil, the AFFC Environmental Representative will evaluate the soil remaining in place and determine if it still impacted by jet fuel. If it is, the AFFC Environmental Representative will recommend to the RPR that two (2) additional vertical feet of Jet Fuel Impacted Soil be removed by the Contractor. This process may continue up to a maximum depth of ten (10) feet.

If at any point during the iterative evaluation/excavation process, the soil remaining in place is determined by the AFFC Environmental Representative to not be impacted by jet fuel, then the final depth of the excavation has been reached.

Upon the recommendations of the AFFC Environmental Representative, the depth and outer boundaries of the Jet Fuel Impacted Soil to be removed will be directed by the RPR.
The AFFC Environmental Representative will collect soil samples from the bottom/sidewalls of the excavation to document the left-in-place soil conditions. Contractor shall allow sufficient time for the AFFC Environmental Representative to collect soil samples. After soil samples are collected, the excavation is available to be backfilled by the Contractor, following the requirements of Item P-152.

**Excavation**

Prior to excavation, the Contractor shall locate all underground utilities in the vicinity of the excavation area. Contractor shall exercise extreme caution when performing excavation in the vicinity of the AFFC Jet-A Hydrant System. Contractor is responsible for repairing damage to all fueling components and underground utilities.

If excavation occurs adjacent to, or under, existing utilities, Contractor shall provide appropriate means and methods to temporarily support the utility prior to excavating below the bottom of fuel pipe lines and hydrant pits.

Contractor shall take care in maintaining an excavation that will not destabilize or impact adjacent soils or concrete panels. Contractor shall maintain a safe excavation, in accordance with OSHA.

Contractor is responsible for monitoring volatile organic compound (VOC) levels in the breathing zone and maintaining a safe working environment in accordance with OSHA.

Contractor shall closely coordinate excavation schedule of concrete panels within twenty (20) feet of the hydrant system with the Engineer and the AFFC Environmental Representative.

If Contractor encounters soil suspected to be contaminated that is outside of the 20-foot radius of the AFFC Jet-A Hydrant System, Contractor shall immediately notify the RPR.

**Disposal**

The AFFC has arranged for disposal of Jet Fuel Impacted Soil at Waste Management’s Butterfield Station Landfill under the existing waste profile number: **BFS 436650AZ**. The tipping fee charged by the landfill will be billed directly to the AFFC.

Waste Management
Butterfield Station
40404 S. 99th Avenue
Mobile, AZ 85239
WM Profile #BFS 436650AZ
Contractor shall excavate, handle, and deliver Jet Fuel Impacted Soil to the Waste Management Butterfield Station Landfill. Contractor shall make arrangements with landfill to receive soil. Contractor shall reference the existing waste profile number BFS 436650AZ on all waste manifests.

The AFFC will be listed as generator on all Jet Fuel Impacted Soil delivered to the Butterfield Station Landfill. A representative of the AFFC will sign the waste manifests.

Periodic sampling of the Jet Fuel Impacted Soil delivered to the Butterfield Station Landfill, if required, will be performed by the AFFC Environmental Representative.

Contractor may directly load Jet Fuel Impacted Soil into trucks for delivery to the landfill, or into roll-off containers provided by Contractor. Roll-off containers shall be lined with plastic and covered with plastic. Roll-off containers may be temporarily staged at the AFFC Fueling Facility for delivery to the landfill by the Contractor at a later date (not to exceed 30 days).

**Backfill**
The volume of Jet Fuel Impacted Soil excavated from below the concrete panel(s) shall be replaced with approved materials to top of subgrade elevation. Approved materials include Replacement Backfill, aggregate base course, and Replacement Bedding Material.

If any hydrant fueling piping is exposed during the excavation and disposal of jet impacted soil, the Contractor shall provide access and adequate time for AFFC to inspect the exposed piping to evaluate the integrity of the coatings and the cathodic protection and make any necessary repairs prior to the Contractor commencing the placement of bedding and backfill material.

Any bedding material surrounding underground utilities, or associated with the hydrant system, that is excavated and disposed of as Jet Fuel Impacted Soil shall be replaced with properly compacted Replacement Bedding Material, as specified by Item P-152.

Backfill material and placement shall conform to P-152 or P-153 material as approved by the Engineer.

Any Excavated Jet Fuel Impacted Soil not consisting of bedding material or aggregate base course material shall be replaced with properly compacted Replacement Backfill, as specified by Item P-152. All Replacement Backfill material shall be free from contamination, as specified by Item P-152.

**Reporting**
All weight tickets for any Jet Fuel Impacted Soil delivered to the Butterfield Station Landfill shall be provided to the Engineer.
Method of Measurement
Jet Fuel Impacted Soil Excavation shall be measured on the basis of the number of tons excavated and delivered to the Butterfield Station Landfill, per landfill weight tickets.

Replacement Backfill shall be measured on the basis of the number of cubic yards measured in its final position at the project site.

Replacement Bedding Material shall be measured on the basis of the number of cubic yards measured in its final position at the project site.

Basis of Payment
For “Jet Fuel Impacted Soil Excavation”, payment shall be made at the contract unit price per ton. This price shall be full compensation for furnishing excavation, hauling to the Butterfield Station Landfill, all materials, labor, equipment, tools, and incidentals necessary to complete the item.

For “Replacement Backfill”, payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item. Replacement Backfill excludes the quantity of aggregate base course as required per Item P-209 or P-219 to be placed below the concrete pavement.

For “Replacement Bedding Material”, payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment shall be made under:

Item P-160.1  Remove Jet Fuel Impacted Soil – per Ton

Item P-160.2  Replacement Backfill for Jet Fuel Impacted Soil – per Cubic Yard

Item P-160.3  Replacement Bedding Material for Jet Fuel Impacted Soil – per Cubic Yard

END ITEM P-160
ITEM P-161 REMOVAL AND DISPOSAL OF CONTAMINATED SOIL

Description
This item covers excavation, handling, and transportation of contaminated soil in areas beyond a 20 foot radius around the fuel pits, fuel high/low points, or fuel valve pits. Excavation, handling and transportation of clean soil is not applicable to this specification section.

Definition
Soil: Soil, as applicable to this specification section only, is defined as any material beneath the concrete pavement, including aggregate base course and utility/pipe bedding materials.

Contaminated Soil: Contaminated Soil is defined as soil beyond a twenty (20) foot radius around existing fuel hydrant pits, fuel valve pits, low-point drains, and high-point vents associated with the AFFC Jet-A Hydrant System, including areas where modifications to the hydrant system will occur. For areas inside of this radius, refer to specification section P-160.

Phoenix Sky Harbor International Airport (Airport) Environmental Representative: Environmental Representative provided and paid for by the Airport to be available for contact and field investigation when excavation work is performed beyond a 20-foot radius of the AFFC Jet-A Hydrant System. The Airport Environmental Representative will be contacted by the Contractor (through coordination with the RPR) when contaminated soil is found and the Environmental Representative will evaluate the soil and determine if it is impacted by jet fuel or other contaminates. All work in the general area of the suspected contamination will cease until the area is evaluated by the Airport Environmental Representative.

Classification
Contaminated Soil Excavation: Contaminated Soil Excavation shall consist of the excavation, handling, and delivery of all Contaminated Soil to the Waste Management Butterfield Station Landfill.

Contaminated Soil Replacement Backfill: Contaminated Replacement Backfill shall consist of the delivery, placement, and compaction of backfill material required to replace the volume of excavated Contaminated Soil. Contaminated Soil Replacement Backfill excludes the quantity of aggregate base course as required per Item P-209 to be placed below the concrete pavement.

Qualifications
Based on Airport requirements for excavation of Contaminated Soil, the companies listed below are the only companies approved to perform the work described in this Item. The Contractor shall subcontract one of these companies to perform the work described in this Item.

KEAR Civil Corporation
22041 N. 23rd Ave
Phoenix, AZ 85027
(623) 580-1100
www.kearcorp.com
Construction Methods

General
If soil is determined by the Airport Environmental Representative to be contaminated, the Airport Environmental Representative will recommend to the RPR that two (2) vertical feet of soil be removed by the Contractor.

Upon removing two vertical feet of Contaminated Soil, the Airport Environmental Representative will evaluate the soil remaining in place and determine if it still contaminated. If it is, the Airport Environmental Representative will recommend to the RPR that two (2) additional vertical feet of Contaminated Soil be removed by the Contractor. This process may continue up to a maximum depth of ten (10) feet.

If at any point during the iterative evaluation/excavation process, the soil remaining in place is determined by the Airport Environmental Representative to not be contaminated, then the final depth of the excavation has been reached.

Upon the recommendation of the Airport Environmental Representative, the depth and outer boundaries of the contaminated soil to be removed will be directed by the RPR.

The Airport Environmental Representative will collect soil samples from the bottom/sidewalls of the excavation to document the left-in-place soil conditions. Contractor shall allow sufficient time for the Airport Environmental Representative to collect soil samples. After soil samples are collected, the excavation is available to be backfilled by the Contractor, following the requirements of Item P-152.

Excavation
Prior to excavation, the Contractor shall locate all underground utilities in the vicinity of the excavation area. Contractor shall exercise extreme caution when performing excavation in the vicinity of the AFFC Jet-A Hydrant System. Contractor is responsible for repairing damage to all fueling components and underground utilities.

If excavation occurs adjacent to, or under, existing utilities, Contractor shall provide appropriate means and methods to temporarily support the utility.

Contractor shall take care in maintaining an excavation that will not destabilize or impact adjacent soils or concrete panels. Contractor shall maintain a safe excavation, in accordance with OSHA.
Contractor is responsible for monitoring volatile organic compound (VOC) levels in the breathing zone and maintaining a safe working environment in accordance with OSHA.

**Disposal**
The Airport has arranged for disposal of Contaminated Soil at Waste Management’s Butterfield Station Landfill under the existing waste profile number: **BFS 436650AZ**. The tipping fee charged by the landfill will be billed directly to the Airport.

Waste Management  
Butterfield Station  
40404 S. 99th Avenue  
Mobile, AZ 85239  
WM Profile #BFS 436650AZ

Contractor shall excavate, handle, and deliver Contaminated Soil to the Waste Management Butterfield Station Landfill. Contractor shall make arrangements with landfill to receive soil. Contractor shall reference the existing waste profile number BFS 436650AZ on all waste manifests.

The Airport will be listed as generator on all Contaminated Soil delivered to the Butterfield Station Landfill. A representative of the Airport will sign the waste manifests.

Periodic sampling of the Contaminated Soil delivered to the Butterfield Station Landfill, if required, will be performed by the Airport Environmental Representative.

**Backfill**
In the event any hydrant piping is exposed during the excavation and disposal of jet impact soil, the Contractor shall provide access and adequate time for AFFC to inspect the exposed piping to evaluate the integrity of the coatings and the cathodic protection and make any necessary repairs prior to the Contractor commencing the placement of bedding and backfill material.

The volume of Contaminated Soil excavated from below the concrete panel(s) shall be replaced with approved materials to the top of subgrade elevation. Approved materials include Contaminated Soil Replacement Backfill and aggregate base course.

Backfill material shall conform to P-152 or P-153 material as approved by the RPR.

Any Excavated Contaminated Soil not consisting of bedding material or aggregate base course material shall be replaced with properly compacted Replacement Backfill, as specified by Item P-152. All Replacement Backfill material shall be free from contamination, as specified by Item P-152.

In the event any hydrant piping is exposed from the excavating of Jet fuel Impact Soil, it shall be replaced with properly compacted Replacement Bedding Material, as specified by Item P-152.
Reporting
All weight tickets for any Contaminated Soil delivered to the Butterfield Station Landfill shall be provided to the RPR.

Method of Measurement
Contaminated Soil Excavation delivered to the Butterfield Station Landfill will be measured on a unit basis as designated by the RPR based on the type of work items performed for payment under the Lump Sum bid item. Contractor shall supply landfill weight tickets to the RPR.

Contaminated Soil Replacement Bedding and Backfill will be measured on a unit basis as designated by the RPR based on the type of work items performed for payment under the Lump Sum bid item.

Basis of Payment
For “Contaminated Soil Excavation”, payment will be made from the Lump Sum based on the approved unit price under P-160.1 per ton.

For “Contaminated Soil Replacement Bedding and Backfill”, payment will be made from the Lump Sum based on the approved unit price under P-160.2 and P-160.3 per cubic yard.

Payment shall be made under:

Item P-161.1 Contaminated Soil Excavation – per Cubic Yard of the Percentage Lump Sum

Item P-161.2 Contaminated Soil Replacement Bedding and Backfill – per Cubic Yard of the Percentage Lump Sum

END ITEM P-161
Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate portion, defined as the portion passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone or gravel that meets the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.
## Crushed Aggregate Base Material Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coarse Aggregate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance to Degradation</td>
<td>Loss: 45% maximum</td>
<td>ASTM C131</td>
</tr>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate</td>
<td>ASTM C88</td>
</tr>
<tr>
<td>Percentage of Fractured Particles</td>
<td>Minimum 90% by weight of particles with at least two fractured faces and 98% with at least one fractured face</td>
<td>ASTM D5821</td>
</tr>
<tr>
<td>Flat Particles, Elongated Particles, or Flat and Elongated Particles</td>
<td>10% maximum, by weight, of flat, elongated, or flat and elongated particles</td>
<td>ASTM D4791</td>
</tr>
<tr>
<td><strong>Fine Aggregate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid limit</td>
<td>Less than or equal to 25</td>
<td>ASTM D4318</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>Not more than five (5)</td>
<td>ASTM D4318</td>
</tr>
</tbody>
</table>

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

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

### 209.2.2 Grading requirements

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

Prior to production, the Contractor shall submit the job mix target gradation percentages on each sieve for the RPR’s review and approval.
Gradation of Aggregate Base

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Design Range Percentage by Weight passing</th>
<th>Contractor’s Final Gradation</th>
<th>Job Control Grading Band Tolerances(^1) (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch (50 mm)</td>
<td>100</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>1-1/2 inch (37.5 mm)</td>
<td>95-100</td>
<td></td>
<td>±5</td>
</tr>
<tr>
<td>1 inch (25.0 mm)</td>
<td>70-95</td>
<td></td>
<td>±8</td>
</tr>
<tr>
<td>3/4 inch (19.0 mm)</td>
<td>55-85</td>
<td></td>
<td>±8</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>30-60</td>
<td></td>
<td>±8</td>
</tr>
<tr>
<td>No. 40(^2) (425 µm)</td>
<td>10-30</td>
<td></td>
<td>±5</td>
</tr>
<tr>
<td>No. 200(^2) (75 µm)</td>
<td>0-10</td>
<td></td>
<td>±3</td>
</tr>
</tbody>
</table>

\(^1\) The “Job Control Grading Band Tolerances for Contractor’s Final Gradation” in the table shall be applied to “Contractor’s Final Gradation” to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

\(^2\) The fraction of material passing the No 200 (75 µm) sieve shall not exceed two-thirds the fraction passing the No 40 (425 µm) sieve.

209-2.3 Sampling and Testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

b. Gradation requirements. The Contractor shall take at least two aggregate base samples per day in the presence of the Resident Project Representative (RPR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the RPR.

209-2.4 Separation Geotextile. Not used.

CONSTRUCTION METHODS

209-3.1 Control strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum
compacted thickness may be increased to a maximum of 12 inches upon the Contractor’s demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

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

209-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the RPR before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the Contractor’s expense, may be required by the RPR if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.5, the approved material may be transported directly to the placement.

209-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

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

209-3.5 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM D1557. The machine shall be calibrated per
ASTM D6938. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

**209-3.6 Weather limitations.** Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

**209-3.7 Maintenance.** The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor’s expense.

**209-3.8 Surface tolerances.** After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor’s expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. **Smoothness.** The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. **Grade.** The grade and crown shall be measured on a 50-foot grid and shall be within +0 and -1/2 inch of the specified grade.

The Contractor’s surveyor shall obtain and document the finish grade elevations on the P-209 at each concrete pavement joint intersection. The finish grade and crown elevations of the surface of the P-209 for other pavement surfaces shall be obtained on a 50-foot grid. The finished elevations shall be within +/- 0.04’ of the specified grade. This survey data shall be forwarded to the RPR for review and approval.

**209-3.9 Acceptance sampling and testing.** Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1200 square yds. Sampling locations will be determined on a random basis per ASTM D3665

a. **Density.** The Contractor’s laboratory shall perform all density tests in the RPR’s presence and provide the test results upon completion to the RPR for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM1557. The in-place field density shall be determined per ASTM D1556 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached.
Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

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

**METHOD OF MEASUREMENT**

**209-4.1** The quantity of crushed aggregate base course will be determined by measurement of the number of square yards of material actually constructed and accepted by the RPR as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

**BASIS OF PAYMENT**

**209-5.1** Payment shall be made at the contract unit price per square yard for crushed aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

When directed by the RPR, P-209 material used to replace unstable subgrade will be measured and paid under Item P-209-5.2 pro-rated. The P-209 material will be paid using the Contractor’s unit bid price for Item P-209-5.2 multiplied by the equivalent area adjusted for thickness based on ten (10") inch depth respectively.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-209-5.1</td>
<td>Crushed Aggregate Base Course or Recycled Concrete Aggregate Base Course (4-inch Depth) - per Square Yard</td>
</tr>
<tr>
<td>P-209-5.2</td>
<td>Crushed Aggregate Base Course or Recycled Concrete Aggregate Base Course (10-inch Depth) - per Square Yard</td>
</tr>
</tbody>
</table>

**REFERENCES**

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

ASTM International (ASTM)

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C29</td>
<td>Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate</td>
</tr>
<tr>
<td>ASTM C88</td>
<td>Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
</tr>
<tr>
<td>Standard Test Method</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>ASTM C117</td>
<td>Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing</td>
</tr>
<tr>
<td>ASTM C136</td>
<td>Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates</td>
</tr>
<tr>
<td>ASTM C142</td>
<td>Standard Test Method for Clay Lumps and Friable Particles in Aggregates</td>
</tr>
<tr>
<td>ASTM D75</td>
<td>Standard Practice for Sampling Aggregates</td>
</tr>
<tr>
<td>ASTM D698</td>
<td>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))</td>
</tr>
<tr>
<td>ASTM D1556</td>
<td>Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method</td>
</tr>
<tr>
<td>ASTM D1557</td>
<td>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN-m/m³))</td>
</tr>
<tr>
<td>ASTM D2167</td>
<td>Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method</td>
</tr>
<tr>
<td>ASTM D3665</td>
<td>Standard Practice for Random Sampling of Construction Materials</td>
</tr>
<tr>
<td>ASTM D4491</td>
<td>Standard Test Methods for Water Permeability of Geotextiles by Permittivity</td>
</tr>
<tr>
<td>ASTM D4643</td>
<td>Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating</td>
</tr>
<tr>
<td>ASTM D4751</td>
<td>Standard Test Methods for Determining Apparent Opening Size of a Geotextile</td>
</tr>
<tr>
<td>ASTM D4791</td>
<td>Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate</td>
</tr>
<tr>
<td>ASTM D5821</td>
<td>Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate</td>
</tr>
<tr>
<td>ASTM D6938</td>
<td>Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)</td>
</tr>
<tr>
<td>ASTM D7928</td>
<td>Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis</td>
</tr>
</tbody>
</table>
American Association of State Highway and Transportation Officials (AASHTO)

M288 Standard Specification for Geosynthetic Specification for Highway Applications

END OF ITEM P-209
Item P-219 Recycled Concrete Aggregate Base Course

DESCRIPTION

219-1.1 This item consists of a base course composed of recycled concrete aggregate, crushed to meet a particular gradation, constructed on a prepared course per these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

219-2.1 Aggregate. Recycled concrete aggregate shall consist of cement concrete. The recycled concrete material shall be free of reinforcing steel and expansion material. Asphalt overlays and any full slab asphalt panels shall be removed from the concrete surface prior to removal and crushing.

Recycled concrete aggregate shall consist of at least 90%, by weight, cement concrete; virgin aggregates may be added to meet the 90% minimum concrete requirement. The remaining 10% may consist of the following materials:

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>0.1% maximum</td>
</tr>
<tr>
<td>Brick, mica, schist, or other friable materials</td>
<td>4% maximum</td>
</tr>
<tr>
<td>Asphalt concrete</td>
<td>10% maximum</td>
</tr>
<tr>
<td>Total</td>
<td>10 % maximum</td>
</tr>
</tbody>
</table>
### Recycled Concrete Aggregate Base Material Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coarse Aggregate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance to Degradation</td>
<td>Loss: 45% maximum</td>
<td>ASTM C131</td>
</tr>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate</td>
<td>ASTM C88</td>
</tr>
<tr>
<td>Flat Particles, Elongated Particles, or Flat and Elongated Particles(^1)</td>
<td>10% maximum, by weight, for fraction retained on the ½ inch (12.5mm) sieve and 10% maximum, by weight, for the fraction passing the 1/2-inch (12.5 mm) sieve</td>
<td>ASTM D4791</td>
</tr>
<tr>
<td>Clay lumps and friable particles</td>
<td>Less than or equal to 3 percent</td>
<td>ASTM C142</td>
</tr>
<tr>
<td><strong>Fine Aggregate Portion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid limit</td>
<td>Less than or equal to 25</td>
<td>ASTM D4318</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>Not more than four (4)</td>
<td>ASTM D4318</td>
</tr>
</tbody>
</table>

\(^1\) A flat particle is one having a ratio of width to thickness greater than three (3); an elongated particle is one having a ratio of length to width greater than five (5).

The fine aggregate shall be produced by crushing stone, gravel, slag, or recycled concrete that meet the requirements for wear and soundness specified for coarse aggregate. Fine aggregate may be added to produce the correct gradation.

Each source of recycled concrete aggregate shall meet the above requirements.

Recycled concrete aggregate shape depends on the characteristics of the recycled concrete, plant type, and plant operation speed. This may require a number of trial batches before crushed recycled concrete aggregate meeting the shape and gradation requirements can be produced.

**219-2.2 Gradation requirements.** The gradation (job mix) of the final mixture shall fall within the design range indicated in the following table, when tested per ASTM C117 and ASTM C136. The final gradation shall be continuously graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.
Gradation of Recycled Concrete Aggregate Base

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by Weight Passing Sieves</th>
<th>Job Mix Tolerances Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch (50 mm)</td>
<td>100</td>
<td>--</td>
</tr>
<tr>
<td>1-1/2 inch (37.5 mm)</td>
<td>95 - 100</td>
<td>±5</td>
</tr>
<tr>
<td>1 inch (25.0 mm)</td>
<td>70 - 95</td>
<td>±8</td>
</tr>
<tr>
<td>3/4 inch (19.0 mm)</td>
<td>55 - 85</td>
<td>±8</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>30 - 60</td>
<td>±8</td>
</tr>
<tr>
<td>No. 30 (600 µm)</td>
<td>12 - 30</td>
<td>±5</td>
</tr>
<tr>
<td>No. 200 (75 µm)</td>
<td>0 - 10</td>
<td>±3</td>
</tr>
</tbody>
</table>

The job mix tolerances in the table shall be applied to the job mix gradation to establish a job control gradation band. The full tolerance still will apply if application of the tolerances results in a job control gradation band outside the design range.

219-2.3 Sampling and testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraphs 219-2.1 and 219-2.2. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

b. Gradation requirements. The Contractor shall take at least two aggregate base samples per day in the presence of the Resident Project Representative (RPR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 219-2.2. The lot will be consistent with the lot size used for density. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the RPR.

219-2.4 Separation Geotextile. Not used.

CONSTRUCTION METHODS

219-3.1 Control Strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor’s demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor’s expense. Full operations shall not continue until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved by the RPR.
219-3.2 Preparing underlying course. The underlying course shall be checked by the RPR before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor’s expense before the base course is placed there. Material shall not be placed on frozen material.

To protect the existing layers and to ensure proper drainage, the spreading of the recycled concrete aggregate base course shall begin along the centerline of the pavement on a crowned section or on the greatest contour elevation of a pavement with a variable uniform cross slope.

219-3.3 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The subbase course shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

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

219-3.4 Compaction. Immediately upon completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM D1557. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

219-3.5 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

219-3.6 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at their expense.

219-3.7 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and
recompacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor’s expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

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

The finished elevation of the recycled concrete base course shall be obtained by the Contractor’s Surveyor. Finished grade elevations on the recycled concrete base shall be taken at each concrete pavement joint intersection, and at a grid not exceeding 25 feet x 25 feet for all other surface pavements. The finished elevations shall be within +/- 0.04’ of the specified grade. This survey data shall be forwarded to the RPR for review and approval.

219-3.8 Acceptance sampling and testing for density. Recycled Concrete Aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1200 square yds. Sampling locations will be determined on a random basis per ASTM D3665

a. Density. The Contractor’s laboratory shall perform all density tests in the RPR’s presence and provide the test results upon completion to the RPR for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM 1557. The in-place field density shall be determined per ASTM D1556 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

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

METHOD OF MEASUREMENT

219-4.1 The quantity of recycled concrete aggregate base course will be determined by measurement of the number of square yards of material actually constructed and accepted as complying with the plans and specifications.
BASIS OF PAYMENT

219-5.1 Should the Contractor, at its own discretion, elect to use P-219 recycled aggregate base course in lieu of P-209, payment shall be made at the contract unit price per square yard for recycled concrete aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

When directed by the RPR, P-219 material used to replace unstable subgrade will be measured and paid under Item P-209-5.2 pro-rated. The P-219 material will be paid using the Contractor's unit bid price for Item P-209-5.2 multiplied by the equivalent area adjusted for thickness based on a ten (10") inch depth respectively.

Payment will be made under:

Item P-209-5.1 Crushed Aggregate Base Course or Recycled Concrete Aggregate Base Course (4-inch Depth) - per Square Yard

Item P-209-5.2 Crushed Aggregate Base Course or Recycled Concrete Aggregate Base Course (10-inch Depth) - per Square Yard

REFERENCES

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

ASTM International (ASTM)

ASTM C29 Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate

ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C117 Standard Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing


ASTM C136 Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregate

ASTM D75 Standard Practice for Sampling Aggregates

ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
<table>
<thead>
<tr>
<th>ASTM D1557</th>
<th>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN-m/m³))</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D3665</td>
<td>Standard Practice for Random Sampling of Construction Materials</td>
</tr>
<tr>
<td>ASTM D4643</td>
<td>Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating</td>
</tr>
<tr>
<td>ASTM D4791</td>
<td>Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate</td>
</tr>
<tr>
<td>ASTM D6938</td>
<td>Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)</td>
</tr>
</tbody>
</table>

**END OF ITEM P-219**
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Item P-403 Asphalt Mix Pavement Surface Course

DESCRIPTION

403-1.1 This item shall consist of pavement courses composed of mineral aggregate and asphalt binder mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

403-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The aggregates should have no known history of detrimental pavement staining due to ferrous sulfides, such as pyrite. Coarse aggregate is the material retained on the No. 4 sieve. Fine aggregate is the material passing the No. 4 sieve.

a. Coarse aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. Coarse aggregate material requirements are given in the table below.
### Coarse Aggregate Material Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to Degradation</td>
<td>Loss: 40% maximum for surface, asphalt binder, and leveling course</td>
<td>ASTM C131</td>
</tr>
<tr>
<td></td>
<td>Loss: 50% maximum for base course</td>
<td></td>
</tr>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate</td>
<td>ASTM C88</td>
</tr>
<tr>
<td>Clay lumps and friable particles</td>
<td>0.3% maximum</td>
<td>ASTM C142</td>
</tr>
<tr>
<td>Percentage of Fractured Particles</td>
<td>For pavements designed for aircraft gross weights of 60,000 pounds (27200 kg) or more:</td>
<td>ASTM D5821</td>
</tr>
<tr>
<td></td>
<td>Minimum 75% by weight of particles with at least two fractured faces and 85% with at least one fractured face(^1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>For pavements designed for aircraft gross weights less than 60,000 pounds (27200 kg):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum 50% by weight of particles with at least two fractured faces and 65% with at least one fractured face(^1)</td>
<td></td>
</tr>
<tr>
<td>Flat, Elongated, or Flat and Elongated Particles</td>
<td>8% maximum, by weight, of flat, elongated, or flat and elongated particles with a value of 5:1 (^2)</td>
<td>ASTM D4791</td>
</tr>
<tr>
<td>Bulk density of slag(^3)</td>
<td>Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)</td>
<td>ASTM C29.</td>
</tr>
</tbody>
</table>

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

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

\(^3\) Only required if slag is specified.

**b. Fine aggregate.** Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel and shall be free from coatings of clay, silt, or other objectionable matter. Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. Fine aggregate material requirements are listed in the table below.
Fine Aggregate Material Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid limit</td>
<td>25 maximum</td>
<td>ASTM D4318</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>4 maximum</td>
<td>ASTM D4318</td>
</tr>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate</td>
<td>ASTM C88</td>
</tr>
<tr>
<td>Clay lumps and friable particles</td>
<td>0.3% maximum</td>
<td>ASTM C142</td>
</tr>
<tr>
<td>Sand equivalent</td>
<td>45 minimum</td>
<td>ASTM D2419</td>
</tr>
<tr>
<td>Natural Sand</td>
<td>0 to 15% maximum by weight of total aggregate</td>
<td>ASTM D1073</td>
</tr>
</tbody>
</table>

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler.

403-2.2 Mineral filler. Mineral filler (baghouse fines) may be added in addition to material naturally present in the aggregate. Mineral filler shall meet the requirements of ASTM D242.

Mineral filler Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasticity Index</td>
<td>4 maximum</td>
<td>ASTM D4318</td>
</tr>
</tbody>
</table>

403-2.3 Asphalt binder. Asphalt binder shall conform to ASTM D6373 Performance Grade (PG) 64-22.

Asphalt Binder PG Plus Test Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic Recovery</td>
<td>75% minimum</td>
<td>ASTM D6084(^1)</td>
</tr>
</tbody>
</table>

\(^1\) Follow procedure B on RTFO aged binder.

403-2.4 Anti-stripping agent. Any anti-stripping agent or additive (anti-strip) shall be heat stable and shall not change the asphalt binder grade beyond specifications. Anti-strip shall be an approved material of the Department of Transportation of the State in which the project is located.

COMPOSITION

403-3.1 Composition of mixture. The asphalt plant mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and asphalt binder. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).
403-3.2 Job mix formula (JMF) laboratory. The laboratory used to develop the JMF shall possess a current certificate of accreditation, listing D3666 from a national accrediting authority and all test methods required for developing the JMF, and listed on the accrediting authority’s website. A copy of the laboratory’s current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

403-3.3 Job mix formula (JMF). No asphalt mixture shall be placed until an acceptable mix design has been submitted to the RPR for review and accepted in writing. The RPR’s review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

When the project requires asphalt mixtures of differing aggregate gradations and/or binders, a separate JMF shall be submitted for each mix. Add anti-stripping agent to meet tensile strength requirements.

City of Phoenix or other pre-approved job mix formulas that have been used at Phoenix Sky Harbor Airport within the past 18 months may be approved without additional verification testing, provided that there have been no changes in the brand and sources of all materials, and the results of the previous uses have resulted in satisfactory performance(s).

The JMF shall be prepared by an accredited laboratory that meets the requirements of paragraph 403-3.2. The asphalt mixture shall be designed using procedures contained in Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples shall be prepared and compacted using a Marshall compactor in accordance with ASTM D6926.

Should a change in sources of materials be made, a new JMF must be submitted to the RPR for review and accepted in writing before the new material is used. After the initial production JMF has been approved by the RPR and a new or modified JMF is required for whatever reason, the subsequent cost of the new or modified JMF, including a new control strip when required by the RPR, will be borne by the Contractor.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

The JMF shall be submitted in writing by the Contractor at least 30 days prior to the start of paving operations. The JMF shall be developed within the same construction season using aggregates proposed for project use.

The submitted JMF shall be dated, and stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items as a minimum:

- Manufacturer’s Certificate of Analysis (COA) for the asphalt binder used in the JMF in accordance with paragraph 403-2.3. Certificate of asphalt performance grade is with modifier already added, if used and must indicate compliance with ASTM D6373. For plant modified asphalt binder, certified test report indicating grade certification of modified asphalt binder.
- Manufacturer’s Certificate of Analysis (COA) for the anti-stripping agent if used in the JMF in accordance with paragraph 403-2.4.
- Certified material test reports for the course and fine aggregate and mineral filler in accordance with paragraphs 403-2.1 and 403-2.2.
- Percent passing each sieve size for individual gradation of each aggregate cold feed and/or hot bin; percent by weight of each cold feed and/or hot bin used; and the total combined gradation in the JMF.
- Specific Gravity and absorption of each course and fine aggregate.
- Percent natural sand.
- Percent fractured faces.
- Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).
- Percent of asphalt.
- Number of blows or gyrations.
- Laboratory mixing and compaction temperatures.
- Supplier recommended mixing and compaction temperatures.
- Plot of the combined gradation on the 0.45 power gradation curve.
- Graphical plots of air voids, voids in the mineral aggregate (VMA), and unit weight versus asphalt content. To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.
- Tensile Strength Ratio (TSR).
- Type and amount of Anti-strip agent when used.
- Asphalt Pavement Analyzer (APA) results.
- Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season shall not be accepted.

### Table 1. Asphalt Design Criteria

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of blows/gyrations</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Air voids (%)</td>
<td>3.5</td>
<td>ASTM D3203</td>
</tr>
<tr>
<td>Percent voids in mineral aggregate (VMA), minimum</td>
<td>See Table 2</td>
<td>ASTM D6995</td>
</tr>
<tr>
<td>TSR(^1)</td>
<td>not less than 80 at a saturation of 70-80%</td>
<td>ASTM D4867</td>
</tr>
<tr>
<td>Asphalt Pavement Analyzer (APA)(^2)</td>
<td>Less than 10 mm @ 4000 passes</td>
<td>AASHTO T340 at 250 psi hose pressure at 64°C test temperature</td>
</tr>
</tbody>
</table>

\(^1\) Test specimens for TSR shall be compacted at 7 ± 1.0 % air voids. In areas subject to freeze-thaw, use freeze-thaw conditioning in lieu of moisture conditioning per ASTM D4867.

\(^2\) AASHTO T340 at 100 psi hose pressure at 64°C test temperature may be used in the interim. If this method is used the required Value shall be less than 5 mm @ 8000 passes.
The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 2 when tested in accordance with ASTM C136 and ASTM C117.

The gradations in Table 2 represent the limits that shall determine the suitability of aggregate for use from the sources of supply, be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa.

### Table 2. Aggregate - Asphalt Pavements

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by Weight Passing Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch (25.0 mm)</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch (19.0 mm)</td>
<td>100</td>
</tr>
<tr>
<td>1/2 inch (12.5 mm)</td>
<td>90-100</td>
</tr>
<tr>
<td>3/8 inch (9.5 mm)</td>
<td>72-88</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>53-73</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>38-60</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>26-48</td>
</tr>
<tr>
<td>No. 30 (600 µm)</td>
<td>18-38</td>
</tr>
<tr>
<td>No. 50 (300 µm)</td>
<td>11-27</td>
</tr>
<tr>
<td>No. 100 (150 µm)</td>
<td>6-18</td>
</tr>
<tr>
<td>No. 200 (75 µm)</td>
<td>3-6</td>
</tr>
<tr>
<td><strong>Voids in Mineral Aggregate (VMA)</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td>15</td>
</tr>
<tr>
<td><strong>Asphalt Percent:</strong></td>
<td></td>
</tr>
<tr>
<td>Stone or gravel</td>
<td>5.0-7.5</td>
</tr>
<tr>
<td>Slag</td>
<td>6.5-9.5</td>
</tr>
<tr>
<td><strong>Recommended Minimum Construction Lift Thickness</strong></td>
<td>2 inch</td>
</tr>
</tbody>
</table>

<sup>1</sup>To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

**403-3.4 Reclaimed Asphalt Pavement (RAP).** RAP shall not be used.

**403-3.5 Control strip.** A control strip is not required.

### CONSTRUCTION METHODS

**403-4.1 Weather limitations.** The asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature
requirements may be waived by the RPR, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

<table>
<thead>
<tr>
<th>Mat Thickness</th>
<th>Base Temperature (Minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Degrees F</td>
</tr>
<tr>
<td>3 inches (7.5 cm) or greater</td>
<td>40</td>
</tr>
<tr>
<td>Greater than 2 inches (50 mm) but less than 3 inches (7.5 cm)</td>
<td>45</td>
</tr>
</tbody>
</table>

403-4.2 Asphalt plant. Plants used for the preparation of asphalt shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 including the following items:

   a. Inspection of plant. The RPR, or RPR’s authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

   b. Storage bins and surge bins. The asphalt mixture stored in storage and/or surge bins shall meet the same requirements as asphalt mixture loaded directly into trucks. Asphalt mixture shall not be stored in storage and/or surge bins for a period greater than twelve (12) hours. If the RPR determines there is an excessive heat loss, segregation or oxidation of the asphalt mixture due to temporary storage, temporary storage shall not be allowed.

403-4.3 Aggregate stockpile management. Aggregate stockpiles shall be constructed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. A continuous supply of materials shall be provided to the work to ensure continuous placement.

403-4.4 Hauling equipment. Trucks used for hauling asphalt shall have tight, clean, and smooth metal beds. To prevent the asphalt from sticking to the truck beds, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the RPR. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

403-4.4.1 Material transfer vehicle (MTV). A material transfer vehicle is not required.

403-4.5 Asphalt pavers. Asphalt pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of asphalt that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface. The asphalt paver shall be equipped with a control system capable of automatically maintaining the specified screed grade and elevation.
If the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued.

The paver shall be capable of paving to a minimum width specified in paragraph 401-4.11.

**403-4.6 Rollers.** The number, type, and weight of rollers shall be sufficient to compact the asphalt to the required density while it is still in a workable condition without crushing of the aggregate, depressions or other damage to the pavement surface. Rollers shall be in good condition, capable of operating at slow speeds to avoid displacement of the asphalt. All rollers shall be specifically designed and suitable for compacting asphalt concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used.

**403-4.6.1 Density device.** The Contractor shall have on site a density gauge during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall also supply a qualified technician during all paving operations to calibrate the density gauge and obtain accurate density readings for all new asphalt. These densities shall be supplied to the RPR upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

**403-4.7 Preparation of asphalt binder.** The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of the unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F when added to the aggregate.

**403-4.8 Preparation of mineral aggregate.** The aggregate for the asphalt shall be heated and dried. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350°F when the asphalt binder is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

**403-4.9 Preparation of asphalt mixture.** The aggregates and the asphalt binder shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all asphalt upon discharge shall not exceed 0.5%.

**403-4.10 Application of Prime and Tack Coat.** Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.
A prime coat in accordance with Item P-602 shall be applied to aggregate base prior to placing the asphalt mixture.

A tack coat shall be applied in accordance with Item P-603 to all vertical and horizontal asphalt and concrete surfaces prior to placement of the first and each subsequent lift of asphalt mixture.

403-4.11 Laydown plan, transporting, placing, and finishing. Prior to the placement of the asphalt, the Contractor shall prepare a laydown plan with the sequence of paving lanes and width to minimize the number of cold joints; the location of any temporary ramps; laydown temperature; and estimated time of completion for each portion of the work (milling, paving, rolling, cooling, etc.). The laydown plan and any modifications shall be approved by the RPR.

Deliveries shall be scheduled so that placing and compacting of asphalt is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to approximately ambient temperature. The Contractor, at their expense, shall be responsible for repair of any damage to the pavement caused by hauling operations.

The Contractor Surveyor shall survey the final lift of asphalt surface and certify to the RPR that the finished lift meets grade and thickness tolerances specified herein. Survey elevations shall be taken transversely at crowns, edges and intermediate shot(s) between if the width exceeds 20' feet. Survey elevations shall be taken longitudinally at intervals not to exceed forty (40') feet. Edges of existing asphalt pavement abutting the new work shall be saw cut and the cut off material and laitance removed. Apply a tack coat in accordance with P-603 before new asphalt material is placed against it.

The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Placement of the asphalt mix shall begin along the centerline of a crowned section or on the high side of areas with a one way slope unless shown otherwise on the laydown plan as accepted by the RPR. The asphalt mix shall be placed in consecutive adjacent lanes having a minimum width of 12 feet except where edge lanes require less width to complete the area. Additional screed sections attached to widen the paver to meet the minimum lane width requirements must include additional auger sections to move the asphalt mixture uniformly along the screed extension.

The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the asphalt may be spread and luted by hand tools.

The RPR may at any time, reject any batch of asphalt, on the truck or placed in the mat, which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or overheated asphalt mixture. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price.
Areas of segregation in the surface course, as determined by the RPR, shall be removed and replaced at the Contractor’s expense. The area shall be removed by saw cutting and milling a minimum of the construction lift thickness as specified in paragraph 401-3.3, Table 2 for the approved mix design. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet (3 m) long.

403-4.12 Compaction of asphalt mixture. After placing, the asphalt mixture shall be thoroughly and uniformly compacted by self-propelled rollers. The surface shall be compacted as soon as possible when the asphalt has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any surface defects and/or displacement occurring as a result of the roller, or from any other cause, shall be corrected at the Contractor’s expense.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross-section, and the required field density is obtained. To prevent adhesion of the asphalt to the roller, the wheels shall be equipped with a scraper and kept moistened with water as necessary.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power tampers.

Any asphalt that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor’s expense. Skin patching shall not be allowed.

403-4.13 Joints. The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid asphalt except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces shall be coated with an asphalt tack coat before placing any fresh asphalt against the joint.

Longitudinal joints which are have been left exposed for more than four (4) hours; the surface temperature has cooled to less than 175°F; or are irregular, damaged, uncompacted or otherwise defective shall be cut back with a cutting wheel or pavement saw a maximum of 3 inches to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material and any laitance produced from cutting joints shall be removed from the project. An asphalt tack coat or other product approved by the RPR shall be applied to the clean, dry joint prior to placing any additional fresh asphalt against the joint. The cost of this work shall be considered incidental to the cost of the asphalt.

403-4.14 Saw-cut grooving. Saw-cut grooving is not required.
403-4.15 Diamond grinding. Diamond grinding shall be completed prior to pavement grooving. Diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive.

Diamond grinding shall be performed with a machine designed specifically for diamond grinding capable of cutting a path at least 3 feet wide. The saw blades shall be 1/8-inch wide with a minimum of 55 to 60 blades per 12 inches of cutting head width; grooves between 0.090 and 0.130 inches wide; and peaks and ridges approximately 1/32 inch higher than the bottom of the grinding cut. The actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Equipment or grinding procedures that causes raveling, aggregate fractures, spalls or disturbance to the pavement will not be permitted.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. The Contractor shall apply a surface treatment per P-608 to all areas that have been subject to grinding.

403-4.16 Nighttime Paving Requirements. The Contractor shall provide adequate lighting during any nighttime construction. A lighting plan shall be submitted by the Contractor and approved by the RPR prior to the start of any nighttime work. All work shall be in accordance with the approved CSPP and lighting plan.

403-5.1 General. The Contractor shall develop a CQCP in accordance with Item C-100. No partial payment will be made for materials that are subject to specific QC requirements without an approved CQCP.

403-5.2 Contractor quality control (QC) facilities. The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor’s QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

403-5.3 Quality Control (QC) testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved CQCP. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A QC Testing Plan shall be developed as part of the CQCP.

   a. Asphalt content. A minimum of two tests shall be performed per day in accordance with ASTM D6307 or ASTM D2172 for determination of asphalt content. When using ASTM D6307, the correction factor shall be determined as part of the first test performed at the beginning of plant production; and as part of every tenth test performed thereafter. The asphalt content for the day will be determined by averaging the test results.

   b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444 and ASTM C136, and ASTM C117.
c. **Moisture content of aggregate.** The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C566.

d. **Moisture content of asphalt.** The moisture content of the asphalt shall be determined once per lot in accordance with AASHTO T329 or ASTM D1461.

e. **Temperatures.** Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the asphalt at the plant, and the asphalt at the job site.

f. **In-place density monitoring.** The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D2950.

g. **Smoothness for Contractor Quality Control.**

The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than ¼ inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues.

The Contractor may use a 12-foot straightedge, a rolling inclinometer meeting the requirements of ASTM E2133, or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using either the FAA profile program, ProFAA, or FHWA ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

(1) **Transverse measurements.** Transverse measurements shall be taken for each day's production placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) **Longitudinal measurements.** Longitudinal measurements shall be taken for each day's production placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the third points of paving lanes when widths of paving lanes are 20 ft or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch shall be corrected with diamond grinding per paragraph 403-
4.15 or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in paragraph 401-6.1d(3). Areas that have been ground shall be sealed with a surface treatment in accordance with Item P-608. To avoid the surface treatment creating any conflict with runway or taxiway markings, it may be necessary to seal a larger area.

Control charts shall be kept to show area of each day’s placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor’s machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day’s production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade shall be evaluated daily to allow adjustments to paving operations when grade measurements do not meet specifications. As a minimum, grade shall be evaluated prior to the placement of the first lift and then prior to and after placement of the surface lift.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch vertically 0.1 feet laterally. The documentation will be provided by the Contractor to the RPR within 24 hours.

Areas with humps or depressions that exceed grade or smoothness criteria and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch less than the thickness specified on the plans. Grinding shall be in accordance with paragraph 403-4.15.

The Contractor shall repair low areas or areas that cannot be corrected by grinding by removal of deficient areas to the depth of the final course plus ½ inch and replacing with new material. Skin patching is not allowed.

403-5.4 Sampling. When directed by the RPR, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

403-5.5 Control charts. The Contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each day shall be calculated and monitored by the QC laboratory.

Control charts shall be posted in a location satisfactory to the RPR and kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor’s test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor’s projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the RPR may suspend production or acceptance of the material.

a. Individual measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The
control charts shall use the JMF target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits for Individual Measurements

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Action Limit</th>
<th>Suspension Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch (19.0 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>1/2 inch (12.5 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>3/8 inch (9.5 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>±5%</td>
<td>±7.5%</td>
</tr>
<tr>
<td>No. 50 (300 µm)</td>
<td>±3%</td>
<td>±4.5%</td>
</tr>
<tr>
<td>No. 200 (75 µm)</td>
<td>±2%</td>
<td>±3%</td>
</tr>
<tr>
<td>Asphalt Content</td>
<td>±0.45%</td>
<td>±0.70%</td>
</tr>
<tr>
<td>Minimum VMA</td>
<td>-0.5%</td>
<td>-1.0%</td>
</tr>
</tbody>
</table>

b. Range. Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

Control Chart Limits Based on Range  
(n = 2)

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Suspension Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 inch (12.5 mm)</td>
<td>11%</td>
</tr>
<tr>
<td>3/8 inch (9.5 mm)</td>
<td>11%</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>11%</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>9%</td>
</tr>
<tr>
<td>No. 50 (300 µm)</td>
<td>6%</td>
</tr>
<tr>
<td>No. 200 (75 µm)</td>
<td>3.5%</td>
</tr>
<tr>
<td>Asphalt Content</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

c. Corrective action. The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

(1) One point falls outside the Suspension Limit line for individual measurements or range; or

(2) Two points in a row fall outside the Action Limit line for individual measurements.
403-5.6 Quality control (QC) reports. The Contractor shall maintain records and shall submit reports of QC activities daily, in accordance with the CQCP described in Item C-100.

MATERIAL ACCEPTANCE

403-6.1. Quality Assurance Acceptance sampling and testing. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the RPR at no cost to the Contractor except that coring as required in this section shall be completed and paid for by the Contractor.

a. Quality Assurance (QA) testing laboratory. The QA testing laboratory performing these acceptance tests will be accredited in accordance with ASTM D3666. The QA laboratory accreditation will be current and listed on the accrediting authority’s website. All test methods required for acceptance sampling and testing will be listed on the lab accreditation.

b. Lot Size. A standard lot will be equal to one day’s production divided into approximately equal sublots of between 400 to 600 tons. When only one or two sublots are produced in a day’s production, the sublots will be combined with the production lot from the previous or next day.

Where more than one plant is simultaneously producing asphalt for the job, the lot sizes will apply separately for each plant.

c. Asphalt air voids. Plant-produced asphalt will be tested for air voids on a sublot basis.

(1) Sampling. Material from each sublot shall be sampled in accordance with ASTM D3665. Samples shall be taken from material deposited into trucks at the plant or at the job site in accordance with ASTM D979. The sample of asphalt may be put in a covered metal tin and placed in an oven for not less than 30 minutes nor more than 60 minutes to maintain the material at or above the compaction temperature as specified in the JMF.

(2) Testing. Air voids will be determined for each sublot in accordance with ASTM D3203 for a set of compacted specimens prepared in accordance with ASTM D6926.

d. In-place asphalt mat and joint density. Each sublot will be tested for in-place mat and joint density as a percentage of the theoretical maximum density (TMD).

(1) Sampling. The Contractor will cut minimum 5 inches diameter samples in accordance with ASTM D5361. The Contractor shall furnish all tools, labor, and materials for cleaning, and filling the cored pavement. Laitance produced by the coring operation shall be removed immediately after coring, and core holes shall be filled within one day after sampling in a manner acceptable to the RPR.

(2) Bond. Each lift of asphalt shall be bonded to the underlying layer. If cores reveal that the surface is not bonded, additional cores shall be taken as directed by the RPR to determine the extent of unbonded areas. Unbonded areas shall be removed by milling and replaced at no additional cost as directed by the RPR.

(3) Thickness. Thickness of each lift of surface course will be evaluated by the RPR for compliance to the requirements shown on the plans after any necessary corrections for grade. Measurements of thickness will be made using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point will not be more than 1/4 inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, will not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or sublot shall be
corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the RPR to circumscribe the deficient area.

(4) **Mat density.** One core shall be taken from each sublot. Core locations will be determined by the RPR in accordance with ASTM D3665. Cores for mat density shall not be taken closer than one foot from a transverse or longitudinal joint. The bulk specific gravity of each cored sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the TMD for that sublot.

(5) **Joint density.** One core centered over the longitudinal joint shall be taken for each sublot which contains a longitudinal joint. Core locations will be determined by the RPR in accordance with ASTM D3665. The bulk specific gravity of each core sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each joint density sample by the average TMD for the lot. The TMD used to determine the joint density at joints formed between lots will be the lower of the average TMD values from the adjacent lots.

403-6.2 Acceptance criteria.

a. **General.** Acceptance will be based on the implementation of the Contractor Quality Control Program (CQCP) and the following characteristics of the asphalt and completed pavements: air voids, mat density, joint density, and grade.

b. **Air voids.** Acceptance of each lot of plant produced material for air voids will be based upon the average air void from the sublots. If the average air voids of the lot are equal to or greater than 2% and equal to or less than 5%, then the lot will be acceptable. If the average is below 2% or greater than 5%, the lot shall be removed and replaced at the Contractor’s expense.

c. **Mat density.** Acceptance of each lot of plant produced material for mat density will be based on the average of all of the densities taken from the sublots. If the average mat density of the lot so established equals or exceeds 94%, the lot will be acceptable. If the average mat density of the lot is below 94%, the lot shall be removed and replaced at the Contractor’s expense.

d. **Joint density.** Acceptance of each lot of plant produced asphalt for joint density will be based on the average of all of the joint densities taken from the sublots. If the average joint density of the lot so established equals or exceeds 92%, the lot will be acceptable. If the average joint density of the lot is less than 92%, the Contractor shall stop production and evaluate the method of compacting joints. Production may resume once the reason for poor compaction has been determined and appropriate measures have been taken to ensure proper compaction.

The areas less than 92% shall be remediated per a means acceptable to the COP Materials Laboratory and the RPR.

e. **Grade.** The final finished surface of the pavement of the completed project shall be surveyed to verify that the grade elevations and cross-sections shown on the plans do not deviate more than 1/2 inch vertically or 0.1 feet laterally.

Cross-sections of the pavement shall be taken at a minimum 50-foot longitudinal spacing and at all longitudinal grade breaks.
The survey and documentation shall be stamped and signed by a licensed surveyor. Payment for sublots that do not meet grade for over 25% of the sublot shall not be more than 95%.


403-6.3 Resampling Pavement for Mat Density.

a. General. Resampling of a lot of pavement will only be allowed for mat density and then, only if the Contractor requests same in writing, within 48 hours after receiving the written test results from the RPR. A retest will consist of all the sampling and testing procedures contained in paragraphs 403-6.1. Only one resampling per lot will be permitted.

(1) A redefined mat density will be calculated for the resampled lot. The number of tests used to calculate the redefined mat density will include the initial tests made for that lot plus the retests.

(2) The cost for resampling and retesting shall be borne by the Contractor.

b. Payment for resampled lots. The redefined mat density for a resampled lot will be used to evaluate the acceptance of that lot in accordance with paragraph 403-6.2.

c. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and density determined using the remaining test values.

METHOD OF MEASUREMENT

403-7.1 Measurement. Plant mix asphalt mix pavement shall be measured by the number of square yards of asphalt pavement (at the depth specified in the plans) used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

BASIS OF PAYMENT

403-8.1 Payment. Payment for a lot of asphalt mixture meeting all acceptance criteria as specified in paragraph 403-6.2 shall be made at the contract unit price per square yard for asphalt. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-403-8.1 Bituminous Surface Course (FAA 3/4”, 4-Inch Thickness) – per Square Yard

REFERENCES

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

ASTM International (ASTM)

ASTM C29 Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate

ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
<table>
<thead>
<tr>
<th>Standard Test Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C117</td>
<td>Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing</td>
</tr>
<tr>
<td>ASTM C127</td>
<td>Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate</td>
</tr>
<tr>
<td>ASTM C136</td>
<td>Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates</td>
</tr>
<tr>
<td>ASTM C142</td>
<td>Standard Test Method for Clay Lumps and Friable Particles in Aggregates</td>
</tr>
<tr>
<td>ASTM C183</td>
<td>Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement</td>
</tr>
<tr>
<td>ASTM C566</td>
<td>Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying</td>
</tr>
<tr>
<td>ASTM D75</td>
<td>Standard Practice for Sampling Aggregates</td>
</tr>
<tr>
<td>ASTM D946</td>
<td>Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction</td>
</tr>
<tr>
<td>ASTM D979</td>
<td>Standard Practice for Sampling Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>ASTM D1073</td>
<td>Standard Specification for Fine Aggregate for Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>ASTM D1074</td>
<td>Standard Test Method for Compressive Strength of Bituminous Mixtures</td>
</tr>
<tr>
<td>ASTM D1461</td>
<td>Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>ASTM D2041</td>
<td>Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>ASTM D2172</td>
<td>Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>ASTM D2489</td>
<td>Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures</td>
</tr>
<tr>
<td>ASTM D2726</td>
<td>Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures</td>
</tr>
<tr>
<td>Standard</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
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</tr>
<tr>
<td>ASTM D2950</td>
<td>Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods</td>
</tr>
<tr>
<td>ASTM D3203</td>
<td>Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>ASTM D3665</td>
<td>Standard Practice for Random Sampling of Construction Materials</td>
</tr>
<tr>
<td>ASTM D3666</td>
<td>Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials</td>
</tr>
<tr>
<td>ASTM D4125</td>
<td>Standard Test Methods for Asphalt Content of Bituminous mixtures by the Nuclear Method</td>
</tr>
<tr>
<td>ASTM D4552</td>
<td>Standard Practice for Classifying Hot-Mix Recycling Agents</td>
</tr>
<tr>
<td>ASTM D4791</td>
<td>Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate</td>
</tr>
<tr>
<td>ASTM D4867</td>
<td>Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures</td>
</tr>
<tr>
<td>ASTM D5444</td>
<td>Standard Test Method for Mechanical Size Analysis of Extracted Aggregate</td>
</tr>
<tr>
<td>ASTM D5821</td>
<td>Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate</td>
</tr>
<tr>
<td>ASTM D6307</td>
<td>Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method</td>
</tr>
<tr>
<td>ASTM D6373</td>
<td>Standard Specification for Performance Graded Asphalt Binder</td>
</tr>
<tr>
<td>ASTM D6926</td>
<td>Standard Practice for Preparation of Bituminous Specimens Using Marshall Apparatus</td>
</tr>
</tbody>
</table>
ASTM D6995  Standard Test Method for Determining Field VMA based on the Maximum Specific Gravity of the Mix (Gmm)
ASTM E11   Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178  Standard Practice for Dealing with Outlying Observations
ASTM E2133 Standard Test Method for Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface

American Association of State Highway and Transportation Officials (AASHTO)
AASHTO M156 Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
AASHTO T329 Standard Method of Test for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method
AASHTO T 340 Standard Method of Test for Determining the Rutting Susceptibility of Hot Mix Asphalt (APA) Using the Asphalt Pavement Analyzer (APA)

Asphalt Institute (AI)
MS-2       Mix Design Manual, 7th Edition
MS-26      Asphalt Binder Handbook
           AI State Binder Specification Database

FAA Orders
5300.1    Modifications to Agency Airport Design, Construction, and Equipment Standards

Federal Highway Administration (FHWA)
            Long Term Pavement Performance Binder program

Software
FAARFIELD

END OF ITEM P-403
Item P-501 Cement Concrete Pavement

DESCRIPTION

501-1.1 This work shall consist of pavement composed of cement concrete with reinforcement and without reinforcement constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross-sections shown on the plans. The terms cement concrete, hydraulic cement concrete, and concrete are interchangeable in this specification.

MATERIALS

501-2.1 Aggregates.

a. Reactivity. Fine and Coarse aggregates to be used in PCC on this project shall be tested and evaluated by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and ASTM C1567. Tests must be representative of aggregate sources which will be providing material for production. Tests must have been completed within 12 months of the date of the concrete mix submittal for commercial sources, and within 6 months of the concrete submittal for all other sources.

   (1) Coarse aggregate and fine aggregate shall be tested separately in accordance with ASTM C1260, however, the length of test shall be extended to 28 days (30 days from casting). Tests must have been completed within 12 months of the date of the concrete submittal for commercial sources and 6 months of the date of the concrete mix submittal for all other sources.

   (2) The combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

   (3) If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) Concrete Research Division (CRD) C662 in lieu of ASTM C1567. If lithium nitrate admixture is used, it shall be nominal 30% ±0.5% weight lithium nitrate in water. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

b. Fine aggregate. Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C33 and the parameters identified in the fine aggregate material
requirements below. Fine aggregate material requirements and deleterious limits are shown in the table below.

<table>
<thead>
<tr>
<th>Fine Aggregate Material Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
</tr>
<tr>
<td>Sand Equivalent</td>
</tr>
<tr>
<td>Fineness Modulus (FM)</td>
</tr>
</tbody>
</table>

Limits for Deleterious Substances in Fine Aggregate for Concrete

| Clay lumps and friable particles | 1.0% maximum | ASTM C142 |
| Coal and lignite | 0.5% using a medium with a density of Sp. Gr. of 2.0 | ASTM C123 |
| Total Deleterious Material | 1.0% maximum |

c. Coarse aggregate. The maximum size coarse aggregate shall be 1-1/2-inch.

Aggregates delivered to the mixer shall be clean, hard, uncoated aggregates consisting of crushed stone, crushed or uncrushed gravel, air-cooled iron blast furnace slag, crushed recycled concrete pavement, or a combination. The aggregates shall have no known history of detrimental pavement staining. Steel blast furnace slag shall not be permitted. Coarse aggregate material requirements and deleterious limits are shown in the table below; washing may be required to meet aggregate requirements.
### Coarse Aggregate Material Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to Degradation</td>
<td>Loss: 40% maximum</td>
<td>ASTM C131</td>
</tr>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate</td>
<td>ASTM C88</td>
</tr>
<tr>
<td>Flat, Elongated, or Flat and Elongated Particles</td>
<td>8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 for any size group coarser than 3/8 sieve $^1$</td>
<td>ASTM D4791</td>
</tr>
<tr>
<td>Bulk density of slag $^2$</td>
<td>Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)</td>
<td>ASTM C29</td>
</tr>
<tr>
<td>D-cracking (Freeze-Thaw)$^3$</td>
<td>Durability factor $\geq$ 95</td>
<td>ASTM C666</td>
</tr>
</tbody>
</table>

$^1$ A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

$^2$ Only required if slag is specified.

Coarse aggregate may only be accepted from sources that have a 20-year service history for the same gradation to be supplied with no history of D-Cracking. Aggregates that do not have a 20-year record of service free from major repairs (less than 5% of slabs replaced) in similar conditions without D-cracking shall not be used unless the material currently being produced has a durability factor greater than or equal to 95 per ASTM C666. The Contractor shall submit a current certification and test results to verify the aggregate acceptability. Test results will only be accepted from a State Department of Transportation (DOT) materials laboratory or an accredited laboratory. Certification and test results which are not dated or which are over one (1) year old or which are for different gradations will not be accepted.

The amount of deleterious material in the coarse aggregate shall not exceed the following limits:

<table>
<thead>
<tr>
<th>Deleterious material</th>
<th>ASTM</th>
<th>Percentage by Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay Lumps and friable particles</td>
<td>ASTM C142</td>
<td>1.0</td>
</tr>
<tr>
<td>Material finer than No. 200 sieve (75 µm)</td>
<td>ASTM C117</td>
<td>1.0$^1$</td>
</tr>
<tr>
<td>Lightweight particles</td>
<td>ASTM C123 using a medium with a density of Sp. Gr. of 2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Chert (less than 2.40 Sp Gr.)</td>
<td>ASTM C123 using a medium with a density of Sp. Gr. of 2.40</td>
<td>0.1$^3$</td>
</tr>
</tbody>
</table>

$^1$ The limit for material finer than 75-µm is allowed to be increased to 1.5% for crushed aggregates consisting of dust of fracture that is essentially free from clay or shale. Test results supporting acceptance of increasing limit are accepted.

$^2$ Only required if slag is specified.

$^3$ The limit for Chert is increased to 0.1%.
to 1.5% with statement indicating material is dust of fracture must be submitted with Concrete mix. Acceptable techniques to characterizing these fines include methylene blue adsorption or X-ray diffraction analysis.

2 Chert and aggregates with less than 2.4 specific gravity.

3 The limit for chert may be increased to 1.0 percent by mass in areas not subject to severe freeze and thaw.

d. Combined aggregate gradation. This specification is targeted for a combined aggregate gradation developed following the guidance presented in United States Air Force Engineering Technical Letter (ETL) 97-5: Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements. Base the aggregate grading upon a combination of all the aggregates (coarse and fine) to be used for the mixture proportioning. Three aggregate sizes may be required to achieve an optimized combined gradation that will produce a workable concrete mixture for its intended use. Use aggregate gradations that produce concrete mixtures with well-graded or optimized aggregate combinations. The Contractor shall submit complete mixture information necessary to calculate the volumetric components of the mixture. The combined aggregate grading shall meet the following requirements:

(1) The materials selected and the proportions used shall be such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in paragraph 501-2.1d(4) below, the point thus determined shall fall within the parallelogram described therein.

(2) The CF shall be determined from the following equation:

$$CF = \frac{\text{(cumulative percent retained on the 3/8 in. (9.5 mm) sieve)}(100)}{\text{(cumulative percent retained on the No. 8 (2.36 mm) sieve)}}$$

(3) The WF is defined as the percent passing the No. 8 sieve based on the combined gradation. However, WF shall be adjusted, upwards only, by 2.5 percentage points for each 94 pounds of cementitious material per cubic meter yard greater than 564 pounds per cubic yard.

(4) A diagram shall be plotted using a rectangular scale with WF on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram a parallelogram shall be plotted with corners at the following coordinates (CF=75, WF=28), (CF=75, WF=40), (CF=45, WF=32.5), and (CF=45, WF=44.5). If the point determined by the intersection of the computed CF and WF does not fall within the above parallelogram, the grading of each size of aggregate used and the proportions selected shall be changed as necessary. The point determined by the plotting of the CF and WF may be adjusted during production ±3 WF and ±5 CF. Adjustments to gradation may not take the point outside of the parallelogram.

e. Contractors combined aggregate gradation. The Contractor shall submit their combined aggregate gradation using the following format:
**Contractor’s Combined Aggregate Gradation**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Contractor’s Concrete mix Gradation (Percent passing by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch (50 mm)</td>
<td>*</td>
</tr>
<tr>
<td>1-1/2 inch (37.5 mm)</td>
<td>*</td>
</tr>
<tr>
<td>1 inch (25.0 mm)</td>
<td>*</td>
</tr>
<tr>
<td>3/4 inch (19.0 mm)</td>
<td>*</td>
</tr>
<tr>
<td>1/2 inch (12.5 mm)</td>
<td>*</td>
</tr>
<tr>
<td>3/8 inch (9.5 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 30 (600 µm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 50 (300 µm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 100 (150 µm)</td>
<td>*</td>
</tr>
</tbody>
</table>

**501-2.2 Cement.** Cement shall conform to the requirements of ASTM 150 Type II low-alkali.

**501-2.3 Cementitious materials.**

- **a. Fly ash.** Fly ash shall meet the requirements of ASTM C618, Class F, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total alkali content less than 3% per ASTM C311. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the Resident Project Representative (RPR).

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

- **c. Raw or calcined natural pozzolan.** Natural pozzolan shall be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and shall have a loss on ignition not exceeding 6%. Class N pozzolan for use in mitigating Alkali-Silica Reactivity shall have a total available alkali content less than 3%.

**501-2.4 Joint seal.** The joint seal for the joints in the concrete pavement shall meet the requirements of Item P-604 or Item P-605 and shall be of the type specified in the plans.

**501-2.5 Isolation joint filler.** Premolded joint filler for isolation joints shall conform to the requirements of ASTM D1751 or ASTM D1752 and shall be where shown on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise approved by the RPR. When the use of more than one piece is required for a joint,
the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the RPR.

501-2.6 Steel reinforcement. Reinforcing shall consist of No. 4 bar mats conforming to the requirements of ASTM A184 or A704 or 4x4—D5xD5 Welded Wire Mat conforming to the requirements of ASTM A1064. Welded wire fabric shall be furnished in flat sheets only.

501-2.7 Dowel and tie bars. Dowel bars shall be plain steel bars conforming to ASTM A615 and shall be free from burring or other deformation restricting slippage in the concrete.

a. Dowel Bars. Before delivery to the construction site each dowel bar shall be epoxy coated per ASTM A1078, Type 1, with a coating thickness after curing greater than 10 mils. Patched ends are not required for Type 1 coated dowels. The dowels shall be coated with a bond-breaker recommended by the manufacturer. Dowel sleeves or inserts are not permitted. Grout retention rings shall be fully circular metal or plastic devices capable of supporting the dowel until the grout hardens.

b. Tie Bars. Tie bars shall be deformed steel bars and conform to the requirements of ASTM A615. Tie bars designated as Grade 60 in ASTM A615 or ASTM A706 shall be used for construction requiring bent bars.

501-2.8 Water. Water used in mixing or curing shall be potable. If water is taken from other sources considered non-potable, it shall meet the requirements of ASTM C1602.

501-2.9 Material for curing concrete. Curing materials shall conform to one of the following specifications:

a. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C309, Type 2, Class A, or Class B. Class A compound shall be wax base only.

b. Water curing – the surface of the concrete shall be kept continuously wet for a period of seven (7) days.

c. A combination of water curing and liquid membrane-forming compounds in (a) and (b).

d. Not used.

501-2.10 Admixtures. The use of any material added to the concrete mix shall be approved by the RPR. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated herein. In addition, the RPR may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the RPR from the supply of the material being furnished or proposed for use in the work to determine whether the admixture is uniform in quality with that approved. Admixtures shall conform to the following specifications:

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

b. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D.
c. Other admixtures. The use of set retarding and set-accelerating admixtures shall be approved by the RPR prior to developing the concrete mix. Retarding admixtures shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating admixtures shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

d. Lithium Nitrate. The lithium admixture shall be a nominal 30% aqueous solution of Lithium Nitrate, with a density of 10 pounds/gallon, and shall have the approximate chemical form as shown below:

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Limit (Percent by Mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LiNO₃ (Lithium Nitrate)</td>
<td>30 ±0.5</td>
</tr>
<tr>
<td>SO₄ (Sulfate Ion)</td>
<td>0.1 (max)</td>
</tr>
<tr>
<td>Cl (Chloride Ion)</td>
<td>0.2 (max)</td>
</tr>
<tr>
<td>Na (Sodium Ion)</td>
<td>0.1 (max)</td>
</tr>
<tr>
<td>K (Potassium Ion)</td>
<td>0.1 (max)</td>
</tr>
</tbody>
</table>

The lithium nitrate admixture dispensing and mixing operations shall be verified and certified by the lithium manufacturer’s representative.

501-2.11 Epoxy-resin. All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolt shall be Type 1, Grade 3, Class C. Class A or Class B shall be used when the surface temperature of the hardened concrete is below 60 degrees F.

b. Epoxy-resin material used for spall repairs shall conform to the requirements of ASTM D412 and ASTM D695. Material shall be FlexSet by ROCKLIN, or approved equal.

c. Material for use for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed Portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.


CONCRETE MIX

501-3.1. General. No concrete shall be placed until an acceptable concrete mix has been submitted to the RPR for review and the RPR has taken appropriate action. The RPR’s review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

501-3.2 Concrete Mix Laboratory. The laboratory used to develop the concrete mix shall be accredited in accordance with ASTM C1077. The laboratory accreditation must be current and listed on the accrediting authority’s website. All test methods required for developing the concrete
mix must be included in the lab accreditation. A copy of the laboratory’s current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

**501-3.3 Concrete Mix Proportions.** Develop the mix using the procedures contained in Portland Cement Association (PCA) publication, "Design and Control of Concrete Mixtures." Concrete shall be proportioned to achieve a 28-day flexural strength that meets or exceeds the acceptance criteria contained in paragraph 501-6.6 for a flexural strength of 650 psi per ASTM C78.

The minimum cementitious material shall be adequate to ensure a workable, durable mix. The minimum cementitious material (cement plus fly ash, or slag cement) shall be 564 pounds per cubic yard. The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall be between 0.38 – 0.45 by weight.

Flexural strength test specimens shall be prepared in accordance with ASTM C192 and tested in accordance with ASTM C78. At the start of the project, the Contractor shall determine an allowable slump as determined by ASTM C143 not to exceed 2 inches for slip-form placement. For fixed-form placement and other hand placement, the slump shall not exceed 4 ½ inches.

The results of the concrete mix shall include a statement giving the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard basis. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

If a change in source(s) is made, or admixtures added or deleted from the mix, a new concrete mix must be submitted to the RPR for approval.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

**501-3.4 Concrete Mix submittal.** The concrete mix shall be submitted to the RPR at least 30 days prior to the start of operations. The submitted concrete mix shall not be more than 180 days old and must use the materials to be used for production for the project. Production shall not begin until the concrete mix is approved in writing by the RPR.

The submitted mix design shall not be more than 90 days old unless the mix has been previously approved and used at PSHIA for P-501 concrete within the last 12 months.

Field trial batches for each mix design from each batch plant shall be performed prior to the beginning of the work. Compressive and flexural strength specimens shall be fabricated, cured, and tested at 2, 3, 5, 7, and 28 days. If the paving is scheduled to commence prior to 28 days, more than one field trial batch will be required for each mix design from each batch plant if the results of the 2, 3, 5, and 7 day flexural strength tests indicate that the required 28-day flexural strength may not be achieved.

Each of the submitted concrete mixes (i.e, slip form, side form machine finish and side form hand finish) shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items and quantities as a minimum:

- Certified material test reports for aggregate in accordance with paragraph 501-2.1. Certified reports must include all tests required; reporting each test, test method, test result, and requirement specified (criteria).
- Combined aggregate gradations and analysis; and including plots of the fine aggregate fineness modulus.
• Reactivity Test Results.
• Coarse aggregate quality test results, including deleterious materials.
• Fine aggregate quality test results, including deleterious materials.
• Mill certificates for cement and supplemental cementitious materials.
• Certified test results for all admixtures, including Lithium Nitrate if applicable.
• Specified flexural strength, slump, and air content.
• Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.
• Flexural and compressive strength summaries and plots, including all individual beam and cylinder breaks.
• Correlation ratios for acceptance testing and Contractor QC testing, when applicable.
• Historical record of test results documenting production standard deviation, when applicable.

501-3.5 Cementitious materials.

a. **Fly ash.** When fly ash is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If fly ash is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

b. **Slag cement (ground granulated blast furnace (GGBF)).** Slag cement may be used. The slag cement, or slag cement plus fly ash if both are used, may constitute between 25 to 55% of the total cementitious material by weight.

c. **Raw or calcined natural pozzolan.** Natural pozzolan may be used in the concrete mix. When pozzolan is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If pozzolan is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

501-3.6 Admixtures.

a. **Air-entraining admixtures.** Air-entraining admixture are to be added in such a manner that will ensure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The use of air-entraining admixtures is not required; however, if air entraining admixtures are used, the percentage of air entrainment shall not exceed 5% by volume.

b. **Water-reducing admixtures.** Water-reducing admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.
c. Other admixtures. Set controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

d. Lithium nitrate. Lithium nitrate shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements in accordance with paragraph 501-2.10d.

CONSTRUCTION METHODS

501-4.1 Control Strip. The control strip(s) shall be to the next planned joint after the initial 250 feet of each type of pavement construction (slip-form pilot lane, slip-form fill-in lane, or fixed form). The Contractor shall demonstrate, in the presence of the RPR, that the materials, concrete mix, equipment, construction processes, and quality control processes meet the requirements of the specifications. The concrete mixture shall be extruded from the paver meeting the edge slump tolerance and with little or no finishing. Pilot, fill-in, and fixed-form control strips will be accepted separately. Minor adjustments to the mix design may be required to place an acceptable control strip. The production mix will be the adjusted mix design used to place the acceptable control strip. Upon acceptance of the control strip by the RPR, the Contractor must use the same equipment, materials, and construction methods for the remainder of concrete paving. Any adjustments to processes or materials must be approved in advance by the RPR. Acceptable control strips will meet edge slump tolerance and surface acceptable with little or no finishing, air content within action limits, strength equal or greater than requirements of P501-3.3. The control strip will be considered one lot for payment (no sublots required for control strip). Payment will only be made for an acceptable control strip in accordance with paragraph 501-8.1 using a lot pay factor equal to 100.

501-4.2 Equipment. The Contractor is responsible for the proper operation and maintenance of all equipment necessary for handling materials and performing all parts of the work to meet this specification.

a. Plant and equipment. The plant and mixing equipment shall conform to the requirements of ASTM C94 and/or ASTM C685. Each truck mixer shall have attached in a prominent place a manufacturer’s nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades. The truck mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch or more. The Contractor shall have a copy of the manufacturer’s design on hand showing dimensions and arrangement of blades in reference to original height and depth.

Equipment for transferring and spreading concrete from the transporting equipment to the paving lane in front of the finishing equipment shall be provided. The equipment shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently.

b. Finishing equipment.
(1) Slip-form. The standard method of constructing concrete pavements shall be with an approved slip-form paving equipment designed and operated to spread, consolidate, screed, and finish the freshly placed concrete in one complete pass of the machine so that the end result is a dense and homogeneous pavement which is achieved with a minimum of hand finishing. The paver-finisher shall be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements.

(2) Fixed-form. On apron projects, and other projects requiring less than 10,000 cubic yards of concrete pavement, or irregular areas at locations inaccessible to slip-form paving equipment, concrete pavement may be placed with equipment specifically designed for placing and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR. Hand screeding and float finishing may only be used on small irregular areas as allowed by the RPR.

c. Vibrators. Vibrator shall be the internal type. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation or voids. The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of American Concrete Institute (ACI) 309R, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The Contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the RPR.

Operating frequency for internal vibrators shall be between 8,000 and 12,000 vibrations per minute. Average amplitude for internal vibrators shall be -0.025-0.05 inches.

Hand held vibrators may only be used in irregular areas and shall meet the recommendations of ACI 309R, Guide for Consolidation of Concrete.

d. Concrete saws. The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations.

e. Fixed forms. Straight side fixed forms shall be made of steel and shall be furnished in sections not less than 10 feet in length and shall have a depth equal to the pavement thickness at the edge, and a base width equal to or greater than the depth. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the RPR. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 1/4 inch. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when approved by the RPR. The forms shall extend the full depth of the pavement section.

501-4.3 Form setting. Forms shall be set to line and grade as shown on the plans, sufficiently in advance of the concrete placement, to ensure continuous paving operation. Forms shall be set to withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the concrete placement.
After the forms have been set to correct grade, the underlying surface shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place sufficiently to maintain the form in position for the method of placement.

Forms shall be set to allow a 3 inch minimum width overpour at all isolation joint edges to allow sufficient width for a full depth saw cut at the joint locations shown on the plans. Unless otherwise approved by the RPR, all transverse construction joints shall be overpoured by at least one (1') foot, and saw cut full length and depth.

Form sections shall be tightly locked and shall be free from movement in any direction. The forms shall be free from movement in any direction. The forms shall not deviate from true line by more than 1/8 inch at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of concrete.

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete.

501-4.4 Base surface preparation prior to placement. Any damage to the prepared base, subbase, and subgrade shall be corrected full depth by the Contractor prior to concrete placement. The underlying surface shall be entirely free of frost when concrete is placed. The prepared grade shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete.

501-4.5 Handling, measuring, and batching material. Aggregate stockpiles shall be constructed and managed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Store and maintain all aggregates at a uniform moisture content prior to use. A continuous supply of materials shall be provided to the work to ensure continuous placement.

501-4.6 Mixing concrete. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials are placed into the drum until the drum is emptied into the truck. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C94 or ASTM C685.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is discharged from the truck shall not exceed 30 minutes when the concrete is hauled in non-agitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. In no case shall the temperature of the concrete when placed exceed 90°F. Retempering concrete by adding water or by other means will not be permitted. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified is not exceeded.
501-4.7 Weather Limitations on mixing and placing. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

   a. Cold weather. Unless authorized in writing by the RPR, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40°F and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F.

   The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50°F at the time of placement. Concrete shall not be placed on frozen material nor shall frozen aggregates be used in the concrete.

   When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150°F. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

   Curing during cold weather shall be in accordance with paragraph 501-4.13d.

   b. Hot weather. During periods of hot weather when the maximum daily air temperature exceeds 85°F, the following precautions shall be taken.

   The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90°F. The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

   The concrete placement shall be protected from exceeding an evaporation rate of 0.2 psf per hour. When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor shall immediately take such additional measures as necessary to protect the concrete surface. If the Contractor’s measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

   Curing during hot weather shall be in accordance with paragraph 501-4.13e.

   c. Temperature management program. Prior to the start of paving operation for each day of paving, the Contractor shall provide the RPR with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. (Federal Highway Administration HIPERPAV 3 is one example of a temperature management program.) As a minimum, the program shall address the following items:

      (1) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity; and anticipated evaporation rate using Figure 19-9, PCA, Design and Control of Concrete Mixtures.

      (2) Anticipated timing of initial sawing of joint.

      (3) Anticipated number and type of saws to be used.

   d. Rain. The Contractor shall have available materials for the protection of the concrete during inclement weather. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils thick of sufficient length and width to cover the plastic concrete slab and any edges. The
sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

501-4.8 Concrete Placement. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 5 feet. The finished concrete product must be dense and homogeneous, without segregation and conforming to the standards in this specification. Backhoes and grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders shall not be used. All concrete shall be consolidated without voids or segregation, including under and around all load-transfer devices, joint assembly units, and other features embedded in the pavement. Hauling equipment or other mechanical equipment will be permitted on adjoining previously constructed pavement when the concrete strength reaches a flexural strength of 450 psi or a compressive strength of 3,000 psi, based on sublot test results. The Contractor must determine that the above minimum strengths are adequate to protect the pavement from overloads due to the construction equipment proposed for the project.

The Contractor shall have available materials for the protection of the concrete during cold, hot and/or inclement weather in accordance with paragraph 501-4.7.

Fixed form concrete placing and finishing equipment will be permitted to ride upon the edges of previously constructed pavement when the concrete has attained a minimum flexural strength of 400 psi, or a compressive strength of 2,500 psi, based on sublot test results.

a. Slip-form construction. The concrete shall be distributed uniformly into final position by a self-propelled slip-form paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well-defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit shall not exceed 9 inches for slipform and at the end of the dowels for the fill-in lanes. The spacing of internal units shall be uniform and shall not exceed 18 inches.

The term internal vibration means vibrating units located within the specified thickness of pavement section.

The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without, segregation, voids, or vibrator trails and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at least one foot. The frequency of vibration or amplitude should be adjusted proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.
The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

For runway and taxiway pavements, not more than 15% of the total free edge of each 500-foot segment of pavement, or fraction thereof, shall have an edge slump exceeding 1/4 inch, and none of the free edge of the pavement shall have an edge slump exceeding 3/8 inch. (The total free edge of 500 feet of pavement will be considered the cumulative total linear measurement of pavement edge originally constructed as nonadjacent to any existing pavement; that is, 500 feet of paving lane originally constructed as a separate lane will have 1,000 feet of free edge, 500 feet of fill-in lane will have no free edge, etc.). The area affected by the downward movement of the concrete along the pavement edge shall be limited to not more than 18 inches from the edge.

The edge slump shall not exceed ¼ inch for apron and other incidental pavement areas.

When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive edge slump will be removed the full width of the slip form lane and replaced at the expense of the Contractor as directed by the RPR.

b. Fixed-form construction. Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall remain in place at least 6 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms. Curing compound shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and coated with a release agent each time they are used and before concrete is placed against them.

Concrete shall be spread, screed, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross-section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery. The equipment must be specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR.

Concrete for the full paving width shall be effectively consolidated by internal vibrators. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation, voids, or leaving vibrator trails.
Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped with a rate of vibration not less than 8,000 cycles per minute.

c. **Consolidation.** Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches. Vibrators shall not be used to transport or spread the concrete. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) or over-consolidation (vibrator trails, segregation, or any other evidence) shall require the immediate stopping of the paving operation and adjustment of the equipment or procedures as approved by the RPR.

Concrete placed with equipment other than slip form pavers, concrete shall be vibrated with approved hand operated immersion vibrators.

If a lack of consolidation of the hardened concrete is suspected by the RPR, referee testing may be required. Referee testing of hardened concrete will be performed by the RPR by cutting cores from the finished pavement after a minimum of 24 hours curing. The RPR shall visually examine the cores for evidence of lack of consolidation. Density determinations will be made by the RPR based on the water content of the core as taken. ASTM C642 shall be used for the determination of core density in the saturated-surface dry condition. When required, referee cores will be taken at the minimum rate of one for each 500 cubic yards of pavement, or fraction. The Contractor shall be responsible for all referee testing cost if they fail to meet the required density.

The average density of the cores shall be at least 97% of the original concrete mix density, with no cores having a density of less than 96% of the original concrete mix density. Failure to meet the referee tests will be considered evidence that the minimum requirements for vibration are inadequate for the job conditions. Additional vibrating units or other means of increasing the effect of vibration shall be employed so that the density of the hardened concrete conforms to the above requirements.

501-4.9 **Strike-off of concrete and placement of reinforcement.** Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the plans and to an elevation that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. The reinforcement shall be positioned in advance of concrete placement. If individual bars are used in lieu of bar mats, the bars shall be tied at a minimum of every 3rd intersection. Lap tie spacing shall be reduced if distortion or displacement of the steel is observed.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

501-4.10 **Joints.** Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the
pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2-inch from their designated position and shall be true to line with not more than 1/4-inch variation in 10 feet. The surface across the joints shall be tested with a 12-foot straightedge as the joints are finished and any irregularities in excess of 1/4 inch shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

Unless otherwise approved by the RPR, all transverse construction and isolation joints shall be overpoured by at least one foot and saw cut the full length and depth once the concrete has hardened. The first pour at longitudinal isolation joints shall be overpoured at least three inches and then saw cut full length and depth once the concrete has hardened.

a. **Construction.** Longitudinal construction joints shall be slip-formed or formed against side forms as shown in the plans.

Transverse construction joints shall be installed at the end of each day’s placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or isolation joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete to within one foot of the planned joint location, and then the excess concrete shall be saw cut full length and depth once the concrete has hardened at the planned joint location.

b. **Contraction.** Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall be installed to the dimensions shown on the plans by saw cutting after the concrete has hardened.

c. **Isolation (expansion).** Isolation joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint. The filler shall be fastened uniformly along the hardened joint face with no buckling or debris between the filler and the concrete interface, including a temporary filler for the sealant reservoir at the top of the slab. The edges of the joint shall be finished and tooled while the concrete is still plastic.

d. **Dowels and Tie Bars for Joints**

(1) **Tie bars.** Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth and within the tolerances in paragraph 501-4.10(f.). When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. Tie bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed.

(2) **Dowel bars.** Dowel bars shall be placed across joints in the proper horizontal and vertical alignment as shown on the plans. The dowels shall be coated with a bond-breaker or other lubricant recommended by the manufacturer and approved by the RPR. Dowels bars at longitudinal construction joints shall be bonded in drilled holes.

(3) **Placing dowels and tie bars.** Horizontal spacing of dowels shall be within a tolerance of ±3/4 inch (19 mm). The vertical location on the face of the slab shall be within a tolerance of ±1/2
inch. The method used to install dowels shall ensure that the horizontal and vertical alignment will not be greater than 1/4 inch per foot, except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge. The portion of each dowel intended to move within the concrete or expansion cap shall be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels shall be installed as specified in the following subparagraphs.

(a) **Contraction joints.** Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors.

Approval of installation methods will be based on the results of the control strip showing that the dowels and tie bars are installed within specified tolerances as verified by cores or non-destructive rebar location devices approved by the RPR.

(b) **Construction joints.** Install dowels and tie bars by the cast-in-place or the drill-and-dowel method. Installation by removing and replacing in preformed holes will not be permitted. Dowels and tie bars shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms.

(c) **Joints in hardened concrete.** Install dowels in hardened concrete by bonding the dowels into holes drilled into the concrete. The concrete shall have cured for seven (7) days or reached a minimum flexural strength of 450 psi before drilling begins. Holes 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete using rotary-core drills. Rotary-percussion drills may be used, provided that excessive spalling does not occur. Spalling beyond the limits of the grout retention ring will require modification of the equipment and operation. Depth of dowel hole shall be within a tolerance of ±1/2 inch of the dimension shown on the drawings. On completion of the drilling operation, the dowel hole shall be blown out with oil-free, compressed air. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel will not be permitted.

(d) **Sawing of joints.** Sawing shall commence, without regard to day or night, as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs and shall continue without interruption until all joints have been sawn. All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing.

Joints shall be cut in locations as shown on the plans. The initial joint cut shall be a minimum 1/8 inch wide and to the depth shown on the plans. Prior to placement of joint sealant or seals, the top of the joint shall be widened by sawing as shown on the plans.

501-4.11 **Finishing.** Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, edging of joints, and then texturing. Finishing shall be by the machine method. The hand method shall be used only on isolated areas of odd slab.
widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Equipment, mixture, and/or procedures which produce more than 1/8 inch of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way. Approved fog (atomizing) mist sprays only will be permitted to be applied to the surface of the concrete during finishing operations.

a. Machine finishing with slipform pavers. The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled non-rotating pipe float may be used while the concrete is still plastic, to remove minor irregularities and score marks. Remove excessive slurry from the surface with a cutting straightedge and wipe off the edge. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

b. Machine finishing with fixed forms. The machine shall be designed to straddle the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

c. Other types of finishing equipment. Clary screeds, other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to the RPR’s approval.

Bridge deck finishers shall have a minimum operating weight of 7,500 pounds and shall have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

d. Hand finishing. Hand finishing methods will not be permitted, except under the following conditions: (1) in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade and (2) in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical.

e. Straightedge testing and surface correction. After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a 12-foot finishing straightedge swung from handles capable of spanning at least one-half the width of the slab. The straightedge
shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straigntedge. Any excess water and laittance in excess of 1/8 inch thick shall be removed from the surface of the pavement and wasted. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the smoothness requirements. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straigntedge and until the slab conforms to the required grade and cross-section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

**501-4.12 Surface texture.** The surface of the pavement shall be finished as designated below for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. The texture shall be uniform in appearance and approximately 1/16 inch in depth. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the RPR.

a. **Brush or broom finish.** Not used.

b. **Burlap drag finish.** Burlap, at least 15 ounces per square yard, will typically produce acceptable texture. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately one foot from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface.

c. **Artificial turf finish.** Shall be applied by dragging the surface of the pavement in the direction of concrete placement with an approved full-width drag made with artificial turf. The leading transverse edge of the artificial turf drag will be securely fastened to a lightweight pole on a traveling bridge. At least 2 feet of the artificial turf shall be in contact with the concrete surface during dragging operations. Approval of the artificial turf will be done only after it has been demonstrated by the Contractor to provide a satisfactory texture. One type that has provided satisfactory texture consists of 7,200 approximately 0.85-inch-long polyethylene turf blades per square foot.

**501-4.13 Curing.** Immediately after finishing operations are completed and bleed water is gone from the surface, all exposed surfaces of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

a. **Impervious membrane method.** Curing with liquid membrane compounds should not occur until bleed and surface moisture has evaporated. All exposed surfaces of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of one gallon to not more than 150 square feet. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by mechanical means. Hand spraying of
odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the RPR, a double application rate shall be used to ensure coverage. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

b. Not Used.

c. Water Curing Method. All surfaces shall be kept damp by applying water with a nozzle that so atomizes the flow of water that a fog mist and not a spray is formed until the surface of the concrete is covered with a curing medium or sprinkling of the surface is permitted. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete. If a curing medium is not used, the concrete shall be kept continuously wet by sprinkling with water for the entire curing period. Burlap, or other approved materials, may be used as a curing medium to retain the moisture during the curing period. Application of the curing medium shall not begin until such time that placement can be made without marring the surfaces of the concrete. If a curing medium is not used, the concrete shall be sprinkled continuously with water for the entire curing period.

d. Concrete protection for cold weather. Maintain the concrete at a temperature of at least 50°F for a period of 72 hours after placing and at a temperature above freezing for the remainder of the 7-day curing period. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged shall be removed and replaced at the Contractor’s expense.

e. Concrete protection for hot weather. Concrete should be continuous moisture cured for the entire curing period and shall commence as soon as the surfaces are finished and continue for at least 24 hours. However, if moisture curing is not practical beyond 24 hours, the concrete surface shall be protected from drying with application of a liquid membrane-forming curing compound while the surfaces are still damp. Other curing methods may be approved by the RPR.

501-4.14 Removing forms. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab shall be cured in accordance with paragraph 501-4.13.

If honeycombed areas are evident when the forms are removed, materials, placement, and consolidation methods must be reviewed and appropriate adjustments made to assure adequate consolidation at the edges of future concrete placements. Honeycombed areas that extend into the slab less than approximately 1 inch, shall be repaired with an approved grout, as directed by the RPR. Extensive honeycombed areas determined by the RPR as defective work, shall be removed and replaced in accordance with paragraph P-501-19.

501-4.15 Saw-cut grooving. If shown on the plans, grooved surfaces shall be provided in accordance with the requirements of Item P-621.

501-4.16 Sealing joints. The joints in the pavement shall be sealed in accordance with Item P-604 or P-605 (as shown on the plans).
501-4.17 Protection of pavement. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor’s employees and agents until accepted by the RPR. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor’s expense.

The only equipment allowed on the pavement prior to 48 hours are 65 HP saws for the initial saw cutting of joints, and a gang drill assembly, excluding compressors, to drill holes for load transfer dowels. Provided the width of the paving pass does not exceed forty, tracks of a slipform paver and work bridges, a wheel mounted Bidwell, Terex 6500, roller screeds, and other wheel mounted finishing equipment can be placed on previously placed concrete after 48 hours, provided backer rod is placed in all contraction joints. Water trucks, pickups, compressors, and all other construction and hauling equipment will not be permitted on the newly placed pavement until the requirements of P-501-17 are satisfied.

All new and existing pavement carrying construction traffic or equipment shall be kept clean and spillage of concrete and other materials shall be cleaned up immediately.

Damaged pavements shall be removed and replaced at the Contractor’s expense. Slabs shall be removed to the full depth, width, and length of the slab.

501-4.18 Opening to construction traffic. The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of 450 pounds per square inch when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion.

501-4.19 Repair, removal, or replacement of slabs. New pavement slabs that are broken or contain cracks or are otherwise defective or unacceptable as defined by acceptance criteria in paragraph 501-6.6 shall be removed and replaced or repaired, as directed by the RPR, at the Contractor’s expense. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. Removal and replacement shall be full depth, shall be full width of the slab, and the limit of removal shall be normal to the paving lane and to each original transverse joint and original longitudinal joint. The RPR will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be have a diameter of 2 inches to 4 inches, shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with a bonding agent, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Owner. Repair of cracks as described in this section shall not be allowed if in the opinion of the RPR the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of cracks shall be allowed in any panel that demonstrates segregated aggregate with an absence of coarse aggregate in the upper 1/8 inch of the pavement surface.

a. Shrinkage cracks. Shrinkage cracks which do not exceed one-third of the pavement depth shall be cleaned and either high molecular weight methacrylate (HMWM) applied; or epoxy resin (Type IV, Grade 1) pressure injected using procedures recommended by the manufacturer and
approved by the RPR. Sandblasting of the surface may be required following the application of HMWM to restore skid resistance. Care shall be taken to ensure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the RPR. Shrinkage cracks which exceed one-third the pavement depth shall be treated as full depth cracks in accordance with paragraphs 501-4.19b and 501-19c.

b. Slabs with cracks through interior areas. Interior area is defined as that area more than 6 inches from either adjacent original transverse joint. The full slab shall be removed and replaced at no cost to the Owner, when there are any full depth cracks, or cracks greater than one-third the pavement depth, that extend into the interior area.

c. Cracks close to and parallel to joints. All full-depth cracks within 6 inches either side of the joint and essentially parallel to the original joints, shall be treated as follows.

(1) Full depth cracks and original joint not cracked. The full-depth crack shall be treated as the new joint and the original joint filled with an epoxy resin.

i. Full-depth crack. The joint sealant reservoir for the crack shall be formed by sawing to a depth of 3/4 inches, ±1/16 inch, and to a width of 5/8 inch, ±1/8 inch. The crack shall be sawed with equipment specially designed to follow random cracks. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent raveling or spalling. The joint shall be sealed with sealant in accordance with P-605 or as directed by the RPR.

ii. Original joint. If the original joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures.

If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures.

Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remained of the width, it shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

(2) Full depth cracks and original joint cracked. If there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab containing the crack shall be removed and replaced.

d. Removal and replacement of full slabs. Make a full depth cut perpendicular to the slab surface along all edges of the slab with a concrete saw cutting any dowels or tie-bars. Remove damaged slab protecting adjacent pavement from damage. Damage to adjacent slabs may result in removal of additional slabs as directed by the RPR at the Contractor’s expense.

The underlying material shall be repaired, re-compacted and shaped to grade.

Dowels of the size and spacing specified for other joints in similar pavement on the project shall be installed along all four (4) edges of the new slab in accordance with paragraph 501-4.10d.

Placement of concrete shall be as specified for original construction. The joints around the new slab shall be prepared and sealed as specified for original construction.

e. Spalls along joints.
(1) Spalls less than one inch wide and less than the depth of the joint sealant reservoir, shall be filled with joint sealant material.

(2) Spalls larger than one inch and/or deeper than the joint reservoir, but less than \( \frac{1}{2} \) the slab depth, and less than 25% of the length of the adjacent joint shall be repaired as follows:
   i. Make a vertical saw cut at least one inch outside the spalled area and to a depth of at least 3 inches. Saw cuts shall be straight lines forming rectangular areas surrounding the spalled area.
   ii. Remove unsound concrete and at least 1/2 inch of visually sound concrete between the saw cut and the joint or crack with a light chipping hammer.
   iii. Clean cavity with high-pressure water jets supplemented with compressed air as needed to remove all loose material.
   iv. Apply a prime coat of epoxy resin, Type III, Grade I, to the dry, cleaned surface of all sides and bottom of the cavity, except any joint face.
   v. Fill the cavity with Flex Set from Rocklin, low slump concrete, mortar, or epoxy resin concrete as approved by the RPR.
   vi. An insert or other bond-breaking medium shall be used to prevent bond at all joint faces.
   vii. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and sealed with the sealer specified for the joints.

(3) Spalls deeper than 1/2 of the slab depth or spalls longer than 25% of the adjacent joint require replacement of the entire slab.

f. Diamond grinding of Concrete surfaces. Diamond grinding shall be completed prior to pavement grooving. Diamond grinding of the hardened concrete should not be performed until the concrete is at least 14 days old and has achieved full minimum strength. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The depth of diamond grinding shall not exceed 1/2 inch and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified.

Diamond grinding shall be performed with a machine specifically designed for diamond grinding capable of cutting a path at least 3 feet wide. The saw blades shall be 1/8-inch wide with sufficient number of flush cut blades that create grooves between 0.090 and 0.130 inches wide; and peaks and ridges approximately 1/32 inch higher than the bottom of the grinding cut. The Contractor shall determine the number and type of blades based on the hardness of the aggregate. Contractor shall demonstrate to the RPR that the grinding equipment will produce satisfactory results prior to making corrections to surfaces.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. All grinding shall be at the expense of the Contractor.
CONTRACTOR QUALITY CONTROL (CQC)

501-5.1 Quality control program. The Contractor shall develop a Quality Control Program in accordance with Item C-100. No partial payment will be made for materials that are subject to specific quality control requirements without an approved quality control program.

501-5.2 Contractor Quality Control (CQC). The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor’s QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

501-5.3 Contractor QC testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to this specification and as set forth in the CQCP. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content. A QC Testing Plan shall be developed and approved by the RPR as part of the CQCP.

The RPR may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, or improper slump. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the actual invoiced price from the subcontractor or material supplier for the volume of material rejected.

a. Fine aggregate.

   (1) Gradation. A sieve analysis shall be made at least twice daily in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

   (2) Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C70 or ASTM C566.

   (3) Deleterious substances. Fine aggregate as delivered to the mixer shall be tested for deleterious substances in fine aggregate for concrete as specified in paragraph 501-2.1b, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

b. Coarse Aggregate.

   (1) Gradation. A sieve analysis shall be made at least twice daily for each size of aggregate. Tests shall be made in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

   (2) Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct
measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C566.

(3) Deleterious substances. Coarse aggregate as delivered to the mixer shall be tested for deleterious substances in coarse aggregate for concrete as specified in paragraph 501-2.1c, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

c. Slump. One test shall be made for each sublot. Slump tests shall be performed in accordance with ASTM C143 from material randomly sampled from material discharged from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

d. Air content. One test shall be made for each sublot. Air content tests shall be performed in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag or other porous coarse aggregate, from material randomly sampled from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

e. Unit weight and Yield. One test shall be made for each sublot. Unit weight and yield tests shall be in accordance with ASTM C138. The samples shall be taken in accordance with ASTM C172 and at the same time as the air content tests.

f. Temperatures. Temperatures shall be checked at least four times per lot at the job site in accordance with ASTM C1064.

g. Smoothness for Contractor Quality Control.

The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than \( \frac{1}{4} \) inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues.

The Contractor may use a 12-foot straightedge or a rolling inclinometer meeting the requirements of ASTM E2133, or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using either the FAA profile program, ProFAA, or FHWA ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

(1) Transverse measurements. Transverse measurements shall be taken for each day’s production placed. Transverse measurements shall be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.
(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day’s production placed. Longitudinal tests shall be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the third points of paving lanes when widths of paving lanes are 20 ft or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch shall be corrected with diamond grinding per paragraph 501-4.19f or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in paragraph 501-6.6.

Control charts shall be kept to show area of each day’s placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor’s machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day’s production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade will be evaluated prior to and after placement of the concrete surface.

The Contractors Surveyor shall obtain finished pavement elevations at each paving joint intersection to confirm that the pavement has been constructed to the elevations established in the plans with a permissible variation of +/- 0.04’. The Contractor shall provide the survey data to the RPR for review and approval.

Areas with humps or depression that that exceed grade or smoothness and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch less than the thickness specified on the plans. If these areas cannot be corrected with grinding then the slabs that are retaining water must be removed and replaced in accordance with paragraph 501-4.19d. Grinding shall be in accordance with paragraph 501-4.19f. All corrections will be at the Contractors expense.

501-5.4 Control charts. The Contractor shall maintain linear control charts for fine and coarse aggregate gradation, slump, and air content. The Contractor shall also maintain a control chart plotting the coarseness factor/workability factor from the combined gradations in accordance with paragraph 501-2.1d.

Control charts shall be posted in a location satisfactory to the RPR and shall be kept up to date at all times. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and suspension Limits, or Specification limits, applicable to each test parameter, and the Contractor’s test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor’s projected data during production indicates a potential problem and the Contractor is not taking satisfactory corrective action, the RPR may halt production or acceptance of the material.

a. Fine and coarse aggregate gradation. The Contractor shall record the running average of the last five gradation tests for each control sieve on linear control charts. Superimposed on the control charts shall be the action and suspension limits. Gradation tests shall be performed by the
Contractor per ASTM C136. The Contractor shall take at least two samples per lot to check the final gradation. Sampling shall be per ASTM D75 from the flowing aggregate stream or conveyor belt.

**b. Slump and air content.** The Contractor shall maintain linear control charts both for individual measurements and range (that is, difference between highest and lowest measurements) for slump and air content in accordance with the following Action and Suspension Limits.

**c. Combined gradation.**

**Control Chart Limits**

<table>
<thead>
<tr>
<th>Control Parameter</th>
<th>Individual Measurements</th>
<th>Action Limit</th>
<th>Suspension Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradation</td>
<td></td>
<td>*3</td>
<td>*3</td>
</tr>
<tr>
<td>Slump</td>
<td>+0.5 to -1 inch</td>
<td>+1 to -1.5 inch</td>
<td></td>
</tr>
<tr>
<td>Air Content</td>
<td>±1.5%</td>
<td>±2.0%</td>
<td></td>
</tr>
</tbody>
</table>

1 Control charts shall be developed and maintained for each control parameter indicated.
2 Control charts shall be developed and maintained for each sieve size.
3 Action and suspension limits shall be determined by the Contractor.

**501-5.5 Corrective action at Suspension Limit.** The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of control. The CQCP shall detail what action will be taken to bring the process into control and shall contain sets of rules to gauge when a process is out of control. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the following conditions exists.

a. Fine and coarse aggregate gradation. When two consecutive averages of five tests are outside of the suspension limits, immediate steps, including a halt to production, shall be taken to correct the grading.

b. Not used.

c. Fine and coarse aggregate moisture content. Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5%, the scale settings for the aggregate batcher and water batcher shall be adjusted.

d. Slump. The Contractor shall halt production and make appropriate adjustments whenever:

   (1) one point falls outside the Suspension Limit line for individual measurements  
       OR

   (2) two points in a row fall outside the Action Limit line for individual measurements.

e. Air content. The Contractor shall halt production and adjust the amount of air-entraining admixture whenever:

   (1) one point falls outside the Suspension Limit line for individual measurements  
       OR
(2) two points in a row fall outside the Action Limit line for individual measurements.

MATERIAL ACCEPTANCE

501-6.1 Quality Assurance (QA) Acceptance sampling and testing. All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section, with the exception of coring for thickness determination, will be performed by the RPR. The Contractor shall provide adequate facilities for the initial curing of beams. The Contractor shall bear the cost of providing initial curing facilities and coring and filling operations, per paragraph 501-6.5b(1).

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60° to 80°F, and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.

501-6.2 Quality Assurance (QA) testing laboratory. Quality assurance testing organizations performing these acceptance tests will be accredited in accordance with ASTM C1077. The quality assurance laboratory accreditation must be current and listed on the accrediting authority’s website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory’s current accreditation and accredited test methods will be submitted to the RPR prior to start of construction.

501-6.3 Lot size. Concrete will be accepted for strength and thickness on a lot basis. A lot will consist of a day’s production not to exceed 4,000 square yards. Each lot will be divided into approximately equal sublots with individual sublots approximately 1,000 square yards. Where three sublots are produced, they will constitute a lot. Where one or two sublots are produced, they will be incorporated into the previous or next lot. Where more than one plant is simultaneously producing concrete for the job, the lot sizes will apply separately for each plant.

501-6.4 Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot or for overages or minor placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

Where three sublots have been produced, they will constitute a lot. Where one or two sublots have been produced, they will be incorporated into the next lot or the previous lot and the total number of sublots will be used in the acceptance criteria calculation, that is, n=5 or n=6.

501-6.5 Acceptance Sampling and Testing.

a. Strength.

(1) Sampling. One sample will be taken for each sublot from the concrete delivered to the job site. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. The concrete will be sampled in accordance with ASTM C172.

(2) Test Specimens. The RPR will be responsible for the casting, initial curing, transportation, and curing of specimens in accordance with ASTM C31. Two (2) specimens will be
made from each sample and slump, air content, unit weight, and temperature tests will be conducted for each set of strength specimens. Within 24 to 48 hours, the samples will be transported from the field to the laboratory while in the molds. Samples will be cured in saturated lime water.

The strength of each specimen will be determined in accordance with ASTM C78. The strength for each sublot will be computed by averaging the results of the two test specimens representing that sublot.

(3) Acceptance. Acceptance of pavement for strength will be determined by the RPR in accordance with paragraph 501-6.6b(1). All individual strength tests within a lot will be checked for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and the remaining test values will be used to determine acceptance in accordance with paragraph 501-6.5b.

b. Pavement thickness.

(1) Sampling. One core will be taken by the Contractor for each sublot in the presence of the RPR. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. Areas, such as thickened edges, with planned variable thickness, will be excluded from sample locations.

Cores shall be a minimum 4 inch in diameter neatly cut with a core drill. The Contractor will furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes will be filled by the Contractor with a non-shrink grout approved by the RPR within one day after sampling.

(2) Testing. The thickness of the cores will be determined by the RPR by the average caliper measurement in accordance with ASTM C174.

(3) Acceptance. Acceptance of pavement for thickness will be determined by the RPR in accordance with paragraph 501-6.6.

501-6.6 Acceptance criteria.

a. General. Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-6.5b:

(1) Strength
(2) Thickness
(3) Grade
(4) Profilograph smoothness - Not used.
(5) Adjustments for repairs

Acceptance for strength, thickness, and grade, will be based on the criteria contained in accordance with paragraph 501-6.6b(1), 501-6.6b(2), and 501-6.6b(3), respectively.

Production quality must achieve 90 PWL or higher to receive full payment.

Strength and thickness will be evaluated for acceptance on a lot basis using the method of estimating PWL. Production quality must achieve 90 PWL or higher to receive full payment. The PWL will be determined in accordance with procedures specified in Item C-110.

The lower specification tolerance limit (L) for strength and thickness will be:
Lower Specification Tolerance Limit (L)

<table>
<thead>
<tr>
<th>Strength</th>
<th>0.93 × strength specified in paragraph 501-3.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>Lot Plan Thickness in inches, - 0.50 in</td>
</tr>
</tbody>
</table>

b. Acceptance criteria.

(1) **Strength.** If the PWL of the lot equals or exceeds 90%, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

(2) **Thickness.** If the PWL of the lot equals or exceeds 90%, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

(3) **Grade.** The final finished surface of the pavement of the completed project will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch vertically or 0.1 feet laterally. The documentation, stamped and signed by a licensed surveyor shall be in accordance with paragraph 501-5.3h.

(4) **Profilograph roughness for QA Acceptance.** Not used.

(5) **Adjustments for repair.** Sublots with spall repairs or crack repairs will be limited to no more than 95% payment.

(6) **Adjustment for grinding.** For sublots with grinding over 25% of a sublot, payment will be reduced 5%.

**METHOD OF MEASUREMENT**

**501-7.1** Concrete pavement shall be measured by the number of square yards of plain or reinforced pavement as specified in-place, completed and accepted. There will be no separate measurement for reinforced and unreinforced PCCP under Item P-501-8.1 Portland Cement Concrete Pavement (18-Inch Thickness) or P-501-8.3 GSE Portland Cement Concrete Pavement (9-Inch Thickness); both will be paid at the unit price bid for this item.

**BASIS OF PAYMENT**

**501-8.1 Payment.** Payment for concrete pavement meeting all acceptance criteria as specified in paragraph 501-6.6. Acceptance Criteria shall be based on results of strength, smoothness, and thickness tests. Payment for acceptable lots of concrete pavement shall be adjusted in accordance with paragraph 501-8.1a for strength and thickness; 501-8.1b for repairs; 501-8.1c for grinding; and 501-8.1d for smoothness, subject to the limitation that:

The total project payment for concrete pavement shall not exceed 100 percent of the product of the contract unit price and the total number of square yards of concrete pavement used in the accepted work (See Note 1 under the Price Adjustment Schedule table below).

Payment shall be full compensation for all labor, materials, tools, equipment, and incidentals required to complete the work as specified herein and on the drawings.

a. **Basis of adjusted payment.** The pay factor for each individual lot shall be calculated in accordance with the Price Adjustment Schedule table below. A pay factor shall be calculated for both strength and thickness. The lot pay factor shall be the higher of the two values when
calculations for both strength and thickness are 100% or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either strength or thickness is 100% or higher. The lot pay factor shall be the lower of the two values when calculations for both strength and thickness are less than 100%.

Price Adjustment Schedule

<table>
<thead>
<tr>
<th>Percentage of Materials Within Specification Limits (PWL)</th>
<th>Lot Pay Factor (Percent of Contract Unit Price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>96 – 100</td>
<td>106</td>
</tr>
<tr>
<td>90 – 95</td>
<td>PWL + 10</td>
</tr>
<tr>
<td>75 – 90</td>
<td>0.5 PWL + 55</td>
</tr>
<tr>
<td>55 – 74</td>
<td>1.4 PWL – 12</td>
</tr>
<tr>
<td>Below 55</td>
<td>Reject2</td>
</tr>
</tbody>
</table>

1 Although it is theoretically possible to achieve a pay factor of 106% for each lot, actual payment in excess of 100% shall be subject to the total project payment limitation specified in paragraph 501-8.1.

2 The lot shall be removed and replaced unless, after receipt of FAA concurrence, the Owner and Contractor agree in writing that the lot will remain; the lot paid at 50% of the contract unit price; and the total project payment limitation reduced by the amount withheld for that lot.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph 501-8.1. Payment in excess of 100% for accepted lots of concrete pavement shall be used to offset payment for accepted lots of concrete pavement that achieve a lot pay factor less than 100%; except for rejected lots which remain in place and/or sublots with adjustments for repairs.

b. Adjusted payment for repairs. The PWL lot pay factor shall be reduced by 5% and be no higher than 95% for sublots which contain repairs in accordance with paragraph 501-4.19 on more than 25% of the slabs within the sublot. Payment factors greater than 100 percent for the strength and thickness cannot be used to offset adjustments for repairs.

c. Adjusted payment for grinding. The PWL lot pay factor shall be reduced by 5% and be no higher than 95% for sublots with grinding over 25% of a sublot.

d. Profilograph Roughness. Not used.

e. Payment. Payment shall be made under:

   Item P-501-8.1  Cement Concrete Pavement (Non Reinforced and Reinforced) (18-Inch Thickness) – per Square Yard

   Item P-501-8.2  GSE Cement Concrete Pavement (9-Inch Thickness) – per Square Yard
REFERENCES

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

ASTM International (ASTM)

ASTM A184 Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704 Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884 Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934 Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A996 Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1035 Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement
ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1078 Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM C29 Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33 Standard Specification for Concrete Aggregates
ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C70 Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94  Standard Specification for Ready-Mixed Concrete
ASTM C114  Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C117  Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123  Standard Test Method for Lightweight Particles in Aggregate
ASTM C136  Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138  Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142  Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143  Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150  Standard Specification for Portland Cement
ASTM C171  Standard Specification for Sheet Materials for Curing Concrete
ASTM C172  Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173  Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C174  Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C231  Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260  Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C295  Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C309  Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311  Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete
ASTM C494  Standard Specification for Chemical Admixtures for Concrete
<table>
<thead>
<tr>
<th>ASTM Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C566</td>
<td>Standard Test Method for Total Evaporable Moisture Content of Aggregates by Drying</td>
</tr>
<tr>
<td>ASTM C595</td>
<td>Standard Specification for Blended Hydraulic Cements</td>
</tr>
<tr>
<td>ASTM C618</td>
<td>Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete</td>
</tr>
<tr>
<td>ASTM C642</td>
<td>Standard Test Method for Density, Absorption, and Voids in Hardened Concrete</td>
</tr>
<tr>
<td>ASTM C666</td>
<td>Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing</td>
</tr>
<tr>
<td>ASTM C685</td>
<td>Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing</td>
</tr>
<tr>
<td>ASTM C881</td>
<td>Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete</td>
</tr>
<tr>
<td>ASTM C989</td>
<td>Standard Specification for Slag Cement for Use in Concrete and Mortars</td>
</tr>
<tr>
<td>ASTM C1017</td>
<td>Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete</td>
</tr>
<tr>
<td>ASTM C1064</td>
<td>Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete</td>
</tr>
<tr>
<td>ASTM C1077</td>
<td>Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation</td>
</tr>
<tr>
<td>ASTM C1157</td>
<td>Standard Performance Specification for Hydraulic Cement</td>
</tr>
<tr>
<td>ASTM C1602</td>
<td>Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete</td>
</tr>
<tr>
<td>ASTM D75</td>
<td>Standard Practice for Sampling Aggregates</td>
</tr>
<tr>
<td>ASTM D1751</td>
<td>Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)</td>
</tr>
</tbody>
</table>
Item P-603 Emulsified Asphalt Tack Coat

DESCRIPTION

603-1.1 This item shall consist of preparing and treating an asphalt or concrete surface with asphalt material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

603-2.1 Asphalt materials. The asphalt material shall be an emulsified asphalt as specified in ASTM D3628 as an asphalt application for tack coat appropriate to local conditions. The emulsified asphalt shall not be diluted. The Contractor shall provide a copy of the manufacturer’s Certificate of Analysis (COA) for the asphalt material to the Resident Project Representative (RPR) before the asphalt material is applied for review and acceptance. The furnishing of COA for the asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer’s COA may be subject to verification by testing the material delivered for use on the project.

CONSTRUCTION METHODS

603-3.1 Weather limitations. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is 50°F or above; the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the RPR.

603-3.2 Equipment. The Contractor shall provide equipment for heating and applying the emulsified asphalt material. The emulsion shall be applied with a manufacturer-approved computer rate-controlled asphalt distributor. The equipment shall be in good working order and contain no contaminants or diluents in the tank. Spray bar tips must be clean, free of burrs, and of a size to maintain an even distribution of the emulsion. Any type of tip or pressure source is suitable that will maintain predetermined flow rates and constant pressure during the application process with application speeds under eight (8) miles per hour or seven (700) feet per minute.

The equipment will be tested under pressure for leaks and to ensure proper set-up before use to verify truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application, spray-bar height and pressure and pump speed, evidence of triple-overlap spray pattern, lack of leaks, and any other factors relevant to ensure the truck is in good working order before use.

The distributor truck shall be equipped with a minimum 12-foot spreader spray bar with individual nozzle control with computer-controlled application rates. The distributor truck shall have an easily accessible thermometer that constantly monitors the temperature of the emulsion, and have an operable mechanical tank gauge that can be used to cross-check the computer accuracy. If the
distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

The distributor truck shall be equipped to effectively heat and mix the material to the required temperature prior to application as required. Heating and mixing shall be done in accordance with the manufacturer’s recommendations. Do not overheat or over mix the material.

The distributor shall be equipped with a hand sprayer.

Asphalt distributors must be calibrated annually in accordance with ASTM D2995. The Contractor must furnish a current calibration certification for the asphalt distributor truck from any State or other agency as approved by the RPR.

A power broom and/or power blower suitable for cleaning the surfaces to which the asphalt tack coat is to be applied shall be provided.

603-3.3 Application of emulsified asphalt material. The emulsified asphalt shall not be diluted. Immediately before applying the emulsified asphalt tack coat, the full width of surface to be treated shall be swept with a power broom and/or power blower to remove all loose dirt and other objectionable material.

The emulsified asphalt material shall be uniformly applied with an asphalt distributor at the rates appropriate for the conditions and surface specified in the table below. The type of asphalt material and application rate shall be approved by the RPR prior to application.

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Residual Rate, gal/SY</th>
<th>Emulsion Application Bar Rate, gal/SY</th>
</tr>
</thead>
<tbody>
<tr>
<td>New asphalt</td>
<td>0.02-0.05</td>
<td>0.03-0.07</td>
</tr>
<tr>
<td>Existing asphalt</td>
<td>0.04-0.07</td>
<td>0.06-0.11</td>
</tr>
<tr>
<td>Milled Surface</td>
<td>0.04-0.08</td>
<td>0.06-0.12</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.03-0.05</td>
<td>0.05-0.08</td>
</tr>
</tbody>
</table>

After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of the tack coat. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed. When the tack coat has been disturbed by the Contractor, tack coat shall be reapplied at the Contractor’s expense.

603-3.4 Freight and waybills The Contractor shall submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.
METHOD OF MEASUREMENT

603-4.1 There will be no direct measurement for payment for furnishing and applying emulsified asphalt tack coat.

BASIS OF PAYMENT

603.5-1 No direct payment will be made for furnishing and applying bituminous material for tack coat, as the work is incidental to the asphalt paving work.

REFERENCES

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

ASTM International (ASTM)

ASTM D2995 Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors
ASTM D3628 Standard Practice for Selection and Use of Emulsified Asphalts

END ITEM P-603
Item P-604 Compression Joint Seals for Concrete Pavements

DESCRIPTION

604-1.1 This item shall consist of preformed polychloroprene compression seals used for sealing joints of rigid pavements.

MATERIALS

604-2.1 Compression seals. Compression joint seal materials shall be a vulcanized elastomeric compound using polychloroprene as the only base polymer. The material and the manufactured seal shall conform to ASTM D2628.

The Contractor shall provide a copy of the manufacturer’s Certificate of Analysis (COA) for the joint seal material delivered to the project. The COA shall be provided to and approved by the RPR before the material is installed. The furnishing of the vendor’s certified test report shall not be interpreted as a basis for final acceptance. The manufacturer’s COA may be subject to verification by testing the material delivered for use on the project.

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided at the job site to protect materials from weather and maintain materials at temperatures recommended by the manufacturer.

Representative sample of joint seal material will be sampled and retained by the RPR for possible testing.

604-2.2 Lubricant/adhesive. Lubricant/adhesive used for the compression elastomeric joint seal shall be a one-component compound conforming to ASTM D2835.

CONSTRUCTION METHODS

604-3.1 Equipment. Machines, tools, and equipment used in the performance of the work required by this section shall be approved by the RPR before the work starts and shall be maintained by the Contractor in satisfactory condition at all times.

a. Joint cleaning equipment.

(1) Concrete saw. A self-propelled power saw with water-cooled diamond saw blades shall be provided for cutting joints to the depths and widths specified and for removing filler, existing old joint seal or other material embedded in the joints or adhered to the joint faces.

(2) Waterblasting equipment. Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, a wand with safety release cutoff controls, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary water resupply equipment shall

Compression Joint Seals for Concrete Pavements
be of sufficient capacity to permit continuous operations. The pumps, hoses, wand, and nozzle shall be of sufficient capacity to permit the cleaning of both walls of the joint and the pavement surface for a width of at least 1/2 inch on either side of the joint. The pump shall be capable of supplying a pressure of at least 3,000 psi. A pressure gauge mounted at the pump shall show at all times the pressure in pounds per square inch at which the equipment is operating.

(3) Sandblasting equipment. Sandblasting is not allowed.

b. Sealing equipment. Equipment used to install the compression seal shall place the compression seal to the prescribed depths within the specified tolerances without cutting, nicking, twisting, or otherwise damaging the seal. The equipment shall not stretch or compress the seal more than 2.0% longitudinally during installation. The machine shall be an automatic self-propelled joint seal application equipment and shall be engine powered. The machine shall include a reservoir for the lubricant/adhesive, a device for conveying the lubricant/adhesive in the proper quantities to the sides the preformed seal or the sidewalls of the joint, a reel capable of holding one full spool of compression seal, and a power-driven apparatus for feeding the joint seal through a compression device and inserting the seal into the joint. The equipment shall also include a guide to maintain the proper course along the joint being sealed. The machine shall at all times be operated by an experienced operator.

Hand operated joint seal application equipment may be used for localized areas and for projects less than 500 square yards. The equipment shall be a two-axle, four-wheel machine that includes means for compressing and inserting the compression seal into the joint and a reel capable of holding one full spool of compression seal material.

CONSTRUCTION METHODS

604-4.1 Environmental conditions. The ambient temperature and the pavement temperature within the joint wall shall be at least 35°F and rising at the time of installation of the materials. Sealant application will not be permitted if moisture or any foreign material is observed in the joint.

When pavements are opened to construction traffic prior to installation of compression seals, the Contractor shall temporarily fill the initial saw cut joint with an acceptable filler material immediately after the initial saw cut is made. This filler shall consist of backer rod. The backer rod used to temporarily seal the initial saw cut shall be installed approximately 1/8 inch below the pavement surface. The temporary backer rod shall be removed immediately prior or during the joint saw cut widening operations.

604-4.2 Trial joint seal and lubricant/adhesive installation. Prior to the cleaning and sealing of the joints for the entire project, a control strip at least 200 feet long shall be prepared at a location designated by the RPR using the specified materials and the approved equipment, to demonstrate the materials and construction processes for joint preparation and sealing of all types of joints included in the project. No other joints shall be sealed until the test installation has been approved by the RPR.

If materials or installation do not meet requirements, the materials shall be removed, and the joints shall be cleaned and a new trial joint seal installation shall be performed at the Contractor’s expense. The RPR approved trial section will be incorporated into the permanent work.
604-4.3 Preparation of joints. Immediately before installation of the compression joint seal, the joints shall be thoroughly cleaned to remove all laitance, filler, existing sealer, foreign material and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed. Cleaning shall extend along pavement surfaces at least 1/2 inch on either side of the joint. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left free of debris and water. Any irregularity in the joint face that would prevent uniform contact between the joint seal and the joint face shall be corrected prior to the installation of the joint seal.

a. Sawing. Joints shall be sawed to clean and to open them to the full specified width and depth. Immediately following the sawing operation, the joint faces and opening shall be thoroughly cleaned using a water jet to remove all saw cuttings or debris remaining on the faces or in the joint opening. Compression seal shall be installed within three (3) calendar days of the time the joint cavity is sawed. Depth of the joint cavity shall be in accordance with manufacturer’s instructions. Submit printed copies of manufacturers’ instructions 60 days prior to use on the project. The saw cut for the joint seal cavity shall at all locations be centered over the joint line. The nominal width of the sawed joint seal cavity shall be as follows; the actual width shall be within a tolerance of ±1/16 inch:

1. If a nominal 13/16 inch wide compression seal is furnished, the nominal width of the saw cut shall be 1/2 inch when the pavement temperature at the time of sawing is between 50 and 115°F. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1/16 inch (2 mm). If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1/16 inch (2 mm).

2. If a nominal one inch (25 mm) wide compression seal is furnished, the nominal width of the saw cut shall be 9/16 inch when the pavement temperature at the time of sawing is between 55 and 180°F. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1/16 inch. If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1/16 inch.

3. If a nominal 1-3/4 inches wide compression seal is furnished, the nominal width of the saw cut shall be one inch when the pavement temperature at the time of sawing is between 55 and 155°F. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1/16 inch. If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1/16 inch.

4. The pavement temperature shall be measured and recorded in the presence of the RPR. Measurement shall be made each day before commencing sawing and at any other time during the day when the temperature appears to be moving out of the allowable sawing range.

b. Waterblast cleaning. The concrete joint faces and pavement surfaces extending at least 1/2 inch from the joint edges shall be waterblasted clean. A multiple pass technique shall be used until the surfaces are free of dust, dirt, curing compound, or any residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

c. Sandblast cleaning. Sandblast cleaning is not allowed

d. Rate of progress. Cleaning of the joint faces shall be limited to the linear footage of joint that can be sealed during the same workday.
604-4.4 Installation of the compression seal.

a. **Time of installation.** Joints shall be sealed within 3 calendar days of sawing the joint seal cavity and the final cleaning of the joint walls, or a temporary seal shall be installed to prevent infiltration of foreign material. If rain interrupts the sealing operations, the joints shall be washed, cleaned with air and be dry before proceeding with installing of the lubricant/adhesive and compression seal.

b. **Installation Sequence.** Unless otherwise approved by the RPR, longitudinal joints shall be sealed first, then seal the transverse joints. Transverse joint seals will be continuous from edge to edge of the pavement. Intersections shall be made monolithic by use of joint seal adhesive and care in fitting the intersection parts together. Seals which do not reach an intersection shall be removed and replaced with new seal as directed by the RPR at the Contractor’s Expense. Seal extender pieces shall not be used at intersections.

c. **Sealing joints.** The sides of the joint seal or the sides of the joint shall be covered with a coating of lubricant/adhesive and the seal installed as specified. Butt joints and seal intersections shall be coated with liberal applications of lubricant/adhesive. Lubricant/adhesive spilled on the pavement shall be removed immediately to prevent setting on the pavement.

The joint seal shall be installed as shown on the plans. Seals in grooved pavements or beveled joints, shall not extend above the bottom of the grooves or bevel, and the maximum allowable deviation shall not exceed 1/8” below the bevel or grooves. Seals shall be installed in non beveled and grooved pavements shall not be more than 1/8” below the surface.

The seal shall be installed in the longest practicable lengths in longitudinal joints and shall be cut at the joint intersections to provide continuous installation of the seal in the transverse joints. The joint seal shall be installed in an upright position, free from twisting, distortion, and cuts. If stretch of installed joint seal exceeds 1%, adjustments shall be made to the installation equipment and procedure. Stretch of installed joint seals exceeding 2% stretch shall be removed and replaced.

After installation of the longitudinal joint seals, it shall set for a minimum of one (1) hour prior to cutting the seal at the joint intersections. For all transverse joints, the minimum length of the preformed joint seal shall be the pavement width from edge to edge.

604-4.5 Clean-up. Upon completion of the project, all unused materials shall be removed from the site, all lubricant/adhesive on the pavement surface shall be removed, and the pavement shall be left in clean condition.

604-4.6 Quality Control and Quality Assurance.

a. **Quality Control** The application equipment shall be inspected to assure uniform application of lubricant/adhesive to the sides of the compression joint seal or the walls of the joint. Equipment causing cutting, twisting, nicking, excessive stretching or compressing of the compression seal, or improper application of the lubricant/adhesive, shall not be used until causes of the deficiencies are determined and corrected by the Contractor.

The seal shall be inspected by the Contractor a minimum of once per 400 feet of seal for compliance to the shrinkage or compression requirements. Measurements shall be made at the same interval to determine conformance with depth and width installation requirements.

b. **Quality Assurance.** Cleaned joints shall be approved by the RPR prior to installation of the lubricant/adhesive and compression joint seal.
Conformance to stretching and compression limitations shall be determined by the RPR using the following procedures:

1. Mark the top surface of the compression seal at one foot intervals in a manner clear and durable to enable length determinations of the seal.
2. After installation, the distance between the marks on the seal shall be measured by the Contractor.
3. If the stretching or compression exceeds the specified limit, the seal shall be removed and replaced with new joint seal at the Contractor’s Expense. The seal shall be removed up to the last correct measurement.

604-4.7 Acceptance. The joint sealing system (compression seal and lubricant/adhesive) shall be inspected by the RPR for proper rate of cure and bonding to the concrete, cuts, twists, nicks, and other deficiencies. Seals exhibiting any defects prior to final acceptance of the project, shall be removed from the joint, wasted, and replaced with new material in a satisfactory manner, at the Contractor’s expense, as determined by the RPR.

METHOD OF MEASUREMENT

604-5.1 Measurement. The quantity of compression joint seals installed and accepted, will be determined by the linear feet.

BASIS OF PAYMENT

604-6.1 Payment. Payment will be made at the contract unit bid prices per linear foot for the compression joint seals. The unit bid prices shall include the cost of all labor, materials, the use of all equipment, and tools required to complete the work.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-604-6.1</td>
<td>Compression Joint Seal, 1/2-Inch Joint – per Linear Foot</td>
<td></td>
</tr>
<tr>
<td>P-604-6.2</td>
<td>Compression Joint Seal, 1-Inch Joint – per Linear Foot</td>
<td></td>
</tr>
<tr>
<td>P-604-6.3</td>
<td>Compression Joint Seal, 1 1/2-Inch Joint – per Linear Foot</td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES

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

ASTM International (ASTM)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D2628</td>
<td>Standard Specification for Preformed Polychloropprene Elastomeric Joint Seals for Concrete Pavements</td>
</tr>
<tr>
<td>ASTM D2835</td>
<td>Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements</td>
</tr>
</tbody>
</table>
Corps of Engineers

Unified Facilities Criteria (UFC)
UFC 3-250-08FA Standard Practice for Sealing Joints and Cracks in Rigid and Flexible Pavements

END ITEM P-604
Item P-605 Joint Sealants for Pavements

DESCRIPTION

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

MATERIALS


Joint sealing materials shall meet the requirements of ASTM D6690 Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements (1:1 W:D ratio). Material shall be Crafco Roadsaver 221 Joint Sealant, or approved equal, for sealing joints between asphaltic concrete and concrete pavement interface.

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

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

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

CONSTRUCTION METHODS

605-3.1 Time of application. Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be 50°F and rising at the time of application of the poured joint sealing material. Do not apply sealant if moisture is observed in the joint.
605-3.2 Equipment. Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and maintained in satisfactory condition at all times. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 14 days prior to use on the project.

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

b. Sandblasting equipment. Sandblasting is not allowed

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

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

e. Hot-poured sealing equipment. The unit applicators used for heating and installing ASTM D6690 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

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

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

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

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

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

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

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, perform a final cleaning with compressed air. Fill the joints from the bottom up to 1/8 inch ±1/16 inch below the top of pavement surface; or bottom of groove for grooved pavement. Remove and discard excess or spilled sealant from the pavement by approved methods. Install the sealant in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the RPR. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer’s instructions. Check the joints frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

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

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

**METHOD OF MEASUREMENT**

**605-4.1** Joint sealing material shall be measured by the linear foot of sealant in place, completed, and accepted.

**BASIS OF PAYMENT**

**605-5.1** Payment for joint sealing material shall be made at the contract unit price per linear foot. The price shall be full compensation for furnishing all materials, for all preparation, delivering, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

- **Item P-605-5.1** Edge Seal — per Linear Foot
- **Item P-605-5.2** Silicone Joint Seal – per Linear Foot
REFERENCES

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

ASTM International (ASTM)

ASTM D789  Standard Test Method for Determination of Relative Viscosity of Polyamide (PA)


ASTM D6690  Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt]

Advisory Circulars (AC)

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

END ITEM P-605
Item P-610 Concrete for Miscellaneous Structures

DESCRIPTION

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

MATERIALS

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

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

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

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

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

Coarse aggregate shall be well graded from coarse to fine. Dust and other coatings shall be removed from the aggregates by washing. The percentage of wear shall be no more than 40 at 500 revolutions when tested in accordance with ASTM C131.
Coarse Aggregate Grading Requirements

<table>
<thead>
<tr>
<th>Maximum Aggregate Size</th>
<th>ASTM C33, Table 3 Grading Requirements (Size No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2 inch (37.5 mm)</td>
<td>467 or 4 and 67</td>
</tr>
<tr>
<td>1 inch (25 mm)</td>
<td>57</td>
</tr>
<tr>
<td>¾ inch (19 mm)</td>
<td>67</td>
</tr>
<tr>
<td>½ inch (12.5 mm)</td>
<td>7</td>
</tr>
</tbody>
</table>

610-2.2.1 Coarse Aggregate susceptibility to durability (D) cracking.

Coarse aggregate may only be accepted from sources that have a 20-year service history for the same gradation to be supplied with no history of D-Cracking. Aggregates that do not have a 20-year record of service free from major repairs (less than 5% of slabs replaced) in similar conditions without D-cracking shall not be used unless the material currently being produced has a durability factor greater than or equal to 95 per ASTM C666. The Contractor shall submit a current certification and test results to verify the aggregate acceptability. Test results will only be accepted from a State Department of Transportation (DOT) materials laboratory or an accredited laboratory. Certification and test results which are not dated or which are over one (1) year old or which are for different gradations will not be accepted.

Crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite or trap rock are considered to meet the D-cracking test requirements but must meet all other quality tests specified in Item P-501.

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

Fine aggregate shall be washed and cleaned, well graded from fine to coarse and shall have a sand equivalent value of not less than 75.

610-2.4 Cement. Cement shall conform to the requirements of ASTM C150 Type II.

The chemical requirements for all cement types specified should meet suitable criteria for deleterious activity. Low alkali cements (less than 0.6% equivalent alkalies).

Total Alkalies (Na2O and K2O) of the cement secured for the production of concrete shall be independently verified in accordance with ASTM C114 or ASTM C1365.

610-2.5 Cementitious materials.

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 13% and a total available alkali content less than 3% per ASTM C311. Fly ash produced in furnace operations using liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall
furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the RPR.

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

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

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

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

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

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

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

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

610-2.10 Steel reinforcement. Reinforcing shall consist of Reinforcing Steel, Welded Steel Wire Fabric, Welded Deformed Steel Fabric, or Bar Mars conforming to the requirements of ASTM A615, ASTM A706, ASTM A775, ASTM A934, ASTM A1064, ASTM A1064, ASTM A184 or ASTM A704 as applicable. Reinforcement shall be as shown on the details on the plans.

610-2.11 Materials for curing concrete. Curing materials shall conform to White-pigmented Liquid Membrane-Forming Compound, Type 2, Class B per ASTM C309.

CONSTRUCTION METHODS

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

610-3.2 Concrete Mixture. The concrete shall develop a compressive strength of 4000 psi in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cementitious material per cubic
yard. The water cementitious ratio shall not exceed 0.45 by weight. The air content, if air entrainment is used, of the concrete shall not exceed 5% by volume as determined by ASTM C231 and shall have a slump of not more than 5 inches as determined by ASTM C143.

After approval of all material to be used in the concrete, the Contractor shall submit a mix design showing the proportions and compressive strength test results obtained from the concrete at 7 and 28 days. The mix design shall include copies of test reports, including test dates, and a complete list of materials including type, brand, source, and amount of cement, flyash, coarse and fine aggregates, water, and admixtures. The air content shall also be shown. The mix design shall be submitted to the RPR at least 45 days prior to the start of operations. The mix design shall not be more than 90 days old unless the mix has been previously approved and used at PSHIA for concrete within the last 18 months. Production shall not begin until the mix design is approved in writing by the RPR and field trial batches are made, tested, and accepted for use. Should a change in sources be made, or admixtures added or deleted from the mix, a new mix design shall be submitted to the RPR for approval.

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

The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F without the RPRs approval. If approval is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F nor more than 90°F. The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his expense.

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

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

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

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

The Contractor shall be responsible for designing and constructing safe and adequate falsework and forms which provide the necessary rigidity, support the loads imposed, and produce in the finished structure the lines, grades, and dimensions shown on the project plans.

Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the RPR. The forms shall be mortar-tight and sufficiently rigid to prevent displacement
and sagging between supports. The surfaces of the forms shall be smooth and free from irregularities, dents, sags, and holes.

Forms are defined as any system of structural elements which provide horizontal support or restraint to the lateral pressure of concrete.

Falsework shall be any system of structural elements that provides temporary support for loads from plastic concrete, forms, reinforcing steel, structural steel, loads from placement operations or other related loads, and continues to provide support until the concrete has attained adequate strength and the structure is capable of self-support.

The Contractor shall submit shop drawings and calculations for falsework, and for forming when requested by the RPR. Shop drawings shall be submitted, and all shop drawings and calculations shall be sealed by a registered professional engineer, licensed to practice in the state in which the work is being performed. Falsework drawings and calculations require written approval of the RPR prior to commencing work.

Falsework shall be constructed to conform to the falsework drawings. The materials used in the falsework construction shall be of the quality necessary to sustain the stresses required by the falsework design. The workmanship used in the falsework construction shall be such quality that the falsework will support the loads imposed on the falsework.

Forms shall be of wood, metal or other suitable material. Forms shall be designed to withstand the pressure of concrete with consideration given to rate of concrete placement, temperature of the concrete, the effects of vibration, and all loads incidental to the construction operations without distortion or displacement.

Forms reused shall always be maintained in good condition as to the accuracy of shape, strength, rigidity, water tightness and smoothness of surface. Forms or form lumber unsatisfactory in any respect shall not be used.

Unless otherwise noted, forms shall be filleted ¾ inch at all exposed, sharp corners of the concrete.

All forms shall be treated with an approved form release agent before concrete is placed. Forms shall be cleaned of all dirt, sawdust, water, and other foreign material prior to placing concrete in the forms.

No falsework or forms shall be relieved of load and no forms shall be removed without approval of the RPR.

If forms are removed before the specified curing period has elapsed, the Contractor shall cure the concrete for the remaining curing period by approved curing methods.

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

**610-3.6 Embedded items.** Before placing concrete, all embedded items shall be firmly and securely fastened in place as indicated. All embedded items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The concrete shall be spaded and consolidated around and against embedded items. The embedding of wood shall not be allowed.
610-3.7 **Concrete Consistency.** The Contractor shall monitor the consistency of the concrete delivered to the project site; collect each batch ticket; check temperature; and perform slump tests on each truck at the project site in accordance with ASTM C143.

610-3.8 **Placing concrete.** Unless otherwise specified in the contract requiring night work or due to average daily temperatures exceeding 85 degrees, concrete shall be placed during daylight hours. The concrete shall not be placed until the depth and condition of foundations, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the RPR. Concrete shall be placed as soon as practical after mixing, but in no case later than ninety (90) minutes after water has been added to the mix. The method and manner of placing shall avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. The concrete shall not be dropped from a height of more than 5 feet. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation. Concrete shall be placed on clean, damp surfaces, free from running water, or on a properly consolidated soil foundation. Concrete in structures shall be placed in horizontal layers not exceeding 24 inches in depth, unless otherwise approved by the RPR.

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

610-3.10 **Joints.** Joints shall be constructed as indicated on the plans. Except under emergency conditions, construction joints shall be located as shown on the plans or the locations approved by the RPR in advance of placing concrete.

After placing of concrete has been completed to the construction joint and before placing fresh concrete, the exposed reinforcing steel and the entire surface of the construction joint shall be thoroughly cleaned of surface laitance, curing compound and other foreign materials. Surfaces of concrete that have been in place for eight hours or more shall be cleaned by abrasive blast methods. Surfaces of concrete that have been in place for less than eight hours may be cleaned with air and water provided that surface laitance and curing compound is removed and reinforcing steel and dowels are cleaned. Expansion joints shall be constructed at such locations and of such dimensions as indicated on the plans. The premolded filler shall be cut to the same depth as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.

610-3.11 **Surface Finishing.** All exposed concrete surfaces shall be true, smooth, and free from open or rough areas, depressions, or projections. All concrete horizontal plane surfaces shall be brought flush to the proper elevation with the finished top surface struck-off with a straightedge and floated. Mortar finishing shall not be used, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces. All formed surfaces will require a Class 1 finish. Formed surfaces normally in view of vehicular, aircraft, or pedestrian traffic shall provide a pleasing appearance of uniform color and texture commonly achieved using clean, smooth plywood forms, joined tightly to taper at the joints, preformed metal forms, tubing forms, or specially treated or coated forms. If a pleasing appearance has not been achieved, either at the formed surface or at the joint, the RPR will order that the surface be finished in accordance with a Class II finish.
Class I Finish. All bolts, wires, snap-ties, and rods shall be clipped and recessed one inch below the surface of the concrete. All holes, honeycomb rock pockets and other surface imperfections shall be cleaned to sound concrete, thoroughly moistened and patched with approved mortar of specialty patching materials.

Class II Finish. The surface shall be patched and pointed as specified for a Class I finish. The surface shall be rubbed with cork, wood or rubber floats, polystyrene, or a mechanical carborundum stone. During the rubbing process a thin mortar, matching the color of the surrounding concrete may be used. The mortar shall not be excessive to create a plaster coating to be left on the finished surface. Rubbing shall continue until irregularities are removed and there is not excess material. The finished surface shall be brushed or sacked to produce a uniform texture and color.

**610-3.12 Curing and protection.**

Curing materials shall conform to one of the following materials:

A. Liquid membrane-forming compounds – for curing the concrete shall conform to the requirements of ASTM C 309, Type 2 applied at a minimum rate of one gallon per 150 square feet.

B. Water curing – the surface of the concrete shall be kept continuously wet.

C. A combination of water curing and liquid membrane–forming compounds.

D. Forms left in place during the curing period.

All concrete shall be properly cured and protected by the Contractor. The work shall be protected from the elements, flowing water, and from defacement of any nature. The concrete shall be cured by one or a combination of the methods specified herein for a minimum of seven (7) calendar days. Unless otherwise shown on the plans, noted in the specifications, or approved by the RPR, construction equipment and traffic will not be permitted until at least seven days following placement and the 28-day required compressive strength has been attained.

The concrete shall be protected from damage until project acceptance.

**610-3.13 Cold weather placing.** The concrete surface temperature shall be maintained above 50 degrees for the first 72 hours, and then maintained at a minimum of 40 degrees for an additional 96 hours.

**610-3.14 Hot weather placing.** During periods of hot weather and when the maximum daily air temperature exceeds 85 degrees, night-time concrete placement may be necessary. The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. Aggregates and/or mixing water may need to be cooled in order to maintain the concrete mixture temperature at 90 degrees or less at the time of placement.

**QUALITY ASSURANCE (QA)**

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

The Contractor shall be responsible for furnishing facilities for storage and curing of the test specimens and for providing the calibrated testing machine for the 28-day acceptance test specimens. All other compressive strength tests prior to 28-days for applying loads or stresses to the structures, shall be fabricated and tested by the Contractor.

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

**METHOD OF MEASUREMENT**

**610-5.1** Concrete shall be considered incidental and no separate measurement shall be made.

**BASIS OF PAYMENT**

**610-6.1**

There will be no separate measurement or payment for concrete, payment will be per structure or item constructed as defined elsewhere.

**REFERENCES**

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

ASTM International (ASTM)

<table>
<thead>
<tr>
<th>Standard Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM A184</td>
<td>Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement</td>
</tr>
<tr>
<td>ASTM A615</td>
<td>Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement</td>
</tr>
<tr>
<td>ASTM A704</td>
<td>Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement</td>
</tr>
<tr>
<td>ASTM A706</td>
<td>Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement</td>
</tr>
<tr>
<td>ASTM A775</td>
<td>Standard Specification for Epoxy-Coated Steel Reinforcing Bars</td>
</tr>
<tr>
<td>ASTM A884</td>
<td>Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement</td>
</tr>
</tbody>
</table>
ASTM A934  Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064  Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31   Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33   Standard Specification for Concrete Aggregates
ASTM C39   Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94   Standard Specification for Ready-Mixed Concrete
ASTM C136  Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C114  Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C143  Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150  Standard Specification for Portland Cement
ASTM C171  Standard Specification for Sheet Materials for Curing Concrete
ASTM C172  Standard Practice for Sampling Freshly Mixed Concrete
ASTM C231  Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260  Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309  Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311  Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C494  Standard Specification for Chemical Admixtures for Concrete
ASTM C618  Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666  Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C685  Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C989  Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

ASTM C1157 Standard Performance Specification for Hydraulic Cement


ASTM C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)

ASTM D1752 Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

American Concrete Institute (ACI)

ACI 305R Hot Weather Concreting

ACI 306R Cold Weather Concreting

ACI 308R Guide to External Curing of Concrete

ACI 309R Guide for Consolidation of Concrete

END OF ITEM P-610
Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, gate envelopes, service roads, and other incidental markings in the airfield in accordance with these specifications and at the locations shown on the plans, or as directed by the Resident Project Representative (RPR). The terms “paint” and “marking material” as well as “painting” and “application of markings” are interchangeable throughout this specification.

MATERIALS

620-2.1 Materials acceptance. The Contractor shall furnish manufacturer’s certified test reports, for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. This certification along with a copy of the paint manufacturer’s surface preparation; marking materials, including adhesion, flow promoting and/or floatation additive; and application requirements must be submitted and approved by the Resident Project Representative (RPR) prior to the initial application of markings. The reports can be used for material acceptance or the RPR may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the RPR upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers that are easily quantifiable for inspection by the RPR.

Review and approval of SDS sheets from PSHIA Aviation Planning and Environmental Division is required for all paint materials and reflective media prior to any painting. All new paint shall be free of lead and 8 RCRA metal free.

620-2.2 Marking materials.

<table>
<thead>
<tr>
<th>Table 1. Marking Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint¹</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>III</td>
</tr>
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<td>III</td>
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<td>III</td>
</tr>
<tr>
<td>III</td>
</tr>
</tbody>
</table>

¹ See paragraph 620-2.2a
² See paragraph 620-2.2b
a. **Paint.** Paint shall be in accordance with the requirements of this paragraph. Paint colors shall comply with Federal Standard No. 595.

Paint shall be manufactured by Ennis Paint, or approved equal.

**Waterborne.** Paint shall meet the requirements of Federal Specification TT-P-1952F, Type III. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

b. **Reflective media.** Glass beads for white and yellow paint shall meet the requirements for Federal Specification TT-B-1325D Type III.

Glass beads for red and pink paint shall meet the requirements for Type III, Gradation A.

Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

Glass beads shall not be used in black and green paint.

Type III glass beads shall not be used in red and pink paint.

The use of recycled glass beads will not be permitted.

Glass beads shall be manufactured/supplied by SWARCO Worldwide or approved equal.

All paint materials stored on Airport property in five (5) gallon or larger containers shall require secondary containment and shall be kept away from storm drains. Spill kits shall be at the site of work at all times and spills shall be cleaned immediately.

**CONSTRUCTION METHODS**

620-3.1 **Weather limitations.** Painting shall only be performed when the surface is dry, and the ambient temperature and the pavement surface temperature meet the manufacturer’s recommendations in accordance with paragraph 620-2.1. Painting operations shall be discontinued when the ambient or surface temperatures does not meet the manufacturer’s recommendations. Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns. Markings shall not be applied when weather conditions are forecasts to not be within the manufacturers’ recommendations for application and dry time.

620-3.2 **Equipment.** Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type or airless type marking machine with automatic glass bead dispensers suitable for application of traffic paint. It shall produce an even and uniform film thickness and appearance of both paint and glass beads at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray. The marking equipment for both paint and beads shall be calibrated daily.

All taxiway and taxilane centerlines and edge lines along with J-Lines shall be painted with an approved painting truck. Hand painting will only be permitted in specific areas approved in advance by the RPR. For hand painting, an approved calibrated bead dispensing apparatus shall be attached to the equipment. Broadcasting of glass beads by hand must be approved in advance by the RPR on a case by case basis.
620-3.3 Preparation of surfaces. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other contaminants that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the RPR. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

   a. Preparation of new pavement surfaces. The area to be painted shall be cleaned by broom, blower, water blasting, or by other methods approved by the RPR to remove all contaminants, including PCC curing compounds, minimizing damage to the pavement surface. Sandblasting to remove curing compound will not be permitted. Unless otherwise directed by the RPR, removal of curing compounds from concrete pavements shall be for both permanent and temporary painting.

   b. Preparation of pavement markings prior to remarking. Prior to remarking existing markings, loose existing markings must be removed minimizing damage to the pavement surface, with a method approved by the RPR. After removal, the surface shall be cleaned of all residue or debris.

Prior to the application of markings, the Contractor shall certify that the surface is dry and free from dirt, grease, oil, laitance, or other foreign material that would prevent the bond of the paint to the pavement or existing markings. This certification along with a copy of the paint manufacturer's application and surface preparation requirements must be submitted to the RPR prior to the initial application of markings.

All paint waste and debris shall be removed and disposed of offsite. Residue from removal operations shall be removed from the pavement by sweeping or vacuuming before residue is blown by action of traffic, wind, or aircraft operations. The waste shall be stored on site in approved containers or lined pits prior to disposal offsite. The waste will be tested by PSHIA Environmental prior to removal from airport property. The Contractor shall allow for approximately 7-10 days for the testing of the waste.

620-3.4 Layout of markings. The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be shown on the plans.

620-3.5 Application. A period of 7 days shall elapse between placement of surface course or seal coat and application of the permanent paint markings. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the RPR.

The edges of the markings shall not vary from a straight line more than 1/2 inch (12 mm) in 50 feet (15 m), and marking dimensions and spacing shall be within the following tolerances:
Marking Dimensions and Spacing Tolerance

<table>
<thead>
<tr>
<th>Dimension and Spacing</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 inch (910 mm) or less</td>
<td>±1/2 inch (12 mm)</td>
</tr>
<tr>
<td>greater than 36 inch to 6 feet</td>
<td>±1 inch (25 mm)</td>
</tr>
<tr>
<td>(910 mm to 1.85 m)</td>
<td></td>
</tr>
<tr>
<td>greater than 6 feet to 60 feet</td>
<td>±2 inch (50 mm)</td>
</tr>
<tr>
<td>(1.85 m to 18.3 m)</td>
<td></td>
</tr>
<tr>
<td>greater than 60 feet (18.3 m)</td>
<td>±3 inch (76 mm)</td>
</tr>
</tbody>
</table>

The paint shall be mixed in accordance with the manufacturer’s instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted.

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads.

Glass beads shall be applied at the rate shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment and distribution should be performed.

**620-3.6 Application--preformed thermoplastic airport pavement markings.**

Preformed thermoplastic pavement markings not used.

**620-3.7 Control strip.** Prior to the initial application of airfield markings, the Contractor shall produce a control strip(s) at a location approved by the RPR to verify the thickness, width, alignment, and glass bead distribution. An initial test strip is required for each piece of equipment to be used on the work and at any time a change of equipment is made. The application of the control strips shall include the application of a minimum of five (5) gallons of paint and the application of fifty (50) pounds of glass beads for truck mounted equipment. A control strip for hand machine(s) shall include a minimum application of two and one half (2.5) gallons of paint and the application of twenty-five (25) pounds of glass beads. Prior to acceptance of the control strip, markings must be evaluated during darkness to ensure a uniform appearance.

Prior to painting on each shift, each paint gun and glass beads dispensing equipment shall be calibrated to apply the proper coverage rate, and to verify the appropriate widths, and glass bead distribution will be achieved with the equipment to be used.

**620-3.8 Retro-reflectance.** Reflectance shall be measured with a portable retro-reflectometer meeting ASTM E1710 (or equivalent). A total of 6 reading shall be taken over a 6 square foot area with 3 readings taken from each direction. The average shall be equal to or above the minimum levels of all readings which are within 30% of each other.
Minimum Retro-Reflectance Values

<table>
<thead>
<tr>
<th>Material</th>
<th>Retro-reflectance (mcd/m²/lux)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White</td>
</tr>
<tr>
<td>Initial Type I</td>
<td>300</td>
</tr>
<tr>
<td>Initial Type III</td>
<td>600</td>
</tr>
<tr>
<td>Initial Thermoplastic</td>
<td>225</td>
</tr>
<tr>
<td>All materials, remark when less than¹</td>
<td>100</td>
</tr>
</tbody>
</table>

¹ ‘Prior to remarking determine if removal of contaminants on markings will restore retro-reflectance

620-3.9 Protection and cleanup. After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the RPR. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes and regulations and the wastes must be tested by PSHIA Environmental before being permitted to leave airport property.

Hazardous materials or solvents used to clean up equipment and materials shall not be used on airport property. The Contractor shall not dispose or dump unused paint into storm drains, drywells, or on the ground.

620-3.10 Removal of Existing and Temporary Paint and Rubber. Painted markings and rubber associated with existing or temporary pavement that will be removed within the demolition limits shall not be performed independently, but will be a part of the pavement demolition operations and be measured and paid for with Item P-101-5.1, Obliterate Pavement Markings. All existing and temporary paint and rubber marking required to be obliterated shall be removed from the surface of the existing pavement shall be measured and paid for with Item P-101-5.1, Obliterate Pavement Markings. Removal of existing pavement markings shall be performed by water blasting methods. Any methods used shall not cause damage to the pavement. Damage is defined as changing the properties of the pavement or removing pavement over 1/16 inch deep. Sand blasting will not be permitted on airfield pavements. Residue from removal operations shall be removed from pavement by sweeping or vacuuming before the residue is blown away.

Any existing paint determined to contain lead, will be removed and disposed offsite. Procedures for the removal and disposal of paint and rubber, along with the location of the disposal site shall be approved by the RPR and the PSHIA Planning and Environmental Division in advance of the work. All paint waste shall be properly stored, contained, and tested on airport property prior to disposal. PSHIA Aviation Planning and Environmental Division must review all waste profiled analytical test results.
METHOD OF MEASUREMENT

620-4.1b The quantity of new paint and markings to be measured for shall be the number of square feet of painting and markings, without glass beads, to the dimensions shown on the Plans or as directed and accepted by the RPR.

620-4.1c The quantity of temporary paint markings to be measured for shall be the number of square feet of painting and markings, with and without glass beads, to the dimensions shown on the Plans or as directed and accepted by the RPR.

BASIS OF PAYMENT

620-5.0 This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item complete in place and accepted by the RPR in accordance with these specifications.

620-5.1 Payment for the accepted quantities of new paint and markings shall be at the contract price for the number of square feet of painting including the reflective media. No separate measurement or payment for painted letters, numbers, or symbols will be made.

620-5.2 Payment for the accepted quantities of temporary paint and markings shall be at the contract price for the number of square feet of temporary painting. No separate measurement or payment for painted letters, numbers, or symbols will be made.

Payment will be made under:

- Item P-620-5.1 Temporary Paint and Markings (without glass beads) – per Square Foot
- Item P-620-5.2 New Permanent Paint and Markings (with and without glass beads) – per Square Foot

REFERENCES

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

ASTM International (ASTM)

- ASTM D476 Standard Classification for Dry Pigmentary Titanium Dioxide Products
- ASTM D1652 Standard Test Method for Epoxy Content of Epoxy Resins
- ASTM D2074 Standard Test Method for Total, Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
- ASTM D2240 Standard Test Method for Rubber Property - Durometer Hardness
<table>
<thead>
<tr>
<th>Standard Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D7585</td>
<td>Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments</td>
</tr>
<tr>
<td>ASTM E303</td>
<td>Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester</td>
</tr>
<tr>
<td>ASTM G154</td>
<td>Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials</td>
</tr>
</tbody>
</table>

**Code of Federal Regulations (CFR)**

- 40 CFR Part 60, Appendix A-7, Method 24: Determination of volatile matter content, water content, density, volume solids, and weight solids of surface coatings

**Federal Specifications (FED SPEC)**

- FED SPEC TT-B-1325D: Beads (Glass Spheres) Retro-Reflective
- FED SPEC TT-P-1952F: Paint, Traffic and Airfield Marking, Waterborne
- FED STD 595: Colors used in Government Procurement

**Commercial Item Description**

- A-A-2886B: Paint, Traffic, Solvent Based

**Advisory Circulars (AC)**

- AC 150/5340-1: Standards for Airport Markings
- AC 150/5320-12: Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces

END OF ITEM P-620
Item D-701 Pipe for Storm Drains and Culverts

DESCRIPTION

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

MATERIALS

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

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

- ASTM C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water.

701-2.3 Concrete. Concrete for pipe cradles shall have a minimum compressive strength of 2000 psi at 28 days and all other concrete shall be 4000 psi at 28 days and conform to the requirements of ASTM C94.

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

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

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

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

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

701-2.9 Precast box culverts. Manufactured in accordance with and conforming to ASTM C1433.
701-2.10 Precast concrete pipe. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or another RPR approved third party certification program.

CONSTRUCTION METHODS

701-3.1 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 12 inches on each side. The trench walls shall be approximately vertical for the first four feet (4') and then shored or sloped per OSHA requirements to the top of existing excavation.

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

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>Pipe Corrugation Depth</th>
<th>Minimum Bedding Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>inch</td>
<td>mm</td>
</tr>
<tr>
<td>1/2</td>
<td>12</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>2-1/2</td>
<td>60</td>
</tr>
</tbody>
</table>

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

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

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

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

**701-3.4 Joining pipe.** Joints shall be made with rubber gaskets. Rubber ring gaskets shall be installed to form a flexible watertight seal.

   **a. Concrete pipe.** Pipe sections at joints shall be fully seated and the inner surfaces flush and even Joints shall be thoroughly wetted before applying mortar or grout.

   **b. Metal pipe.** Metal pipe shall be firmly joined by form-fitting bands conforming to the requirements of ASTM A760 for steel pipe and AASHTO M196 for aluminum pipe. (Not Used).

   **c. PVC, Polyethylene, or Polypropylene pipe.** Joints for PVC, Polyethylene, or Polypropylene pipe shall conform to the requirements of ASTM D3212 when leak resistant joints are required. Joints for PVC and Polyethylene pipe shall conform to the requirements of AASHTO M304 when soil tight joints are required. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M252 or ASTM M294. Fittings for polypropylene pipe shall conform to ASTM F2881, ASTM F2736, or ASTM F2764. (Not Used).

**701-3.5 Embedment and Overfill.** Pipes shall be inspected before any fill material is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor’s expense.
701-3.5-1 Embedment Material Requirements

a. Concrete Pipe. The pipe embedment shall conform to the class specified on the plans. When no embedment class is specified or detailed on the plans, the requirements for Class B bedding shall apply.

   Class A embedment shall consist of a continuous concrete cradle conforming to the plan details. If the concrete cradle does not extend to the top of the pipe, the remaining embedment to one foot above the top of pipe shall be Class B embedment.

   Class B embedment shall consist of a bed of granular material having a thickness of at least 6 inches below the bottom of the pipe and extending to one foot above the pipe. The embedment material shall be sand or selected sandy soil, all of which passes a 3/8-inch sieve and not more than 10 percent of which passes a No. 200 sieve. CLSM conforming to Specification Section P-153 can also be used for embedment material from the bottom of the pipe to one foot above the top of the pipe. Care shall be taken as to not float the pipe.

   Embedment shall be compacted in layers not exceeding 8 inches on both sides of the pipe and shall be brought up to one foot above the top. Care shall be exercised to thoroughly compact the backfill material under the haunches of the pipe. Materials shall be brought up evenly on both sides of the pipe.


c. Metal Pipe. Pipe embedment for metal pipe shall conform to the requirements of Section D-701-3.5-1.

701-3.5-2 Placement of Embedment Material

The embedment material shall be placed in layers not exceeding 6 inches on each side of the pipe and compacted to a density of 95% in accordance with Specification P-152. The embedment material shall extend to one foot above the top of the pipe. Additional material required from one foot above the top of pipe to subgrade elevation or existing natural ground shall also meet the quality and density requirements of P-152. Thoroughly compact the embedment material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

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

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

It shall be the Contractor’s responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.
### 701-3.6 Overfill

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

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

### 701-3.7 Inspection Requirements

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

The Contractor shall furnish all labor, materials, and equipment and use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe interior. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera’s view or interfere with proper documentation of the pipe’s condition. The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe.

### METHOD OF MEASUREMENT

#### 701-4.1

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

### BASIS OF PAYMENT

#### 701-5.0

These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item. No separate payment will be made for ductile iron pipe fittings or connections.

#### 701-5.5

Payment will be made at the contract unit price per linear foot for 10-Inch and 12-Inch DIP Storm Drain Connector Pipe. Payment will be made at the contract unit price per linear foot for 24-inch RGRCP Class V Storm Drain Pipe.
Payment will be made under:

- Item D-701-5.1 10-Inch DIP Storm Drain Connector Pipe - per Linear Foot
- Item D-701-5.2 12-Inch DIP Storm Drain Connector Pipe – per Linear Foot
- Item D-701-5.3 24-Inch RGRCP Cl. V Storm Drain – per Linear Foot

REFERENCES

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

- ASTM C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- ASTM C150 Standard Specification for Portland Cement
- ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water

END ITEM D-701
Item D-751 Manholes, Catch Basins, Inlets and Inspection Holes

DESCRIPTION

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

MATERIALS

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

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

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

751-2.4 Precast concrete pipe manhole rings. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches (90 cm) nor more than 48 inches (120 cm). There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole. Gaskets shall conform to the requirements of ASTM C443.

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

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

   a. Gray iron castings shall meet the requirements of ASTM A48, Class 30B and 35B.
   b. Malleable iron castings shall meet the requirements of ASTM A47.
   c. Steel castings shall meet the requirements of ASTM A27.
   d. Structural steel for grates and frames shall conform to the requirements of ASTM A283, Grade D.
   e. Ductile iron castings shall conform to the requirements of ASTM A536, Grade 65-45-12.
   f. All tempered ductile iron castings shall conform to the requirements of ASTM A897.
   g. Storm Drain & Communication Manholes – Neenah R3492-A Bolted Down Frame and Cover (200,000-pound proof load test), or approved equal, with letters on cover to read “PHOENIX STORM DRAIN”, “PHOENIX SEWER”, and “PHOENIX COMMUNICATIONS.” Slotted manhole frame and covers shall be Neenah 3492-A1, or approved equal.
All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified 100,000 lbs. heavy aircraft design.

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

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

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

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

CONSTRUCTION METHODS

751-3.1 Unclassified excavation.

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

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

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

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

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

751-3.2 Brick structures. Not Used.

751-3.3 Concrete structures. Concrete structures which are to be cast-in-place within the project boundaries shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction shall conform to the requirements specified in Item P-610.
Any reinforcement required shall be placed as indicated on the plans and shall be approved by the RPR before the concrete is placed.

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

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

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

751-3.5 Corrugated metal structures. Not Used.

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

751-3.7 Placement and treatment of castings, frames, and fittings. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the RPR, and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

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

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

751-3.8 Installation of steps. Not Used.

751-3.9 Backfilling.

   a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches in loose depth, and compacted to the density
required in Item P-152. If material is not designated on the plans, approved materials shall conform to P-152, P-153, P-209, or P-219 requirements. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

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

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

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

**METHOD OF MEASUREMENT**

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

**BASIS OF PAYMENT**

**751-5.1** The accepted quantities of manholes, catch basins, inlets, and inspection holes will be paid for at the contract unit price per each in place when completed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor equipment, tools and incidentals necessary to complete the structure.

Payment will be made under:

- **Item D-751-5.1** Aircraft Rated Manhole Cap (Detail 1, A.CG-106) - per Each
- **Item D-751-5.2** Storm Drain Manhole Riser (COP STD DET P1520, MAG STD DET 522) – per Each
- **Item D-751-5.3** Catch Basin, Type F (MAG STD DET 535, with Bolted Grate) – per Each
- **Item D-751-5.4** Connect to Existing Pipe (MAG STD DET 505) – per Each

**REFERENCES**

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

- ASTM C32: Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
- ASTM C144: Standard Specification for Aggregate for Masonry Mortar
- ASTM C478: Standard Specification for Precast Reinforced Concrete Manhole Sections
- ASTM C913: Standard Specification for Precast Concrete Water and Wastewater Structures

American Association of State Highway and Transportation Officials (AASHTO)

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

END OF ITEM D-751
Item D-752 Trench Drains

DESCRIPTION

752-1.1 This item shall consist of the airfield rated trench drain constructed in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the RPR.

MATERIALS

752-2.1 Concrete. Reinforced concrete shall meet the requirements of Item P-610.

752-2.2 Reinforcing Steel. Shall meet the requirements of P-610.

752-2.3 Joint Filler and Pre-molded Material. The pre-formed joint filler materials and pre-molded joint material shall conform to Item P-604 and P-605.

752-2.4 10-inch and 12-inch DIP Outlet Pipe to Collector System. The trench drain outlet pipe, from the trench drain to the collector system, shall be 10-inch or 12-inch DIP mechanical joint pipe per specification P-701 as depicted on the project plans.

752-2.5 Trench Drain Frame and Grate Materials. Trench drain frame and grate shall meet the requirements of Neenah Frame and Grate Type R-4993-DAB with Type A grate and Type T frame, or approved equal. The grates shall be bolted with SAE stainless bolts. Each end of the trench drain section shall have lift grates (Neenah Frame and Grate Type R-4993-DAH with Type A grate and Type T frame, LiftMate Series, or approved equal) to enable flushing and cleaning. The design load shall be 100,000 pounds or more.

CONSTRUCTION METHODS

752-3.1 Foundation and Reinforcing Steel.

a. Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades and elevations shown on the plans per P-152 requirements. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure reinforcing steel shown. The elevations of the bottoms of the encasement, as shown on the plans, shall be considered as approximate only; and the RPR may approve, in writing, changes in dimensions or elevations of encasement necessary to secure a satisfactory foundation.

b. The Contractor shall do all bracing (to ensure grade and to resist floating), sheathing, or shoring necessary to perform and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for trench drain.
c. All bracing, sheathing, or shoring shall be removed by the Contractor after the completion of the structure. Removal shall be not disturb or damage the finished concrete. The cost of removal shall be included in the unit price bid for trench drain.

d. After each excavation is completed, the Contractor shall notify the RPR. No concrete (reinforcing steel shall be placed) until the RPR has approved the depth of the excavation, the character of the foundation material, and the reinforcing steel placement.

e. Isolation joints of the type called for in the plans shall be constructed around the perimeter of the trench drain concrete.

f. The trench drain outlet shall be connected to the trench drain and the outlet collector pipe or structure in accordance with the details shown on the plans, or RPR approved means.

752-3.2 Backfilling.

a. After a structure has been completed, backfilling with approved material shall be accomplished by applying the fill in horizontal layers not to exceed 8 inches in loose depth, and compacted. The field density of the compacted material shall be at least 100% of the maximum density for cohesive soils and 95% of the maximum density for non-cohesive soils. The maximum density shall be determined in accordance with ASTM D1557. The field density shall be determined in accordance with ASTM D1556.

b. No backfilling shall be placed against any structure until approved by the RPR. For concrete, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill or the placement methods.

c. The requirement of the thickened edge of the adjacent panels for aircraft load transfer shall be paid under the P-501 cement concrete pavement item of the adjacent paving item.

d. Installation of Frames and Grates. Trench Drain frames and grates shall be installed in accordance with the details shown on the plans. Frames and grates shall be suspended to obtain the correct finish elevation and alignment with devices acceptable to the RPR. Concrete shall be placed in horizontal lifts not exceeding 24” in depth and consolidated in a manner that will not dislodge or float the suspended trench drain frame and grates.

e. If the adjacent concrete pavement is placed prior to excavation of the trench drains, there will be no backfill required.

752-3.3 Cleaning and restoration of site. After the concrete placement is completed, the Contractor shall dispose of all surplus material from the site. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

After the trench drain and adjacent pavement have been completed, the surrounding area or pavement shall be flooded with water to confirm the trench drain receives, conveys, and drains properly.
METHOD OF MEASUREMENT

752-4.1 The quantity of unclassified excavation for trench drain excavation shall be incidental to the work.

752-4.2 Concrete (P-610) shall be incidental to the work, complete in place and accepted. No measurements or other allowances shall be made for forms, false work, cofferdams, pumping, bracing, isolation joints, reinforcing steel or embedded items, or finishing of the concrete.

752-4.3 Joint filler shall be measured per the P-604 or P-605 contract specifications.

752-4.4 The trench drain outlet pipe work shall be measured and paid for under the P-701 12-inch DIP Outlet Pipe specification item.

752-4.5 The quantity of trench drain shall be the length of linear feet, including concrete end blocks, placed as shown on the plans, completed, in-place, and accepted.

BASIS OF PAYMENT

752-5.1 Payment will be made at the contract unit price per linear foot for trench drain. These unit prices shall be full compensation for furnishing all materials and for all preparation, excavation, and placing the isolation and reinforcing steel, and for all labor, equipment, tools, and incidentals necessary to complete the trench drain.

Payment will be made under:

Item D-752-5.1 Trench Drain - per Linear Foot

END OF ITEM D-752
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Item L-108 Underground Power Cable for Airports

DESCRIPTION

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

EQUIPMENT AND MATERIALS

108-2.1 General.

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

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

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

d. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor’s submittals shall be electronically submitted in pdf format. The RPR reserves the right to reject any and all equipment, materials, or procedures that do not meet the system design and the standards and codes, specified in this document.
f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner. The Contractor shall maintain a minimum insulation resistance in accordance with paragraph 108-3.10e with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period when tested in accordance with AC 150/5340-26, Maintenance Airport Visual Aid Facilities, paragraph 5.1.3.1, Insulation Resistance Test.

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

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

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

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

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

108-2.3 Bare copper wire (counterpoise, bare copper wire ground and ground rods). Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare solid copper wire for counterpoise and/or No. 6 AWG insulated stranded for grounding bond wire per ASTM B3 and ASTM B8, and shall be bare copper wire. For voltage powered circuits, the equipment grounding conductor shall comply with NEC Article 250.
Ground rods shall be copper or copper-clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than 10 feet (2.54 m) long and 3/4 inch (19 mm) in diameter.

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

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

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

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

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

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

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

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

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

108-2.7 Flowable backfill. Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.
108-2.8 **Cable identification tags.** Cable identification tags shall be made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.

108-2.9 **Tape.** Electrical tapes shall be Scotch™ Electrical Tapes –Scotch™ 88 (1-1/2 inch (38 mm) wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch (50 mm) wide), as manufactured by the Minnesota Mining and Manufacturing Company (3M™), or an approved equivalent.

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

108-2.11 **Existing circuits.** Whenever the scope of work requires connection to an existing circuit, the existing circuit’s insulation resistance shall be tested, in the presence of the RPR. The test shall be performed per this item and prior to any activity that will affect the respective circuit. The Contractor shall record the results on forms acceptable to the RPR. When the work affecting the circuit is complete, the circuit’s insulation resistance shall be checked again, in the presence of the RPR. The Contractor shall record the results on forms acceptable to the RPR. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the existing circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance (O&M) Manual.

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

**CONSTRUCTION METHODS**

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

Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor shall be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections unless otherwise authorized in writing by the RPR or shown on the plans.

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

Provide not less than 3 feet (1 m) of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at least one foot (30 cm) vertically above the top of the access structure. This
requirement also applies where primary cable passes through empty light bases, junction boxes, and access structures to allow for future connections, or as designated by the RPR.

Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans.

108-3.2 Installation in duct banks or conduits. This item includes the installation of the cable in duct banks or conduit per the following paragraphs. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

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

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

Duct banks or conduits shall be installed as a separate item per Item L-110, Airport Underground Electrical Duct Banks and Conduit. The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to ensure that the duct bank or conduit is open, continuous and clear of debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, light bases, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be re-cleaned at the Contractor’s expense. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

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

The Contractor shall submit the recommended pulling tension values to the RPR prior to any cable installation. If required by the RPR, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the RPR. Cable pull tensions shall be recorded by the Contractor and reviewed by the RPR. Cables exceeding the maximum allowable pulling tension values shall be removed and replaced by the Contractor at the Contractor’s expense.
The manufacturer’s minimum bend radius or NEC requirements (whichever is more restrictive) shall apply. Cable installation, handling and storage shall be per manufacturer’s recommendations. During cold weather, particular attention shall be paid to the manufacturer’s minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer’s minimum installation temperature. At the Contractor’s option, the Contractor may submit a plan, for review by the RPR, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer’s minimum cable installation temperature.

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

108-3.3 Installation of direct-buried cable in trenches. NOT USED.

108-3.4 Cable markers for direct-buried cable. NOT USED.

108-3.5 Splicing. NOT USED.

108-3.6 Bare counterpoise wire installation for lightning protection and grounding. If shown on the plans or included in the job specifications, bare solid #6 AWG copper counterpoise wire shall be installed for lightning protection of the underground cables.

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

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

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

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

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

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

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

   All components rise and fall at the same potential; with no potential difference, no damaging arcing and no damaging current flow.
See AC 150/5340-30, Design and Installation Details for Airport Visual Aids and NFPA 780, Standard for the Installation of Lightning Protection Systems, Chapter 11, for a detailed description of the Equipotential Method of lightning protection.

Reference FAA STD-019E, Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment, Part 4.1.1.7.[not used]

b. Isolation. NOT USED

c. Common Installation requirements. 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.

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

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

The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet (150 m) apart around the entire circuit. The counterpoise system shall be continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode-grounding system. The connections shall be made as shown on the plans and in the specifications.

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

d. Parallel Voltage Systems. Provide grounding and bonding in accordance with NFPA 70, National Electrical Code.

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

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

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

108-3.9 Exothermic bonding. Bonding of counterpoise wire shall be by the exothermic welding process or equivalent method accepted by the RPR. Only personnel experienced in and regularly engaged in this type of work shall make these connections.
Contractor shall demonstrate to the satisfaction of the RPR, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer’s recommendations and the following:

a. All slag shall be removed from welds.

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

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

108-3.10 Testing. The Contractor shall furnish all necessary equipment and appliances for testing the airport electrical systems and underground cable circuits before and after installation. The Contractor shall perform all tests in the presence of the RPR. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the RPR. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

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

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

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

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

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

e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than 1 megohms. Verify continuity of all series airfield lighting circuits prior to energization.

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

g. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.
h. That all affected circuits (existing and new) are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.

i. That the impedance to ground of each ground rod does not exceed 20 ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test shall be used, as described by American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81, to verify this requirement. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. Test equipment and its calibration sheets shall be submitted for review and approval by the RPR prior to performing the testing.

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

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

METHOD OF MEASUREMENT

108-4.1 Trenching shall be measured by the linear feet of trench, including the excavation, conduits, backfill, and restoration, completed, measured as excavated, and accepted as satisfactory. When specified, separate measurement shall be made for trenches of various specified widths.

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

108-4.2 Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet installed and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. The measurement for this item shall not include additional quantities required for slack. Cable and counterpoise slack is considered incidental to this item and is included in the Contractor’s unit price. No separate measurement or payment will be made for cable or counterpoise slack. No separate measurement or payment will be made for markers, which are incidental to the cable or duct bank pay item.

108-4.3 Ground rods if required, shall be incidental to the bid items. No separate measurement or payment will be made for the ground rod and incidentals.

BASIS OF PAYMENT

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

- **Item L-108-5.1**  
  Installation of Power from Obstruction Lights to Terminal Building (Below Ground) - per Linear Foot

- **Item L-108-5.2**  
  Installation of Power from Existing Taxiway Edge Light to New Taxiway Edge Light - per Linear Foot

- **Item L-108-5.3**  
  Installation of Grounding Conductor from Existing Taxiway Edge Light to New Taxiway Edge Light - per Linear Foot

REFERENCES

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

**Advisory Circulars (AC)**

- AC 150/5340-26  
  Maintenance of Airport Visual Aid Facilities

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

- AC 150/5345-7  
  Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits

- AC 150/5345-26  
  Specification for L-823 Plug and Receptacle, Cable Connectors

- AC 150/5345-53  
  Airport Lighting Equipment Certification Program

**Commercial Item Description**

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

- A-A-55809  
  Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic ASTM International (ASTM)

- ASTM B3  
  Standard Specification for Soft or Annealed Copper Wire

- ASTM B8  
  Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

- ASTM B33  
  Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes

- ASTM D4388  
  Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes Mil Spec

- MIL-PRF-23586F  
  Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical

- MIL-I-24391  
  Insulation Tape, Electrical, Plastic, Pressure Sensitive National Fire Protection Association (NFPA)

- NFPA-70  
  National Electrical Code (NEC)
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<tr>
<td>FAA STD-019E</td>
<td>Lightning and Surge Protection, Grounding Bonding and Shielding Requirements for Facilities and Electronic Equipment</td>
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END OF ITEM L-108
Item L-110 Airport Underground Electrical Duct Banks and Conduits

DESCRIPTION

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

EQUIPMENT AND MATERIALS

110-2.1 General.

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

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

c. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

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

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner.

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

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

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

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

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

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

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

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

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

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

110-2.5 Conduit spacers. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads. They shall be designed to accept No. 4 reinforcing bars installed vertically.
110-2.6 Concrete. Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures.

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

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

110-2.9 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) red (electrical power lines, cables, conduit and lighting cable), orange (telephone/fiber optic cabling) with continuous legend magnetic tape shall be polyethylene film with a metallized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item.

CONSTRUCTION METHODS

110-3.1 General. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The RPR shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches (50 mm) inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches (75 mm) per 100 feet (30 m). On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. Under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade; in other locations, the top of the duct bank or underground conduit shall be not less than 18 inches (0.5 m) below finished grade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch (6 mm) smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

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

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200-pound (90 kg) test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back
into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet (1.5 m).

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

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

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

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

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

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

Joints in plastic conduit shall be prepared per the manufacturer’s recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (60 cm).

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

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the RPR, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the RPR.
All excavation shall be unclassified and shall be considered incidental to Item L-110. Dewatering necessary for duct installation, and erosion per federal, state, and local requirements is incidental to Item L-110.

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

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

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

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

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

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

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

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 inches (75 mm) apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches (75 mm) thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor
shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot (1.5-m) intervals.

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

Install a plastic, detectable, color as noted, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

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

110-3.3 Conduits without concrete encasement. Trenches for single-conduit lines shall be not less than 6 inches (150 mm) nor more than 12 inches (300 mm) wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch (6.3 mm) sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport’s secured area where trespassing is prohibited are at least 18 inches (0.5 m) below the finished grade. Conduits outside the Airport’s secured area shall be installed so that the tops of the conduits are at least 24 inches (60 cm) below the finished grade per National Electric Code (NEC), Table 300.5.

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and lot less than 6 inches (150 mm) apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.
Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the RPR for review prior to use.

110-3.4 Markers. The location of each end and of each change of direction of conduits and duct banks shall be marked by a concrete slab marker 2 feet (60 cm) square and 4 - 6 inches (100 - 150 mm) thick extending approximately one inch (25 mm) above the surface. The markers shall also be located directly above the ends of all conduits or duct banks, except where they terminate in a junction/access structure or building. Each cable or duct run from a line of lights and signs to the equipment vault must be marked at approximately every 200 feet (61 m) along the cable or duct run, with an additional marker at each change of direction of cable or duct run.

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

110-3.5 Backfilling for conduits. For conduits, 8 inches (200 mm) of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 except that material used for back fill shall be select material not larger than 4 inches (100 mm) in diameter.

Flowable backfill may alternatively be used.

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

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

110-3.6 Backfilling for duct banks. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 “Excavation and Embankment” except that the material used for backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the requirements of Item P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet (76 m) of duct bank or one work period’s construction, whichever is less.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.
The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

**110-3.7 Restoration.** 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 paving 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.

**110-3.8 Ownership of removed cable.** Dispose of all cable removed per local and airport standards.

**METHOD OF MEASUREMENT**

**110-4.1** Underground conduits and duct banks shall be measured by the linear feet (meter) of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated material, and restoration, and for drain lines, the termination at the drainage structure, all measured in place, completed, and accepted. No separate measurement or payment will be made for markers, which are incidental to the cable or duct bank pay item.

**BASIS OF PAYMENT**

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

Payment will be made under:

- Item L-110-5.1 Concrete Encased Electrical Conduit, 1-Way 2-inch from Existing Taxiway Edge Light to New Taxiway Edge Light - per linear foot

  Note: The concrete utilized above would be minimum 3000 psi up to 4000 psi concrete as specified in Item L-110-2.6.

**REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
Advisory Circular (AC)
   AC 150/5340-30 Design and Installation Details for Airport Visual Aids
   AC 150/5345-53 Airport Lighting Equipment Certification Program

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

National Fire Protection Association (NFPA)
   NFPA-70 National Electrical Code (NEC)

Underwriters Laboratories (UL)
   UL Standard 6 Electrical Rigid Metal Conduit - Steel
   UL Standard 514B Conduit, Tubing, and Cable Fittings
   UL Standard 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
   UL Standard 1242 Electrical Intermediate Metal Conduit Steel
   UL Standard 651 Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
   UL Standard 651A Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110
Item L-115 Electrical Manholes and Junction Structures

DESCRIPTION

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

EQUIPMENT AND MATERIALS

115-2.1 General.

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

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

c. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are of good quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

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

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from the
date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner.

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

115-2.3 Precast concrete structures. Not used.

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

115-2.5 Mortar. Not used.

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

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

- a. ASTM A48 Gray iron castings
- b. ASTM A47 Malleable iron castings
- c. ASTM A27 Steel castings
- d. ASTM A283, Grade D Structural steel for grates and frames
- e. ASTM A536 Ductile iron castings
- f. ASTM A897 Austempered ductile iron castings

All castings specified shall withstand a maximum tire pressure of 250 psi and maximum load of 200,000 lbs.

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

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

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

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

Each manhole shall be provided with a “DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER” safety warning sign as detailed in the Contract Documents and in accordance with OSHA 1910.146 (c)(2).
115-2.8 Ladders. NOT USED.

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

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

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

115-2.12 Cable trays. Not used.


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

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

115-2.16 Ground rods. Ground rods shall be one piece copper. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 8 feet (2.4 m) long nor less than 5/8 inch (16 mm) in diameter.

CONSTRUCTION METHODS

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

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

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

Boulders, logs and all other objectionable material encountered in excavation shall be removed. All rock and other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the RPR. All seams, crevices, disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.
The Contractor shall provide all bracing, sheeting and shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheeting and shoring shall be included in the unit price bid for the structure.

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

After each excavation is completed, the Contractor shall notify the RPR. Structures shall be placed after the RPR has approved the depth of the excavation and the suitability of the foundation material. Prior to installation the Contractor shall provide a minimum of 6 inches (150 mm) of sand or a material approved by the RPR as a suitable base to receive the structure. The base material shall be compacted and graded level and at proper elevation to receive the structure in proper relation to the conduit grade or ground cover requirements, as indicated on the plans.

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

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

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

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

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

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

**115-3.5 Installation of ladders.** Ladders shall be installed such that they may be removed if necessary. Mounting brackets shall be supplied top and bottom and shall be cast in place during fabrication of the structure or drilled and grouted in place after erection of the structure.
**115-3.6 Removal of sheeting and bracing.** In general, all sheeting and bracing used to support the sides of trenches or other open excavations shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a structure shall be withdrawn, unless otherwise directed, before more than 6 inches (150 mm) of material is placed above the top of the structure and before any bracing is removed. Voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.

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

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

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

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

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

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

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of one foot (30 cm) above the floor of the structure and separate from other cables. No. 2 American wire gauge (AWG) bare copper pigtails shall bond the grounding bus to all cable trays and other metal hardware within the concrete structure. Connections to the grounding bus shall be exothermic. If an exothermic weld is not possible, connections to the grounding bus shall be made by using connectors approved for direct burial in soil or concrete per UL 467. Hardware connections may be mechanical, using a lug designed for that purpose.
115-3.10 Cleanup and repair. After erection of all galvanized items, damaged areas shall be repaired by applying a liquid cold-galvanizing compound per MIL-P-21035. Surfaces shall be prepared and compound applied per the manufacturer’s recommendations.

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

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

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

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

Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

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

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

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

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

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

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

**METHOD OF MEASUREMENT**

115-4.1 Electrical manholes and junction structures shall be measured by each unit completed in place and accepted. The following items shall be included in the price of each unit: All required excavation and dewatering; sheeting and bracing; all required backfilling with on-site materials; restoration of all surfaces and finished grading and turfing; all required connections; temporary cables and connections; and ground rod testing.

115-4.2 Manhole elevation adjustments shall be measured by the completed unit installed, in place, completed, and accepted. Separate measurement shall not be made for the various types and sizes.

**BASIS OF PAYMENT**

115-5.1 The accepted quantity of electrical manholes, canisters 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 manhole 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 RPR.

Payment will be made under:

Item L-115-5.1 Electrical Junction Structure Taxiway Edge Light Canister - per Each

**REFERENCES**

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

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


Advisory Circular (AC)

- AC 150/5345-7 Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26 Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-42 Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
AC 150/5340-30 Design and Installation Details for Airport Visual Aids
AC 150/5345-53 Airport Lighting Equipment Certification Program

Commercial Item Description (CID)
A-A 59544 Cable and Wire, Electrical (Power, Fixed Installation)

ASTM International (ASTM)
ASTM A27 Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47 Standard Specification for Ferritic Malleable Iron Castings
ASTM A48 Standard Specification for Gray Iron Castings
ASTM 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

EB #83 In Pavement Light Fixture Bolts

Mil Spec
MIL-P-21035 Paint High Zinc Dust Content, Galvanizing Repair National Fire Protection Association (NFPA)
NFPA-70 National Electrical Code (NEC)

END OF ITEM L-115
Item L-119 Airport Obstruction Lights

DESCRIPTION

119-1.1 This item shall consist of furnishing and installing obstruction lights per these specifications. Included in this item shall be the furnishing and installing of wood poles, steel or iron pipes, or other supports as required in the plans or specifications and in accordance with the requirements in advisory circular (AC) 70/7460-1, Obstruction Marking and Lighting.

This item shall also include all wire and cable connections, the furnishing and installing of all necessary conduits and fittings, insulators, pole steps, pole cross arms, and the painting of poles and pipes. In addition, it includes the furnishing and installing of all lamps and, if required, the furnishing and installing of insulating transformers, the servicing and testing of the installation and all incidentals necessary to place the lights in operation as completed units to the satisfaction of the RPR.

EQUIPMENT AND MATERIALS

119-2.1 General.

a. Airport lighting equipment and materials covered by specifications shall be certified under AC 150/5345-53, Airport Lighting Equipment Certification Program (ALECP) and listed in the ALECP 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 RPR.

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

d. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in the project that accrue directly or indirectly from late submissions or resubmissions of submittals.
e. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor’s submittals shall be submitted electronically in pdf format, tabbed by specification section. The RPR reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes, specified in this document.

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 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.

119-2.2 Obstruction lights. The obstruction lighting assembly shall be Type L-810 meeting the requirements of AC 150/5345-43, Specification for Obstruction Lighting Equipment.

119-2.3 Isolation transformers. Where required for series circuits, the isolation transformers shall conform to the requirements of AC 150/5345-47, Specification for Series to Series Isolation Transformers for Airport Lighting Systems.

119-2.4 Transformer housing. Transformer housings, if specified, shall be per AC 150/5345-42, Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories.

119-2.5 Conduit. Steel conduit and fittings shall be per Underwriters Laboratories Standards 6, 514B, and 1242.

119-2.6 Plastic conduit (for use below grade only). Plastic conduit and fittings shall be per:

- UL 514B covers W-C-1094 - Conduit fittings all types, classes 1 through 3 and 6 through 10 at 690 volts
- 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 and must 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.

119-2.7 Electrical wire and cable. For ratings up to 600 volts, moisture and heat resistant thermoplastic wire conforming to Commercial Item Description A-A-59544A, Type THWN-2, shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal. Overhead line wire from pole to pole, where specified, shall be per American National Standards Institute/Insulated Cable Engineers Association (ANSI/ICEA) S-70-547-2007.

119-2.8 Miscellaneous. Paint, poles, pole steps, insulators, and all other miscellaneous materials necessary for the completion of this item shall be new and first-grade commercial products. These products shall be as specified in the plans or specifications.
CONSTRUCTION METHODS

119-3.1 Placing the obstruction lights. The Contractor shall furnish and install single-or double-obstruction lights as specified and shown in the plans. The obstruction lights shall be mounted on poles, buildings, or towers at approximately the location shown in the plans. The exact location shall be approved by the RPR in accordance with AC 70/7460-1, Obstruction Marking and Lighting.

119-3.2 Installation on poles. Where obstruction lights are to be mounted on poles, each obstruction light shall be installed with its hub at least as high as the top of the pole. All wiring shall be run in not less than one inch (25 mm) galvanized rigid steel conduit. If specified, pole steps shall be furnished and installed, the lowest step being 5 feet (1.5 m) above ground level. Steps shall be installed alternately on diametrically opposite sides of the pole to give a rise of 18 inches (0.5 m) for each step. Conduit shall be fastened to the pole with galvanized steel pipe straps and shall be secured by galvanized lag screws. Poles shall be painted as shown in the plans and specifications.

When obstruction lights are installed on existing telephone or power poles, a large fiber insulating sleeve of adequate diameter and not less than 4 feet (1.2 m) long, shall be installed to extend 6 inches (150 mm) above the conductors on the upper cross arm. In addition, the sleeve shall be at least 18 inches (0.5 m) below the conductors on the lower cross arm. The details of this installation shall be per the plans.

119-3.3 Installation on beacon tower. Where obstruction lights are installed on a beacon tower, two obstruction lights shall be mounted on top of the beacon tower using one inch (25 mm) conduit. The conduit shall screw directly into the obstruction light fixtures and shall support them at a height of not less than 4 inches (100 mm) above the top of the rotating beacon. If obstruction lights are specified at lower levels, the Contractor shall install not less than one inch (25 mm) galvanized rigid steel conduit with standard conduit fittings for mounting the fixtures. The fixtures shall be mounted in an upright position in all cases. The conduit shall be fastened to the tower members with Wraplock® straps (or equivalent), clamps, or approved fasteners spaced approximately 5 feet (1.5 m) apart. Three coats of international orange paint per Federal Specification 595, Number 12197 shall be applied (one prime, one body, and one finish coat) to all exposed material installed.

119-3.4 Installation on buildings, towers, smokestacks, etc. Where obstruction lights are to be installed on buildings or similar structures, the installation shall be made per the details shown in the plans. The hub of the obstruction light shall be not less than one foot (30 cm) above the highest point of the obstruction except in the case of smokestacks where the uppermost units shall be mounted not less than 5 feet (1.5 m), nor more than 10 feet (3 m) below the top of the stack. Conduit supporting the obstruction light units shall be fastened to wooden structures with galvanized steel pipe straps and shall be secured by 1-1/2 inch (38 mm) No. 10 galvanized wood screws. Conduit shall be fastened to masonry structures by the use of expansion shields, screw anchors, or toggle bolts using No. 10, or larger, galvanized wood or machine screws. Conduit fastened to structural steel shall have the straps held with not less than No. 10 roundhead machine screws in drilled and tapped holes. Fastenings shall be approximately 5 feet (1.5 m) apart. Three coats of paint shall be applied (one prime, one body, and one finish coat) with color per Federal Specification 595, international orange, number 12197 paint to all exposed material installed.
119-3.5 Series isolation transformers. If it is designed for use in a series lighting circuit, the L-810 series obstruction light does not include a film cutout. Therefore, an isolation transformer is required with each series lamp. Double series units of this type require two isolation transformers. The transformer shall be housed in a light base per paragraph 119-2.4 or buried directly in the earth per the details shown in the plans.

119-3.6 Wiring. The Contractor shall furnish all necessary labor and materials. The Contractor shall make complete electrical connections from the underground cable or other source of power per the wiring diagram furnished with the project plans. If underground cable is required for the power feed and if duct is required under paved areas, the cable and duct shall be installed per and paid for as described in Item L-108, Underground Power Cable for Airports, and Item L-110, Airport Underground Electrical Duct Banks and Conduit.

119-3.7 Lamps. The Contractor shall furnish and install in each unit one or two lamps that are per the manufacturer’s requirements. Provide two lamp sets as spares.

119-3.8 Tests. The installation shall be fully tested by continuous operation for not less than 1/2 hour as a completed unit prior to acceptance. These tests shall include the functioning of each control not less than 10 times.

METHOD OF MEASUREMENT

119-4.1 The quantity of lights to be paid for under this item shall be the number of single- or double-type obstruction lights installed and accepted as completed units, in place, ready for operation.

BASIS OF PAYMENT

119-5.1 Payment will be made at the contract unit price for each completed obstruction light installed, in place by the Contractor, and accepted by the RPR. 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. No separate measurement shall be made for grounding rods, above ground conduit or cable, or additional incidentals necessary to complete the work described herein and shall be considered incidental to the obstruction light bid item.

Payment will be made under:

Item L-119-5.1 Airport Obstruction Light Type L-810, in Place - per each

REFERENCES

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

Advisory Circulars (AC)

AC 70/7460-1 Obstruction Marking and Lighting
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 150/5345-42 Specification for Airport Light Bases, Transformer Housing, Junction Boxes, and Accessories
AC 150/5345-43 Specification for Obstruction Lighting Equipment
AC 150/5345-47 Specification for Series to Series Isolation Transformers for Airport Lighting Systems
AC 150/5345-53 Airport Lighting Equipment Certification Program

American National Standards Institute / Insulated Cable Engineers Association (ANSI/ICEA)
ANSI/ICEA S-70-547 Standards for Weather-Resistant Polyolefin Covered Connectors Commercial Item Description (CID)
A-A-59544A Cable and Wire, Electrical (Power, Fixed Installation)

Federal Standard (FED STD)
FED STD 595 Colors used in Government Procurement National Fire Protection Association (NFPA)
NFPA-70 National Electrical Code (NEC) Underwriters Laboratories (UL)
UL Standard 6 Electrical Rigid Metal Conduit – Steel
UL Standard 514B Conduit, Tubing, and Cable Fittings Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL Standard 651 Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL Standard 651A Type EB and A Rigid PVC Conduit and HDPE Conduit
UL Standard 1242 Electrical Intermediate Metal Conduit - Steel

END OF ITEM L-119
Item L-125 Installation of Airport Lighting Systems

DESCRIPTION

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

EQUIPMENT AND MATERIALS

125-2.1 General.

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

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

c. All materials and equipment used shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be clearly made with arrows or circles (highlighting is not acceptable). The Contractor shall be responsible for delays in the project accruing directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the RPR, to determine compliance with the plans and specifications. The Contractor’s submittals shall be submitted electronic PDF format, tabbed by specification section. The RPR reserves the right to reject any or all equipment, materials or procedures, which, in the RPR’s opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final
acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner.

f. All LED light fixtures, with the exception of obstruction lighting (AC 150/5345-43) must be warranted by the manufacturer for a minimum of 4 years after date of installation inclusive of all electronics.” Obstruction lighting warranty is set by the individual manufacturer.

### EQUIPMENT AND MATERIALS

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

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

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

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

**125-2.6 Retroreflective Markers.** Not used.

**125-2.7 Runway and Taxiway Lights.** Runway and taxiway lights shall conform to the requirements of AC 150/5345-46. Lamps shall be of size and type indicated, or as required by fixture manufacturer for each lighting fixture required under this contract. Filters shall be of colors conforming to the specification for the light concerned or to the standard referenced.

<table>
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<th>Type</th>
<th>Class</th>
<th>Mode</th>
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**125-2.8 Runway and Taxiway Signs.** Runway and Taxiway Guidance Signs should conform to the requirements of AC 150/5345-44.

<table>
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<tr>
<th>Signs</th>
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**125-2.9 Runway End Identifier Light (REIL).** Not used

**125-2.10 Precision Approach Path Indicator (PAPI).** Not used

**125-2.11 Circuit Selector Cabinet.** Not used

**125-2.12 Light Base and Transformer Housings.** Light Base and Transformer Housings should conform to the requirements of AC 150/5345-42. Light bases shall be Type L-868, Class 1B, Size B shall
be provided as indicated or as required to accommodate the fixture or device installed thereon. Base plates, cover plates, and adapter plates shall be provided to accommodate various sizes of fixtures.

**125-2.13 Isolation Transformers.** Isolation Transformers shall be Type L-830, size as required for each installation. Transformer shall conform to AC 150/5345-47.

### INSTALLATION

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

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

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

[ Insert project specific installation information from AC 150/5345-30 as required.]

**125-3.2 Testing.** All lights shall be fully tested by continuous operation for not less than 24 hours as a completed system prior to acceptance. The test shall include operating the constant current regulator in each step not less than 10 times at the beginning and end of the 24-hour test. The fixtures shall illuminate properly during each portion of the test.

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

**125-3.4 Elevated and In-pavement Lights.** Water, debris, and other foreign substances shall be removed prior to installing fixture base and light.

A jig or holding device shall be used when installing each light fixture to ensure positioning to the proper elevation, alignment, level control, and azimuth control. Light fixtures shall be oriented with the light beams parallel to the runway or taxiway centerline and facing in the required direction. The outermost edge of fixture shall be level with the surrounding pavement. Surplus sealant or flexible embedding material shall be removed. The holding device shall remain in place until sealant has reached its initial set.

### METHOD OF MEASUREMENT

**125-4.1 Runway and taxiway lights will be measured by the number of each type installed as completed units in place, ready for operation, and accepted by the RPR. Obstruction lights will be measured by the number of each type installed as completed units in place, ready for operation, and accepted by the RPR**
BASIS OF PAYMENT

125-5.1 Payment will be made at the Contract unit price for each complete runway or taxiway light, guidance sign, reflective marker, runway end identification light, precision approach path indicator, or abbreviated precision approach path indicator installed by the Contractor and accepted by the RPR. This payment will be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Item L-125-2.7 Taxiway Edge Light Type L-861 – per each

REFERENCES

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

Advisory Circulars (AC)

AC 150/5340-18 Standards for Airport Sign Systems
AC 150/5340-26 Maintenance of Airport Visual Aid Facilities
AC 150/5340-30 Design and Installation Details for Airport Visual Aids
AC 150/5345-5 Circuit Selector Switch
AC 150/5345-7 Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26 Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-28 Precision Approach Path Indicator (PAPI) Systems
AC 150/5345-39 Specification for L-853, Runway and Taxiway Retroreflective Markers
AC 150/5345-42 Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
AC 150/5345-44 Specification for Runway and Taxiway Signs
AC 150/5345-46 Specification for Runway and Taxiway Light Fixtures
AC 150/5345-47 Specification for Series to Series Isolation Transformers for Airport Lighting Systems
AC 150/5345-51 Specification for Discharge-Type Flashing Light Equipment
AC 150/5345-53 Airport Lighting Equipment Certification Program Engineering Brief (EB)
EB No. 67 Light Sources Other than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures
END OF ITEM L-125