DALLAS-FORT WORTH INTERNATIONAL AIRPORT
Northeast End Around Taxiway Package II

Contract No. 9500723
Permit No. A20-111B
Issued for Bid
April 23, 2020
Volume 1 of 2

STANDARD SPECIFICATION BOOK
VERSION 2
PUBLISH DATE
December 07, 2018
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| **Electrical** |       |           |
| Name:          |       |           |
| Robert E Leazure |       |           |
| License/Registration #: |       |           |
| 82701           |       |           |
| Firm Name / Registration #: |       |           |
| CH2M / F-2297   |       |           |

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Incorporated into the Contract Documents will be the Dallas-Fort Worth International Airport Standard Specification Book Version 2, Published December 07, 2018, and can be found at [https://www.dfwairport.com/business/solicitations](https://www.dfwairport.com/business/solicitations).

Any Section marked as “Applicable” below is hereby incorporated into the Project Manual by reference. Any Section revised or a new Section to be added to supersede the above published document are as indicated and dated below and are hereby included in the Project Manual. Any Section included in the published book that are not included in the table below are not included in the Project Manual.

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Contract No. 9500723

Issued for Bid

Permit No. A20-111B

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April 23, 2020
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PART 1 – GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

The Work of this Contract consists of the complete construction of Taxiways, N, EE, widening of existing Taxiways P, R, N, and Y, relocation of the ARFF roadway, relocation of the AOA fence, the construction of a blast fence adjacent to the DART, and all associated airfield lighting upgrades and installation of the necessary storm system infrastructure to support the new pavement construction. Construction will be inside the Airport’s Air Operations Area (AOA). The Contractor shall be responsible for reviewing all existing conditions associated with the Work prior to commencement of work activities.

1.2 CONSTRUCTION PHASING

A. The contractor shall perform all work in accordance with Contract Documents and described herein. The Contractor shall perform the work of each phase within the periods of time and durations specified. Contractor shall provide all labor, material and equipment, including standby equipment necessary to guarantee construction and completion of the work within the constraints and timeframes specified for the individual phases and the overall project, and within the requirements of the Contract Documents. Liquidated damages in the amounts specified in the Contract Documents will be assessed if the Contractor fails to complete specific phases within the specified allowed durations.

B. The contractor will be responsible of transportation of DPS guards from gate T-1 to T-3.

C. The contractor will be responsible managing the East Materials Management Site (EMMS).

D. Anticipated construction phase durations and sequencing are shown below. Milestone dates shall govern.

E. Phase 1 (Base)

1. Work Area M
   a. Work Area M is bounded by the Taxiway Q TOFA on the northeast, Taxiway EJ TOFA on the south, and Taxiway P TOFA on the west.
   b. Restrictions and required closures: The ARFF road must always remain open.
   c. Work includes construction of proposed drainage just north of TW EJ.

2. Work Area AC
   a. Work Area AC includes the Taxiway EJ TOFA and is bounded on the northeast by the Taxiway Q TOFA and as shown on the southwest.
   b. Restrictions and required closures: Work within Area AC requires closure of Taxiway EJ between Taxiway P and Taxiway Q. The ARFF road must always be kept open.
   c. Work includes proposed drainage.

3. Work Area AD
SUMMARY OF WORK
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a. Work Area AD is bounded by the Taxiway EJ TOFA on the northwest, Taxiway Q TOFA on the southeast, and as shown.

b. Restrictions and required closures: None.

c. Work includes construction of south outfall channel.

F. Phase 2 (Base)

1. Work Area E

a. Work Area E is bounded by the Taxiway Z TOFA on the north, Taxiway P TOFA on the east, Taxiway EJ TOFA on the south, and the Runway 17C-35C ROFA on the west.

b. Restrictions and required closures: None.

c. Work includes: Construction of proposed Taxiway N. Electrical signage, taxiway edge and center lights, and demolition of existing lights. Proposed grading and drainage. Pavement marking.

2. Work Area I

a. Work Area I is bounded by the edge of existing pavement on Taxiway S (future Taxiway N) on the north, Runway 17C-35C ROFA on the east, the Taxiway Z TOFA on the south, and the Runway 17C-35C RSA on the west.

b. Restrictions and required closures: No stockpiles or equipment may be left within the Runway 17C-35C ROFA.

c. Work includes: Proposed grading within 17C-35C ROFA, just west of future Taxiway N. Demolition of existing road.

3. Work Area J

a. Work Area J is bounded by the edge of existing pavement on Taxiway S (future Taxiway N) on the north, the Runway 13L-31R TOFA on the northeast, the Taxiway N (future Taxiway R) TOFA on the southeast, the Taxiway Y TOFA on the south, and the Runway 17C-35C ROFA on the west.

b. Restrictions and required closures: None.


4. Work Area S

a. Work Area S is bounded by the Taxiway EF TOFA on the north, Taxiway S TOFA on the east, Taxiway S edge of pavement, and the Runway 17C-35C ROFA on the west.

b. Restrictions and required closures: Work may not occur within the glideslope critical area while Runway 17C is in use.


5. Work Area AG
a. Work Area AG is within the Runway 17C-35C ROFA and is bounded on the north by the Taxiway Z TOFA, on the east by the Taxiway N TOFA, on the south by the Taxiway EJ TOFA, and on the west by the Runway 17C-35C RSA

b. Restrictions and required closures: No stockpiles or equipment may be left within the Runway 17C-35C ROFA.

c. Work includes proposed grading just north of area C.

G. Phase 3 (Base)

1. Work Area F

a. Work Area F is within the Taxiway Z TOFA, bounded by the Taxiway P TOFA on the east, and Runway 17C-35C ROFA on the west.

b. Restrictions and required closures: Work within Area F will require closure of Taxiway Z between Runway 17C-35C and Taxiway P, and closure of Taxiway N between Taxiway Y and Taxiway Z. Taxiways Y and Z may not be closed at the same time. Taxiway Z may not be closed concurrently with Taxiway EJ. Taxiway Z closure shall be no more than 90 days.


2. Work Area G

a. Work Area G is within the Taxiway Z TOFA, bounded by the Runway 17C-35C ROFA on the east, and the Runway 17C-35C RSA on the west.

b. Restrictions and required closures: Work within Area G will require closure of Taxiway Z between Runway 17C-35C and Taxiway N. Taxiways Y and Z may not be closed at the same time. No stockpiles or equipment may be left within the Runway 17C-35C ROFA. Taxiway Z may not be closed concurrently with Taxiway EJ. Taxiway Z closure shall be no more than 90 days.


3. Work Area L

a. Work Area L is within the Taxiway P and Taxiway Z TOFAs and is bounded by the Taxiway Y TOFA on the north and as shown on the south.

b. Require closure of Taxiway P between Taxiway EJ and Taxiway Y, and Taxiway Z between Taxiway Q and Taxiway N. Taxiways Y and Z may not be closed at the same time. Taxiway Z may not be closed concurrently with Taxiway EJ. Taxiway Z closure shall be no more than 90 days.

4. Work Area Y
   a. Work Area Y includes the Runway 17C-35C RSA.
   b. Restrictions and required closures: Work within Area Y requires closure of Runway 17C-35C.
   c. Work includes: Pavement marking.

5. Work Area AH
   a. Work Area AH is within the Taxiway Z TOFA and is bounded on the east by the Runway 17C-35C RSA and on the west by the Runway 17R-35L ROFA.
   b. Restrictions and required closures: Work in Area AH requires closure of Taxiway Z between Runway 17C-35C and Runway 17R-35L and closure of Taxiway M between Taxiway EJ and Taxiway Y. Taxiway Z may not be closed at the same time as Taxiway Y. No stockpiles or equipment may be left within the Runway 17C-35C ROFA.
   c. Work includes: Pavement marking at intersection of Taxiway M and Taxiway Z.

H. Phase 4 (Base)

1. Work Area H
   a. Work Area H is within the Taxiway Y TOFA, bounded by the Runway 17C-35C ROFA on the east, and the Runway 17C-35C RSA on the west.
   b. Restrictions and required closures: Work within Area H will require closure of Taxiway Y between Runway 17C-35C and Taxiway N. Taxiways Y and Z may not be closed at the same time. No stockpiles or equipment may be left within the Runway 17C-35C ROFA. Taxiway Y may not be closed concurrently with Taxiway EJ. Taxiway Y closure shall be no more than 90 days.

2. Work Area K
   a. Work Area K is within the Taxiway Y and Taxiway N TOFAs, bounded by the Taxiway N (future Taxiway T) TOFA on the northwest, the Taxiway R TOFA on the northeast, the Taxiway P TOFA on the southeast, Taxiway Z TOFA on the south, and the Runway 17C-35C ROFA on the west.
   b. Restrictions and required closures: Work within Area K will require closure of Taxiway Y between Runway 17C-35C and Taxiway P, and closure of Taxiway N (future Taxiway T) between Taxiway R and Taxiway Z. Work in Area P must be completed prior to beginning work in Area K. Taxiway Y closure shall be no more than 90 days.
   c. Work includes: Proposed construction at intersection of Future Taxiway N and Taxiway Y. Placement of taxiway edge and center lights and demo of existing. Placement of electrical signage and demolition of existing.

3. **Work Area Y**
   a. Work Area Y includes the Runway 17C-35C RSA.
   b. Restrictions and required closures: Work within Area Y requires closure of Runway 17C-35C.
   c. Work includes: Pavement markings

4. **Work Area Al**
   a. Work Area Al is within the Taxiway Y TOFA and is bounded on the east by the Runway 17C-35C RSA and on the west by the Runway 17R-35L ROFA.
   b. Restrictions and required closures: Work in Area Al requires closure of Taxiway Y between Runway 17C-35C and Runway 17R-35L and closure of Taxiway M between Taxiway Z and Taxiway EG. Taxiway Y may not be closed at the same time as Taxiway Z. No stockpiles or equipment may be left within the Runway 17C-35C ROFA.
   c. Work includes: Pavement marking at intersection of Taxiway Y and Taxiway M.

I. **Phase 5 (Base)**

1. **Work Area A**
   a. Work Area A is bounded by the Taxiway EJ Taxiway Object Free Area (TOFA) on the north, Taxiway P TOFA on the east, the Aircraft Rescue and Fire Fighting (ARFF) road on the south, and the Runway 17C-35C ROFA on the west.
   b. Restrictions and required closures: No restriction, except that Work Area A will be unavailable after Taxiway N1 is opened for use.

2. **Work Area B**
   a. Work Area B is bounded by the Taxiway EJ Taxiway Object Free Area (TOFA) on the north, Runway 17C-35C ROFA on the east, the ARFF road on the south, and the Runway 17C-35C RSA on the west.
   b. Restrictions and required closures: No stockpiles or equipment may be left within the Runway 17C-35C ROFA. Work Area B will be unavailable after Taxiway N1 is opened for use.

3. **Work Area C**
   a. Work Area C is within the Taxiway EJ Taxiway Object Free Area (TOFA), bounded by the Runway 17C-35C ROFA on the east, and the Runway 17C-35C RSA on the west.
b. Restrictions and required closures: Work within Area C will require closure of Taxiway EJ. No stockpiles or equipment may be left within the Runway 17C-35C ROFA. Taxiway EJ may not be closed concurrently with either Taxiways Y or Z.


4. Work Area D

a. Work Area D is within the Taxiway EJ TOFA, bounded by the Taxiway P TOFA on the east, and Runway 17C-35C ROFA on the west.

b. Restrictions and required closures: Work within Area D will require closure of Taxiway EJ and will be unavailable after Taxiway N1 is opened for use. Taxiway EJ may not be closed concurrently with either Taxiways Y or Z.

c. Work includes: Installation of new taxiway edge lights, center lights, and electrical signage at intersection of Taxiway N and EJ. Demolition of existing lights. Pavement marking.

5. Work Area Y

a. Work Area Y includes the Runway 17C-35C RSA.

b. Restrictions and required closures: Work within Area Y requires closure of Runway 17C-35C.

c. Work includes: Placement of electrical signage and demo of circuitry within 17C-35C RSA. Pavement marking on Taxiway N1 within RSA.

J. Phase 6 (Base)

1. Work Area T-1

a. Work Area T-1 is bounded by Taxiway S (future Taxiway N) TODA on the north and west and as sown on the south and east.

b. Restrictions and required closures: Work within Area T-1 requires the closure of Taxiway EF, Taxiway S (future Taxiway N), and the North Air Freight Ramp connector. The new ARFF road construction must be completed prior to demolition of the existing ARFF road. Work in Area V must be completed prior to beginning work in Area T-1.

c. Work includes: Construction of proposed ARFF just south of East Pump Station. Work in area T-1 shall be completed in 21 calendar days.

2. Work Area T

a. Work Area T includes Area T-1 and T-2. It is bounded partially by the 17C-35C RSA and as shown

b. Restrictions and required closures: Work within Area T requires the closure of Taxiway EF, Taxiway S (future Taxiway N), and the North Air Freight Ramp connector. The new ARFF road construction must be completed prior to demolition of the existing ARFF road. Work in Area V must be completed prior to beginning work in Area T-2. Restrictions and required closures: Work may not occur within the glideslope critical area while Runway 17C is in use.
c. Work includes: Demolition of existing ARFF road, proposed grading, proposed drainage, placement of electrical, signage and taxiway centerline lights, and pavement marking.

3. Work Area U
   a. Work Area U is within the Taxiway EJ TOFA and is bounded on the east by the Runway 17C-35C ROFA, and on the west by the Runway 17C-35C RSA.
   b. Restrictions and required closures: Work within Area U requires the closure of Taxiway EJ. No stockpiles or equipment may be left within the Runway 17C-35C ROFA. Area U is also within the Runway 17C POFZ, and work may not occur when Runway 17C is in use.
   c. Work includes: Placement of electrical signage on Taxiway EF within ROFA.

4. Work Area V
   a. Work Area V is bounded by the North Air Freight Ramp connector TOFA on the south and as shown.
   b. Restrictions and required closures: Construction of the new ARFF road and connecting portion of Taxiway S (future Taxiway N) must be completed prior to demolition of the existing ARFF road in Work Area T. Work in Area V must be completed prior to beginning work in Area T.

5. Work Area W
   a. Work Area W is bounded as shown on the phasing plans.
   b. Restrictions and required closures: None
   c. Work includes: Construction of future Taxiway N. Placement of taxiway edge/center lights and electrical signage. Proposed drainage and grading. Construction of northeast outfall channel. Proposed fencing. Pavement marking. Contractor will be required to include an access road from Gate 210 to the NE EAT Package III work area. Access will be required at all times.

6. Work Area X
   a. Work Area X is bounded by the Taxiway M and Taxiway EE TOFAs.
   b. Restrictions and required closures: Work within Area X requires closure of Taxiway M between Taxiway EF and Taxiway EE, closure of Taxiway K between Taxiway EF and Taxiway M, and Taxiway EE between Taxiway K and Taxiway M.
   c. Work includes: Placement of taxiway edge and center lights at intersection of Taxiway M and future Taxiway N. Pavement marking.

K. Phase 7 (Base)
   1. Work Area J
SUMMARY OF WORK
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1. Work Area J
a. Work Area J is bounded by the edge of existing pavement on Taxiway S (future Taxiway N) on the north, the Runway 13L-31R TOFA on the northeast, the Taxiway N (future Taxiway R) TOFA on the southeast, the Taxiway Y TOFA on the south, and the Runway 17C-35C ROFA on the west.

b. Restrictions and required closures: None.

c. Work includes: Proposed grading and drainage.

2. Work Area N
a. Work Area N is within the Taxiway R and Taxiway N TOFAs and is bounded by the Taxiway N TOFA on the northwest, the Runway 13L-31R ROFA on the northeast, the Taxiway P TOFA on the southeast, and the Taxiway R TOFA on the southwest.

b. Restrictions and required closures: Work within Area N will require closure of Taxiway R between Taxiway P and Taxiway N, and Taxiway N (future Taxiway R) between Runway 13L-31R and Taxiway R. Taxiway N (future Taxiway R) and Taxiway P may not be closed at the same time.

c. Work includes: Proposed grading, proposed drainage & asbestos abatement.

3. Work Area O
a. Work Area O is within the Taxiway N TOFA and is bounded by the Runway 13L-31R RSA on the northeast and the Runway 13L-31R ROFA on the southwest.

b. Restrictions and required closures: Work within Area O will require closure of Taxiway N (future Taxiway R) between Runway 13L-31R and Taxiway R. No stockpiles or equipment may be left within the Runway 13L-31R ROFA. Taxiway N (future Taxiway R) and Taxiway P may not be closed at the same time.

c. Work includes: Asbestos abatement.

4. Work Area P
a. Work Area P is within the Taxiway R, R1, and P TOFAs, and is bounded by the Taxiway P TOFA on the northwest, and as shown on the southeast.

b. Restrictions and required closures: Work within Area P will require closure of Taxiway R between Taxiway R1 and Taxiway N and Taxiway P between Runway 13L-31R and Taxiway N. Work in Area P must be completed prior to beginning work in Area K. Work within Area P must be completed prior to beginning work in Area AE.

c. Work includes: Proposed grading & asbestos abatement.

5. Work Area Z
a. Work Area Z includes the Runway 13L-31R RSA.

b. Restrictions and required closures: Work within Area Z requires closure of Runway 13L-31R.
**SUMMARY OF WORK**

**Section: 01 11 00**

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c. Work includes: Placement of electrical signage within 13L-31R RSA. Pavement marking for existing Taxiway N and Taxiway P within RSA.

6. **Work Area AA**

   a. Work Area AA is within the Taxiway N (future Taxiway R) TOFA and is bounded by the East Air Freight Ramp on the northeast, and the Runway 13L-31R ROFA on the southwest.

   b. Restrictions and required closures: Work in Area AA requires closure of Taxiway N (future Taxiway R) between the East Air Freight Ramp and Runway 13L-31R. Taxiway N (future Taxiway R) may not be closed at the same time as Taxiway P.

   c. Work includes: Placement of electrical signage near East Air Freight Ramp.

7. **Work Area AB**

   a. Work Area AB is within the Taxiway N (future Taxiway R) TOFA and is bounded by the Runway 13L-31R ROFA on the northeast and the Runway 13L-31R RSA on the southwest.

   b. Restrictions and required closures: Work in Area AB requires closure of Taxiway N (future Taxiway R) between the East Air Freight Ramp and Runway 13L-31R. Taxiway N (future Taxiway R) may not be closed at the same time as Taxiway P. No stockpiles or equipment may be left within the Runway 13L-31R ROFA. The ARFF road must always remain open.

   c. Work includes: Placement of electrical signage near Runway 13L ARFF road within Runway 13L-31 R ROFA.

8. **Work Area AE**

   a. Work Area AE includes portions of the Taxiway Q and Taxiway R1 TOFAs and is bounded on the northeast by the Taxiway R1 TOFA and as shown on the south.

   b. Restrictions and required closures: Work within Area AE requires closure of Taxiway Q between Taxiway EJ and Taxiway R1, and closure of Taxiway R1 between Taxiway R and Taxiway P. Taxiway R1 cannot be closed simultaneously with Taxiway P. Work within Area P must be completed prior to beginning work in Area AE. Taxiway R1 shall remain open to traffic until Taxiway R and Y construction is complete and open to traffic.

   c. Work includes: Proposed grading and drainage.

9. **Work Area AF**

   a. Work Area AF is bounded by the Taxiway N (future Taxiway R) TOFA on the northwest, the Runway 13L-31R ROFA on the northeast, as shown on the southeast, the Taxiway R TOFA on the southwest.

   b. Restrictions and required closures: Work in Area AF requires closure of Taxiway P. Taxiway P may not be closed at the same time as Taxiway N (future Taxiway R). No stockpiles or equipment may be left within the Runway 13L-31R ROFA. Area AF is also within the Runway 13L POFZ, and work may not occur when Runway 13L is in use.

   c. Work includes: Proposed grading and drainage.
10. Work Area AJ
   a. Work Area AJ is within the Taxiway R and R1 TOFAs and is bounded on
      the northeast by the Runway 13L-31R ROFA, as shown on the south, and
      by the Taxiway Q TOFA on the southwest. Restrictions and required
      closures: None.
   b. Restrictions and required closures: Work in Area AJ requires closure of
      Taxiway R between Taxiway EJ and Taxiway P, and closure of Taxiway
      R1 between Runway 13L-31R and Taxiway Q. ARFF road access must
      always be maintained. Taxiway R1 shall remain open to traffic until Taxiway
      R and Y construction is complete and open to traffic.
   c. Work includes: Proposed grading.

1.3 FORMS
   A. The Contractor and all Subcontractors must obtain and pay for all Airport
      Identification/Access Badges and Access Permits as required by the Airport.
   B. All appropriate forms and applications must be obtained, completed and
      submitted. A minimum required list of forms and applications is as follows:
      1. AOA Area Access or Parking Revenue Area (PRA) Access Permits Form (1
         page). This form can be obtained from Airport Design, Code, and Construction
         Department (DCC).
      2. Access Badge Application (3 pages). This form can be obtained on the Airport
         website: https://www.dfwairport.com/badge/

1.4 CONTRACT TIME & SCHEDULE MILESTONES
   A. The Contractor shall sequence and stage the Work in accordance with the
      requirements of the Contract Documents to meet the following interim requirements
      and Final Completion date.
      1. 555 Consecutive Calendar Days for Substantial Completion of the Base, from
          the date set forth in the NTP
         120 Consecutive Calendar Days for Final Completion, from the date set forth for
         Substantial Completion for Base Bid.
      2. Total Contract Time = 675 Calendar Days for Base consecutive from NTP.
   B. The following milestones apply;
      1. Phase 1, All Work Areas shall be completed within 445 calendar days. This
         phase may start on day 46.
      2. Phase 3, Work Areas F, G, and L shall be completed within 100 calendar days.
         This phase will start when the Contractor begins any work in Work Areas F, G, or
         L.
      3. Phase 4, Work Areas H and K shall be completed within 100 calendar days. This
         phase will start when the Contractor begins any work in Work Areas H or K.
      4. Phase 6, Work Area T-1 (ARFF Road Construction and Demolition only) shall
         be complete within 21 calendar days. This phase will start when the
         Contractor begins any ARFF Road related work in Work Area T-1.
C. The Owner reserves the right to request the completion of work based on Milestones established in the Contract Documents.

D. The Owner reserves the right to apply Liquidated Damages associated with the request to complete the work based on Milestones.

1.5 HOURS OF WORK

A. The Work may be performed in all areas up to 24 hours a day, 7 days a week, as necessary to meet the Project completion dates, except as noted below.

B. Exceptions to above work hours:

1. Limit airfield access to TWO, 8-hours shift – due to gate guard & Ops agent shortage.

2. Any Work within an aircraft parking apron and Object Free Area (OFA) of an active Taxiways or Taxilane will be restricted to the following:
   a. From 22:45 hours to 05:15 hours.
   b. Work activities within these areas may be canceled and the area reopened in the event of airfield emergencies, late airline complexes, and unforeseen conditions that could create significant delays to the Airport.

3. There are two types of Holiday Blackout periods. One governs the area within the Air Operations Area (AOA) and the other holiday blackout periods governs the area outside of the Air Operations area. The following construction blackout dates are recognized for the Project:

   a. Airfield Blackout Dates
      1) No airfield closures or lighting circuit lockouts should be scheduled beginning at 2200 hours on Friday night, November 20, 2020 until 2200 hours on Monday night, November 30, 2020.
      2) No airfield closures or lighting circuit lockouts should be scheduled beginning at 2200 hours on Thursday night, December 17, 2020 until 2200 hours on Monday night, January 4, 2021.
      3) No airfield closures or lighting circuit lockouts should be scheduled beginning at 2200 hours on Friday night, November 19, 2021 until 2200 hours on Monday night, November 29, 2021.
      4) No airfield closures or lighting circuit lockouts should be scheduled beginning at 2200 hours on Friday night, December 17, 2021 until 2200 hours on Monday night, January 3, 2022.

   b. Landside Blackout Dates
      The following dates have been established as construction blackout dates in the landside and customer service areas. During the noted landside Holiday blackout dates any work that impacts ramp level operations, roadways, guests inside the terminals and non-emergency utility outage requests, will normally not be approved. Work and utility outages that do not impact stakeholder operations or have limited impact
will be evaluated on a case by case basis during the blackout periods. The dates listed are the primary dates and others may follow:

- Spring Break – Thursday, Feb 27 at 00:00 am – Monday, March 16, 2020 at 11:59 pm
- Memorial Day – Thursday, May 21 at 00:00 am through Tuesday, May 26, 2020 at 11:59 pm
- July 4 – Thursday, July 02 at 00:00 am through Monday, July 06, 2020 at 11:59 pm
- Labor Day – Thursday September 3 at 00:00 am through Tuesday, September 8, 2020 at 11:59 pm
- Thanksgiving – Thursday, November 19 at 00:00 am through Tuesday, December 1, 2020 at 11:59 pm
- Christmas/New Year – Friday, December 18, 2020 at 00:00 am through Tuesday, January 5, 2021 at 11:59 pm
- Spring Break – Thursday, Mar 04 at 00:00 am – Monday, March 22, 2021 at 11:59 pm
- Memorial Day – Thursday, May 27 at 00:00 am through Tuesday, Jun 01, 2021 at 11:59 pm
- July 4 – Thursday, July 1 at 00:00 am through Tuesday, July 6, 2021 at 11:59 pm
- Labor Day – Thursday September 2 at 00:00 am through Tuesday, September 7, 2021 at 11:59 pm
- Thanksgiving – Thursday, November 18 at 00:00 am through Tuesday, November 30, 2021 at 11:59 pm
- Christmas/New Year – Friday, December 17, 2021 at 00:00 am through Monday, January 3, 2022 at 11:59 pm
- Additionally, events in the DFW Metroplex may trigger heavier than normal travel. As a result, when we are made aware of such events we will add an addendum to the above dates.

c. For all utility outages, a Utility Outage Request form must be submitted seven days in advance to Poweroutage@dfwairport.com. For power outage requests, all impacted panel schedules must be submitted with the request. Operations will review and if needed, coordinate a stakeholder meeting to discuss mitigation plans. One hour prior to all utility outages, the requestor must call the Airport Operations Center at 972-973-3112 one hour prior to the scheduled outage for a final go/no-go. The Utility Outage Request form may be found on
1.6 DECLARATION OF DISASTER – COVID-19

A. The Contractor must follow the latest Dallas County order for novel coronavirus now designated SARS-CoV2 which causes the disease COVID-19. See order below for order dated March 29, 2020. For latest order visit: https://www.dallascounty.org/covid-19/

AMENDED ORDER OF COUNTY JUDGE CLAY JENKINS
Stay Home Stay Safe
DATE AMENDED ORDER ISSUED: March 29, 2020
Visit https://www.dallascounty.org/covid-19/ for current Order.

WHEREAS, pursuant to Texas Government Code Section 418.108, Dallas County Judge Clay Jenkins issued a Declaration of Local Disaster for Public Health Emergency on March 12, 2020, due to a novel coronavirus now designated SARS-CoV2 which causes the disease COVID-19;

WHEREAS, on March 12, 2020, Judge Jenkins issued an Order in furtherance of his authority to protect the safety and welfare of the public by slowing the spread of the virus;

WHEREAS, the on-going evaluation of circumstances related to the virus and the updated recommendations of the Centers for Disease Control and the Texas Department of State Health Services warrant the March 12, 2020 Order of County Judge Clay Jenkins be amended;

WHEREAS, on March 16, 2020, President Trump acknowledged the gravity of the COVID-19 pandemic, releasing strict new guidelines to limit people’s interactions, including that Americans should avoid groups of more than 10 people; and

WHEREAS, on March 19, 2020, the Dallas County Commissioners Court issued an Order of Continuance of Declaration of Local Disaster for Public Health Emergency that affirmed the activation of the Dallas County Emergency Management Plan and extends the Declaration of Local Disaster until 11:59 p.m. on April 3, 2020, unless rescinded by order of the Commissioners Court.

THEREFORE, the March 12, 2020, Order of County Judge Clay Jenkins is hereby AMENDED as follows:

Summary: The virus that causes 2019 Coronavirus Disease (COVID-19) is easily transmitted through person to person contact, especially in group settings, and it is essential that the spread of the virus be slowed to protect the ability of public and private health care providers to handle the influx of new patients and safeguard public health and safety. Because of the risk of the rapid spread of the virus, and the need to protect the most vulnerable members of the community, this Order requires all individuals anywhere in Dallas County to shelter in place – that is, stay at home – except for certain essential activities and work to provide essential business and government services or perform essential public infrastructure construction, including housing. This Order takes effect at 11:59 p.m. on March 29, 2020 and will continue through 11:59 p.m. on April 3, 2020, subject to the limited exceptions and under the terms and conditions more particularly set forth below.
UNDER THE AUTHORITY OF TEXAS GOVERNMENT CODE
SECTION 418.108, DALLAS COUNTY JUDGE CLAY JENKINS ORDERS:

1. Effective as of 11:59 p.m. on March 29, 2020, and continuing until 11:59 p.m. on April 3, 2020:
   (a) All individuals currently living within Dallas County are ordered to shelter at their place of residence. For the purposes of this Order, residences include hotels, motels, shared rentals, and similar facilities. To the extent individuals are using shared or outdoor spaces, they must at all times as reasonably as possible maintain social distancing of at least six feet from any other person when they are outside their residence. All persons may leave their residences only for Essential Activities, or to provide or perform Essential Governmental Functions, or to operate Essential Businesses, all as defined in Section 2.
   (b) All businesses operating within Dallas County, except Essential Businesses as defined in below in Section 2, are required to cease all activities at facilities located within the County except Minimum Basic Operations as defined in Section 2. For clarity, businesses may continue operations consisting exclusively of employees or contractors performing activities at their own residences (i.e. working from home). To the greatest extent possible, all Essential Businesses shall comply with the Social Distancing Rules attached, including maintaining six feet social distancing for both employees and the general public.
   (c) All public or private gatherings of any number of people occurring outside a single household or living unit are prohibited, except as otherwise provided herein. Nothing in this Order prohibits the gathering of members of a household or living unit.
   (d) All elective medical, surgical, and dental procedures are prohibited anywhere in Dallas County. Hospitals, ambulatory surgery centers, dental offices, and other medical facilities are directed to identify procedures that are deemed "elective" by assessing which procedures can be postponed or cancelled based on patient risk considering the emergency need for redirection of resources to COVID-19 response.

2. Definitions:
   a. For purposes of this Order, individuals may leave their residence only to perform any of the following “Essential Activities”:
      i. To engage in activities or perform tasks essential to their health and safety, or to the health and safety of their family or household members (for example, obtaining medical supplies or medication, visiting a health care professional, or obtaining supplies need to work from home).
      ii. To obtain necessary services or supplies for themselves and their family or household members, or to deliver those services or supplies to others (for example, food, pet supply, and any other household consumer products, and products necessary to maintain the safety, sanitation, and essential operation of residences).
      iii. To engage in outdoor activity, provided the individuals comply with social distancing requirements of six feet (for example, walking, biking, hiking, running, golfing, and tennis).
iv. To perform work providing essential products and services at an Essential Business or to otherwise carry out activities specifically permitted in this Order.

v. To care for a family member or pet in another household.

vi. To move to another residence either in or outside Dallas County.

vii. To engage in “Essential Travel,” which includes travel for any of the following purposes: (1) travel related to the provision of or access to Essential Activities, Essential Governmental Functions, Essential Businesses Essential Critical Infrastructure, and Minimum Basic Operation; (2) travel to care for elderly, minors, dependents, persons with disabilities, or other vulnerable persons; (3) travel to or from educational institutions for purposes of receiving materials for distance learning, for receiving meals, and any other related services; (4) travel to return to a place of residence from outside the jurisdiction; (5) travel required by law enforcement or court order; (6) travel by church staff or clergy for the purpose of production of remote delivery of religious services and other ministries requiring travel; (7) travel related to attending a funeral service; or (8) travel required for non-residents to return to their place of residence outside the County.

b. For purposes of this Order, “Essential Businesses” means:

i. Essential Healthcare Operations. Healthcare Operations includes but is not limited to hospitals, clinics, dentists, chiropractors, physical therapy, optometry offices, pharmacies, pharmaceutical and biotechnology companies, other healthcare facilities, healthcare suppliers, mental health providers, substance abuse service providers, blood banks, medical research, laboratory services, or any related and/or ancillary healthcare services. Home-based and residential-based care for seniors, adults, or children are also considered healthcare operations. Healthcare operations also includes veterinary care and all health and welfare services provided to animals. This exemption shall be viewed broadly to avoid any impacts to the delivery of healthcare. Healthcare operations do not include fitness and exercise gyms, personal training, gymnastics studios, and similar facilities. Healthcare operations do not include elective medical, surgical, and dental procedures as established in accordance with Subsection 1(f) of this Order.

ii. Essential Governmental Functions. All services provided by local governments needed to ensure the continuing operation of the government agencies to provide for the health, safety and welfare of the public. Each governmental body will determine its Essential Governmental Functions and identify the employees and/or contractors necessary to the performance of those functions. Further, nothing in this order shall prohibit any individual from performing or accessing “Essential Governmental Functions.” All Essential Governmental Functions shall be performed in compliance with social distancing requirements of six feet, to the extent possible. This Order does not apply to Federal or State Government.

iii. Essential Critical Infrastructure. All public and private facilities and assets, including both physical and cyber systems, and other functions and sectors vital to the security, governance, and public health, safety of Dallas County. Critical infrastructure includes, but is not limited to, utilities such as electricity, gas, water and wastewater, roads and highways, public transportation, solid waste and recycle collection and removal, oil refining, roads and highways, public transportation, defense and national security-related operations, and manufacturing operations suppling essential items.
iv. **Stores that Sell Groceries and Other Essential Supplies.** Grocery stores, supermarkets, warehouse stores, big-box stores, bodegas, liquor stores, convenience stores, and farmers’ markets that sell food products and household consumer products (such as cleaning and personal care products). This includes stores that sell groceries and also sell other non-grocery products. The sale of self-service food items is prohibited. To the greatest extent possible, essential retail establishments shall follow the guidelines below:

1. Designate shopping times for at risk populations (seniors, pregnant people, and people with underlying health conditions);
2. Limit the amount of people in a store at once so that social distancing is possible;
3. Implement an organized line system where people are spaced at least a few feet apart (ideally 6 feet);
4. Implement purchase limits on high-demand items (toilet paper, soap, hand sanitizer);
5. Offer pick up or deliveries of grocery items.

v. **Restaurants.** Restaurants with or without drive-in or drive-through services and microbreweries, micro-distilleries, or wineries may only provide take out, delivery, or drive-through services as allowed by law. In-person service is prohibited. Customers may order and pay inside, but are prohibited from waiting inside the restaurant for their food. All food must be brought outside to customers. To allow for increased access to restaurants, this Order hereby suspends all laws and regulations prohibiting people from walking in a drive-through.

vi. **Food Cultivation.** Food cultivation, including farming, fishing, and livestock.

vii. **Delivery of Groceries and Essential Supplies.** Businesses that ship or deliver groceries, food, hygiene products, and essential supplies directly to residences or essential businesses.

viii. **Transportation.** Operation, maintenance, and repair of airlines, taxis, and other private transportation providers (such as Uber and Lyft) that provide transportation services necessary for the performance of essential activities and essential travel.

ix. **Gas Stations and Businesses Needed for Transportation.** Gas stations, auto-supply stores, auto-repair, and bicycle repair. Auto-dealerships, for in-person mechanical services or to complete an online transaction on an appointment basis only. Gas stations and convenience stores are prohibited from selling self-service food items.

x. **Critical Trades.** Plumbers, electricians, exterminators, janitors, lawn care services, pool cleaners, maintenance and security, and other service providers who provide services that are necessary to maintaining the safety, sanitation, and essential operations of residences, Essential
Businesses, Essential Government Functions, and Critical Infrastructure. Critical Trade does not include discretionary maintenance or improvements. Union representatives and their staff, if they represent employees of an Essential Business, Essential Government Functions, or Critical Infrastructure.

xi. **Construction.** Construction for public works, residential, commercial, and schools. Elective additions and maintenance are prohibited. Protecting construction worker from the spread of COVID19 is extremely important for their safety and for public health, all construction sites must follow the COVID-19 Safety Recommendations issued by the Construction Industry Safety Coalition, including, but not limited to, the following:

1. All workers and contractors (hereafter referred to as “workers”) must take their temperature at their residence. If a worker has a temperature above 99.6 degrees Fahrenheit, then they are prohibited from going to work and must remain at their residence;
2. To the greatest extent possible, implement a system whereby supervisors must check the temperature of all workers and contractors with a forehead thermometer before the worker begins work. If a worker or contractor has a temperature above 99.6 degrees Fahrenheit, then they are to be sent home immediately;
3. Shift work must be implemented such that each shift shall have no more than fifty percent (50%) of the workers who were on shift on March 16, 2020. Once assigned to a shift, workers shall not change from one shift to another;
4. To the greatest extent possible, limit crossover of subcontractors;
5. Gatherings during meals or breaks are prohibited;
6. Workers must keep a 6 foot distance between people at all times, unless the work being performed requires multiple individuals for the safety of the workers;
7. Workers must not use a common water cooler. Employers shall provide individual water bottles or instruct workers to bring their own;
8. Employers must allow non-essential personnel to work from home when possible;
9. Employers must provide soap and water and hand sanitizer in the workplace, including all restrooms. Ensure that adequate supplies are maintained;
10. If running water is available at the site, workers must wash their hands for at least twenty (20) seconds before beginning work, when they remove gloves, and before and after the use of shared items such as tools or multi-user devices, before and after any meal or restroom breaks, and when their shift or work time ends.
11. Rest breaks of at least fifteen (15) minutes for every four (4) hours worked must be provided so workers may follow hygiene guidelines;
12. Employers must provide one (1) working flushing toilet for every fifteen (15) workers on site or one (1) outdoor portable toilet for every 10 workers on site;
13. There shall be no adverse action taken against an employee who has been quarantined, or advised to self-quarantine, due to possible exposure to coronavirus; and

14. Employers must designate a COVID-19 safety monitor on each site who has the authority to enforce these rules;

Failure to strictly comply with this Order can result in penalties described below. Additionally, the general contractor and non-compliant subcontractor can be removed from the essential business list.

xii. Professional Services. Professional services, such as legal or accounting services, when necessary to assist in compliance with legally mandated activities or services necessary to avoid imminent harm to a client. Real estate and inspection services, but only for the purpose of title work and closing; in-person open houses and showings are prohibited.

xiii. Financial Institutions. Banks and related depository financial institutions, credit unions, insurance companies, title companies, payroll and accounting services. Non-depository institutions (such as payday lenders) are prohibited.

xiv. Information Technology Services/Telecommunications Services. IT and IT services and their essential service vendors, including the provision of essential global, national, and local infrastructure for computing services, business infrastructure, communications, and web-based services, and critical manufacturing, as well as telecommunications services, internet access and broadband/communications services.

xv. Essential Retail. Laundromats, dry cleaners, and laundry service providers., hardware stores, and related facilities. Firearm and ammunition suppliers and retailers for purposes of safety and security. Hardware stores and business that sell electrical, plumbing, and other materials necessary to support Essential Businesses, and Essential Government Functions, and Critical Infrastructure. To the greatest extent possible, essential retail establishments shall follow the guidelines below:

1. Designate shopping times for at risk populations (seniors, pregnant people, and people with underlying health conditions);
2. Limit the amount of people in a store at once so that social distancing is possible; and
3. Implement an organized line system where people are spaced at least a few feet apart (ideally 6 feet).

xvi. Hotels and Motels. Hotels and motels, to the extent used for lodging or delivery or carry-out food services.

xvii. Providers of Basic Necessities to Economically Disadvantaged Populations. Businesses or organizations that provide food, shelter, and social services, and other necessities of life for economically disadvantaged or otherwise needy individuals.

xviii. Essential Services Necessary to Maintain Essential Operations of Residences or Other Essential Businesses. Businesses or services that supply other Essential Businesses, Essential Government Services, and Critical Infrastructure with the support or supplies needed to operate; including but not limited to mail, shipping and delivery services, warehouse/distribution and fulfillment, storage, moving services, janitorial services, laundry services, computer, audio or video electronics, sanitary
equipment, and medical equipment. To the extent possible, services shall be provided in compliance with Social Distancing Rules attached, including distancing of six feet and routine use of hand sanitizer.

xix. **Supplies to Work From Home.** Businesses that supply products needed for people to work from home.

xx. **Public and Private Education.** Public and private educational institutions, only for the purposes of facilitating distance learning or performing essential functions, provided compliance with the Social Distancing Rules is maintained

xxi. **News Media.** Newspapers, television, radio, and other media services.

xxii. **Childcare Services.** Childcare facilities providing services or community service providers offering childcare services that enable employees exempted in this Order may operate under the following mandatory conditions:

1. Childcare must be carried out in stable groups of 12 or fewer (“stable” means that the same 12 or fewer children are in the same group each day).
2. Children shall not change from one group to another.
3. If more than one group of children is cared for at one facility, each group shall be in a separate room. Groups shall not mix with each other.
4. Childcare providers shall remain solely with one group of children.

xxiii. **Animal Care Services.** Animal shelters, veterinary care, and pet food and supply stores. Grooming, if necessary for the health and wellbeing of the animal. Pet daycare, but only for employees of Essential Businesses. To the greatest extent possible, all services must be performed in compliance with social distancing requirements of six feet.

xxiv. **Religious and Worship Services.** Religious and worship services may only be provided by audio, video, and teleconference. Religious institutions must limit in-person staff to ten (10) people or less at one time, and twenty-five (25) people total per day, when preparing for or conducting video or teleconference services, and all individuals must follow the Social Distancing Rules including the six feet social distancing.

xxv. **Funeral Services.** Funeral, mortuary, cremation, burial, cemetery, and related services, provided that social distancing of six feet per person is maintained to the greatest extent possible.

c. For purposes of this Order, **Minimum Basic Operations** means the following, provided that employees comply with the Social Distancing Rules:

i. The minimum necessary activities to maintain the value of the business's inventory, ensure security, process payroll and employee benefits, or for related functions.

ii. The minimum necessary activities to facilitate employees of the business being able to continue to work remotely from their residences.

3. The Dallas County Sheriff's Office, the Dallas County Fire Marshal’s Office, and other peace officers, are hereby authorized to enforce this Order. A violation of this order may be punishable through criminal or civil enforcement. A violation of this Order is a misdemeanor punishable by a fine not to exceed $1,000 and/or confinement in jail for a term not to exceed 180 days.
4. Any manufacturer who retools their business for the purpose of manufacturing and producing ventilators, masks, personal protective equipment, or any supply necessary for Essential Healthcare Operations may apply for an “essential business” exemption under this Order. Submit requests for an exemption to BusinessCOVID19@dallascounty.org.

5. Under this Order, no person shall sell any of the following goods or services for more than the regular retail price the person charged for the goods or services on March 16, 2020, except where an increased retail price is the result of increased supplier or other costs (including the loss of supplier supporting funds):
   a. groceries, beverages, toilet articles, and ice;
   b. restaurant, cafeteria, and boarding-house meals; and
   c. medicine, pharmaceutical and medical equipment, and supplies.

6. Grocery stores, supermarkets, warehouse stores, hospitals, and medical facilities are experiencing high levels of demand for a large number of products, requiring more deliveries from manufacturers and distribution centers to serve their customers. A number of Texas cities and local associations have implemented restrictions on delivery hours to stores to mitigate truck noise and traffic. Due to the need to deliver products as quickly and efficiently as possible during this critical timeframe, this Order hereby suspends all delivery hour restrictions for transport to or from any entity involved in the selling or distribution of food products, medicine, or medical supplies in Dallas County for the next 60 days.

7. Due to increased demand for bath or toilet tissue resulting from stock up buying and individuals who purchase for resale, a mandatory limit on toilet paper sales is instituted until the supply chain meets the demand or two weeks, whichever comes first. All sales of bath or toilet tissue occurring in Dallas County are limited to the greater of: (a) twelve (12) rolls per purchase or (b) one (1) package per purchase.

8. Due to the public health emergency, the Office of the Dallas County Judge hereby advises the Dallas County Justices of the Peace to suspend eviction hearings and writs of possession for at least the next 60 days to prevent renters from being displaced.

9. If someone in a household has tested positive for coronavirus, the household is ordered to isolate at home. Members of the household cannot go to work, school, or any other community function, except for workers included in Essential Healthcare Operations who may continue to work in accordance with CDC guidance.

10. Nursing homes, retirement, and long-term care facilities are instructed by this Order to prohibit non-essential visitors from accessing their facilities unless to provide critical assistance or for end-of-life visitation.

11. Public and private schools and institutions of higher education are instructed by this Order to provide a safety plan to Dallas County Office of Homeland Security and Emergency Management 72 hours before students return to a classroom setting.

12. Additionally, the Office of the Dallas County Judge and the Health Authority instructs all employees to remain at home if sick. Employees of private businesses and nonprofits with six (6) or more employees in the City of Dallas can use their paid sick leave when they are sick or to care for sick family members.

13. This Order shall be in effect until 11:59 p.m. on April 3, 2020, or until it is either rescinded, superseded, or amended pursuant to applicable law.

14. The County of Dallas must promptly provide copies of this Order by posting on the Dallas County Health and Human Services website. In addition, the owner, manager, or operator of any facility that is likely to be impacted by this Order is strongly encouraged to post a copy of this Order onsite and to provide a copy to any member of the public asking for a copy. If any subsection, sentence, clause, phrase, or word of this Order or any application
of it to any person, structure, gathering, or circumstance is held to be invalid or unconstitutional by a decision of a court of competent jurisdiction, then such decision will not affect the validity of the remaining portions or applications of this Order.

IT IS SO ORDERED

CLAY JENKINS  
DALLAS COUNTY JUDGE

DCHHS Social Distancing Rules

1) Vulnerable Populations: Limit Outings  
   - Vulnerable populations include people who are:
     - 60 years old and older.
     - People with certain health conditions such as heart disease, lung disease, diabetes, kidney disease and weakened immune systems.
   - For vulnerable populations, don’t go to gatherings unless it is essential. Stay home. Avoid people who are sick.

2) Workplace and Businesses: Minimize Exposure  
   - Suspend nonessential employee travel.
   - Ensure employees practice social distancing and do not work within six feet of one another.
   - Urge essential employees to stay home when they are sick and maximize flexibility in sick leave benefits.
   - Do not require a doctor’s note for employees who are sick.
   - Maximize telecommuting options.
   - Persons who need to be at work to provide essential services of great benefit to the community must take steps in their workplace to minimize risk.

3) Cancel Non-essential Events  
   - Cancel non-essential events.
   - Do not attend any events or gatherings if sick.
   - For events that aren’t cancelled, we recommend:
     - Having hand washing capabilities, hand sanitizers and tissues available.
     - Frequently cleaning high touch surface areas like counter tops and hand rails.
     - Finding ways to implement social distancing.

4) Schools: Safety First  
   - Do not have your child attend school if sick.
   - If you have a child with chronic health conditions, consult the child’s doctor about school attendance.
   - Schools should equip all classrooms with hand sanitizers and tissues.
   - Recommend rescheduling or cancelling events that are not essential.
   - Explore remote teaching and online options to continue learning.
• Schools should develop a plan for citywide school closures, and families should prepare for further closures.

5) Transit: Cleaning and Protection
• Increase cleaning of vehicles and high touch surface areas.
• Provide hand washing/hand sanitizers and tissues in stations and on vehicles.
• Ensure social distancing practices are implemented to the full extent possible.

6) Health Care Settings: Avoid as possible, protect the vulnerable
• Long-term care facilities should have a COVID-19 plan in accordance with CDC or state guidelines.
• Long-term care facilities should restrict all visitation except for certain compassionate care situations, such as end of life situations.
• The general public should avoid going to medical settings such as hospitals, nursing homes and long-term care facilities, even if you are not ill.
• If you are ill, call your health care provider ahead of time, and you may be able to be served by phone.
• Do not visit emergency rooms unless it is essential.
• Follow guidance and directions of all facilities.

7) Everyone: Do your part
The best way for all Dallas County residents to reduce their risk of getting sick, as with seasonal colds or the flu, still applies to prevent COVID-19:
• Wash hands with soap and water for at least 20 seconds.
• Cough or sneeze into your elbow or a tissue. Throw the tissue in the trash.
• Stay home if you are sick.
• Avoid touching your face.
• Try alternatives to shaking hands, like an elbow bump or wave.
• If you have recently returned from a country, state or region with ongoing COVID-19 infections, monitor your health and follow the instructions of public health officials and CDC guidance.
• There is no recommendation to wear masks at this time to prevent yourself from getting sick.

You can also prepare for the disruption caused by an outbreak. Preparedness actions include:
• Prepare to work from home if that is possible for your job, and your employer.
• Make sure you have a supply of all essential medications for your family.
• Prepare a child care plan if you or a caregiver are sick.
• Make arrangements about how your family will manage school closures.
• Plan for how you can care for a sick family member without getting sick yourself.
• Take care of each other and check in by phone with friends, family and neighbors that are vulnerable to serious illness or death if they get COVID-19.
• Keep common spaces clean to help maintain a healthy environment for you and others. Frequently touched surfaces should be cleaned regularly with disinfecting sprays, wipes or common household cleaning products.
PART 2 – PRODUCTS
Not Used.

PART 3 – EXECUTION
Not Used.

PART 4 – MEASUREMENT AND PAYMENT
Not Used.

- END OF SECTION –
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PART 1 – GENERAL

1.1 SUMMARY
This Section includes the required forms and schedules necessary to meet the wage rate requirements for the Project.

1.2 FORMS
A. Request for Authorization of Additional Classification and Rate - Standard Form 1444  
   https://www.gsa.gov/forms-library/request-authorization-additional-classification-and-rate
B. General Wage Decision Rates for Tarrant and Dallas County, Texas -  
   https://www.wdol.gov/dba.aspx

1.3 WAGE RATES
A. United State Department of Labor (DOL) provides the required minimum wages and fringe benefits to be paid to all laborers and mechanics employed to work on this Contract, either directly under this Contract or under a related subcontract. The Contractor and all Subcontractors are required to report the actual wages paid to laborers and mechanics performing work under this Contract. The reported wages will be verified by review of the weekly payroll reports and by periodic on-site interviews conducted by the Construction Manager.

B. The Wage Determination establishes the minimum wages and fringe benefits to be paid to laborers and mechanics throughout the duration of this Contract. In no event shall these minimum wages be modified.

C. If the Work specified in this Contract requires work performed by laborers or mechanics whose job classification is not listed in the Wage Determination, the Contractor is responsible for preparing the Request for Authorization of Additional Classification and Rate Standard (Form 1444) located in Section 01 29 85.01. The latest version of Form 1444 may also be obtained at the following address:  
   https://www.gsa.gov/forms-library/request-authorization-additional-classification-and-rate

D. Additional copies of the latest Form 1444 may also be obtained from the Owner’s Authorized Representative (OAR). The Contractor must complete Items 3 through 15 and submit the request to the OAR prior to issuance of the Notice to Proceed (NTP) or as soon as the need for the additional classification or rate is identified, if the work has been authorized to begin.

PART 2 – PRODUCTS
Not Used.

PART 3 – EXECUTION
Not Used.

PART 4 – MEASUREMENT AND PAYMENT
Not Used.
"General Decision Number: TX20200025 01/03/2020
Superseded General Decision Number: TX20190025
State: Texas
Construction Type: Highway
Counties: Archer, Callahan, Clay, Collin, Dallas, Delta, Denton, Ellis, Grayson, Hunt, Johnson, Jones, Kaufman, Parker, Rockwall, Tarrant and Wise Counties in Texas.

HIGHWAY CONSTRUCTION PROJECTS (excluding tunnels, building structures in rest area projects & railroad construction; bascule, suspension & spandrel arch bridges designed for commercial navigation, bridges involving marine construction; and other major bridges).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.80 for calendar year 2020 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded and any solicitation was issued) on or after January 1, 2015.

If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.80 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number Publication Date
0 01/03/2020

* SUTX2011-007 08/03/2011
### WAGE RATE REQUIREMENTS

**Section: 01 29 85**

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Contract No. 9500723  
Permit No. A20-111B  
NE-EAT Package II  

01 29 85 - 3  
Wage Rate Requirements  
Issued for Bid  
April 23, 2020
WAGE RATE REQUIREMENTS
Section: 01 29 85

Roller, Other...............$ 11.51
Scraper.....................$ 12.96
Small Slipform Machine.....$ 15.96
Spreader Box...............$ 14.73
Servicer.....................$ 14.58
Steel Worker (Reinforcing)....$ 16.18

TRUCK DRIVER
  Lowboy-Float................$ 16.24
  Off Road Hauler...............$ 12.25
  Single Axle..................$ 12.31
  Single or Tandem Axle Dump
  Truck..........................$ 12.62
  Tandem Axle Tractor with
  Semi Trailer................$ 12.86
  Transit-Mix..................$ 14.14

WELDER.....................$ 14.84

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year.

Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking.

Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts. Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses 29CFR 5.5 (a) (1) (ii)).
The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier. Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG=OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage
determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

----------------------------------------------------------------

WAGE DETERMINATION APPEALS PROCESS

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to: Branch of Construction

Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.
3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

   Administrative Review Board
   U.S. Department of Labor
   200 Constitution Avenue, N.W.
   Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

- END OF SECTION –
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PART 1 – GENERAL

1.1 AOA PROCEDURES

A. These Procedures specify requirements and limitations imposed on construction and maintenance activity within the Aircraft Operations Area (AOA), the purpose of which is to ensure the safe and efficient operation of the Airport while providing maximum allowable flexibility for personnel. Any deviation from the procedures as stated herein constitutes a violation and shall be subject to enforcement in accordance with subsection 1.14.

B. Construction projects at the Airport are reviewed through conferences prior to the start of work to establish the parameters within which the work can be performed.

C. Construction projects within the Security Identification Display Area (SIDA)/AOA require that personnel display appropriate Airport Access/Identification Badges issued in accordance with subsection 1.11.

D. Motor vehicles entering the AOA must display an AOA Access Permit and be in compliance with subsection 1.12.

E. Construction projects that take place in the public areas of terminal concourses (sterile area) to include “back of house” areas such as offices and concessions within the Security Identification Display Area/Air Operations Area (SIDA/AOA) require a tool management plan in accordance with Section 01 35 13.13.01.

F. Prior to beginning the Project, the Contractor shall submit to the Owner’s Authorized Representative and the Airport Department of Public Safety (DPS) a security plan that describes how the Contractor intends to provide for the security of the construction site, Contractor staging area, and property throughout the duration of the project.

G. The Contractor’s Authorized Representative (CAR) is responsible for ensuring that these procedures are followed. Any exceptions require specific authorization by the Airport’s Operations Department and DPS on a case-by-case basis.

H. Disruption of underground Utilities on the Airport can cause degradation of aviation safety, and wide spread loss of the use of airport facilities and or services. Procedures concerning underground utilities location and protection are located in Section 01 18 16, and shall be adhered to at all times.

I. Progress meetings are to be held weekly unless otherwise stated in Contract Documents, in order to discuss schedules, planned closures, dig book, safety and security issues, and other related matters.

J. The Contractor is required to conduct daily safety briefings with all workers who will access AOA construction sites and include topics relevant to these requirements and the activities being performed. Discuss specific project movement restrictions as well as general AOA safety procedures and guidelines. Follow the safety meeting agenda provided by the Owner’s Authorized Representative (OAR). The meeting will be conducted both in English and Spanish when the size of the worker population requires bilingual communications, and will be attended by all Contractor and subcontractor personnel working inside the AOA that day. The Contractor shall record meeting attendance, including attendees’ names and employers, and shall provide a copy of the attendance sheet to the OAR. Failure by the Contractor or
Subcontractor personnel to attend these mandatory meetings could result in AOA access being denied to those individuals.

K. The Contractor’s designated Quality Control representative will conduct an “AOA Readiness Checklist” review with all personnel prior to crews entering the AOA. The AOA Readiness Checklist form is included in Section 01 35 13.13.01.

1. The AOA Readiness Checklist is to be provided by the OAR upon completion. The purpose of the checklist is to ensure that all personnel entering the AOA understand the limits of the designated work area, have all tools, materials, and equipment necessary to complete the planned activities, and have verified the operability of all powered equipment and hand tools prior to entering the AOA.

2. The intent of the AOA Readiness Checklist is to reduce or eliminate superfluous travel to and from the work site due to Contractor’s lack of initial readiness. The OAR will not call for Operations escort until the checklist review is complete.

L. Prior to the start of any project on the AOA, the Contractor, through the OAR, shall provide the Airport Operations Center (AOC) with an Emergency Phone List listing the pager, cell phone and/or home phone numbers of key members of the construction team including the OAR. The listing shall be in priority order for contacting personnel during off-duty hours, and specifically identify the individual(s) on call 24-hours a day for emergency maintenance of hazard lighting and barricades. This list shall be revised as required.

M. Project management including the Contractor’s Safety Officer must be on duty at the Airport whenever the Contractor is performing work on the AOA.

N. The Contractor shall document the condition of the work site and access roads to it prior to start of construction and restore the area to original (or better) condition when area is no longer marked as a construction site. This requirement does not apply to attaining a stand of grass as long as grass has been planted.

1.2 FORMS AND INSTRUCTIONS

A. The following forms and instructions are included in Section 01 35 13.13.01 for the Contractor’s use, as applicable on the Project:

1. Contractor’s AOA Readiness Checklist
2. Lockout Procedure for Airfield Series Lighting Circuits
3. Lockout Log for Airfield Series Lighting Circuits
4. Airfield Closure/Activity/Circuit Lockout Request Form
5. Airfield Closure/Activity/Circuit Lockout Instructions
6. Airport Construction Security Procedures Tool Management Plan
7. AOA Escort Release/Pick up Point Notice/Instructions
8. Airport Airspace Review Form

1.3 CONSTRUCTION - AIRCRAFT MOVEMENT AREA

A. When construction is being performed within the Aircraft Movement Area (AMA), the following procedures will apply:
1. All vehicle operators shall abide by the Airport Driving Handbook, published by the Operations Department and available at the following location:

2. The OAR will provide notification to and obtain approval from Airfield Operations before entering the AOA and proceeding into the construction site.

3. Approval to enter closed areas within the Movement Area must be obtained from Airfield Operations Port Control.

4. A log of each vehicle entering and exiting the closed area shall be maintained by Port Control or his/her designee.

5. Contractors are required to obtain approval to clear a work site which must be compliant with these requirements.

6. The OAR will again notify Airfield Operations when the construction activity has been cleared of all personnel.

7. Summary of Notification Requirement: Notify the OAR in advance of commencement of the following work activities by not less than the number of calendar days shown:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Notice (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Work Activities in AOA</td>
<td>Daily **</td>
</tr>
<tr>
<td>2. Airfield Operations Escort</td>
<td>2</td>
</tr>
<tr>
<td>3. Installation of Safety Area and Object Free Area boundary and Haul Route Markers</td>
<td>5</td>
</tr>
<tr>
<td>4. Temporary Lighting</td>
<td>5</td>
</tr>
<tr>
<td>5. Disconnect or Disabling of Power Circuits</td>
<td>5</td>
</tr>
<tr>
<td>6. Rerouting of ARFF Road</td>
<td>14</td>
</tr>
<tr>
<td>7. Runway/Taxiway Closure (First Notice)</td>
<td>30*</td>
</tr>
<tr>
<td>8. Runway/Taxiway Closure (Second Notice)</td>
<td>7</td>
</tr>
<tr>
<td>9. Crane Operations (FAA Approval)</td>
<td>60*</td>
</tr>
</tbody>
</table>

*Denotes "Notice" process initiated by the Airport
** Daily schedules of work activities, closures, and circuit lockouts within the AOA must be submitted in writing by email or other means to the Coordination Center.

B. Vehicle Operator

1. As approved by Airfield Operations, contractors may designate personnel to complete Airport-approved training for driving within the AMA. Successful completion of the annual training includes passing all required tests.

2. Trained and qualified vehicle operators shall only drive routes within the AMA specified by Airfield Operations. These routes shall not include crossing of an active Runway or any portion of an active Runway Safety Area (RSA). Vehicle operators will not operate in the AMA during Surface Movement Guidance &
Control System (SMGCS) Conditions (low visibility operations).

3. No vehicle shall operate unescorted within the AMA unless it is equipped with an operational flashing yellow beacon, an Airport Board radio (800 MHz, contractor furnished), and a VHF frequency radio (contractor furnished) to monitor FAA ATCT communications. This does not apply to crossing a Taxiway through an approved flagging operation.

4. All vehicles, unescorted and escorted, operating within the AMA shall not interfere with aircraft operations and must always yield right-of-way to aircraft and emergency vehicles.

5. Airfield Operations may suspend or discontinue contractor vehicle operations involving AMA-trained drivers at any time it is deemed necessary for safety and/or operational purposes.

C. Personnel Escort Requirements

1. At least one person with escort privileges possessing an Airport Identification/Access Badge must escort any individual or group of un-badged persons.

2. The proximity of the badged person to non-badged person(s) must be such that the unbadged person(s) must remain within sight and sound of the escort at all times and be under the control of the badged escort individual at all times.

3. At a minimum, the CAR, Contractor’s Quality Control Representative, Safety Officer, and all Subcontractor superintendents, foremen, and lead men will be badged. Although other members of the construction work force may obtain an Airport Identification/Access Badge, not all badged personnel will be granted escort privileges based on job classification.

4. The maximum ratio for escorting individuals within the AOA/SIDA will be one AOA badged individual to five non-badge individuals.

D. Vehicle Escort Requirements

1. Each Certified Movement Area Escort (CMAE) must be currently licensed as required by the State of Texas, possess valid insurance coverage as required by the Airport, possess a valid Airport Identification/Access Badge, and be thoroughly familiar with the provisions of this Section. A CMAE must escort all other vehicle operators at all times within the movement area.

2. A CMAE must possess their unexpired AMA Driver’s Certification on their person during all times driving unescorted within the AMA. That certification must be presented to an Airport Board employee upon request.

3. In order to sustain AMA driving privileges, a CMAE must ensure training (retraining) is completed within 12 calendar months of their initial or previous retraining session.

4. The vehicle operated by a CMAE during the performance of a vehicle escort within the AMA shall be clearly marked with "ESCORT" on both sides and on the back of the vehicle. The minimum height of the letters must be four (4) inches. Magnetic signs are acceptable.

5. A maximum of five (5) vehicles may be escorted for a total of six (6) vehicles including the escort.
6. Vehicle operators must have the ability to communicate via radio or phone with project management and each vehicle must possess a map of the Project site with detailed depictions of AOA entrance/exit points, Haul Roads, restricted areas, and other vital information.

7. Dedicated escort requirements must be coordinated with Airfield Operations in advance through the OAR.

E. All vehicle escorts must enter the AOA through a DPS Security services staffed AOA gate.

F. The escort and person(s) to be escorted will meet prior to the escort and verbally communicate the location of the intended destination, the route to be taken, and give further instruction as necessary. All escorts for construction projects on the AOA, including, without limitation, the AMA, shall be performed in a manner calculated to ensure that the escorted party (Contractor equipment, vehicles, personnel, etc.) will be released from the escort only at the designated Release Point inside the construction work area.

Details of Contractor Provided Escort Operations (Details of an Airport provided escort are identical to using an Airfield Agent):

1. The CMAE will arrive at location to begin an escort.

2. The CMAE will get out of his/her vehicle and meet with all personnel who will be under their escort and will pass out laminated Release/Pick-Up Point Escort Instruction sheets to the operator of each vehicle to be escorted.

3. The CMAE will ensure there is at least one (1) badged person for every five (5) non-badged persons.

4. The CMAE shall verbally instruct each vehicle operator to follow the escort vehicle at all times, and as closely as considerations of safety will permit, until the vehicles are released from the escort at the Release/Pickup Point preferably located at least 50’ inside of the construction work area. Contractor shall be responsible for the materials and maintenance of the Release/Pickup Point.

5. The CMAE will then escort the vehicles to the Release Point within the construction work area.

6. Upon arrival at the construction work area Release Point, the CMAE will drive around it and verify that all vehicles have arrived.

7. After the CMAE has verified that all escorted vehicles have arrived, all escorted vehicles will be directed to stop and their drivers to return the laminated escort instruction sheets back to the Airfield Operations employee.

8. Same procedure will apply for escorting vehicles out of the construction work area to an AOA gate.

9. The CMAE will not terminate the escort or release any escorted party except at a designated Release Point. For example, the CMAE shall not release the vehicle(s) being escorted outside of a cone line established for a closure and allow the vehicles to drive past the cone line into the work area unescorted. The CMAE will perform the escort past the cone line into the construction work area.
10. The CMAE will release the escort at the designated Release Point, ensuring all vehicles being escorted follow the escort vehicle past the established cone line and inside to their work area.

11. An Escort performed to construction work areas on the AOA in which a closure of a Taxiway or Runway is not in effect and an established Release Point is not being used will be conducted in a manner that the vehicles will be released at the designated point agreed to by the CMAE and the person being escorted. The release of the escort will be agreed to at the verbal briefing performed prior to the CMAE getting underway.

G. Airport provided escorts must be coordinated with Airfield Operations in advance though the OAR.

H. Contractors may perform an escort only along established Haul Roads provided the following procedures are adhered to:
   1. The vehicle operator displays a valid Airport Identification/Access Badge.
   2. The vehicle displays a valid AOA Access Permit.
   3. The vehicle is clearly marked with a three-foot square orange and white checkered flag for daytime activities or a 360-degree rotating or flashing amber light for daytime or nighttime activities.
   4. Supervisor vehicles shall have a rotating or flashing amber light that operates continuously.

NOTE: Only authorized Airport Board and FAA personnel or their assigned agents may perform escorts off established Haul Roads.

1.4 HAUL ROADS

A. Airfield Operations must approve the establishment of Contractor Haul Roads. Prior to approving Haul Road activities, the following must be established:
   1. Green flags or markers, not to be smaller than six (6) inches square mounted on wooden stakes no higher than 18 inches above the ground, must prominently mark each side of the Haul Road at intervals of not more than 100 feet apart.
   2. Stop signs (30 inches x 30 inches), or other traffic control devices, conforming to the Texas Manual of Uniform Traffic Control Devices (TMUTCD), must be clearly posted on either side of intersecting roadways, emergency roads, Taxiways and other areas specified by the Airfield Operations. Signs must normally be no nearer than 160 feet (193 feet for certain taxi routes) from the Taxiway centerline or 10 feet from the edge of the emergency road.
   3. In some cases, traffic control signal lights may be required for controlling Taxiway crossings. When signal lights are used, they shall have either 8 inch or 12 inch circular red and green lenses, and shall normally be located a minimum of 160 feet (or up to 193 feet) from the Taxiway centerlines and between 2 and 10 feet from the outside edge of the Haul Road surface. The signal height shall be no less than 9 feet or more than 15 feet above the Haul Road surface. Approval for use of traffic control signal lights will be approved on a case by case basis only by Airfield Operations.
   4. Flaggers, wearing bright reflective outer clothing, shall be posted at each
crossing to control Haul Road traffic either through flags or traffic signals. A flagger may not be allowed to perform any other function and must be able to speak and understand English.

For active Taxiway crossings, flaggers shall have completed Airport-approved training concerning the AMA. Successful completion of the annual training includes passing all required tests. Each flagger must actively monitor a VHF tower radio (Contractor furnished) tuned into the appropriate frequency when engaged in flagging operations at or near an active Taxiway. Unless otherwise specified, a flagger is required on each side of the active Taxiway to be crossed, i.e., two (2) for a single crossing point.

5. Paved areas must be kept clean at all times. An operational sweeper driven by a CMAE shall be provided at each active Taxiway crossing during hauling operations.

6. All vehicles shall stop at each Taxiway and/or emergency road before crossing to ensure the route is clear.

7. Construction vehicles must yield right-of-way to all Airport vehicles and aircraft at all times.

8. Hauling operations will be discontinued at the direction of Airfield Operations when the operation of the airfield warrants due to inclement weather or other conditions affecting aircraft movement.

9. Provide wheel wash stations for the removal of mud from trucks and other vehicles at the following locations:
   a. Prior to entry onto public thoroughfares.
   b. Prior to crossing Airport roadways, Ramps, Taxiways and Runways.

   **Note:** If the Contractor can successfully exhibit his ability to keep the paved areas, listed above, clean, the OAR may waive the requirement for wheel wash stations.

1.5 CLOSING AIRFIELD AREAS

A. No portion of the airfield may be closed to aircraft or vehicles without specific authorization from Airfield Operations. Any construction activity that affects the utilization of roadways, Taxiways, Runways, Navigational Aids (NAVAIDs), or associated electrical circuits must be prearranged and scheduled in accordance with contract documents, and specific approval granted by Airfield Operations. The Lockout Procedure for Airfield Series Lighting Circuits is included in Section 01 35 13.13.01.

B. The following activities are considered an impact to airfield areas and require closures:
   1. Obstruction of any roadway or emergency access road.
   2. Objects, excavations, men, or material within:
      a. Runway Safety Area - 250 feet from the centerline
      b. Runway Safety Area - 1000 feet off the end
      c. Taxiway Object Free Area - 160 feet from centerline (193 feet for certain...
taxi routes)

d. Taxilane Object Free Area - 138 feet from centerline (up to 167 feet for certain taxi routes)

e. Within a NAVAID Critical Area (NCA)

C. Initial notification of intended airfield closures should be prearranged no less than 30 Calendar Days in advance, except where noted otherwise within the Contract Documents or as granted by Airfield Operations on a case-by-case basis.

D. In order to enable proper coordination of airfield activities, a description of all AOA activity and planned closures must be e-mailed to the Coordination Center by 11:00 a.m. of the morning preceding nighttime closures (7:00 p.m. to 7:00 a.m.) and/or the following day's daytime closures (7:00 a.m. to 7:00 p.m.). For closures on a holiday, daytime on the day following a holiday, Saturday, Sunday and daytime on Monday, the request must arrive at the Coordination Center by 11:00 a.m. on the last Working Day prior to the holiday or weekend. The Contractor will complete an Airfield Closure/Activity/Circuit Lockout Request form, included in Section 01 35 13.13.01, and submit to the OAR with time to meet the requirement to receive the request to the Coordination Center by 11:00 a.m. Notification of cancellation of scheduled closures should be submitted to the Coordination Center by the most expeditious means available.

E. Airfield Operations reserves the right to refuse any closure due to unforeseen conditions that may require continued utilization of the area for aircraft operations. These conditions include, but may not be limited to:

1. Inclement weather/low visibility conditions
2. Delayed aircraft operations
3. Closures of higher priority (e.g. urgent maintenance activities)
4. Emergency situations

F. Closures require the placement of low profile barricades (edge of grass to edge of grass) with reflective tape and red flashing lights placed across closed Taxiways or portions of the Runway. Airfield Operations can require the Contractor to modify the locations of the barricades from what may be shown on the Plans if in their opinion such modification is necessary due to aircraft utilization of the Airport. Lighted cones may be approved in certain circumstances at the discretion of Airfield Operations.

G. Runway closures require the placement of lighted "X's" at each end of the Runway if personnel or equipment will be on the Runway at any time. Preferably, those will be trailered X's. Note, Runway closures are only restrictions for aircraft takeoffs and landings and not necessarily restrictions for aircraft taxi operations on available Runway pavement.

On Runways with intersection departures, the placement of barricades (edge of grass to edge of grass) with reflective tape and red flashing lights placed across the closed Runway to prevent inadvertent departures from the intersection will be directed by Airfield Operations.
H. For work that requires any Runway closure, any required construction equipment, materials, etc. shall be mustered on-site or at a designated area approved by the OAR prior to the execution of a Runway closure. Prior to a Runway closure, the Contractor may also be required to demonstrate the good working order of his equipment, availability of materials if off-site, adequacy of material quantities on-hand, or any other factors which might delay the Contractor’s work and subsequent reopening of the closed Runway to the satisfaction of the OAR and/or Airfield Operations.

I. All areas closed to aircraft operations must be prominently marked and lighted in accordance with these standards, or as directed by Airfield Operations or the OAR. **No construction activities will be allowed to begin prior to completion of all marking and lighting requirements as well as the installation of the Release/Pick up Point.**

J. Taxiway guidance signs, centerline lights, and edge lights that could otherwise lead an aircraft into a closed area shall be deactivated and/or covered as directed by Airfield Operations. Signs must be obscured with blank panels. Plastic wrap is prohibited.

K. Taxiway centerline markings that could otherwise lead an aircraft into a closed area shall be obliterated by means of water blasting. Any existing markings that are effected by the removal operations must be restored for continuity, i.e., centerline removed over top of Runway edge marking.

L. For any work activity located at or beyond the Runway holding position markings and on or within 50 feet of pavement, a Runway closure is required regardless of the distance from the Runway centerline.

1.6 MARKING AND LIGHTING

A. All construction equipment must be marked by a 3-foot square orange and white checkered flag during daylight hours or an amber rotating or flashing beacon during daylight or nighttime. Supervisory and escort vehicles must display a 360-degree amber rotating or flashing beacon. For nighttime construction, certain other vehicles, cranes, and pieces of construction equipment may require lighting as directed by Airfield Operations.

B. All excavations and closed areas on the AOA must be prominently marked with low profile barricades with reflective tape and lighted with red flashing lights or as directed by Airfield Operations and the OAR.

C. The low profile barricades shall be interconnected and must extend from edge of grass to edge of grass or across entire paved surface of closed area.

D. No construction activities will be allowed to end before all excavations have been marked and lighted as required.

E. Excavations adjacent to full strength Taxiway pavement of an active Taxiway or excavations within a Taxiway Safety Area shall be marked with lighted barricades that must be as low as possible to the ground; of low mass; easily collapsible upon contact with an aircraft or any of its components; and weighted or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, or other surface wind currents. If the barricades are affixed to the surface, they must be frangible at grade level or as low as possible, but not to exceed 3 inches above the
ground. Non-frangible hazard markings, such as concrete barriers, metal-drum type barricades or timbers (railroad ties) shall not be used in the AOA.

F. Excavations within the Non-Movement Areas shall be marked with collapsible barricades marked with diagonal, alternating orange and white stripes; each barricade attached or joined together with two flashing red lights on each end.

G. Excavations within 10 feet of emergency roads shall be marked with lighted Type A barricades or Airport approved traffic control devices.

H. Orange construction fencing shall be used in the AOA as depicted in the construction phasing plans in accordance with the following:
   1. Plastic construction fencing shall not be utilized within a Runway or Taxiway Object Free Area (OFA), within 138 feet (up to 193 feet in some locations) of a taxilane centerline, or in any other area where jet blast could be a problem.
   2. Approval of the material by the OAR is required before using construction fencing on the AOA.
   3. Construction fencing and supports must be kept in a satisfactory condition (all supports in place, material securely attached to the supports and no tears in the material).
   4. The use of construction fencing is no substitute for prominently marking and lighting an excavation.
   5. When used to mark the boundaries of the construction site, the posts shall have a white reflective marker at the top of the post that is visible from outside the construction site.

I. Barricades, cones, and/or construction fence shall be removed when directed by the OAR or when the requirement for marking of hazardous areas no longer exists.

J. Release/Pick Up Point markings shall consist of 3 foot square black and white checkered flag located within a group of five (5) orange cones with amber lights placed 50 feet inside of the closed area

K. All marking, lighting, signs, flags, cones, barricades, and other safety related devices shall be maintained to 100 percent serviceability at all times.

1.7 SAFETY AREAS

A. A Safety Area is the surfaces surrounding a Runway and Taxiway in which no potentially hazardous ruts, humps, depressions, or other surface variations (in excess of 3 inches) may exist. Surface conditions must be capable under dry conditions of supporting the Aircraft Rescue and Fire Fighting (ARFF) vehicles and other heavy equipment, and supporting the occasional passage of aircraft without causing major damage to the aircraft.

B. Safety Area dimensions are as follows:
   1. Runways: 250 feet either side of centerline, 1000 feet off each end.
   2. Taxiways: 107 feet either side of the centerline, total 214 feet side (131 feet from centerline on certain taxi routes).

C. The Contractor may be required to immediately terminate his work within an RSA at the instructions of the OAR or Airfield Operations. Work may be performed outside
an RSA without closure as long as weather minimums are not less than 1000-foot ceiling and/or 3 miles visibility.

D. Barricades with lights will be required to mark the RSA adjacent to the actual work areas.

E. Barricades will be required to be placed on both sides of the nearest Taxiway intersection to prevent any planes turning into the closed area.

1.8 OBSTACLE FREE ZONE

A. An Obstacle Free Zone OFZ is a three-dimensional area involving imaginary surfaces in the vicinity of a Runway. Objects, vehicles, and stockpiled material will not be permitted to penetrate an OFZ whenever the weather conditions are below an 800 foot ceiling or less than two miles visibility and aircraft are using an Instrument Landing System (ILS) approach.

B. OFZ surfaces are as follows:

1. An inner-transitional surface OFZ begins at 200 feet from the Runway centerline, rises vertically to an elevation of 39 feet above the Runway elevation, and then slopes 6:1 to a height of 150 feet above the established Airport elevation. (For Category II/III Runways, the surface rises vertically to an elevation of 23 feet above the Runway elevation and then slopes 5:1 for a distance of 657 feet from the Runway centerline, then slopes 6:1 to 150 feet above the established Airport elevation.)

2. An inner-approach OFZ begins 200 feet from the Runway threshold at the same elevation as the Runway threshold and ends 200 feet beyond the last approach light unit. Its width is 400 feet and it rises at a slope of 50:1.

3. Objects that do not penetrate the OFZ may still require approval by the Airport Operations Department based on the requirements contained in Federal Aviation Regulation Part 77.

C. Object Free Area

1. An Object Free Area (OFA) is a two-dimensional area surrounding a Taxiway and Taxilane within which no object may be located that is not completely mobile and capable of clearing the OFA for each passing aircraft. EXCEPTION: Airport Approved objects such as barricades, markers, flags, and lights used to define excavations are allowed to remain within the OFA.

2. Normal OFA dimensions are as follows:

   a. Taxiways - 160 feet from centerline. (193 feet for certain taxi routes).
   b. Taxilanes - 138 feet from centerline. (167 feet for certain taxi routes).

3. Airfield Operations must authorize construction activities within OFAs in advance.

4. No objects will be allowed to remain within a Taxiway or Taxilane OFA above barricade height.

5. At the approval of Airfield Operations, mobile equipment and/or personnel on foot may operate within the OFA provided it is properly marked and lighted, and a flag person is used to signal the pullback of all persons and equipment for each passing aircraft. A flag person may not be allowed to perform any other
function.

6. Using "pull back" procedures when working within a Taxiways' OFA during nighttime hours is prohibited unless the area of work has sufficient light in the opinion of Airfield Operations. Sufficient light may include artificial light that is either existing or supplied by the Contractor. If it is chosen to bring in additional artificial light for the work area, a layout plan shall be submitted to Airfield Operations for approval. At a minimum, the plan shall show the type(s) of light, the location of light(s) and whether or not the light(s) will be shielded. Airfield Operations may require additional information to determine the impact of construction lights on airfield operations.

**Exception:** No activities will be allowed within 160 feet (193 feet for certain taxi routes) of a High Speed Exit (HSE) Taxiway unless that HSE Taxiway is closed.

D. NAVAID Critical Area

1. Work will not be authorized within an NAVAID Critical Area (NCA) without specific approval by Airfield Operations.

2. NCAs include Runway ILS NAVAIDS and microwave signal paths.

E. Criteria for Marking Construction Sites, Safety Areas, OFA, and NCAs

1. White markers or flags are used to prominently mark the boundaries of construction sites when such marking is determined to be feasible. Alternatively, orange construction fence may be used for this purpose in accordance with subsection 1.6.H above.

2. Red markers or flags must prominently mark the boundary of a RSA and a Taxiway OFA. Prior to beginning any activity within 50 feet of the RSA or Taxiway OFA, the boundary shall be further marked with low profile barricades that are interconnected.

3. Yellow markers or flags must prominently mark the boundary of a Runway OFA (400 feet from a Runway centerline) and an NCA. **NOTE:** Construction activities are subject to being terminated whenever visibility is at or below 3/4 mile, except as approved on a case-by-case basis.

4. All markers/flags must be made of reflective material and be no smaller than 6 inches square mounted on 2 inches x 2 inches wooden stakes no higher than 18 inches above the ground. Each marker or flag must be placed no further apart than 50 feet and extend to the limits of the construction site. **NOTE:** Airfield Operations on a case-by-case basis may grant exceptions.

5. No work shall begin in areas requiring these markers or flags until the OAR have confirmed the correct placement.

6. The markers or flags must be continuously maintained as installed unless work is confined to periods when the associated Runway, Taxiway, or Taxilane is closed or the NAVAID has been removed from service.

7. Workers and equipment are prohibited from passing beyond red or yellow markers or flags designating a Safety Area, OFA, or NCA without the approval of the OAR as obtained from Airfield Operations on a case-by-case basis except when the associated Runway or Taxiway/Taxilane is closed.
8. Markers or flags shall be removed when directed by the OAR or when work within these areas is completed.

F. Trenches, Excavations, and Stockpiles

1. No trenches or excavations will be permitted within the following areas:
   a. Within 250 feet of a Runway centerline (200 feet if approved by Airfield Operations).
   b. Within 1000 feet from the Runway end.
   c. Within 107 feet (131 feet on certain taxi routes) of a Taxiway centerline unless the opening is properly barricaded and lighted.

2. Stockpiles (including spoils piles) are not permitted within the boundaries of the AOA; however, the Contractor may submit a request to the OAR for a stockpile within the AOA. When such a stockpile is permitted, it shall be restricted to 3 feet tall and shall not be permitted in the following areas unless additional specific approval has been granted:
   a. Within 400 feet of a Runway centerline.
   b. Within 160 feet of a Taxiway centerline (193 feet on certain taxi routes).
   c. Within 138 feet of a Taxilane centerline (167 feet on certain taxi routes).
   d. Within 2700 feet of the end of a Runway (Runway OFA Extension).
   e. Within an NCA.

3. All trenches, excavations, and stockpiles must be prominently marked and lighted.

G. Staging of Construction Equipment

1. Construction equipment is not permitted to be staged (stored) within the boundaries of the AOA; however, the Contractor may submit a request to the OAR for equipment storage within the AOA. When such an authorization has been obtained, the equipment shall not be permitted in the following areas unless additional specific approval has been granted:
   a. Within 400 feet of a Runway centerline.
   b. Within 160 feet of a Taxiway centerline (193 feet on certain taxi routes).
   c. Within 138 feet of a Taxilane centerline (167 feet on certain taxi routes).
   d. Within 2700 feet of the end of a Runway (Runway OFA Extension).
   e. Within an NCA.

2. All construction equipment authorized to be staged (stored) within the boundaries of the AOA, must be prominently marked and lighted as directed and approved by the OAR.

H. Use of Extended Height Equipment

1. The use or installation of extended height construction equipment (more than 20 ft. high) such as cranes, "cherry pickers", drill rigs, and batch plants are prohibited without prior approval of the Airport.
2. The Contractor shall provide advanced notice for the use of such equipment at any location on the Project site. The Contractor shall complete and submit to the OAR the Airport Airspace Review Form included in Section 01 35 13.13.01.

3. No such equipment shall be transported onto the Airport site prior to the approval of Airfield Operations through the OAR.

4. If utilized at night or in conditions of poor visibility (less than 3 miles visibility), the equipment must be lighted in accordance with FAA Advisory Circular 70/7460-1 (most current version) Obstruction Marking and Lighting and/or as directed in the airspace study. Lights must be visible throughout 360°, and steady burning red lights must have a minimum light intensity of 32.5 candelas and flashing red lights shall have a peak effective intensity of 2000 ± 25 % candela.

5. This equipment shall be lowered to its stowed height when not in use or as directed by the OAR in concurrence with Airfield Operations.

I. Maintenance of Construction Areas

1. Construction boundaries shall be clearly defined and marked/fenced as directed by Airfield Operations.

2. The Contractor shall be responsible for maintaining construction areas to the same standards used on the remainder of the airfield including such items as:
   a. Maintaining grass height of 6 inches to 10 inches.
   b. Maintaining the work area to remain clear of debris, trash, and excessive construction materials at all times.
   c. Maintaining all markers, barricades, cones, signs, lighting and erosion control devices in proper working/functional condition.

1.9 CONSTRUCTION - NON-MOVEMENT AREAS

When construction activity is performed within the Non-Movement Area of the AOA (Ramp, Taxilane, etc.), the procedures established for the movement area generally apply unless otherwise authorized by Airfield Operations, EXCEPT:

Unescorted access though Terminal Security Gates is limited to those persons displaying a valid Airport Identification/Access Badge encoded with “terminal gate access” authorization. The term “Terminal gate access” is defined as any badge holder whose badge has been encoded to grant access through security gate checkpoints within passenger terminals. Those badge holders who do not have terminal gate access privileges encoded in their badge must be escorted by someone who has terminal access privileges.

1.10 AIR OPERATIONS AREA SECURITY

A. Each employee working within the AOA must be briefed on AOA security regulations and a record of such training maintained by the Contractor. Each employee must attend AOA Safety Coordination meetings prior to the start of work within the AOA that includes security enforcement subject matter. Failure to attend may result in employee being denied access to the AOA.

B. Each non-badged employee that is allowed escorted access to the AOA for the purpose of construction activities must possess and render for inspection...
government-issued picture identification. Identification documents shall be subject to
being verified through a credential check process by the Airport. All non-badged
individuals will be required to carry valid government issued identification with them
at all times while working inside the AOA.

C. It is the responsibility of every Airport Identification/Access Badge holder to challenge
anyone in the AOA who does not have an Airport Identification/Access Badge
prominently displayed unless that individual is under escort by a properly badged
individual with escort authority.

D. Construction storage/office areas located outside the AOA must be secured to
prevent unauthorized entry by the public.

E. The Contractor shall maintain project related AOA fences intact and secure at all
times. A 10 foot clear zone will be maintained on both sides of the fence. The clear
zone will remain free of stockpiled materials and/or vehicles.

F. Notify Airfield Operations each Working Day, through the OAR, prior to initial entry of
any personnel into the AOA. Airfield Operations shall be notified again after the last
personnel leave the AOA at the end of each workday.

G. The Contractor shall utilize approved AOA staffed gates to gain access to the AOA
provided coordination has been made through the OAR and the DPS. The
Contractor may also request approval from the Airport Operations Department and
the DPS to install a new gate (normally such gates are not approved within the
SIDA). If approved, a gate number will be assigned by DPS and a work order will be
submitted to install a DPS approved lock. Gates in the Central Terminal Area (CTA)
will require Access Control equipment and will be manned by DPS Security Officers.
Gates not located in the CTA will also be manned by DPS Security Officers.

H. The Owner will be responsible for funding and the Contractor will be responsible for
coordination of staffing with DPS and the OAR. Additionally, the Contractor will be
responsible for installing an air conditioned and heated security post, restroom and
telephone. Specifications for guard houses may be obtained from the Airport Design
Criteria Manual. Any exceptions will be at the discretion of the DPS.

I. All AOA gates, that are not automatic or manned, shall be secured with a single
Airport locking mechanism.

J. The use of Contractor provided locks in place of or in addition to Airport locks is
specifically prohibited. The DPS will not issue an AOA gate key to the Contractor or
any Subcontractor on the Project.

K. In the event that construction requires a portion of the AOA fence or gate to remain
open on a temporary basis, the opening will be secured by a DPS Police or Security
Officer.

1. The Owner shall be responsible for the funding. The Contractor will be
responsible for coordination of staffing with DPS and the OAR. The DPS
provides Police or Security Officers from the off-duty employment pool. Contact
the DPS Airport Security Staffing Coordinator (972-973-4710) or by email at
asi@dfwairport.com.

2. All fence openings or gates shall remain closed until the Security Officer has
verified the vehicle and all occupants are authorized to enter the AOA.

3. Persons or vehicles with proper identification shall be denied entry if their
presence in the AOA is not related to the Project. Unauthorized entry shall be reported immediately to the DPS and the AOC.

L. Entrance through Terminal Security Gates in the CTA may be permitted under the following conditions:

1. Unescorted access through Terminal Security Gates is limited to those persons displaying a valid Airport Identification/Access Badge programmed with "access" authorization in a vehicle displaying a valid AOA Vehicle Access Permit.

2. A person issued an Airport Identification/Access Badge with "access" must present their badge to the DPS Airport Security Officer or DPS authorized representative for validation.

3. A person issued an Airport Identification/Access Badge with "access" authorization but does not have the badge in their possession or a person issued a badge without "access" authorization shall not be permitted to enter the AOA through a Terminal Security Gate even under escort.

4. A person who does not possess a valid Airport Identification/Access Badge or has not been issued a badge may be allowed to enter the AOA through a Terminal Security Gate only on official business and only when under escort. The non-badged individual will be documented on a visitor's log along with the authorized individual conducting the escort and must also have a valid government issued photo identification on their person at all times.

5. The maximum ratio for escorting individuals within the CTA will be one (1) Airport Identification/Access Badge individual with escort authority to five (5) non-badged individuals. Non-badged individuals must remain within visual and physical proximity to the badge holder and also must have valid government issued photo identification on their person at all times.

6. No one will be permitted to enter a Terminal Security Vehicle Gate on foot. All persons and property are subject to inspection by security personnel.

NOTE: Violations of AOA security requirements within Contractor controlled areas of responsibility, which result in criminal or civil penalties, or fines shall be the responsibility of the Contractor and/or individual to resolve or pay, and may result in the temporary or permanent suspension of the Airport Identification/Access Badge.

M. For AOA access and/or construction activities in the west airfield, all badged personnel shall successfully complete the West Cargo Area training program. Upon completion of the training, each badge holder must request the West Cargo Matrix be added to their badge access through the authorized signatory.

1.11 AIRPORT IDENTIFICATION/ACCESS BADGE

A. No person shall enter the SIDA/AOA without authorization. Any person found on the SIDA/AOA without proper identification as described herein shall be considered unauthorized, removed from the SIDA/AOA, and subject to prosecution and suspension or revocation of the Airport Identification/Access Badge.

B. All persons authorized access to the SIDA/AOA shall clearly display a valid Airport Identification/Access Badge issued by the Airport on their outer garment, above the
waist and below the neck or shall be escorted by an authorized agent of the Airport, the FAA, or a representative of the airline or tenant.

C. It is the responsibility of every Airport Identification/Access Badge holder to challenge anyone on the SIDA who does not have a valid Airport Identification/Access Badge prominently displayed unless that individual is obviously under proper authorized escort.

D. The ACO administers Airport Identification/Access Badges and is managed by the DPS: The Airport Identification/Access Badge is an easily identifiable badge, about the size of a standard credit card. It must be prominently displayed on the outermost garment above the waist and below the neck of the person to whom it was issued.

E. Applications
   1. New applications for an Airport Identification/Access Badge shall be submitted in the manner prescribed by the ACO and coordinated with the OAR. Copies of the application may be obtained from the OAR. Instructions for filling out the form are on the back of the form. Care should be followed in filling out the application.
   2. Each applicant must submit to a criminal history records check through submission of fingerprints to the FBI. In addition, each applicant must receive an “Approved” Security Threat Assessment (STA) result from the TSA prior to badge issuance. Those persons who have been convicted of a disqualifying crime and/or who do not receive an “Approved” STA result from the TSA per CFR 1542 shall be denied a badge.
   3. Upon approval of the Airport, the application shall be submitted on-line to the ACO located at Terminal D, on the departure level, between Gates 19 and 22.
   4. The fees for fingerprinting and the Airport Identification/Access Badge shall be per the current Schedule of Charges.

F. Revocation
   2. Upon termination or upon conclusion of the requirement to access the SIDA, the employees of the Contractor shall be responsible for immediately surrendering the Airport Identification/Access Badge to the authorized signatory.
   3. The Contractor shall be billed a non-returned badge fee for all badges not returned to the ACO within ten (10) Working Days from the date the ACO is notified of the termination of access privileges.
   4. DPS and the badge holder’s sponsor have authority to revoke an Airport Identification/Access badge. If an individual’s Airport Identification/Access Badge is revoked, the person will be immediately escorted from the SIDA/AOA or detained by DPS.

G. Authority
   1. The authority to produce and issue an Airport Identification/Access Badge lies solely with the Airport.
2. No person shall produce, copy, issue, or use a similar badge at the Airport.

3. No person shall in any way alter an Airport Identification/Access Badge.

4. The Airport Identification/Access Badge is the sole property of the Airport and issued for the exclusive use of the individual identified thereon.

5. The Airport Identification/Access Badge must be surrendered for inspection upon request of an authorized agent of the Airport.

1.12 AIR OPERATIONS AREA ACCESS PERMIT

A. No motor vehicle shall enter the AOA unless such vehicle displays an AOA Access Permit or is under escort by a duly authorized agent of the Airport, the FAA, or tenant responsible for the AOA gate through which the person is to enter.

B. The ACO administers Access Permits for the AOA.

C. A permanent Access Permit is an easily identifiable decal affixed to the left front and rear bumpers of the vehicle to which the permit has been issued and is valid for a maximum of three (3) years. It displays the permit number and expiration date.

1. A temporary permit is a green colored hanging card placed on the rear-view mirror of the vehicle to which the permit has been issued. A temporary permit is not transferable to another vehicle. This permit is valid for a specific period of time up to 90 Calendar Days, and contains the following information:
   a. Vehicle license plate number
   b. Expiration date
   c. AOA rules

2. Applications
   a. An application for an Access Permit shall be submitted in the manner prescribed by the DPS and coordinated with the OAR. Copies of the application may be obtained from the OAR or the DPS webpage at: https://www.dfwairport.com/badge/
   b. An application for an Access Permit approved by the sponsoring Airport department shall be submitted to the ACO for issuance. Note: Contact the Airport Risk Management Office for insurance requirements necessary to obtain a vehicle permit.

3. Revocation
   a. Violation of the AOA Rules and Regulations is grounds for immediate revocation of AOA vehicle access authority.
   b. Upon termination or upon conclusion of the requirement to access the AOA, the employer/holder shall be responsible for surrendering the Access Permit to the Airport.

4. Authority
   a. The authority to produce and issue an Access Permit lies solely with the Airport.
   b. No person shall produce, copy, issue or use a similar permit at the Airport.
c. No person shall in any way alter an Access Permit.

d. An Access Permit is issued for the exclusive use of the vehicle identified on the permit application.

1.13 MOTOR VEHICLES ON AOA

A. Authorization and Registration of Vehicles

1. No motorized vehicle shall enter the AOA unless its driver thereof is duly authorized to operate such vehicle on state or municipal highways and has duly authorized access to the AOA/SIDA (if required). All persons authorized unescorted access to the AOA/SIDA shall display an Airport Identification/Access Badge issued by the Airport.

2. No motorized vehicle shall enter the AOA unless such vehicle displays an Access Permit issued by the Airport, or is under proper escort.

3. All traffic within the AOA shall comply with all lawful orders, signals, or directions of any authorized agent of the Airport. When signs or pavement markings control such traffic, they shall be obeyed unless otherwise directed by an authorized agent of the Airport.

B. Safe Operation of Vehicles:

1. No vehicle shall be operated within the AOA in a careless or negligent manner, in disregard of the rights and safety of others, at a speed or in a manner which endangers persons or property, while the driver thereof is under the influence of an intoxicant, or if such vehicle is so loaded or poorly maintained as to endanger persons or property.

2. Prior to driving within the AOA, the vehicle operator must complete the Airport Driver Training Program on AOA Awareness and/or Nonmovement Area driving. For activities in the west airfield, the vehicle operator must also complete the West Cargo Area driver's training.

3. Night or Low Visibility Operations: For night or low visibility operation, all headlights, tail lights, and running or clearance lights on the vehicle shall be operational. The driver of each vehicle shall be responsible for the proper operation of such lights. During SMGCS conditions (visibility less than 1,200 feet visibility) there may be restrictions on the use of vehicles on the AOA. Vehicles not directly in support of aircraft operations will not be allowed access to the AMA; and non-essential vehicles in support of aircraft operations should not be operated on Ramps and aircraft parking areas.

4. Vehicles to Stay to the Right: All vehicles on the AOA shall remain on the right side of a roadway, shall pass any vehicle approaching on an open unmarked traffic area to the right, and shall yield the right-of-way to vehicles approaching from the driver's right unless otherwise directed by sign, signal, or an authorized agent of the Airport or when necessary to maintain the safe operation of the vehicle relative to traffic flows.

5. Vehicle Speed:

a. The maximum speed limit on all AOA Ramps is 20 mph and is enforced by the DPS.

b. Vehicles operating on the Ramps, Aprons, and operational areas of the
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Airport shall proceed with care. Erratic driving and excess speeds on these areas are forbidden. Judgment of such excess speed or erratic driving shall lie with the DPS, Airfield Operations, the OAR, and other authorized agents of the Airport.

6. Involvement of Vehicles in Accidents:
The driver of any vehicle involved in an accident within the AOA, which results in injury or death to any person or damage to any property, shall stop at the scene of the accident and render such assistance as may be needed. The driver shall also provide his or her name, address, and operator's license number to the person injured or to the representative of the owner of the property damaged or to any officer or witness of the injury. Further, the operator shall immediately notify the AOC and submit a report of that accident to the DPS.

7. Parking Vehicles:
a. No person shall park a vehicle or permit the same to remain in the AOA except at such places and for such a period of time as may be prescribed or permitted by the Airport or under emergency conditions.
b. No person shall stop or park a vehicle so as to block a driveway, an AOA gate, an aircraft gate or a fire lane, or in other than authorized areas or within 15 feet of a fire hydrant.

8. Right-of-Way:
All motor vehicles on the AOA shall yield the right-of-way to aircraft in motion under all conditions, and all Airport vehicles have right-of-way over Contractor vehicles.

C. Prohibited Vehicles:
1. The use of motorcycles, bicycles, and two-wheeled motor scooters on the AOA is prohibited. EXCEPTION: DPS vehicles.
2. Vehicles that are not in sound mechanical order with adequate lights, horn, brakes, and have clear vision from the driver's seat are prohibited from operating on the AOA.
3. Trailers and semi-trailers shall be equipped with proper brakes so that when disengaged from towing vehicle, neither aircraft engine blast nor wind shall cause them to become free rolling. Positive couplings shall be required for all towed equipment.
4. Vehicles that have not obtained specific authorization from Airfield Operations are prohibited from operating on active portions of the AMA. When authorized, vehicles shall have a radio transceiver or shall be escorted by a vehicle with such equipment to ensure clear two-way radio communication with the Control Tower, and all operators shall have had successfully passed ground vehicle operator training prior to operating vehicles on the AMA.

D. Driving Under Aircraft: It is prohibited to drive under any portion of an aircraft.
E. Taxiway: At no time shall a vehicle enter an active Taxiway, unless it is operated by an AMA trained and qualified driver and appropriately equipped, or accompanied or
directed by a radio-equipped vehicle in contact with, and has been so authorized by the FAA Tower.

F. Runway: At no time shall a vehicle enter a Runway, unless it is accompanied or directed by a radio-equipped vehicle in contact with, and has been so authorized by the FAA Tower.

G. Taxiway: At no time shall a vehicle enter an active Taxiway, unless it is operated by an AMA trained and qualified driver and appropriately equipped, or accompanied or directed by a radio-equipped vehicle in contact with, and has been so authorized by the FAA Tower.

H. Runway: At no time shall a vehicle enter a Runway, unless it is accompanied or directed by a radio-equipped vehicle in contact with, and has been so authorized by the FAA Tower.

I. Driving between Aircraft and Loading Gate: No Person shall drive any vehicle between an aircraft and a loading gate, when passengers are using the surface walkway between such gate and aircraft, or between an aircraft signal person and an aircraft being pushed out or preparing to taxi.

J. Driving Distance from Exhaust: Modern, large jet aircraft produce exhaust velocities that can be hazardous to vehicle operations as much as 70 feet behind the aircraft at idle thrust. At the thrust levels required for an aircraft to start moving from a stop, that distance increases to as much as 300 feet. Therefore, extreme caution must always be exercised whenever passing behind large jet aircraft.

K. Fueling or De-fueling of Vehicles:

No person shall fuel or de-fuel vehicles, or other equipment, in an enclosed space at the Airport without the prior approval of the DPS Fire Prevention Bureau.

L. Special Vehicle Marking:

Vehicles operating on a Runway or Taxiway that do not require an escort must display an amber-rotating beacon.

1.14 ENFORCEMENT OF AOA PROCEDURES

Violations of any of these procedures may, at the discretion of the Vice President of Operations (Vice President of Public Safety for regulatory statutes, i.e. Airport Rules & Regulations) or his/her designated representative(s) and depending on the severity of the violation, result in the following:

A. A verbal and/or written warning.

B. The individual or vehicle in violation being temporarily or permanently removed from the AOA.

C. The Contract work being stopped until corrective measures are taken to preclude a recurrence of the violations.

D. Civil and/or criminal penalties per applicable local, state, and federal laws and the Code of Rules and Regulations.

1.15 RULES AND REGULATIONS FOR THE CONTROL OF AOA BOUNDARY CROSSING BY VEHICLES

A. General Requirements
1. Statement of Policy: It is the policy of the Airport that all vehicles, unless otherwise authorized herein, shall enter and exit the AOA via established gates.

2. Authority for Enforcement: The Vice President of Public Safety is designated the Administrator of the Code of Rules and Regulations (Administrator) for the control of AOA boundary crossings. He/she may establish procedures not inconsistent with the Code of Rules and Regulations that he/she determines are necessary to affect the policy of the Code of Rules and Regulations. The DPS shall be responsible for the enforcement of the Code of Rules and Regulations.

B. Enforcement of AOA Boundary Crossing Regulations

1. Violations
   a. If the Administrator determines that a badge holder violates terms of its operating authority, the Code of Rules and Regulations, the Administrator may notify the holder in writing of the violation and by written order direct the holder to correct the violation within a reasonable period of time. In setting the time for correction, the Administrator shall consider the nature of the violation.
   b. If the violation involves equipment that is unsafe or functioning improperly, the Administrator or his/her authorized agent shall order the holder to immediately cease use of the equipment.
   c. If the Administrator determines that a violation is an imminent and serious threat to the public health or safety, the Administrator or his/her authorized agent shall order the holder to correct the violation immediately. If the holder fails to comply, the Administrator shall promptly take, or cause to be taken, any action considered necessary for the immediate enforcement of the order.

2. The Administrator shall include in a notice issued under this subsection:
   a. An identification of the violation;
   b. The date of issuance of the notice;
   c. The time period within which the violation must be corrected;
   d. A warning that failure to comply with the order may result in suspension or revocation of operating authority; and
   e. A statement indicating that the order may be appealed to the Executive Vice President Airport Operations.

C. Service of Notice

1. A holder shall designate and maintain a representative to:
   a. Receive service of notice required under the Code of Rules and Regulations to be given a holder; and
   b. Serve notice required under the Code of Rules and Regulations to be given a driver employed or contracting with a holder.

2. Notice required under the Rules and Regulations to be given:
A holder must be personally served by the Administrator or on notice sent by certified United States mail, five (5) day return receipt requested, to the holder or the holder's designated representatives.

a. A driver must be personally served by the Administrator or notice sent by certified United States mail, to the address last known to the Administrator of the person to be notified, or to the designated representative for the driver.

b. Service executed in accordance with this subsection constitutes notice to the person to whom the notice is addressed. The date of service for a notice that is mailed is the date of receipt.

D. Appeal

1. A holder may appeal a correction order issued under subparagraph 1.b. above or any other action of the Administrator if an appeal is requested in writing not more than fourteen (14) Calendar Days after notice of the order or action is received.

2. The Executive Vice President Airport Operations shall act as the appeal-hearing officer in an appeal hearing under this subsection. The hearing officer shall give the appealing party an opportunity to present evidence and make argument in his/her behalf.

3. The hearing officer may affirm, modify, or reverse all or part of the order of the Administrator.

1.16 SURFACE INCIDENTS AND RUNWAY INCURSIONS

The Contractor shall perform all work in compliance with this Section, and avoid surface incidents and Runway Incursions at all possible cost. Should a surface incident or Runway Incursion occur due to the Contractor’s negligence, it will constitute a violation and shall be subject to enforcement per subsection 1.14. Entry into the AMA without a CMAE or authorized Airport provided escort and AOA Construction Escort Release/Pick Up Point Instruction Card or without clear instruction/direction from a flag person at a controlled intersection are examples of violations.

Course of action for such occurrence includes a monetary fine of $30,000 for each occurrence.

A. Definitions

1. Surface Incident is an unauthorized or unapproved movement within the designated movement area (excluding Runway Incursions) or an occurrence in that same area associated with the operation of an aircraft that affects or could affect the safety of flight. Examples include, but are not limited to, not yielding right-of-way to aircraft; entering a Taxiway when not qualified, under escort, or directed by a flag person; or depositing debris on a Taxiway resulting in a stopped or damaged aircraft.

2. Runway Incursion is any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and takeoff of aircraft. Examples include, but are not limited to, crossing the Runway holding position marking or entering the RSA from the grassy area regardless of whether or not an active aircraft
operation was taking place at the time.

B. An AOA Incident Review Board, chaired by the Vice President of Operations or his/her authorized designee will review the facts surrounding movement area surface incidents and/or Runway Incursions including the affected Contractor and/or department’s policies and procedures.

C. The Review Board’s recommendation(s) will be coordinated with the Human Resources advisor (if required), and a decision as to the level of disciplinary action to be taken per Airport Board Policy will be made by the Chairman.

D. The Chairman will notify the affected Contractor and/or department vice president of the disciplinary action to be administered.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

PART 4 – MEASUREMENT AND PAYMENT

Not Used.

- END OF SECTION -
PART 1 - GENERAL

1.1 This Section includes the requirements of the temporary facilities and controls required on the Project.

A. Temporary utilities:
   1. The temporary utilities include providing electrical service, lighting, heating, cooling and ventilation, telephone, water, and sanitary facilities for the Project.
   2. The Temporary facilities may include the use of existing system as applicable.
   3. The Contractor shall be responsible for installation, operation, and maintenance throughout the Project period and removal of the systems at the end of the Project.

B. Barriers and Construction Signing: Furnish, install and maintain suitable barriers as required to prevent public entry, and to protect the work, existing facilities, trees and plants from construction operations; remove when no longer needed, or at completion of Work. Provide barriers and construction signing as required or deemed necessary to protect the work area and traveling public, as indicated on the Drawings, or as directed by the Owner’s Authorized Representative for work in the ramp areas to protect tug traffic, aircraft, airline personnel and other assets in the active airfield during construction of the project. The Contractor is ultimately responsible to plan, execute and maintain barriers, traffic control devices, etc.

C. The installation and removal of temporary construction barricades per Section 01 56 23 – Temporary Barricades.

D. The Contractor shall be responsible for the control of dust on the Project site as well as temporary erosion and pollution controls.

E. Temporary Controls:
   1. Dust Control Plan
   2. Temporary Erosion and Sediment Control
   3. Pollution Control

1.2 REQUIREMENTS OF REGULATORY AGENCIES

A. Barriers and Construction Signs shall comply with federal, state and local codes and all regulations pertaining to traffic control devices and construction sign regulations. Coordinate Traffic Control devices and Construction Sign Regulation with Design, Code, & Construction Traffic Engineer through coordination with the Owner’s

1.3 TEMPORARY UTILITY SERVICE REQUIREMENTS

The Contractor shall provide all the temporary utilities including the following services:

A. Electrical: Power Source: Current Owner approved Electrical Service provider, Oncor Electric Delivery.
B. Provide temporary lighting for field offices, storage facilities, shops, Work areas, circulation areas for personnel and other construction areas.

C. Provide heating, ventilation and cooling:
   1. Maintain temperature, humidity, and ventilation in enclosed areas to provide ambient conditions for storage, preparation, and Work; to cure installed materials, to prevent condensation, and to prevent accumulations of dust, fumes and gases.
   2. During non-working hours, maintain temperature in enclosed areas at a minimum of 50 degrees F or higher as specified in the individual Sections.

D. Arrange with local telephone service companies to provide and install direct line service to field offices.

E. Provide water acceptable for use in its intended purpose.
   1. Potable water may be obtained from the Owner's existing service water facilities. Obtain water at locations approved by Owner's Authorized Representative (OAR).
   2. Provide the meter(s) required to record amount of water used.
   3. Complete and submit the Water Request Form included in Section 01 50 00.01.

F. Provide all utilities and associated facilities at time of Mobilization.

1.4 TEMPORARY UTILITY DISTRIBUTION
   A. Provide weatherproof distribution boxes with required outlets, fused switches and equipment grounds.
   B. Provide wiring, connections, and protection for temporary lighting.
   C. Provide wiring, connections, and protection for temporary and permanent equipment for environmental control, for temporary use of electrically operated equipment, and for testing.
   D. Provide valve controlled outlets located so that water is available under adequate pressure by means of hoses.

1.5 USE OF EXISTING SYSTEMS
   A. The Contractor may use the existing mechanical and electrical systems temporarily and shall coordinate such use with the OAR for terms and conditions for use of systems in Owner occupied areas.
   B. The Contractor shall monitor utilities usage to prevent any interference with Owner's normal requirements and notify the OAR of any abnormal usage (volume, pressure, or duration).

1.6 USE OF PERMANENT SYSTEMS
   A. If the Contractor wishes to use any Owner permanent system, the Contractor shall obtain written authorization from the Owner for such use and establishing the start of warranty and conditions of use for:
1. Completed systems with all utility connections and safety devices installed and operational.

2. Completed systems that operate using automatic controls as required by the Contract Documents.

3. Filters and other protective devices for the equipment are in place and operational.

B. Submit an Indoor Air Quality Plan to the OAR for review and approval to ensure the use of any Owner permanent system will not negatively impact the Owner's use of the facility. The Contractor shall monitor the continuously monitor conditions to ensure air and water system cleanliness throughout the construction period.

C. Use of Fire Hydrants:

No person shall open, turn off, interfere with, attach any pipe or hose to or connect anything with any fire hydrant, stop valve, or stop cock, or tap any water main belonging to the Owner, unless authorized to do so by the Central Utilities Plant coordinated through the OAR and have an approved Water Request Form on file.

1.7 COST OF TEMPORARY FACILITIES

A. The Contractor shall pay for the cost of the following:

1. Permits and inspections unless otherwise provided for in the Contract.

2. Installation of temporary utilities, materials, operation, maintenance and removal.

3. Energy consumed until beneficial occupancy unless provided for in Contract.

4. Fuel consumed by portable units.

5. Water used throughout the Contract.

NOTE: Water will be billed to Contractor at the rate of $ X.XX per 1,000 gallons used.

B. The Owner will pay the cost for the following:

1. Fuel consumed in use of existing systems, except for fuel consumed by portable units.

2. Temporary easements required across property outside the Owner’s property.

1.8 MAINTENANCE OF TEMPORARY FENCE

A. Maintain temporary fence in good repair, with gates and locks in good operating condition.

B. No graffiti will be permitted. If any is found, remove by appropriate means, or repaint, as necessary.

1.9 PROJECT SIGNS ON FENCING

A. The number, size, style, and type of project signs displayed upon this fence are subject to the approval of the Owner’s Authorized Representative and must be reviewed by Owner prior to being erected or displayed.

1.10 DESIGN OF TEMPORARY FENCE
A. Temporary barricade fence shall be a 6'-0" high chain link fence.

B. Vehicle gates and personnel gates shall be equipped with sufficient and suitable hardware to function unabatedly throughout course of construction. Gate locations shall be as approved by the Owner’s Authorized Representative.

1.11 VENDING MACHINES

A. The Owner has exclusive vending contracts in place within the Airport for food, snacks and beverages that pay a substantial sum of money to the Owner on an annual basis. If the Contractor desires to place vending machines on their Project site, the Contractor shall coordinate all requests for placement of vending machines with the Airport Concessions Department through the OAR.

B. Prior to submitting an application to add any other vending source, the Contractor shall first receive a turndown in writing from the primary vending source(s). After receiving a turndown, the Contractor may ask for approval to place other vendor’s equipment on the Project site.

C. No vending equipment may be set-up on the Project site or elsewhere on the Airport prior to receiving the Airport Concessions Department’s written approval from the OAR.

PART 2 - PRODUCTS

2.1 MATERIALS FOR TEMPORARY FACILITIES

The Contractor shall provide the following:

A. New or used materials which are adequate to the intended purpose.

B. All devices and equipment shall meet Underwriter’s Laboratory (UL) requirements.

C. Telephone Equipment: Products of the local service company or specialty devices compatible with service company requirements.

D. Drinking water dispensers of the size and number sufficient to service the Contractor and Owner’s staff. The number and locations of dispensers will be approved by the OAR.

E. Water meter(s) as shown on the Plans which remote reading indicators can be added as a standard option and be equal to those manufactured by Hersey Products, Inc. Only water meter(s) designed to be installed on fire hydrants will be approved for such use.

F. Backflow preventer on all temporary construction water services with a line sized backflow preventer equal to Beeco Model 6-C as shown on the Plans. The Contractor shall install a test valve for facilitating a backflow prevention test.

G. Enclosed portable toilet facilities, self-contained units, secluded from public view meeting the requirements of State and local health regulations and ordinances.

PART 3 – EXECUTION

3.1 TEMPORARY FACILITIES INSTALLATION

The Contractor shall provide the services and facilities as follows:

Contract No. 9500723 01 50 00 - 4 Issued for Bid
Permit No. A20-111B Temporary Facilities and Controls April 23, 2020
NE-EAT Package II
3.2 OPERATION AND MAINTENANCE

A. The Contractor shall operate and maintain the temporary systems to provide continuous service throughout the Project and promptly replace worn or defective parts.

B. Permanent heating, ventilation and cooling:
   1. Clean or replace filters and install filters in duct extensions as necessary to maintain the work areas and finished areas in a condition meeting the requirements of the Contract.
   2. Prior to operation of permanent equipment, the Contractor shall verify that controls and safety devices are complete, equipment has been tested, and inspection made by authorities and approved for operation.
   3. Place zones of permanent HVAC system in operation sequentially as work progresses.
   4. Install temporary filters in air handling units and ducts, replace as necessary to prevent dust in equipment and ducts, to avoid contaminates in work of finished areas as set forth in the approved Indoor Air Quality Plan.

C. Clean sanitary facilities twice per week and maintain in a sanitary condition. Provide all supplies such as toilet paper, paper towels, and soap in suitable dispensers.

D. Dispose of water or sewage in a satisfactory manner so that no nuisance is created and so that the Work under construction will be adequately protected.

3.3 TEMPORARY BARRIERS AND SIGNAGE INSTALLATION

A. Install barriers and controls to a uniform appearance, structurally sound and adequate for the purpose intended.

B. Maintain barriers during entire construction period as required for each area.

C. Relocate barriers as required by progress of construction.

D. Install concrete traffic barriers (CTB) in accordance with the Traffic Control Plan Drawings and as directed by the Owner’s Authorized Representative.

E. Cover trenches and holes when not in use. Erect barriers at sharp changes in plane compliance with OSHA Regulations.

3.4 FENCE INSTALLATION

A. Prior to start of work at Project site, install enclosure fence with locked entrance gates where shown on Contract Documents.
B. Provide construction fence around material storage and construction areas to prevent unauthorized access.

3.5 DUST CONTROL
A. The Contractor shall provide positive methods and apply dust control materials to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from dispersing into atmosphere.
B. The Contractor shall maintain dust control measures including, but not limited to, watering down materials to prevent blowing dust/materials and taking necessary actions to abate any nuisance related to excessive dust caused or brought about by the Work to the satisfaction of the OAR.

3.6 EROSION CONTROL
A. The Contractor shall plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
B. Hold areas of bare soil exposed at one time to a minimum. Provide temporary control measures such as berms, dikes, and drains.
C. Construct fills and waste areas by selective placement to eliminate surface silts or clays, which will erode.
D. Periodically examine earthwork to detect any evidence of erosion, apply corrective measures as required by pollution control in accordance with Section 01 57 13.

3.7 POLLUTION CONTROL
A. The Contractor shall provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by discharge of noxious substances from construction operations.
B. Perform emergency measures required to contain any spillage and to remove contaminated soil or liquids. Excavate and dispose of contaminated earth offsite and replace with suitable compacted fill and topsoil.
C. Prevent harmful substances from entering public waters and the disposal of wastes, effluence, chemicals or other substances adjacent to streams or in sanitary or storm sewers.
D. Provide systems for control of atmospheric pollutants and prevent toxic concentrations of chemicals and harmful dispersal of pollutants into atmosphere.
E. Comply with the Storm Water Pollution Prevention Plan (SWPPP) included in the Plans.

3.8 WASTE DISPOSAL
The Contractor shall dispose of waste throughout the Project in accordance with Section 01 74 19.

3.9 REMOVAL OF TEMPORARY FACILITIES AND CONTROLS
A. The Contractor shall perform the following:
B. Remove the temporary materials and equipment at Substantial Completion of the Project.

C. Restore existing and permanent equipment when used for temporary service to original condition at Substantial Completion.

D. Remove any temporary underground installations to a depth of two (2) feet and grade site as indicated in the Plans.

E. Replace temporary filters with new, clean, reusable filters at Substantial Completion.

F. Remove each water meter at Substantial Completion and leave the water valve in place when the temporary service has been supplied through a water main. Install coat valve and piping remaining with coal tar coating system in accordance with NAPCA (National Association of Pipe Coating Applicators) TF-2, TF-3, TG-2 or TG-3 specifications.

G. Remove portable toilets when no longer required for the Contractor or Owner’s staff.

PART 4 MEASUREMENT AND PAYMENT

Not Used.

- END OF SECTION -
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PART 1- GENERAL

This Section covers the requirements for the construction, layout, and furnishing of the Owner’s Field Office for the Project including maintenance, service, and removal.

PART 2 - PRODUCTS

The Owner’s Field Office shall include more than one (1) desk for support staff of designers, auditors, purchasing agents, computer operators etc. The Owner’s Field Office layout and facilities shall comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the Texas Accessibility Standards (TAS), whichever is more stringent, and with associated local permitting and inspection regulations. Evidence that the structure itself has been approved by the Airport Design, Code and Construction Department (DCC) shall be required.

Temporary construction trailer (one-triple wide trailer) used for the Owner’s Authorized Representative (OAR) shall include stairways, landing platforms, and ADA ramps that comply with the Accessibility Code for buildings and with associated local permitting and inspection regulations. Evidence that the building itself has been approved by the OAR is required.

PART 3 - EXECUTION

3.1 The Owner’s Field Office shall meet the following:

A. The Contractor shall provide a minimum of one (1) Construction Field Offices in the Contractor's Staging Area for the OAR's sole use that meets the requirements of Part 2. Any other construction site field offices needed by the Contractor for his/her use shall be supplied by the Contractor.

B. The Construction Site Field Offices shall be located in the Contractor's Staging Area. The site is outside of the air operations area and outside the AOA security fence. Installation of the Construction Field Offices, including all permitting, furnishings, equipment, and utilities shall be completed by the Contractor within fifteen (15) Days of the Notice to Proceed and shall be maintained by the Contractor through the duration of the Project at no additional expense to the
OAR. The Contractor is responsible for the installation and maintenance, including any direct or incidental expenses related to, of power and telecommunications line between Field Office(s) and point of service and the maintenance, use, and upkeep for the duration of the Project. The Contractor is responsible for temporary power and telecommunications service being installed and operational within fifteen (15) days from the Notice to Proceed. Internet Connectivity with a minimum speed of 50 Mbps. The Contractor is responsible for ensuring that the Construction Site Field Office(s) are properly permitted (including, but not limited to plumbing permits).

C. The Contractor's Staging Area and access thereto shall be kept neat and orderly throughout construction and all deficiencies in the maintenance of this area shall be promptly corrected by the Contractor. The site shall be restored to a condition equal to the condition prior to the start of construction and equal to the condition of areas adjacent to the site and as approved by the OAR. Stockpiling of any material will not be permitted without prior approval of the OAR.

D. The Construction Field Offices for the OAR use shall remain on-site and available to the OAR throughout construction, and through project closeout, and shall have a minimum of two (2) doors and a window area of not less than forty-eight (48) square feet. Windows shall be provided with security bars. All doors and windows shall be provided with screens and secure locks. Provide mini-blinds for all windows.

E. Electric power shall be provided to include a minimum of four (4) 100-volt a/c duplex electric convenience outlets. At least one such outlet shall be located on each wall. The electrical distribution panel shall provide not less than two (2) circuits providing 110-volt, 60-Hertz service.

F. Lighting shall be provided for office to provide illumination at the tables and desk at a level of 100-foot candles. An outdoor lighting fixture with three hundred (300) watts shall be provided at each door.

G. Heating and air conditioning of sufficient capacity shall be provided at no expense to the OAR to adequately control the temperature at all times.

H. The Contractor shall provide integral sanitary facilities within offices for the sole use of office personnel. Sanitary facilities shall include a water closet and washbasin with hot and cold potable running water. Contractor to obtain sanitary sewer permit and provide connection to sanitary sewer or equip trailers with holding tanks that will be maintained daily. Each restroom shall be provided with liquid soap and dispensers, toilet paper and dispenser, toilet seat covers and dispenser, paper towels and dispenser, waste baskets, industrial first aid kits with eye washers, and continuous on-going supply of all disposable goods.

I. Extended area, non-coin-operated telephone service shall be provided within the office area. Contractor shall be responsible for telephone service installation and installation fees. The installation shall include sufficient extension cord to serve the plan table and desk. Telephone system shall include voice mail accessible
from outside phone line and shall accommodate keying in sufficient number of digits to allow access to outside voice mail by name or by number. Submit system specifications for the OAR approval. Include connection fees, usage fees, and full maintenance.

J. Construction Field Offices for the OAR personnel shall be equipped with the furniture, services and equipment listed below. All furniture, services and equipment will be maintained by the Contractor upon issuance of the Notice to Proceed and continue through the duration of the Project at no additional expense to the OAR.

<table>
<thead>
<tr>
<th>Furniture, Services, and Equipment</th>
<th>OAR Offices</th>
<th>OAR Bull Pen</th>
<th>Conference Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lockable, four-drawer file cabinets (legal size)</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>3-shelf bookcases</td>
<td>3</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Metal plan rack, 12 sticks</td>
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<td>2</td>
<td>-</td>
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<tr>
<td>In/Out Mailboxes</td>
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<td>6</td>
<td>-</td>
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<tr>
<td>Lockable metal supply cabinet</td>
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<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Refrigerator, minimum 18 cubic feet</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Microwave, minimum 2.0 cubic feet</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Bulletin board and marker board, 4' x 8'</td>
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<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Wastebasket</td>
<td>6</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Dry erase board 3’ x 2’ white boards</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Refrigerated bottled water dispenser unit, with hot and cold water dispenser and disposable cup supply</td>
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<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Conference room with table &amp; chairs to accommodate 10 persons</td>
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<td>1</td>
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</tr>
<tr>
<td>Herman Miller Aeron Work Chairs</td>
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<td>8</td>
<td>-</td>
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<tr>
<td>Standard size desk with six drawers</td>
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</tr>
<tr>
<td>Full Height Cubicles – 5.5 high with integrated storage cabinets -2 and draws suitable for holding file with locks</td>
<td>0</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Color Copy/Scan Machine with at least following features: Plain paper, dry toner type and capable of printing/scanning 11”x17” documents via feeder. This includes paper and all other necessary accessories.</td>
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<td>-</td>
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<tr>
<td>FAX machine with dedicated phone line</td>
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<td>-</td>
</tr>
<tr>
<td>Hard wired telephone and internet connection jacks</td>
<td>3</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

3.2 PARKING FACILITIES
The Contractor shall provide well drained, graded paved, or well compacted gravel surface for use by the Owner's staff. Provide not less than 10 parking spaces for standard sedans and pickup trucks.

3.3 MAINTENANCE AND CLEANING

A. Daily janitorial service shall be provided for offices with periodic cleaning and maintenance for storage areas.

B. The Contractor shall maintain approach walks free of mud and water.

C. The Contractor shall be responsible for all costs associated with equipment and services provided for the Owner’s Field Office, including costs for equipment and/or services which are provided by the Contractor, but which are not specifically required by this Section.

3.4 REMOVAL

A. At Final Completion of the Project Work, or earlier if agreed by the Owner’s Authorized Representative (OAR), the Contractor shall remove the structure(s), foundation, utility services, and all remaining debris and restore the area to its original condition to the satisfaction of the OAR.

PART 4 - MEASUREMENT AND PAYMENT

Not Used.

- END OF SECTION -
PART 1 – GENERAL
1.1 REQUIREMENTS INCLUDE:
A. Public Safety and Convenience
B. Temporary Traffic Control Plan
C. Temporary Traffic Control Devices
D. Traffic Signage and Pavement Markings
E. Traffic Control Signals
F. Flagger Control
G. Haul Routes
H. Removal
I. Vehicle Relocation Procedures
J. Requesting Off-Duty Officers for Traffic Control

PART 2 – PRODUCTS
2.1 TRAFFIC CONTROL DEVICES
A. Provide traffic control devices for street and highway construction, maintenance, utility, or incident management operations that conform to the current edition of the Texas Manual on Uniform Traffic Control Devices (Texas MUTCD) and AASHTO's Roadside Design Guide. The Texas MUTCD serves as the principal standard governing the application, design, and placement of traffic control devices.
B. Provide a traffic control plan which describes temporary traffic control measures to be used for facilitating roadway users through work zones or incident areas in a safe and orderly manner.
C. Provide signs, channelizing devices, portable changeable message signs, traffic barriers, cones, drums, and temporary pavement markings that comply to the Texas MUTCD.
D. Provide an engineering study to determine whether the installation of a traffic control signal is justified at a particular location. The study will include the analysis of the applicable factors contained in the traffic signal warrants listed in the Texas MUTCD.

PART 3 – EXECUTION
3.1 PUBLIC SAFETY AND CONVENIENCE
A. Submit a traffic control plan to the Airport’s Traffic Engineer for approval. Plan must be approved before any temporary traffic control devices are put in place. The Work is located on a major and operational airport. The Owner considers the safety, the orderly movement, and unrestricted flow of the traveling public and other users of the Airport, to be of the utmost importance, and, therefore, to be an essential part of the Contract. Public safety and convenience and provisions therefore, made necessary by the Work, shall be the direct responsibility of the Contractor and shall be performed at its own expense.
B. Do not close any bridge, drainage facility, or any portion of the roadway to traffic except as designated in the approved traffic control plan or Drawings.
and other areas involving pedestrian movement shall remain open and accessible to pedestrians unless designated otherwise in the traffic control plan or Drawings.

C. The Contractor shall coordinate with Owner’s Authorized Representative for designated parking areas for each construction project.

3.2 TRAFFIC CONTROL PLAN

A. The development and application of a well-designed temporary traffic control plan can ensure safe mobility for all road users and safeguard for workers in a work zone.

B. Provide a sealed and signed traffic control plan for all work that displaces the traffic stream during construction, maintenance, and utility activities. Describe lane closures, shoulder closures, mobile closures, and any activities within the “clear zone”, as defined by AASHTO’s *Roadside Design Guide*. Specify traffic control devices and procedures necessary to protect workers and motorists, and to route motorists safely and efficiently through lane closures and work zones. Place traffic control signage within the road user’s view so that maximum visual acuity is provided. Position signage with respect to location, orientation, height, and lateral clearance, as specified in the current edition of the Texas MUTCD.

C. Address pavement drop-offs in work zones in the traffic control plan as specified by TxDOT’s *Roadway Design Manual – Appendix B*. Appendix B addresses the proper treatment for different pavement drop-offs in work zones with respect to lateral clearance and condition of vertical drop.

D. DPS Fire and Emergency response vehicles must have an adequate lane width for movements through a work zone. The absolute minimum lane width is 11 feet. Provide additional width along a road horizontal curve to provide to accommodate the path sweep and off-tracking of oversized vehicles.

3.3 TEMPORARY TRAFFIC CONTROL DEVICES

A. Traffic control devices are all signs, signals, markings, and other devices used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street, highway, and pedestrian facility.

B. Do not erect temporary traffic control devices prior to the placement of advance-warning signs.

C. Maintain channelizing devices, and advance warning signs. Keep them clean, visible, in good condition, and properly positioned at all times. Replace damaged devices. Provide enough traffic control devices to replace any damaged devices during construction.

D. Monitor traffic control component parts or the areas of a temporary traffic control work zone to ensure that traffic control measures are operating effectively and that all devices are clearly visible, clean and in good condition.

E. Use proper traffic control devices during hours of low visibility to delineate traffic lanes and to guide traffic.

F. Coordinate all traffic control work zones within the airport roadway network with the Airport’s Traffic Engineer 72 hours prior to implementing a temporary traffic control. Airport’s Traffic Engineer will coordinate with DPS, AOC, and the airport community.
3.4 TRAFFIC SIGNAGE AND PAVEMENT MARKINGS
A. Provide traffic signs that comply with Part 2, Signs, and Part 6 of the Texas MUTCD
B. Provide traffic markings that comply with Part 3, Markings, of the Texas MUTCD

3.5 FLAGGER CONTROL
A. Provide Flagger’s that meet the requirements of Chapter 6E of the Texas MUTCD Temporary Traffic Control.
B. Provide trained and equipped flaggers to regulate traffic when construction operations encroach on public traffic lanes or as specified in the temporary traffic control plan.
C. For daytime and nighttime activity, flaggers shall wear safety apparel meeting the requirements expressed in the Texas MUTCD.
D. Flaggers should be able to demonstrate the following abilities:
   1. Receive and communicate traffic related instructions.
   2. Control signaling devices to provide clear and positive guidance to drivers.
   3. Understand and apply safe traffic control practices.

3.6 HAUL ROUTES
A. Use only established roadways or use temporary roadways constructed by the Contractor when and as authorized by the Owner. Do not load vehicles beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by and federal, state, or local law or regulation when materials are transported in prosecuting the Work. Protect curbs and sidewalks from damage. Repair any damaged curbs, sidewalks, or roads.
B. Notify the Owner in writing at least forty-eight hours prior to the movement of heavy equipment or wide or slow-moving vehicles to or from the Site. Adhere to vehicular routes established by the Owner.

3.7 REMOVAL
A. Remove all traffic control devices and equipment immediately when no longer required. Repair any damage caused by the installation of traffic control devices. Remove post setting to a depth of two feet.
B. Remove, cover or turn away traffic control devices from approaching traffic so the devices are not visible to drivers when work is suspended for short periods or that are no longer appropriate for the conditions.

3.8 VEHICLE RELOCATION PROCEDURES
The following procedures are established in order to relocate legally parked vehicles in public parking facilities operated by the Airport Board due to construction.
A. Post a “30 Day Closure Notice” sign at the entrance to the parking facility. Sign specifications are available from the DFW Sign Shop.
B. If the closure involves only a section of the parking facility, the signs should be posted in the affected area to delineate closure of the specific section. Cones, barrels, tape, barricades or any combination thereof may be used to secure vacant spaces.
C. If vehicles have not been removed after 30 days, the DFW Project Manager will ensure that the Contractor:

1. Contact the Board’s contract wrecker service 48 hours in advance to ensure the company has adequate staffing.
2. Barricade the entrance to prevent additional vehicles from parking if the entire lot is involved.
3. Ensure that before and after photographs are taken of vehicles that will be relocated.
4. Create a vehicle log that includes the color, make, model, license plate number and document any existing damage.
5. Note the location where the vehicle was parked and to where it has been relocated. Relocation should be as close as practical to the original location.
6. If relocating vehicles at Remote Parking, notify Guest Services at (972) 973-4840.
7. If relocating vehicles parked at Express Parking, notify Parking Contract Bussing at (972) 574-0370 and AMPCO at (972) 574-7414.
8. If relocating vehicles parking at the Employee Parking Lots, notify Parking Contract Bussing at (972) 822-7704.
9. Fax a copy of the vehicle log to DPS Communications at (972) 973-3194, DPS Project Planning & Management Division at (972) 973-3597, DFW Customer Service at (972) 574-0342, Parking Guest Relations at (972) 973-4841, South Parking Control Plaza at (972) 973-3816, North Parking Control Plaza at (972) 973-3806 and the Airport Operations Center (AOC) at (972) 973-3188.

3.9 REQUESTING OFF-DUTY OFFICERS FOR TRAFFIC CONTROL

A. This section contains information and instructions on the proper procedures used to request Off-Duty Police Officers for traffic control purposes. Owner shall furnish a DPS gate guard at any gate while it is opened or un-locked. No unguarded airfield security fence opening shall be permitted at any time.

B. Procedures:

1. Conduct work in accordance with a Traffic Control Plan submitted and approved by the DFW Traffic Engineer. Robert Rodriguez, P.E. can be contacted at (972) 973-1783 to assist with this process.
2. Attend the weekly Traffic Control Coordination Meeting to discuss the project scope and the need for Off-Duty Police Officers. Traffic related project must be included in the weekly Traffic Advisory that is maintained and distributed to the Airport Community by DFW DPS.
3. Submit a formal request for off-duty police officers to the Project Planning & Management Division Commander at DPS Station 1. Contractor shall be responsible for all payment for off-duty police officers. Off-duty officers are considered incidental to the traffic control pay item.
4. The Project Planning & Management Division Commander or designee will
review the request and may consult the DFW Traffic Engineer to insure that the Traffic Control Plan complies with all applicable laws/ordinances.

5. The Project Planning & Management Division Commander retains the right to approve or reject the utilization of Off-Duty Police Officers. The determination is based on public safety and proper implementation of the Traffic Control Plan per legal/industry standards – Texas MUTCD.

6. Once authorization has been granted, the Project Planning & Management Division Commander will notify the Off-Duty Coordinator to process the request and initiate the off-duty job notification.

7. If there are any questions concerning these procedures, changes or cancellations for Off-Duty Police Officers, please contact the DPS Desk Sargent at (972) 973-3533.

C. Additional information and responsibilities for Contractors:

   1. Attend the weekly Traffic Control Coordination Meeting is held in Conference Room 120 of the DCC Building located at 3003 S. Service Road, DFW Airport. The DFW Traffic Engineer facilitates this meeting every Monday at 10:00 a.m.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

   A. Traffic control shall be measured per lump sum for all traffic control required for this project.

   B. No separate measurement is required for DPS Gate Guard as this work shall be considered an incidental obligation to Traffic Control pay item 01 55 26-1.

4.2 PAYMENT

   A. Traffic control shall be paid for at the contract unit price per lump sum. This price shall be full compensation for all preparation, removal, maintenance, relocation, delivery, labor, furnished equipment, tools, and incidentals necessary to complete this item. This price shall include the DPS gate guard. No separate payment shall be made for furnishing and installing barricades, closure markers, properly equipped vehicles and construction equipment, signage, traffic cones, fencing, gates or any other required materials and equipment required by this specification as these items shall be considered a subsidiary obligation to Traffic Control.

   B. Guard shack shall be incidental. This includes all preparation, removal, maintenance, relocation, delivery, labor, install/remove utilities, furnished equipment, tools, power, heater, air conditioner, sani hut, and incidentals necessary to complete this item.

   C. No separate payment shall be made for DPS gate guard as this shall be considered a subsidiary obligation to the Traffic Control pay item 01 55 26-1.

   D. Furnished Lighted Cones, Furnished Type B Collapsible Barricades (AOA), and Installation, Maintenance, and Removal of Traffic Control and Barricades (AOA) shall be incidental to the work.
E. Lighted Runway Closure Markers and Low Profile Barricades shall be incidental to the work. These items will be furnished and returned to DFW at the Completion of the Project.

F. Detour Pavement, Temporary Barricades, Temporary Construction Fencing, Signs, and Traffic Handling shall be incidental to the work.

G. Installation, Maintenance, and Removal of Temporary, All-Weather Haul Roads will be incidental to the work.

Payment will be made under:

Item 01 55 26-1 Traffic Control – per Lump Sum
Item 01 55 26-2 Guard Shack – per Each

- END OF SECTION -
PART 1 – GENERAL

1.1 This Section includes all the requirements for the staging areas to be required for the Project.

1.2 SUMMARY

A. The staging area(s) for the Project shall be assigned by the Airport Environmental Affairs Department (EAD) if shown on the Plans.

B. The staging area on the Airport shall not be used for the storage of chemicals, materials, and equipment related to any Contractor's off-site work.

C. The Contractor shall submit an Erosion Control Plan (ECP) and a Storm Water Pollution Prevention Plan (SWPPP) to the Owner's Authorized Representative (OAR) if the staging area(s) is/are not already included in the Plans ECP or SWPPP.

D. The Contractor shall comply with the EAD Administrative Policy Staging Yard Authorization and Utilization procedures, the International Building Code 2009 (IBC), and the International Fire Code 2009 (IFC) and Local Amendments.

1.2 DEFINITIONS

A. Final Stabilization: A construction site status where all soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as crushed stone, riprap, gabions, or geotextiles) have been employed.

B. Temporary Structure: A portable building, Conex container, or shade structure that will be on-site less than ninety-one (91) Calendar Days from the date of the letter of authorization to construct, deliver, or erect such a structure.

1.3 SUBMITTALS

A. Site Plan: The Contractor shall submit a proposed site plan to the OAR for review and approval after coordinating the site with the EAD. The site plan shall at a minimum, include the following.

1. Proposed location(s) and dimensions of any area to be fenced and used by Contractor for staging.

2. Location and dimensions of each temporary and permanent structures.

3. Avenues of ingress and egress.

4. Details of the fence and gate installation. Comply with IFC Chapter 506 which requires a Knox Lock at all gates to grant access to Emergency Personnel.

5. Methods or devices to be used at exits to prevent the tracking of mud.

6. Location of material storage areas.

7. Location of equipment storage, and vehicle parking.

8. Location of areas for fuel storage, fueling operations

9. Locations for vehicle or equipment maintenance, including areas for washing of equipment.
10. Location of storm drains and drainage channels that could receive runoff from the staging area.

11. Identify the Subcontractors or others that will share the staging area.

12. Location and methods of containment for any flammables, chemicals or hazmat materials that will be stored in the staging area. Include a Material Safety Data Sheet (MSDS) for all such materials.

B. The Contractor shall obtain the approval of the OAR for the Subcontractors or others that will share the staging area.

C. A structure over 1,000 square feet shall be provided with a fire alarm system. For a structure with less than 1,000 square feet, the Contractor shall obtain a determination through the OAR from the Airport Fire Marshal and Design, Code, and Construction Department (DCC) whether a fire alarm or other measures must be incorporated to ensure life safety.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 STAGING AREA

A. The Contractor shall obtain an EAD Construction Staging Yard Checklist from the OAR.

B. The entrance to the staging area shall be provided with signs including:
   1. The name of the Contractor and all Subcontractors.
   2. Address – To be provided by the OAR
   3. The Contractor’s 24 hour emergency contact number.

C. Project(s) Identifiers: Permit Number, Project Name, Contract Number, SWPPP and NOI notices.

D. A copy of the Contractor material and chemicals list and the Construction Staging Yard Application (which includes a list of material and chemicals to be stored) shall always be available at the staging area.

E. Implement erosion control measures in accordance with Section 01 57 13.

F. Arrange for a Life Safety Inspection by the DCC after setup, after tear down and annually while the staging area is in operation.

G. Enclose the staging area with a security fence.

H. Establish an all-weather access road to ensure emergency equipment access to structures, and material and equipment storage areas in accordance with IFC Chapter 5. Obtain approval of the temporary access road from OAR for the Design, Code, and Construction Department (DCC) and the Airport Fire Marshal.

I. Install construction exits in areas of ingress/egress, equipment service areas, and in parking areas to prevent rutting and the tracking of mud and in accordance with Section 01 57 13.
J. Obtain approval of separate and distinct storage areas, including employee parking from the OAR and the EAD.

K. Design and construct temporary and permanent structures in accordance with the IBC, IFC, and Local Amendments.

L. Obtain General Work Permits in accordance with IFC Chapter 105 from the OAR.

M. Stockpile all materials inside the Contractor staging area.

N. Provide each entrance to the primary staging area or all separate or distinct storage areas with an appropriate Knox Box in a location approved by the Fire Marshal in accordance with IFC Chapter 506. Provide a key to each structure inside the staging area in the Knox Box. Order boxes through the Fire Marshal’s office.

O. Park all mobile construction equipment within the staging area at the end of each Working Day.

P. Store salvageable materials resulting from demolition activities within the staging area or at a supplemental storage area approved by the EAD in accordance with the ECP and SWPPP.

Q. Stack stored materials and products off the ground within the staging area. Maintain stored materials and products in a neat and orderly method that allows ready access to materials and products.

R. Follow the IFC guidelines when using or storing hazardous, flammable or combustible materials. Specifically reference Chapter 34 which requires the NFPA 704 placard and proper labeling of all products. Store drums and containers off the ground and on pallets and properly seal containers and label each container. Provide any secondary containment as appropriate.

3.2 MAINTENANCE OF STAGING AREA

The Contractor shall maintain the staging area throughout the Project including, but not limited to the following:

A. Maintain the perimeter fence in good repair and proper alignment.

B. Comply with IFC Chapter 3 which includes the following general precautions against fire: maintain vegetation, establish designated Smoking Areas, post No Smoking signs, provide orderly storage, and remove construction debris, waste, and packing materials from the staging area before it becomes a nuisance / fire hazard.

C. Check the staging area daily for spills, standing water, and other sources of contamination. Immediately implement reporting and removal procedures when found in accordance with Section 01 57 19.13.

D. Properly clean dirt or mud that becomes tracked out of staging area onto paved or surfaced roadways as soon as possible and no later than the same Working Day and eliminate the source of the tracking material.

E. Maintain all-weather roads to ensure emergency equipment access to structures, equipment, and material storage areas. Repair potholes and ruts as they are identified and no later than 24 hours after identification.
3.3 RESTORATION OF STAGING AREA

At the end of the Project, the Contractor shall restore the staging area at Substantial Completion to its pre-existing condition, or as otherwise directed by the OAR, by performing the following:

A. Remove all structures, materials and equipment from within the staging area.
B. Remove all fencing and fence posts completely or as otherwise directed by the OAR.
C. Fill in all holes and depressions.
D. Remove all gravel and apply four (4) inches of clean top soil and seeding as needed to restore the site to a stabilized condition or as otherwise directed by the OAR.

3.4 CLOSURE

A. The OAR will perform a Final Stabilization inspection and approval of the OAR is required prior to being approved for Construction Permit Closure.
B. A final fire and life safety inspection will be conducted by the DCC and Fire Marshal to determine if the site meets all relevant codes.
C. The Owner may, at their discretion, not require the staging area to be demobilized and restored if the staging area will subsequently be utilized to support in-progress Airport projects.

In such case, the later contractor will be required to fulfill all of the guidelines to ensure the staging area is maintained and updated if the current Contractor is requested to turn over the staging area.

D. If the Contractor is involved in more than one contract on the Airport that warrants a staging area, the Contractor may transfer the staging area responsibilities into the most current SWPPP when the Contractor has completed the Project.
E. The OAR will be solely responsible for all interpretations of codes and guidelines and will make the final determination. The Construction Permit Closure shall not be granted until all OAR approvals have been obtained.

PART 4 – MEASUREMENT AND PAYMENT

Not Used.

- END OF SECTION -
20PART 1 – GENERAL

1.1 SUMMARY
A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades required by governing authorities for public rights-of-way and for public access to adjacent building.
C. Provide protection for plant life designated to remain. Replace damaged plant life.
D. Protect non-owned vehicular traffic, site and structures from damage.

1.2 DESCRIPTION
A. Furnish, install and maintain suitable barriers as required to prevent public entry, and to protect the work, existing facilities, trees and plants from construction operations; remove when no longer needed, or at completion of Work.

1.3 QUALITY ASSURANCE
A. Barriers and Construction Signs shall comply with federal, state and local codes and all regulations pertaining to traffic control devices and construction sign regulations.
B. Provide barriers and construction signing as required or deemed necessary to protect the work area and traveling public, as indicated on the Drawings, or as directed by the Owner's Authorized Representative for work in the ramp areas to protect tug traffic, aircraft, airline personnel and other assets in the active airfield during construction of this project. Plan, execute and maintain barriers, traffic control devices, etc.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL
A. Provide fixed signs as shown on the Traffic Control Plan Drawings and conforming to the latest edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

PART 3 – EXECUTION

3.1 INSTALLATION
A. Install barriers and controls to a uniform appearance, structurally sound and adequate for the purpose intended.
B. Maintain barriers during entire construction period as required for each area.
C. Relocate barriers as required by progress of construction.
D. Install concrete traffic barriers (CTB) in accordance with the Traffic Control Plan Drawings and as directed by the Owner's Authorized Representative.
E. Cover trenches and holes when not in use. Erect barriers at sharp changes in plane compliance with OSHA Regulations.
3.2 REMOVAL

A. Completely remove barricades when construction has progressed to the point that they are no longer needed, and when approved by the OAR.

B. Clean and repair damage caused by installation if any, fill and grade the areas of the site to required elevations and slopes, and clean the area.

– END OF SECTION –
PART 1 – GENERAL

1.1 SUMMARY
A. This Section covers all the temporary erosion controls required by the Contractor during the construction of the Project.
B. The Contractor shall conform to the Owner’s policies and regulations and all Federal, State, and local environmental regulations pertaining to the prevention of storm water pollutants, including the Texas Pollutant Discharge Elimination System (TPDES) General Permit TXR150000 and all applicable Owner storm water requirements.
C. Any project that disturbs soil, removes a protective surface layer to expose soil, or stores a significant amount of potential storm water pollutants shall prepare a Storm Water Pollution Prevention Plan (SWPPP) or an Airport specific Erosion Control Plan (ECP). Storm Water Pollution Prevention Plans and Erosion Control Plans are intended to minimize pollutants from entering the storm water runoff.
D. DFW will NOT accept Hay Bales as an erosion and sediment control BMP, unless approved by the OAR.

1.2 DEFINITIONS
A. iSWM: Integrated Storm Water Management. A program of Best Management Practice (BMP) manuals and technical manuals published by the North Central Texas Council of Governments (NCTCOG) for control of quality of storm water runoff from construction activities.
B. Minimize Pollutant: To reduce or eliminate a pollutant to the extent achievable using storm water controls that are technologically available and economically practicable and achievable based on best industry practices.

1.3 SUBMITTALS
A. The Contractor shall attend an Environmental Review Meeting prior to obtaining a construction permit. In that meeting, the Airport Environmental Affairs Department (EAD) will discuss the environmental submittals required for the Project.
B. All documents that require mailing to the Texas Commission on Environmental Quality (TCEQ) shall be submitted to the OAR for forwarding to EAD to perform the mailing.
C. If the Project is subject to the TPDES Construction General Permit (CGP), the Contractor shall prepare a site-specific Storm Water Pollution Prevention Plan (SWPPP). A copy of the SWPPP, the original Construction Site Notice (CSN), Delegation of Authority Letter, and Notice of Intent (NOI) shall be submitted to the OAR for forwarding to the EAD, prior to obtaining a construction permit and prior to beginning any construction activities.
D. If the Project disturbs less than one (1) acre of soil and is not part of a SWPPP a site-specific Erosion Control Plan (ECP) shall be submitted to the OAR for review and approval of the EAD.
E. Submit copies of ECP and SWPPP Inspection Reports within 48 hours after completing the inspection. Reports are to be signed and certified by the Contractor’s Superintendent, or the delegated inspector, and submitted to the OAR.

F. Submit the following close-out documentation to the OAR, prior to demobilizing or when Final Stabilization is achieved whichever comes first.

1. If the Project required an ECP, submit copies of all inspection reports.
2. If the Project required an SWPPP, one copy of the final SWPPP that includes all inspection reports, maintenance records, date tracking records, amendments, and any additional recordkeeping required by the CGP.
3. If the Project required a NOI, a completed, signed Notice of Termination (NOT) of coverage.

PART 2 - PLANS

2.1 EROSION CONTROL PLANS

A. If the Project disturbs less than one (1) acre of soil and that is not covered under an SWPPP, then the Project must submit a project specific ECP.

B. An ECP template has been prepared by the Owner and is available at https://www.dfwairport.com/sustainability/index.php. The Contractor shall complete the ECP template and submit to the OAR for EAD approval prior to obtaining a construction permit.

C. The ECP addresses the following topics:

1. Detailed site description
2. Names of the Contractor and all Subcontractors
3. Sequence of construction activities
4. Detailed project maps
5. Erosion and sediment controls
6. Good housekeeping controls
7. Potential pollutants
8. Non-storm water discharges
9. BMP maintenance
10. Inspections
11. Certifications

D. The Contractor shall designate the onsite contact person responsible for implementing the ECP with the authority to direct resources towards the maintenance or repair of the storm water management controls, and should be readily accessible onsite during work hours.
E. Inspections:

1. The Contractor shall employ and provide a qualified inspector to provide and record inspections of the Project site and all associated areas such as staging area(s) a minimum of once every fourteen (14) Calendar Days and within 24 hours after any storm event of greater than 0.5 inch or an alternate schedule of once (1) every seven (7) Calendar Days on the same day each week.

2. Inspection reports shall include, at a minimum, a summary of the scope of the inspection, name(s) of personnel conducting the inspection, the date of the inspection, a record of failed or damaged BMPs, evidence of pollutants escaping the site, and actions taken.

3. A qualified inspector must meet the requirements of TXR150000. Proof of formal training is preferred, but not mandatory. The Owner reserves the right to reject an inspector as unqualified and may either require proof of formal training or require the inspector to submit to a written exam to prove such knowledge and skills or require appointment of a different inspector.

F. The Contractor shall maintain a copy of the ECP onsite available for review by Federal/State inspectors or the OAR within 24 hours of a review request.

2.2 STORM WATER POLLUTION PREVENTION PLANS

A. The Contractor shall apply for and meet the requirements and provisions of the TPDES CGP, Permit No. TXR150000, under the permitting authority of the TCEQ. A copy of the CGP and other information can be found at the TCEQ website https://www.tceq.texas.gov/permitting/stormwater/construction

The SWPPP shall adhere to the requirements in TXR150000, and include the following statements as required by the local authority having jurisdiction, the Airport. These statements are considered BMPs that the Contractor shall be responsible for implementing on the Project.

1. All trucks carrying erodible materials such as soil, sand, gravel, crushed or broken up concrete, shall use a cover, in functional condition, over the bed of the truck while on the public roads of the Airport.

2. Water from any source accumulating in an excavation that has visual or olfactory evidence of contamination such as a sheen or odor or is at a site within the Voluntary Cleanup Program (VCP) area shall not be released from the Project site or allowed to mix with uncontaminated water and shall be contained, stored and properly disposed of in accordance with the Project’s Soil Management Plan and Waste Management Plan.

3. If high pH is observed by the Owner at an outfall sampling point downstream of the Project, the Contractor will be asked to pH test standing water (rainwater or groundwater) at the Project site prior to pumping or draining off. If the standing water is found to be higher than pH 9.0, it shall not be pumped or drained off as routine storm water discharge as “dewatering” and will be considered a wastewater to be recorded on the Project Waste Management Plan for disposal. Water
between pH 9.0 to 11.0 may be disposed through a sanitary sewer line with prior approval from EAD, through the OAR. Water above pH 11.0 shall be disposed of off the Airport through a reputable company as wastewater.

4. The following segments are listed as impaired waters on either the Clean Water Act (CWA) 303(d) list or the Texas Integrated Report of Surface Water Quality for CWA sections 305(b) and 303(d): Segment 0822A (Cottonwood Branch Creek), 0822B (Grapevine Creek) and segment 0841 (Estelle Creek). All segments are impaired waters for bacteria. Caution shall be taken with sources of bacteria, such as portable toilets and exposure of sanitary sewer lines, during construction in order to not contribute bacteria to these water segments. Potential bacteria sources on the Project shall be identified and BMPs incorporated into the SWPPP. All portable toilets shall be located at least 50 feet away from any storm drain inlet and at least 100 feet away from the edge of a surface water.

5. Include a list of all Subcontractors in the SWPPP and require a responsible representative of each Subcontractor sign an acknowledgement certifying they are aware of the SWPPP regulations and shall abide by them for this Project.

B. The Contractor shall implement the SWPPP in its entirety, including but not limited to: posting and maintaining of notices, performing required inspections, BMP installation and maintenance, updating and amending the SWPPP documentation as the Project proceeds, and advise the OAR when the Plans or funds are insufficient to meet or maintain the standards of the CGP.

C. Designate the onsite contact person responsible for implementing the SWPPP. This person must have the authority to direct resources towards the maintenance or repair of the storm water management controls, and should be readily accessible onsite during work hours.

D. Inspections:

1. The Contractor shall employ and provide a qualified inspector to provide and record inspections of the Project site and all associated areas including staging area(s) a minimum of once (1) every fourteen (14) Calendar Days and within 24 hours after any storm event of greater than 0.5 inch, or an alternate schedule of once (1) every seven (7) Calendar Days on the same day each week.

2. Inspection reports shall include, at a minimum, a summary of the scope of the inspection, name(s) of personnel conducting the inspection, the date of the inspection, a record of failed or damaged BMPs, evidence of pollutants escaping the site, and actions taken.

3. A qualified inspector must meet the requirements of TXR150000. Proof of formal training is preferred, but not mandatory. The Owner reserves the right to reject an inspector as unqualified and may either require proof of formal training or require the inspector to submit to a written exam to prove such knowledge and skills or require appointment of a different inspector.
E. The Contractor shall maintain a copy of the SWPPP onsite available for review by Federal, State or the OAR within 24 hours of a review request.

PART 3 PRODUCTS

3.1 MATERIALS

A. All erosion and sediment controls shall adhere to the NCTCOG iSWM program. Other published material guidelines may be accepted upon submittal for review and approval to EAD, through the OAR.

B. Do not use silt fence or silt fabric as an erosion and sediment control BMP within the Airport Operations Area (AOA) without prior approval from Airport Operations.

C. Do not use hay bales as an erosion and sediment control BMP on the Project.

D. Do not use straw waddles or other flow blocking devices at active street curb inlets.

E. Install and maintain erosion and sediment control products according to manufacturer’s recommendations and instructions, or NCTCOG iSWM program. Replace or change controls as needed to restore effectiveness.

PART 4 - EXECUTION

4.1 GENERAL

The Contractor shall:

A. Prevent water pollution associated with the construction activity from entering any surface water, drainage device, or adjacent property.
   1. Ensure all applicable water quality standards are met. Additional storm water controls may be required to meet water quality standards.
   2. Immediately capture and remove any sediment that escapes from the Project site. The Contractor shall be responsible for documenting any pre-existing accumulated sediment or debris.

B. Install and maintain all BMPs and structural controls in accordance with the NCTCOG iSWM program and any additional manuals approved by the EAD, through the OAR.

C. Immediately correct ineffective control measures and implement new or additional controls as directed by the OAR.

D. Plan and conduct all land disturbing activities to minimize the area to be exposed at any one time, and to minimize the time of exposure.

E. Protect materials from rain exposure by:
   1. Provide protected storage areas for paints, chemicals, solvents, fertilizers, and other potential pollutants.
   2. Store containers on a raised surface.
   3. Cover erodible materials with a tarp or plastic.
F. Upon discovery, immediately contain and remove all spills or leaks.

G. Properly contain and dispose of wastewater, such as concrete truck washout, wash water for cleaning paint tools, and curing compounds.

H. Cover all trucks or trailers hauling an erodible material such as soil, gravel, small rock or sand with a tarp while on the public roads of the Airport.

I. Tracking
   1. Prevent off-site tracking by installing and maintaining a construction exit
   2. Keep paved areas free from tracking. Sediment tracked off-site shall be cleaned with a vacuum truck or sweeping by hand. Sweeper trucks are not allowed.

J. Dust Control:
   1. Maintain dust control in all areas impacted by construction via water application or additional methods as approved by the OAR.
   2. Do not apply water to the point that causes flooding, erosion or pollution.

4.2 SEQUENCING AND SCHEDULING

A. Prior to ground disturbing activities, the Contractor shall perform the following:
   1. The ECP or SWPPP must have been approved by the EAD.
   2. Submit NOI to the OAR for forwarding to TCEQ (if applicable), and coordinate submission of the NOI and payment of filing fees with the EAD, through the OAR.
   3. Post the CSN at the Project site (if applicable)
   4. Provide a hardcopy of the ECP or SWPPP at the Project site
   5. All storm water management controls for the initial phase of construction shall be installed and inspected by a qualified storm water inspector.

B. Divide larger sites into distinct portions. Begin permanent stabilization when work is complete on a portion of the Project site. At minimum, detention basins, drainage swales, creek banks, channel banks, and culverts will be considered distinct portions; and stabilization will be initiated independent of ongoing activities in other sections of the Project site.

4.3 MAINTENANCE

A. General
   1. Maintain all erosion, sediment, and pollutant control measures in effective operating condition throughout the Project until Final Acceptance.
   2. The EAD will inspect the project for environmental compliance and any deficiencies, including installation and maintenance of storm water controls, shall be corrected in the time indicated.
   3. If the Contractor fails to correct the deficiencies to the satisfaction of the EAD, the Owner may separately contract a crew to perform the necessary maintenance and the cost will be deducted from Contract Amount.
B. Construction Exit
   1. Maintain construction entrance/exits in a condition which will prevent the tracking of sediment onto any paved surface.
   2. For stone exits, periodically re-grade and top with additional stone to maintain efficiency in removal of tracked materials.

C. Perimeter Control
   1. Inspect the perimeter of the Project site regularly and remove sediment before it reaches half the height of the control.
   2. Ensure perimeter BMPs are properly embedded or toed-in and repair any under-cutting the BMP.

D. Check Dam
   When a check dam is required for erosion control on the Project, the Contractor shall provide the check dam meeting the following requirements:
   1. The top of the ends of the check dam shall be a minimum of 12 inches higher than the middle of the dam, unless otherwise directed by the OAR.
   2. The check dam shall be embedded a minimum of 18 inches into the side of the drainage ditch, swale, or channel to minimize the potential for flows to erode around the side of the check dam.
   3. The check dam shall be inspected regularly, and sediment removed when it reaches approximately one-third the height of the check dam or 12 inches, whichever is less.

E. Inlet Protection
   When inlet protection is required for erosion control on the Project, the Contractor shall provide the inlet protection meeting the following requirements:
   1. Inspect the inlet protection regularly for damage.
   2. Remove any blockage from the inlet or inlet protection after every storm event.
   3. Clean and/or replace the inlet protection when clogged with sediment, to ensure effectiveness.
   4. Remove sediment from the inlet protection before it reaches approximately 50 percent of the design height or volume of the inlet protection.

4.4 CLOSE OUT
A. Prior to close-out of the construction permit, the EAD, through the OAR, must approve the Final Stabilization, or the transfer of responsibility for the SWPPP or ECP to another contractor.
   1. The Contractor shall request an inspection to determine if the Final Stabilization meeting the CGP definition has been accomplished.
   2. If the EAD determines Final Stabilization has been accomplished, the Contractor shall submit, through the OAR, the following
a. The NOT, as applicable, shall be submitted to the OAR for forwarding to TCEQ after approval from the EAD.

b. All Project inspection reports.

c. All amendments incorporated into the SWPPP or ECP during construction.

d. Additional recordkeeping as required by the CGP, as applicable.

B. The Contractor shall remove all materials, wastes, and temporary BMPs from the Project site including any accumulated sediment issues identified by the OAR.

C. The Contractor shall fully resolve any issue of non-compliance or violation brought by a Federal or State agency.

D. The Contractor shall have completed all submittals and received approvals required for closeout.

PART 5 – MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

Storm Water Inlet Protection, Silt Fence with Fiber Roll Backing, Construction Entrance, and Concrete Washout Area shall be incidental to the Erosion Control pay item.

5.2 PAYMENT

The work performed and materials furnished and measured as provided under “Measurement” will be paid for at the unit bid price per lump sum of “Erosion and Sediment Control”. The price shall include full compensation for furnishing, hauling, and placing all materials, labor, tools, equipment, and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating the fence, removal of silt, and removal and disposal of all materials at the completion of construction in and revegetation of disturbed areas.

Payment will be made under:

Item 01 57 13-1 Erosion and Sediment Control - per Lump Sum

- END OF SECTION -
PART 1 - GENERAL

1.1 SUMMARY
This Section includes the following:
A. Mobilization of equipment, personnel, material, supplies, tools, and all other resources necessary prior to beginning the Work.
B. Establishment of temporary facilities and all other facilities necessary prior to beginning the Work.
C. When a staging area is required in the Plans, the Contractor shall abide by the Land Use Application provided in Section 01 71 14.01.

PART 2 - PRODUCTS
Not Used.

PART 3 - EXECUTION

3.1 PROJECT INITIATION
A. The Mobilization fee shall not exceed eight (8) percent of the total Contract Amount.
B. The Contractor shall complete all required coordination and forms, submit permits and insurance certificates prior to beginning any construction activity.
C. The Contractor may complete all required temporary facilities as outlined in the Division 01 Sections prior to other construction activities and complete the move-in process after the Land Use Application has been completed and approved.
D. The Contractor shall coordinate with the Owner’s Authorized Representative (OAR) to establish the Project submittals procedures, Baseline Schedule and payment procedures.

3.2 FINAL CLEANUP
Complete clean up and submit all required final documentation prior to move-out.

PART 4 – MEASUREMENT AND PAYMENT

A. Measurement
Measurement of the item "Mobilization" will be by the "Lump Sum," as the Work progresses as specified in the Contract.

B. Payment
1. When one (1) percent of the Contract Amount has been earned by the Contractor, 50 percent of the Mobilization Pay Item or five (5) percent of the total Contract Amount, whichever is less, will be paid. Previous payments under this item will be deducted from this amount.
2. When five (5) percent of the Contract Amount has been earned, 75 percent of the Mobilization Pay Item, or ten (10) of the total Contract Amount, whichever is less, will be paid. Previous payments under this item will be deducted from this amount.
3. When ten (10) percent of the Contract Amount is earned, 90 percent of the Mobilization Pay Item or fifteen (15) percent of the total Contract Amount, whichever is
less, will be paid. Previous payments under this item will be deducted from this amount.

4. Upon completion of all Work under this Contract, payment for remainder of the Mobilization Pay Item will be paid.

Payment will be made under:

Item 01 71 13-1    Mobilization (South) - per Lump Sum

- END OF SECTION -
PART 1 – GENERAL

1.1 SUMMARY
This Section covers the requirements of cleaning the Work area and disposal of waste materials, debris, and rubbish during construction of the Project.

PART 2 – PRODUCTS

2.1 EQUIPMENT
The Contractor shall provide covered containers for waste materials, debris, and rubbish.

PART 3 – EXECUTION

3.1 CLEANING
The Contractor shall perform the following and as may be directed by the Owner’s Authorized Representative (OAR):

A. Remove waste materials, debris, and rubbish at least daily. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, culverts, and other closed or remote spaces prior to closing the space.
C. Clean interior areas prior to application of finishes and maintain in a clean condition to eliminate dust.
D. Avoid causing flying debris in the ramp areas or near the airfield.
E. Keep the Air Operations Area (AOA) and all haul routes free of any debris that may be generated from a construction activity.

3.2 DISPOSAL
Collect and remove waste materials, debris, and rubbish from the Project site in accordance with Section 01 74 19.

3.3 OWNER’S RIGHT TO CLEAN UP

A. The Owner may provide progress cleaning if the Contractor fails to comply with this Section. In such case, the Owner will deduct the cost of this cleanup effort from the Contract Amount.

If a dispute arises as to responsibility for cleaning up, the Owner may affect the cleanup, and charge the cost thereof to the Contractor as the Owner shall determine to be just. The Contractor shall pay such costs as the Owner assesses hereunder.

PART 4 – MEASUREMENT AND PAYMENT

Not Used.

- END OF SECTION –
PART 1 - GENERAL

1.1 SUMMARY
   A. This Section covers furnishing of all labor, materials, equipment, tools, supervision, and incidentals necessary for seeding or sodding. Turf materials must address the elimination and/or mitigation of materials that could attract hazardous wildlife on and/or around an airport.

1.2 REFERENCES
   A. Federal Aviation Administration (FAA) Advisory Circular 150/5200-33A, Hazardous wildlife Attractants on or Near Airports
   B. FAA Advisory Circular 150/5370-10G, Standards for Specifying Construction of Airports (Specifically Part 10, Turfing)
   D. Texas Commission on Environmental Quality (TCEQ) Stormwater Construction General Permit TXR150000 (specifically Final Stabilization criteria)
   E. TxDOT approved product list: https://www.txdot.gov/business/resources/erosion-control.html

1.3 DEFINITIONS
   A. Adequate Grass Stand (FAA): A good stand of grass of uniform color and density, and when unviable or bare spots are one square foot or less, randomly dispersed, and do not exceed 3% of the area sodded.
   B. Airside: The airside consists of all areas within the AOA fence at the completion of the project, all areas extending 20 ft from the AOA fence, and all Runway Protection Zones (RPZ).
   C. Cool season: The cool season is October 1st through March 31st.
   D. Final Stabilization (TCEQ): All soil disturbing activities at the site have been completed and uniform (evenly distributed without large bare areas) perennial vegetative cover with a density of at least 70% approved vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures. In addition, Airside areas have established “Adequate Grass Stand”.
   E. Non-public area: All non-Airside areas greater than 30 feet from a leased area, not mowed, and not landscaped.
F. Permanent Seed: approved perennial grass species/varieties for final stabilization

G. PLS: Pure Live Seed (Purity x Germination / 100 = PLS)

H. Public area: All non-Airside areas within 30 feet of a leased area, mowed, or landscaped.

I. Sun Area: An area receiving greater than 4 hours of direct sunlight daily.

J. Shade area: An area receiving 4 or less hours of direct sunlight daily.

K. Temporary Seed: approved annual grass species/varieties

L. TxDOT: Texas Department of Transportation

M. Warm season: The warm season is April 1st through September 30th.

1.4 SUBMITTALS

A. Seed/Sod Plan: Submit a seed/sod plan for approval. Plan shall include number of acres/square yards to seed/sod, application method, grass species/va riet y latin name , supplier name and location, sod type/quality designation, seed vendor certification, total quantity of seed to be applied, tackifier SDS, mulch selected from TxDOT approved list, soil retention blanket selected from TxDOT approved list, soil retention blanket's manufacturer installation instructions, topsoil source and quantity.

B. Fertilizer Plan: Submit a fertilizer plan for approval. The plan shall include the soil analysis laboratory results, laboratory fertilizer recommendation based on soil results and grass species/va riet y, proposed fertilizer mix and application rate.

PART 2 – PRODUCTS

2.1 SEED

A. Provide and install seed as shown on the plans or as directed by OAR. All seed must be from previous season’s crop and meet the requirement of the Texas Seed Law.

B. All seed weight shall be per PLS pounds. Minimum application rate is indicated per acre.

C. Only seed meeting the land use, season, and sun exposure requirements may be applied. Refer to charts below for permanent and temporary seed options. Seed shall be applied at the application rate specified in the table below.
### PERMANENT SEED OPTIONS

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Season During Application</th>
<th>Sun Exposure</th>
<th>Minimum Application Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Warm</td>
<td>Cold</td>
<td>Sun</td>
</tr>
<tr>
<td>Airside</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No seed options available (Sod Only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unhulled Bermuda <em>Cynadon dactylon</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hulled Bermuda <em>Cynadon dactylon</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Zoysia Grass <em>Zoysia japonica</em></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Non-public</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unhulled Bermuda <em>Cynadon dactylon</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hulled Bermuda <em>Cynadon dactylon</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Buffalo Grass <em>Bouteloua dactyloides</em> / Blue Grama Grass (native) <em>Bouteloua gracilis</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Buffalo Grass <em>Bouteloua dactyloides</em> w/ Sand Drop <em>Sporobolus cryptandrus</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Buffalo Grass <em>Bouteloua dactyloides</em> w/ Hooded Windmill <em>Chloris cucullata</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Blue Grama Grass (native) <em>Bouteloua gracilis</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>TXDOT Permanent Urban Seed Mix (District 18 Clay Soils) <em>Green Sprangletop-Leptochloa dubia</em>, <em>Sideots Grama</em> (El Reno)- <em>Boutelous curtipendula</em>, <em>Buffalograss</em> (Texoka)- <em>Bouteloua dactyloides</em>, <em>Bermudagrass-Cyando dactylon</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

### TEMPORARY SEED OPTIONS

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Season During Application</th>
<th>Sun Exposure</th>
<th>Application Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Warm</td>
<td>Cold</td>
<td>Sun</td>
</tr>
<tr>
<td>Airside</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No seed options available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No seed options available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-public</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teff Grass <em>Eragrostis tef</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Creeping red fescue <em>Festuca rubra</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Western Wheatgrass <em>Passcorypurum smithii</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

#### 2.2 SOD

A. Use grass sod with a healthy root system and dense matted roots throughout the soil of the sod for a minimum thickness of 1in.
B. Keep sod moist from the time it is dug until it is planted. Grass sod with dried roots is unacceptable.

C. Sod shall be relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials.

D. Sod must be green and have evidence of 99% root establishment to achieve final stabilization. Sod that is placed during the cool season will require an inspection in the warm season to confirm viability.

E. Sod will be considered under warranty for one year after final stabilization is achieved.

F. Approved sod options vary based on season, sunlight, and location on Airport property. Refer to the chart below for sod options. Only sod meeting the land use, season, and sun exposure requirements may be utilized.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Season During Application</th>
<th>Sun Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Warm</td>
<td>Cold</td>
</tr>
<tr>
<td>Airside</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bermuda Cynodon dactylon</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Public</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bermuda Cynodon dactylon</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Non-public</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bermuda Cynodon dactylon</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Zoysia Zoysia japonica</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Buffalo Grass Bouteloua dactyloides</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

2.3 FERTILIZER

A. Provide and distribute fertilizer over all areas to be seeded or sodded.

B. Fertilizer is subject to testing by the Texas A&M Feed and Fertilizer Control Service or another approved lab in accordance with the Texas Fertilizer Law.

2.4 WATER

A. Use water that is clean and free of industrial wastes and other substances harmful to the growth of vegetation.

B. Water may be from a Potable Water source or Reclaimed Water source, but never pumped directly from a creek, stream or pond.

C. The water source and supply location is subject to approval by the OAR prior to use.
2.5 MULCH
A. Mulch is required to cover all seeded areas.
B. See chart below for the approved mulch types and minimum application rates.

<table>
<thead>
<tr>
<th>Type</th>
<th>Application Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat Straw Mulch</td>
<td>2 tons per acre</td>
</tr>
<tr>
<td>TxDOT Approved Cellulose Fiber Mulch</td>
<td>per manufacturer rate but no less than 2000 lbs. per acre</td>
</tr>
</tbody>
</table>

C. Wheat straw mulch must be crimped into the soil using an approved Straw Mulch Crimper.
D. Recycled paper based cellulose mulches are prohibited.

2.6 TACKIFIER
A. Use a tacking agent for all hydroseed applications. Apply per manufacturer’s recommendations.

2.7 SOIL RETENTION BLANKET
A. Soil retention blanket is required on all seeded areas with a slope of 3:1 or greater, and in any area where concentrated flow occurs.
B. Use an soil retention blanket from the TxDOT Approved Product List

2.8 TOPSOIL
A. Use easily cultivated, fertile topsoil that is free from objectionable material and resistant to erosion.
B. Utilize existing topsoil from the project site.
C. If necessary to obtain additional topsoil, adhere to the soil transfer requirements in 01 33 29.06.01 Contaminated Media Management Plan.

PART 3 - EXECUTION

3.1 General
A. All seed or sod applications must adhere to all applicable TCEQ or FAA Circulars including most recent versions of 150/5200-33, and 150/5370-10.
B. All seed or sod applications will be considered under warranty for one year after final stabilization is achieved.
3.2 SEED

A. General
1. Submit a seed/sod plan for approval by the OAR prior to application.
2. Seed may be applied by the following methods: broadcast, drill seeding, hydroseeding.
3. All seed applications will require soil prep, top soil, fertilizer, and mulch. Tackifier and soil retention blankets are required based on application method and site conditions.

B. Soil Prep
1. After grading of the area has been completed, thoroughly loosen and work soil to a depth of not less than 5 inches, and break any clods greater than 1" in diameter.
2. The area shall be raked or otherwise cleared of stones, sticks, stumps, and other debris greater than 1" in diameter. The surface shall be prepared in a manner that is loose and level without voids, openings, or pores.

C. Topsoil
1. Complete soil prep prior to placing topsoil.
2. Spread the topsoil to a uniform loose cover with a minimum depth of 4 inches.

D. Inspection
1. Once soil is prepped and top soil is placed, request a DFW environmental inspection.
2. Soil prep and topsoil placement must be inspected and approved by a DFW environmental inspector prior to seed application.

E. Fertilizer
1. Submit a Fertilizer Plan for OAR approval.
2. Fertilizer mix and application rate shall be determined based on a soil laboratory analysis.
3. A soil sample shall be submitted to Texas A&M Agrilife Extension or equivalent laboratory certified in soil analysis. Follow the laboratory’s procedure for collecting a soil sample. Soil sample may be collected at any point post-grading and prior to seed application.
4. Submit the lab results and proposed fertilizer for review and approval by OAR prior to application.
5. Apply fertilizer at the approved application rate.
a. If broadcast application method is selected, contractor shall evenly distribute seed across the entire area at the approved application rate.

2. Drill seed Application

a. If drill seed application is selected, contractor shall evenly distribute seed in rows no further than 7” apart, utilizing an industry approved grass seed drill.

3. Hydroseed Application

a. If hydroseed application method is selected, contractor must evenly apply seed, and tackifier at approved application rates.

b. All equipment shall be clean and free of contaminants prior to use.

G. Mulch

1. The Contractor is required to apply an approved mulch at the rates specified over the planted seed bed.

2. If wheat straw mulch is utilized, it must be crimped into the soil using an approved Straw Mulch Crimper.

H. Soil retention Blanket

1. All areas with a slope of 3:1 or greater, and any area where concentrated flow occurs will require soil retention blanket.

2. Install and anchor the soil retention blanket according to the manufacturer’s installation instructions.

I. Water

1. Water as needed until final stabilization is achieved and approved by the OAR.

2. Ponding is not allowed. Do not water to the point of ponding.

J. Mowing

1. Mowing is required when the grass reaches 6” in height.

2. Additional mowing may be required by the OAR until final stabilization is achieved.

K. Reseeding

1. The area may require reseeding to achieve final stabilization. Reseeding is considered incidental to the cost of seeding and will be done at no additional expense to the owner.

2. If final stabilization is not achieved in the warm season, reseeding will be required in the next warm season.

3. At a minimum, reseeding consists of seed, fertilizer, and water application. Mulch, tackifier and soil retention blankets may be utilized.

3.3 SOD
A. General
   1. Submit a seed/sod plan for approval by the OAR prior to application.

B. Soil Prep
   1. After grading of the area has been completed, thoroughly loosen and work soil to a depth of not less than 5 inches, and break any clods greater than 1” in diameter.
   2. The area shall be raked or otherwise cleared of stones, sticks, stumps, and other debris greater than 1” in diameter. The surface shall be prepared in a manner that is loose and level without voids, openings, or pores.

C. Topsoil
   1. Complete soil prep prior to placing topsoil.
   2. Spread the topsoil to a uniform loose cover with a minimum depth of 4 inches.

D. Inspection
   1. Once soil is prepped and top soil is placed request a DFW Environmental Inspection.
   2. Soil prep and topsoil placement must be inspected and approved by a DFW Environmental Inspector prior to sod installation.

E. Fertilizer
   1. If placing sod in a warm season, submit a fertilizer plan for approval.
   2. If placing sod in a cool season, OAR may require fertilizer in the warm season.
   3. Fertilizer mix shall contain primarily Nitrogen, and be applied at a rate of 100 lbs. of Nitrogen per acre.

F. Installation
   1. Place sod over the prepared area and roll or tamp to create a solid mat.
   2. Sod placed on the Airside, in ditches, or on slopes greater than 4:1 will require staples. Use 12” wood staples to secure the sod.
   3. Fill all gaps with additional topsoil.
G. Water
   1. Water as needed until final stabilization is achieved and approved by the OAR.
   2. Ponding is not allowed. Do not water to the point of ponding.

H. Mowing
   1. Mowing may be required by the OAR until final stabilization is achieved.
   2. Mowing will be conducted within the time frame specified by the OAR.

3.4 FINAL STABILIZATION
A. All areas shall be maintained until final stabilization is achieved.
B. Final stabilization is achieved when the following conditions are met:
   1. All soil disturbing activities at the site have been completed.
   2. Uniform (evenly distributed without large bare areas) perennial vegetative cover with a density of at least 70% approved vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures.
   3. All Airside areas achieve a good stand of grass of uniform color and density, and when unviable or bare spots are one square foot or less, randomly dispersed, and do not exceed 3% of the area sodded.
C. Final stabilization will be determined during the warm season (April 1st thru September 31st)

PART 4 MEASUREMENT AND PAYMENT
4.1 MEASUREMENT
A. The area to be seeded/sodded is measured by the square yard/acre as indicated by the limits of disturbance on the design plans. Any additional area of disturbance will be seeded/sodded by the contractor at no additional cost to the owner.
B. Seed is measured by the square yard or by the acre.
C. Sod is measured by the square yard in its final position.
D. Fertilizer is measured by the acre of surface area covered or by the ton (2,000 lb.) Measurement by ton will use guaranteed weight of bags or containers as shown by the manufacturer.

E. Hydromulch or straw mulch is measured by the square yard or by the acre.

F. Tackifier is measured by the acre.

G. Soil retention blanket is measured by the square yard of surface area covered.

4.2 PAYMENT

A. The contractor will be paid for 90% of the sod installed during the monthly estimate period based on the actual quantities installed using the unit Price amount for the pay item. The remaining 10% will be paid once the owner has made final acceptance of the sodded areas. The unit price bid is full compensation for securing a source, excavation, loading, hauling, placing, rolling, finishing, furnishing materials, equipment, labor, tools, supplies, and incidentals. Sod is under warranty for one year after final stabilization is achieved. Sod must be green and have evidence of root establishment to achieve final stabilization. Sod that is placed during the cool season will require an inspection in the warm season to confirm viability for final acceptance. Areas where sod has failed to thrive shall be replaced with living green sod at the contractor’s expense.

B. The contractor will be paid for 75% of the seeding installed during the monthly estimate period based on the actual quantities installed using the unit Price amount for the pay item. The remaining 25% will be paid once the owner has made final acceptance of the seeded areas.

C. Fertilizer is considered subsidiary to the seed and sod bid items of the contract. Work performed, materials furnished, equipment, labor, tools and incidentals will not be paid for directly unless otherwise specified in the contract.

D. The contractor will be paid for 100% of Hydromulch or straw mulch installed during the monthly estimate period based on the actual quantities installed using the unit Price amount for the pay item.

E. Tackifier is considered subsidiary to the Hydromulch or straw mulch bid items of the contract. Work performed, materials furnished, equipment, labor, tools and incidentals will not be paid for directly unless otherwise specified in the contract.

F. The contractor will be paid for 100% of the erosion blanket installed during the monthly estimate period based on the actual quantities installed using the unit Price amount for the pay item.

G. Protective barriers, mowing and other maintenance activities are considered subsidiary to the seed or sod unit price. Work performed,
materials furnished, equipment, labor, tools and incidentals will not be paid for directly unless otherwise specified in the contract.

Payment will be made under

- Item 32 92 19-1 Seeding – per Acre
- Item 32 92 19-2 Hydromulch – per Acre
- Item 32 92 19-3 Sodding – per square yard

- END OF SECTION -
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
- ASTM C506 Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
- ASTM C507 Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

701-2.3 CONCRETE. Concrete used for pipe collars shall meet the requirements of Item P-610 and have a minimum compressive strength of 4,000 psi at 28 days.

701-2.4 RUBBER GASKETS. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443.

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

701-2.6 JOINT FILLERS. Not used.

701-2.7 PLASTIC GASKETS. Not used.

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. Not used.
701-2.10 PRECAST CONCRETE PIPE. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification Program.

701-2.11 GEOTEXTILE. The geotextile shall meet the requirements shown in Table 1.

Table 1. AASHTO M288, Class 2 Requirements

<table>
<thead>
<tr>
<th>Fabric Property</th>
<th>Test Method</th>
<th>Test Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength, lbs</td>
<td>ASTM D4632</td>
<td>125 min</td>
</tr>
<tr>
<td>Grab Tensile Elongation %</td>
<td>ASTM D4632</td>
<td>50 min</td>
</tr>
<tr>
<td>Burst Strength, psi</td>
<td>ASTM D3787</td>
<td>125 min</td>
</tr>
<tr>
<td>Trapezoid Tear Strength, lbs</td>
<td>ASTM D4533</td>
<td>55 min</td>
</tr>
<tr>
<td>Puncture Strength, lbs</td>
<td>ASTM D4833</td>
<td>40 min</td>
</tr>
<tr>
<td>Abrasion, lbs</td>
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</tr>
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<td>Equivalent Opening Size</td>
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</tr>
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<tr>
<td>Accelerated Weathering</td>
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</tr>
<tr>
<td>(UV Stability)</td>
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<td></td>
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<tr>
<td>(Strength Retained - %)</td>
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</tr>
<tr>
<td>* (500 hrs exposure)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>ASTM D4355</td>
<td>70</td>
</tr>
</tbody>
</table>

CONSTRUCTION METHODS

701-3.1 EXCAVATION. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 12 inches on each side. The trench walls shall be approximately vertical.

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

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

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

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

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

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

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.

Prior to laying the pipe the geotextile shall be placed at each joint location. The geotextile shall be placed to prevent any folds during the pipe laying process.

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.

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

Each joint shall be wrapped with geotextile as shown on the plans.

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

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.

a. Embedment Material Requirements

(1) Concrete Pipe. Embedment material and compaction requirements shall be in accordance with the applicable Type of Standard Installation (Types 1, 2, 3, or 4) per ASTM C1479.

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

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

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 to a density required under item P-152. The soil shall contain no debris, organic matter, frozen material, or stones with a diameter greater than one half the thickness of the compacted layers being placed.

701-3.7 INSPECTION REQUIREMENTS

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

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.

For pipe sizes larger than 48 inches, a walk-through visual inspection shall be performed.

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

METHOD OF MEASUREMENT

701-4.1 The length of pipe shall be measured in linear feet 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. Each class, type, and
size of pipe shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipe being measured.

**BASIS OF PAYMENT**

**701-5.1** 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.

Payment will be made under:

- Item D-701-5.1 24-Inch Reinforced Concrete Pipe, Class III – per linear foot
- Item D-701-5.2 30-Inch Reinforced Concrete Pipe, Class III – per linear foot
- Item D-701-5.3 36-Inch Reinforced Concrete Pipe, Class III – per linear foot
- Item D-701-5.4 54-Inch Reinforced Concrete Pipe, Class III – per linear foot
- Item D-701-5.5 60-Inch Reinforced Concrete Pipe, Class III – per linear foot
- Item D-701-5.6 36-Inch Reinforced Concrete Pipe, Class V – per linear foot
- Item D-701-5.7 48-Inch Reinforced Concrete Pipe, Class V – per linear foot
- Item D-701-5.8 60-Inch Reinforced Concrete Pipe, Class V – per linear foot
- Item D-701-5.9 72-Inch Reinforced Concrete Pipe, Class V – per linear foot
- Item D-701-5.10 42-Inch Dual Reinforced Concrete Pipe, Class V – per linear foot
- Item D-701-5.11 38x24-Inch Horizontal Elliptical Reinforced Concrete Pipe or 22-1/2 x 35-3/4-Inch Reinforced Concrete Arch Pipe, Class III – per linear foot
- Item D-701-5.12 42x27-Inch Horizontal Elliptical Reinforced Concrete Pipe or 26-5/8 x 43-3/4-Inch Reinforced Concrete Arch Pipe, Class III – per linear foot
- Item D-701-5.13 45x29-Inch Horizontal Elliptical Reinforced Concrete Pipe or 31-5/8 x 51-1/8-Inch Reinforced Concrete Arch Pipe, Class III – per linear foot
- Item D-701-5.14 49x32-Inch Horizontal Elliptical Reinforced Concrete Pipe or 31-5/8 x 51-1/8-Inch Reinforced Concrete Arch Pipe, Class III – per linear foot
- Item D-701-5.15 76x48-Inch Horizontal Elliptical Reinforced Concrete Pipe or 45 x 73-Inch Reinforced Concrete Arch Pipe, Class III – 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 C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- ASTM C144 Standard Specification for Aggregate for Masonry Mortar
- ASTM C150 Standard Specification for Portland Cement
ASTM C443  Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C506  Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C507  Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C655  Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
ASTM C1479 Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
ASTM C1840 Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe
AASHTO R73  Standard Practice for Evaluation of Precast Concrete Drainage Productions

National Fire Protection Association (NFPA)

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

END ITEM D-701
ITEM D-705 PIPE UNDERDRAINS FOR AIRPORTS

DESCRIPTION

705-1.1 This item shall consist of the construction of pipe drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

705-2.1 GENERAL. Materials shall meet the requirements shown on the plans and specified below.

705-2.2 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.

HDPE pipe shall conform to AASHTO M252, Type S or SP with Class II perforations as shown on the plans.

705-2.3 JOINT MORTAR. Pipe joint mortar shall consist of one part by volume of Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

705-2.4 ELASTOMERIC SEALS. Elastomeric seals shall conform to the requirements of ASTM F477.

705-2.5 POROUS BACKFILL. Porous backfill shall be free of clay, humus, or other objectionable matter, and shall conform to the gradation in Table 1 when tested in accordance with ASTM C136.

<table>
<thead>
<tr>
<th>Table 1. Gradation of Porous Backfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Designation (square openings)</td>
</tr>
<tr>
<td>Porous Material No.</td>
</tr>
<tr>
<td>1-1/2 inch</td>
</tr>
<tr>
<td>1 inch</td>
</tr>
<tr>
<td>3/8 inch</td>
</tr>
<tr>
<td>No. 4</td>
</tr>
<tr>
<td>No. 8</td>
</tr>
</tbody>
</table>

705-2.6 GRANULAR MATERIAL. Granular material used for backfilling shall conform to the requirements of ASTM D2321 for Class IA, IB, or II materials.
705-2.7 FILTER FABRIC. The filter fabric shall conform to the requirements of AASHTO M288 Class 2 or equivalent.

<table>
<thead>
<tr>
<th>Fabric Property</th>
<th>Test Method</th>
<th>Test Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength, lbs</td>
<td>ASTM D4632</td>
<td>125 min</td>
</tr>
<tr>
<td>Grab Tensile Elongation %</td>
<td>ASTM D4632</td>
<td>50 min</td>
</tr>
<tr>
<td>Burst Strength, psi</td>
<td>ASTM D3786</td>
<td>125 min</td>
</tr>
<tr>
<td>Trapezoid Tear Strength, lbs</td>
<td>ASTM D4533</td>
<td>55 min</td>
</tr>
<tr>
<td>Puncture Strength, lbs</td>
<td>ASTM D4833</td>
<td>40 min</td>
</tr>
<tr>
<td>Abrasion, lbs</td>
<td>ASTM D4886</td>
<td>15 max loss</td>
</tr>
<tr>
<td>Equivalent Opening Size</td>
<td>ASTM D4751</td>
<td>70-100</td>
</tr>
<tr>
<td>Permittivity sec-1</td>
<td>ASTM D4491</td>
<td>0.80</td>
</tr>
<tr>
<td>Accelerated Weathering (UV Stability)</td>
<td>ASTM D4355 *(500 hrs exposure)</td>
<td>70</td>
</tr>
</tbody>
</table>

705-2.8 Controlled low-strength material (CLSM). Controlled low-strength material shall conform to the requirements of Item P-153.

CONSTRUCTION METHODS

705-3.1 EQUIPMENT. All equipment required for the construction of pipe underdrains shall be on the project, in good working condition, and approved by the RPR before construction is permitted to start.

705-3.2 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 shall not be less than the external diameter of the pipe plus 6 inches on each side of the pipe. The trench walls shall be approximately vertical.

Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 4 inches. The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches in uncompacted depth to form a uniform but yielding 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.

Excavated material not required or acceptable for backfill shall be disposed of by the Contractor as directed by the RPR. The excavation shall not be carried below the required depth.
depth; if this occurs, the trench shall be backfilled at the Contractor’s expense with material approved by the RPR and compacted to the density of the surrounding material.

The pipe bedding shall be constructed uniformly over the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 inch when the bedding thickness is less than 6 inches, and 1-1/2 inch 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.

The Contractor shall do trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to federal, state and local laws. Unless otherwise provided, the bracing, sheathing, or shoring shall be removed by the Contractor after the backfill has reached at least 12 inches over the top of the pipe. The sheathing or shoring shall be pulled as the granular backfill is placed and compacted to avoid any unfilled spaces between the trench wall and the backfill material. The cost of bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid per foot for the pipe.

705-3.3 LAYING AND INSTALLING PIPE.

a. Polyethylene pipe. Polyethylene pipe shall be installed in accordance with the requirements of ASTM D2321. The pipe shall be laid accurately to line and grade.

b. All types of pipe. The upgrade end of pipelines, not terminating in a structure, shall be plugged or capped as approved by the RPR.

Unless otherwise shown on the plans, a 4-inch bed of granular backfill material shall be spread in the bottom of the trench throughout the entire length under all perforated pipe underdrains.

Pipe outlets for the underdrains shall be constructed when required or shown on the plans. The pipe shall be laid with tight-fitting joints. Porous backfill is not required around or over pipe outlets for underdrains. All connections to other drainage pipes or structures shall be made as required and in a satisfactory manner. If connections are not made to other pipes or structures, the outlets shall be protected and constructed as shown on the plans.

c. Filter fabric. The filter fabric shall be installed in accordance with the manufacturer’s recommendations, or in accordance with the AASHTO M288 Appendix, unless otherwise shown on the plans.

705-3.4 MORTAR. The mortar shall be of the desired consistency for caulking and filling the joints of the pipe and for making connections to other pipes or to structures. Mortar that is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted.

705-3.5 JOINTS IN CONCRETE PIPE. Not Used.

705-3.6 EMBEDMENT AND BACKFILL

a. Earth. All trenches and excavations shall be backfilled soon after the pipes are installed, unless additional protection of the pipe is directed. The embedment material shall be select material from excavation or borrow and shall be approved by the RPR. The select material shall be placed on each side of the pipe out to a distance of the nominal pipe diameter.
and one foot over the top of the pipe and shall be readily compacted. It shall not contain stones 3 inches or larger in size, frozen lumps, chunks of highly plastic clay, or any other material that is objectionable to the RPR. The material shall be moistened or dried, as required to aid compaction. Placement of the embedment material shall not cause displacement of the pipe. Thorough compaction under the haunches and along the sides to the top of the pipe shall be obtained.

The embedment material shall be placed in loose layers not exceeding 6 inches in depth under and around the pipe. Backfill material over the pipe shall be placed in lifts not exceeding 8 inches. Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the RPR, until the trench is completely filled and brought to the planned elevation. Embedment and backfilling shall be done to avoid damaging top or side of the pipe.

In embankments and other unpaved areas, the backfill shall be compacted per Item P-152 to the density required for embankments in unpaved areas. Under paved areas, the subgrade and any backfill shall be compacted per Item P-152 to the density required for embankments for paved areas.

b. Granular backfill. When granular backfill is required, placement in the trench and about the pipe shall be as shown on the plans. The granular backfill shall not contain an excessive amount of foreign matter, nor shall soil from the sides of the trench or from the soil excavated from the trench be allowed to filter into the granular backfill. When required by the RPR, a template shall be used to properly place and separate the two sizes of backfill. The backfill shall be placed in loose layers not exceeding 6 inches in depth. The granular backfill shall be compacted by hand and pneumatic tampers to the requirements as given for embankment. Backfilling shall be done to avoid damaging top or side pressure on the pipe. The granular backfill shall extend to the elevation of the trench or as shown on the plans.

When perforated pipe is specified, granular backfill material shall be placed along the full length of the pipe. The position of the granular material shall be as shown on the plans.

If porous backfill is placed in paved or adjacent to paved areas before grading or subgrade operations is completed, the backfill material shall be placed immediately after laying the pipe. The depth of the granular backfill shall be not less than 12 inches, measured from the top of the underdrain. During subsequent construction operations, a minimum depth of 12 inches of backfill shall be maintained over the underdrains. When the underdrains are to be completed, any unsuitable material shall be removed exposing the porous backfill. Porous backfill containing objectionable material shall be removed and replaced with suitable material. The cost of removing and replacing any unsuitable material shall be at the Contractor's expense.

If a granular subbase blanket course is used which extends several feet beyond the edge of paving to the outside edge of the underdrain trench, the granular backfill material over the underdrains shall be placed in the trench up to an elevation of 2 inches above the bottom surface of the granular subbase blanket course. Immediately prior to the placing of the granular subbase blanket course, the Contractor shall blade this excess trench backfill from the top of the trench onto the adjacent subgrade where it can be incorporated into the granular subbase blanket course. Any unsuitable material that remains over the underdrain trench shall be removed and replaced. The subbase material shall be placed to provide clean contact between the subbase material and the underdrain granular backfill material for the full width of the underdrain trench.
c. **Controlled low-strength material (CLSM).** Controlled low-strength material shall conform to the requirements of Item P-153.

705-3.7 **FLEXIBLE PIPE RING DEFLECTION.** The flexible pipe shall be inspected by the Contractor during and after installation to ensure that the internal diameter of the pipe barrel has not been reduced by more than 5 percent. For guidance on properly sizing mandrels, refer to ASTM D3034 and ASTM F679 appendices.

705-3.8 **CONNECTIONS.** When the plans call for connections to existing or proposed pipe or structures, these connections shall be watertight and made to obtain a smooth uniform flow line throughout the drainage system.

705-3.9 **CLEANING AND RESTORATION OF SITE.** After the backfill is completed, the Contractor shall dispose of all surplus material, soil, and rubbish from the site. Surplus soil may be deposited in embankments, shoulders, or as directed by the RPR. Except for paved areas of the airport, the Contractor shall restore all disturbed areas to their original condition.

**METHOD OF MEASUREMENT**

705-4.1 The length of pipe shall be the number of linear feet of pipe underdrains in place, completed, and approved; measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. The several classes, types, and sizes shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipeline being measured.

**BASIS OF PAYMENT**

705-5.1 Payment will be made at the contract unit price per linear foot for pipe underdrains of the type, class, and size designated. These prices shall be full compensation 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.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item D-705-5.1</th>
<th>8-Inch Perforated HDPE Underdrain Pipe – per linear foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item D-705-5.2</td>
<td>8-Inch Non-Perforated HDPE Underdrain Pipe in Pavement – per linear foot</td>
</tr>
<tr>
<td>Item D-705-5.3</td>
<td>8-Inch Non-Perforated HDPE Underdrain Pipe in Turf – per linear foot</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)

- ASTM C136 Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
- ASTM C144 Standard Specification for Aggregate for Masonry Mortar
ASTM C150  Standard Specification for Portland Cement

ASTM D2321  Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

ASTM D3786  Standard Test Method for Bursting of Textile Fabrics – Diaphragm Bursting Strength Tester Method

ASTM D4355  Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in Xenon-Type Apparatus

ASTM D4491  Standard Test Methods for Water Permeability of Geotextiles by Permittivity

ASTM D4533  Standard Test Method for Trapezoid Tearing Strength of Geotextiles

ASTM D4632  Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

ASTM D4751  Standard Test Methods for Determining Apparent Opening Size of a Geotextile


ASTM D4886  Standard Test Method for Abrasion Resistance of Geotextiles (Sandpaper/Sliding Block Method)

ASTM F477  Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M252  Standard Specification for Corrugated Polyethylene Drainage Pipe

AASHTO M288  Standard Specification for Geotextile Specification for Highway Applications

AASHTO  Standard Specifications for Highway Bridges

END OF ITEM D-705
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. Not Used.

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

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

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

751-2.5 CORRUGATED METAL. Not Used.

751-2.6 FRAMES, COVERS, AND GRATES. The castings shall conform to one of the following requirements:
   a. ASTM A48, Class 35B: Gray iron castings
   b. ASTM A47: Malleable iron castings
   c. ASTM A27: Steel castings
   d. ASTM A283, Grade D: Structural steel for grates and frames
   e. ASTM A536, Grade 65-45-12: Ductile iron castings
   f. ASTM A897: Austempered ductile iron castings

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.
Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

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

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

**751-2.8 PRECAST INLET STRUCTURES.** Manufactured in accordance with and conforming to ASTM C913.

**CONSTRUCTION METHODS**

**751-3.1 UNCLASSIFIED EXCAVATION.**

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

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

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

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

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

**751-3.2 BRICK STRUCTURES.** 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 mortar shall be placed around these pipes to form a tight, neat connection.

751-3.7 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES, AND FITTINGS. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the RPR, and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

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

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

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

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

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

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

751-3.9 BACKFILLING.

a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches in loose depth and compacted to the density required in Item P-152. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the RPR.

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

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

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

METHOD OF MEASUREMENT

751-4.1 Manholes, inlets, and underdrain cleanouts shall be measured by each unit, in place, completed and accepted by the RPR.

BASIS OF PAYMENT

751-5.1 The accepted quantities of manholes, inlets, and underdrain cleanouts 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 shall also include full compensation for the final design of diversion and junction structures.

Payment will be made under:

Item D-751-5.1 Underdrain Manhole – per each
Item D-751-5.2 Underdrain Cleanout, Type I – per each
Item D-751-5.3 Underdrain Cleanout, Type II – per each
Item D-751-5.4 Underdrain Cleanout, Type III – per each
Item D-751-5.5 Drainage Inlet, Type B – per each
Item D-751-5.6 Drainage Inlet, Type B-AR – per each
Item D-751-5.7 Drainage Inlet, Type C – per each
Item D-751-5.8 Drainage Manhole, Type M – per each
Item D-751-5.9 Diversion Structure – per each
Item D-751-5.10 Junction Structure – 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 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 A897 Standard Specification for Austempered Ductile Iron Castings
ASTM C144 Standard Specification for Aggregate for Masonry Mortar
ASTM C150 Standard Specification for Portland Cement
ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections
ITEM D-752 CONCRETE CULVERTS, HEADWALLS, AND MISCELLANEOUS DRAINAGE STRUCTURES

DESCRIPTION

752-1.1 This item shall consist of reinforced concrete culverts, headwalls, and miscellaneous drainage structures 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.

CONSTRUCTION METHODS

752-3.1 UNCLASSIFIED EXCAVATION.

a. Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades and elevations shown on the plans. 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 approximate only; and the RPR may approve, in writing, changes in dimensions or elevations of footings necessary to secure 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. When 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 steel is placed.

c. The Contractor shall do all bracing, 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 excavation.

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

e. After each excavation is completed, 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.
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. All backfill material shall be compacted to a density required under Item P-152.

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. Fill placed around concrete culverts shall be deposited on each side at the same time and to approximately the same elevation. All slopes bounding or within the areas to be backfilled shall be stepped or serrated to prevent wedge action against the structure.

d. Backfill will not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for “unclassified excavation for structures.”

752-3.3 WEEP HOLES. Weep holes shall be constructed as shown on the plans.

752-3.4 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 embankment, 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

752-4.1 Concrete headwalls shall be measured be each unit, in place, completed and accepted by the RPR.

BASIS OF PAYMENT

752-5.1 The accepted quantities of concrete headwalls 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, and placing the materials, and for all labor, equipment, tools, and incidentals necessary to complete the structure.

Payment will be made under:

Item D-752-5.1 TxDOT Headwall CH-FW-0 – per each

END OF ITEM D-752
ITEM F-162 CHAIN-LINK FENCE

DESCRIPTION

162-1.1 This item shall consist of furnishing and erecting a chain-link fence in accordance with these specifications, the details shown on the plans, and in conformity with the lines and grades shown on the plans or established by the RPR.

MATERIALS

162-2.1 FABRIC. The fabric shall be woven with a 10-gauge galvanized steel wire in a 2-inch mesh and shall meet the requirements of ASTM A392.

162-2.2 BARBED WIRE. Barbed wire shall be 2-strand 12-1/2-gauge aluminum-coated wire with 4-point barbs and shall conform to the requirements of ASTM A121, Class II.

162-2.3 POSTS, RAILS, AND BRACES. Line posts, rails, and braces shall conform to the requirements of ASTM F1043 or ASTM F1083 as follows:

- Galvanized tubular steel pipe shall conform to the requirements of Group IA, (Schedule 40) coatings conforming to Type A, or Group IC (High Strength Pipe), External coating Type B, and internal coating Type B or D.
- Roll Formed Steel Shapes (C-Sections) shall conform to the requirements of Group IIA, and be galvanized in accordance with the requirements of ASTM F1043, Type A.
- Aluminum Pipe shall conform to the requirements of Group IB.
- Aluminum Shapes shall conform to the requirements of Group IIB.
- Posts, rails, and braces furnished for use in conjunction with aluminum alloy fabric shall be aluminum alloy or composite.

Posts, rails, and braces, with the exception of galvanized steel conforming to ASTM F1043 or ASTM F1083, Group 1A, Type A, or aluminum alloy, shall demonstrate the ability to withstand testing in salt spray in accordance with ASTM B117 as follows:

- External: 1,000 hours with a maximum of 5% red rust.
- Internal: 650 hours with a maximum of 5% red rust.

The dimensions of the posts, rails, and braces shall be in accordance with Tables I through VI of Federal Specification RR-F-191/3.

162-2.4 GATES. Not used.

162-2.5 WIRE TIES AND TENSION WIRES. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric.
type. Tension wire shall be 7-gauge marcelled steel wire with the same coating as the fabric type and shall conform to ASTM A824.

All material shall conform to Federal Specification RR-F-191/4.

162-2.6 MISCELLANEOUS FITTINGS AND HARDWARE. Miscellaneous steel fittings and hardware for use with aluminum-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A153. Miscellaneous aluminum fittings for use with aluminum alloy fabric shall be wrought or cast aluminum alloy. Barbed wire support arms shall withstand a load of 250 pounds applied vertically to the outermost end of the arm.

162-2.7 CONCRETE. Concrete shall have a minimum 28-day compressive strength of 4,000 psi.

162-2.8 MARKING. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the gauge of the wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.

162-2.9 CABLE BARRIER SYSTEM. The Cable Barrier System (CASS) shall be Texas Department of Transportation (TxDOT) Gibraltar Cable Barrier System TL-4 or approved equal.

162-2.10 BOLLARDS. Bollards shall be a galvanized steel pipe conforming to ASTM A53, Grade B, placed in concrete.

162-2.11 SIGNS. Signs shall be of the size and color(s) indicated on the plans. The Owner will furnish sign graphics in the form of a master suitable for photographic enlargement. Signs shall be constructed of a screen-printed reflective vinyl film on a 0.080-inch anodized aluminum panel. The sings shall be anchored to the fence fabric with #6 galvanized wire ties.

162-2.12 RAZOR WIRE. Razor wire shall be type 304 stainless steel, with CB-65 barbs and a solid wire core. All hardware required to mount the razor wire to the fence shall be provided by the manufacture and be of the same material as the razor wire.

162-2.13 GROUND WIRE AND GROUND RODS. Wire for grounding shall be No. 6 AWG bare TINNED solid copper wire that meets the requirements of ASTM B33. All ground rods shall be stainless steel, 3/4-inch in diameter, and 10 feet in length.

162-2.14 CONCRETE BARRIERS. Temporary precast concrete safety barriers (F-shape) conforming to the dimensions of TxDOT standard detail CSB (1)-10.

162-2.15 GATE OPERATOR. All materials and equipment required for the gate operator shall be as shown on the plans.

162-2.16 CRASH BARRIER. All materials and equipment required for the crash barrier shall be as shown on the plans.
CONSTRUCTION METHODS

162-3.1 GENERAL. The fence shall be constructed in accordance with the details on the plans and as specified here using new materials. All work shall be performed in a workmanlike manner satisfactory to the RPR. The Contractor shall layout the fence line based on the plans. The Contractor shall span the opening below the fence with barbed wire at all locations where it is not practical to conform the fence to the general contour of the ground surface because of natural or manmade features such as drainage ditches. The new fence shall be permanently tied to the terminals of existing fences as shown on the plans. The Contractor shall stake down the woven wire fence at several points between posts as shown on the plans.

The Contractor shall arrange the work so that construction of the new fence will immediately follow the removal of existing fences. The length of unfenced section at any time shall not exceed 300 feet. The work shall progress in this manner and at the close of the working day the newly constructed fence shall be tied to the existing fence.

162-3.2 CLEARING FENCE LINE. Clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions that will interfere with proper construction of the fence. Stumps within the cleared area of the fence shall be grubbed or excavated. The bottom of the fence shall be placed a uniform distance above ground, as specified in the plans. When shown on the plans or as directed by the RPR, the existing fences which interfere with the new fence location shall be removed by the Contractor as a part of the construction work unless such removal is listed as a separate item in the bid schedule. All holes remaining after post and stump removal shall be refilled with suitable soil, gravel, or other suitable material and compacted with tampers.

The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction.

162-3.3 INSTALLING POSTS AND BOLLARDS. All posts and bollards shall be set in concrete at the required dimension and depth and at the spacing shown on the plans.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within seven (7) days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches. After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one-part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

162-3.4 INSTALLING TOP RAILS. The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.

162-3.5 INSTALLING BRACES. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.
162-3.6 INSTALLING FABRIC. The wire fabric shall be firmly attached to the posts and braced as shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than one inch or more than 4 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used, and multiple strands of barbed wire stretched to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches or less.

162-3.7 ELECTRICAL GROUNDS. Electrical grounds shall be constructed where a power line passes over the fence and at 500 feet intervals. When installed at the intersection with overhead electrical lines the ground shall be installed directly below the point of crossing. The ground shall be accomplished with a ground rod driven vertically until the top is 6 inches below the ground surface. A ground wire conductor shall be exothermically welded to the ground rod and clamped to the fence in such a manner that each element of the fence is grounded. The Contractor shall comply with FAA-STD-019, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment, paragraph 4.2.3.8, Lightning Protection for Fences and Gates, when fencing is adjacent to FAA facilities.

162-3.8 CLEANING UP. The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction. All disturbed areas shall be seeded or sodded as shown on the plans.

Once there is no longer a need for the temporary fencing shown on the plans it shall be removed and the area shall be cleaned up as indicated above. All openings made in the existing AOA fence or new AOA fence for temporary gates shall be restored to their original condition and the gates shall be turned over to the Owner once they are no longer needed.

162-3.9 CONCRETE BARRIERS. Temporary concrete barriers shall be installed at the locations shown on the plans or as directed by the RPR. Each segment of the barriers shall be interlock to provide a continuous barrier.

162-3.10 GATE OPERATOR. The power and control of the gate shall be installed as per the manufacture’s recommendations and as shown on the plans.

162-3.11 CRASH BARRIER. The crash barrier shall be constructed in accordance with the manufacture’s recommendations and as shown on the plans.

METHOD OF MEASUREMENT

162-4.1 Chain-link fence will be measured for payment by the linear foot. Measurement will be along the top of the fence from center to center of end posts, excluding the length occupied by gate openings. No separate measurement will be made for the cable barrier system. No separate measurement will be made for the removal of temporary fence or gates. No separate measurement will be made for the concrete barriers.

162-4.2 Gates, excluding gate 210, will be measured for payment per each type and size of gate that is installed. Any additional fence required of the installation of man gates between the AOA fence and DART right-of-way fence shall be considered incidental to the installation of the man gate.
162-4.3 Gate 210 will be measured for payment on a lump sum basis. This shall include all appurtenances, including the crash barrier and gate operator, to provide a fully operational gate and crash barrier as shown on the drawings and accepted by the RPR.

**BASIS OF PAYMENT**

162-5.1 Payment for chain-link fence will be made at the contract unit price per linear foot for the fence installed and accepted by the RPR. Payment for temporary fence will be made as follows: 75% of the bid price will be paid once the fence is installed and accepted; The remaining 25% of the bid price will be made once the temporary fence has been removed and the area has been restored.

162-5.2 Payment for bollards will be made at the contract unit price for each gate, excluding Gate 210, installed and accepted by the RPR. Payment for temporary gates will be made as follows: 75% of the bid price will be paid once the gate is installed and accepted; The remaining 25% of the bid price will be made once the temporary gate has been removed and the area has been restored.

162-5.3 Payment for Gate 210 and crash barrier will be made at the contract lump sum price.

The price shall be full compensation for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

- Item F-162-5.1 AOA Fence with Mow Strip and CASS – per linear foot
- Item F-162-5.2 AOA Fence with Mow Strip without CASS – per linear foot
- Item F-162-5.3 Bollard – per each
- Item F-162-5.4 3-Foot Permanent Man Gate for DART – per each
- Item F-162-5.5 Gate 210 and Crash Barrier – per lump sum
- Item F-162-5.6 12-Foot Temporary Gate and Removal – per each
- Item F-162-5.7 20-Foot Temporary Gate and Removal – per each
- Item F-162-5.8 Temporary AOA Fence in Non-Paved Area and Removal – per linear foot
- Item F-162-5.9 Temporary AOA Fence in Paved Area and Removal – 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 A121 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
- ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A392  Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491  Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A824  Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence
ASTM B117  Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B221  Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM F1043 Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

Federal Specifications (FED SPEC)

FED SPEC RR-F-191/3 Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FED SPEC RR-F-191/4 Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

FAA Standard

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

Texas Department of Transportation

TxDOT Standard Specifications of Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014)

**END OF ITEM F-162**
ITEM L-100 GENERAL PROVISIONS—AIRFIELD LIGHTING SYSTEMS

DESCRIPTION

100-1.1 SPECIAL REQUIREMENTS FOR ELECTRICAL WORK. These special requirements shall apply for the electrical work. Where the contract special conditions or general provisions also apply, the stricter of the documents shall apply.

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

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

100-1.3 PROJECT PAY ITEMS. The project pay items are provided to be inclusive of all work to be performed as shown in the Contract Documents. All work not identified with a specific pay item is to be considered work to complete the project and is to be subsidiary to the cost of project pay items provided.

100-1.4 REFERENCES

a. ANSI/NFPA 70 – National Electrical Code
b. NECA – National Electrical Contractors’ Association
c. NEMA – National Electrical Manufacturers’ Association
d. UL – Underwriters Laboratories, Inc.
e. FS – Federal Specifications
f. NESC – National Electrical Safety Code
g. ANSI – American National Standards Institute
h. IES – Illuminating Engineering Society
i. IEEE – The Institute of Electrical and Electronic Engineers
j. ICEA – Insulated Cable Engineers Association
k. National Bureau of Standards
l. NFPA – National Fire Protection Association
m. OSHA – Occupational Safety and Health Administration
n. EPA – U.S. Environmental Protection Agency

o. International Electrical Testing Association

p. AWS – American Welding Society

q. Other standards as referenced in individual sections

**SUMMARY OF WORK**

**100-2.1 SUPERVISION AND ATTENDANCE.** The Contractor shall provide a resident field superintendent who has had a minimum of four years previous successful experience on projects of comparable sizes and complexity. The Superintendent shall be present at all times that work under this division is being installed or affected.

**100-2.2 RECORD DOCUMENTS.** The Contractor shall maintain the contract documents, shop drawings and samples at the site, in good order and annotated daily to show all changes made during the construction process, per Item L-106, Submittals, Record Documents and Maintenance Manuals. These shall be available to the Engineer for examination.

**100-2.3 SAFETY AND PROTECTION.** The Contractor shall be solely and completely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

a. All employees on the work and other persons (including but not limited to the general public) who may be affected thereby,

b. All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and

c. Other property at the site, adjacent thereto, or utilized by the Contractor including but not limited to trees, shrubs, lawns, walks, pavements, structures, underground facilities, and other utilities not designated for removal, relocation or replacement in the course of construction regardless of whether or not such other property is indicated in the Contract Documents.

Existing underground utilities and systems both shown on the plans and those not shown. The Contractor shall have all utilities and systems field located by the FAA or appropriate authorities having jurisdiction and shall take whatever measures necessary to protect the utilities and systems from damage.

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

All hoisting machinery shall be inspected by a competent person or by a government or private agency recognized by the U.S. Department of Labor. A copy of the written inspection report shall be submitted to the Engineer prior to the start of work requiring the use of this equipment.
The installation and/or removal of lighting equipment may be critical to airport operations; therefore, the Contractor shall follow work schedules established in the plans and specifications or as directed by the Engineer. The system shall be installed in accordance with the National Electrical Code and/or local code requirements.

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

The Contractor shall provide all safety rails as required in the performance of the work at building perimeters, at perimeters of floor and/or roof openings and on scaffold systems or platforms in accordance with the above regulations. Maintain safety rails during the duration of the work for this Contract. This Contractor shall be responsible for the removal and replacement of any safety rail necessary for the installation of equipment or materials provided in this work.

Power-actuated fasteners will not be allowed without express written approval of the Engineer. No fasteners shall pierce the structure until approved by the Engineer.

Clean up of scrap materials and waste of the Contractor to be completed daily or more frequently as needed.

100-2.4 ENGINEERING INSPECTIONS. Items noted by the Engineer during construction and before final acceptance, which do not comply with the contract documents will be listed in accordance with the specifications. These items will be sent to the Contractor for action. The Contractor shall have these items corrected.

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

100-2.5 EXISTING CONDITIONS. Investigate the construction site thoroughly and reroute all conduit and wiring in areas of new construction in order to maintain continuity of existing circuitry. Existing conduit shown on plans is presented at approximate locations only. The Contractor must verify and coordinate existing site utilities, conduits, and piping. The specifications include hand digging within five (5) feet of all existing utilities and all required rerouting in areas of existing utilities, conduits and/or pipes.

The Contractor shall check the construction site and exiting conditions thoroughly before bidding. The Contractor shall advise the Engineer of discrepancies or questions noted.

Special attention is called to the fact that work involved in this project is in connection with existing systems/facilities, which must remain in operation while work is being performed. Work must be done in accordance with the schedule specified in the contract documents. Schedule work for a minimum outage to the Owner. Request written permission and receive written approval from the Owner a minimum of 72 hours in advance of any shut-down of existing systems. Perform work required at other than standard working hours where outages cannot be approved during regular working hours. Protect existing buildings and equipment during construction as required.

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

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

100-2.6 SPECIAL PROVISIONS FOR PROTECTION OF CABLES, CONTROLS, NAVAIDS AND WEATHER BUREAU FACILITIES. This provision for the protection of cables, controls, navigational aids and weather bureau facilities has been taken from Appendix 3 of FAA Advisory Circular 150/5370-4. Although the Advisory Circular has been cancelled, the requirements of Appendix 3 are included herein and made a part of this specification.

The Contractor is hereby informed that there are installed on the Airport FAA NAVAIDS; including, without limitation, ASR, UHF and VHF Receivers and Transmitters, U.S. Weather Bureau facilities, electric cables and controls, relating to such NAVAIDS and facilities, and other electric power cables serving other facilities. Such NAVAIDS, Weather Bureau and other facilities, and electric cables must be fully protected during the entire construction duration. Work under this contract can be accomplished in the vicinity of these facilities and cables only at approved periods of time. Approval is subject to withdrawal at any time because of changes in the weather, emergency conditions on the existing airfield areas, anticipation of emergency conditions, and for any other reason determined by the Engineer acting under the orders and instructions of the airport management and/or the designated FAA representatives. Any instructions to the Contractor to clear any given area, at any time, by the Engineer or the FAA Air Traffic Control Tower (by radio or other means) shall be immediately executed. Construction work will be commenced in the cleared area only when additional instructions are issued by the proper authorities.

Power and control cables leading to and from any FAA NAVAIDS, Weather Bureau and other facilities, will be marked in the field by the authority having jurisdiction or the utility locating authority for the information of the Contractor, before any work in their general vicinity is started. Thereafter, through the entire time of this construction they shall be protected from any possible damage, including crossing with unauthorized equipment, etc.

These provisions intend to make perfectly clear the need for protection of FAA NAVAIDS, Weather Bureau and other facilities, and cables by the Contractor at all times.

The Contractor shall immediately repair, with identical or higher quality material by skilled workmen, any underground cables serving FAA NAVAIDS, Weather Bureau and other facilities, which are damaged by the Contractor’s workmen, equipment or work. Prior approval of the FAA must be obtained for the materials, workmen, time of day or night, method of repairs, and for any temporary or permanent repairs the Contractor proposes to make to any FAA NAVAIDS and facilities damaged by the Contractor. Prior approval of the Engineer must be obtained for the materials, workmen, time of day or night, and for the method of repairs for any temporary or permanent repairs the Contractor proposes to make to any other airport facilities and cables damaged by the Contractor.

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

100-2.7 WORK OF SEQUENCE.

a. Install Work to accommodate Airport’s present occupancy requirement during the construction period. Coordinate electrical schedule and operations with Engineer, Contractors working on site and other requirements of the specifications. The Airport will remain in operation during construction.

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

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

d. Coordinate all work with all other contractors and subcontractors.

100-2.8 SYSTEMS OF GUARANTEE. The work required under this specification shall include a one (1) year warranty unless required otherwise by these specifications. This warranty shall be by the Contractor to the Owner for any defective workmanship or material, which has been furnished under this contract for a period of one year (1) from the date of final acceptance of the system. This warranty shall not include light bulbs in service after one (1) month from date of final acceptance of the system. Explain the provisions of the warranty to the Owner at the “Demonstration of Completed System.”

100-2.9 SUBSTANTIAL COMPLETION. All specified work shall be complete prior to final inspection of the work, and all forms and other information requested, including maintenance manuals, shall be submitted to the Engineer for approval one (1) week before the request for substantial completion of the work.

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

100-2.10 FINAL ACCEPTANCE. All work specified shall be complete after the substantial completion observation, all repairs made, and all required information approved at which time the Owner shall formally accept the project and take possession of all work on a permanent basis.

100-2.11 CONTRACTORS RESPONSIBILITIES. Provide necessary layout, labor, material, equipment, tools, transportation, full time supervision and services required for the
satisfactory and timely completion of the work in accordance with the drawings and specifications and contract documents.

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

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

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

Provide all engineering and layout required to perform the work.

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

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

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

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

Provide and pay for all permits, licenses, fees and inspections required for the performance of the work. The Contractor shall pay all sales, consumer, use and other taxes required to be paid in accordance with the laws of the place of the project.

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

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

Provide sleeves for all conduit required as specified.

Protect all work of this contract from damage and intrusion of dirt and foreign objects. Close off open ends of conduit and sleeves on work, which is to be completed at a later date. Remove closure material prior to continuance of work.
Prior to Final Inspection, submit to the Engineer, all Record Drawings and Operation and Maintenance Manuals as specified. Instruct Owner’s maintenance personnel in the operation and maintenance of the systems as required by the Specifications.

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

100-2.12 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS. Should anything necessary for the clear understanding of the electrical work be omitted from the contract documents, or should the requirements appear to be in conflict, the Contractor shall secure written instructions from the Engineer before proceeding with the work affected thereby; otherwise the Contractor will be deemed to be proceeding at his own risk and expense. It is understood and agreed that the work shall be performed according to the true intent of the contract documents.

BASIC MATERIAL AND METHODS

100-3.1 REQUIREMENTS OF BASIC MATERIALS AND METHODS. The work shall include the furnishing of the systems, equipment and material specified in these specifications and as called for on the drawings, to include: supervision, operations, methods and labor for the fabrication, installation, start-up and tests for the complete electrical installation. Provide the necessary intertrade/Contractor coordination for the installation to be in a neat and workman like manner.

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

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

Conduit routed through any buildings that interferes with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit, and fixtures shall fit into available spaces in the building; do not introduce these into the building at such times or in such manner as to cause damage to the structure. Equipment that requires servicing shall be readily accessible.

Locate all openings required for work performed under this section. Provide sleeves, guards or other approved methods to allow passage of items installed under this section.

Keep cutting and patching to a minimum. Insofar as possible, determine in advance the proper chase size and openings necessary for the work.

Where cutting and patching are required due to an error of the Contractor, or where the Contractor has not given enough advance notice of the need for holes, recesses, and
chases, patching shall be performed by those trades skilled in the use of the materials involved and shall be done at the Contractor's expense.

Any cutting of work in place shall be patched and decorated by such mechanics and in such a manner that the quality of workmanship and finish shall be compatible with that of adjacent construction.

The approximate location of building fixtures, wall switches, etc., is indicated on the drawings. Exact locations shall be determined by the Engineer as building work progresses. The indicated locations may be changed by ten (10) feet in any direction without additional cost before the items are installed.

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

The basis for new design requires that electrical services, switchgear, panelboard and transformers total calculated connected load not be more than 60% of the service size. The total calculated load requirements for alterations shall not be more than 80%.

Furnish to roofer all pitch pans required for electrical items, which pierce roof whether or not shown on drawings. Roof penetrations are to be waterproofed in such a manner that roofing guarantees are fully in force. Floor penetrations shall be sealed with fire proof sealant to prevent water from leaking to floor below and to provide a 3 hour fire and smoke barrier. Wall penetrations shall be sealed to provide a 3 hour rated fire seal.

Surface mounted fixtures, outlets, cabinets, conduit, panels, etc., shall have finish or shall be painted as directed by the Engineer. Paint shall be in accordance with other applicable sections of these specifications.

All materials utilized shall be suitable for the environment encountered. No combination of materials shall be used that forms an electrolytic coupling of such nature that in the presence of moisture corrosion is accelerate

In general, all relays, contactors, starters, motor control centers, switchboards, panelboards, dry type transformers, disconnect switches, circuit breakers, and manual motor starter switches are to be supplied and manufactured by the same manufacturer and shall be submitted and approved as equal to that specified.

Make electrical connections to constant current regulators, transformers, motors, instruments, mechanical equipment, controls and at other locations as required with approximately 3 feet (12" minimum) of liquid tight flexible metal conduit (LFMC). The LFMC shall utilize strain relief type connectors by adding a wire mesh grip to each LFMC connector. Determine the requirements from drawings, these specifications, and the approved manufacturer drawings.

Provide inserts, hangers, supports, braces, and anchor bolts as necessary for all work called for under these specifications.
All conduits shall contain one copper grounding conductor, in accordance with NFPA 70, NEC Article 250. No. 6 AWG and smaller shall have green insulation. No. 4 AWG and larger shall be bare. The only exception is the 5KV airfield lighting conduits and ductbanks.

All galvanized materials shall be hot-dip galvanized after fabrication, conforming to ASTM A123 and/or A153, unless noted otherwise.

Unless noted otherwise, all panelboards, motor starters, junction boxes, wireways, etc., shall be spaced off the concrete structure by using a square washer provided by the approved strut manufacturer between the mounting surface and the equipment at each mounting point. Equipment as listed above, mounted on strut shall have a square washer provided by the approved strut manufacturer installed between the strut channel and the equipment at each mounting point. All bolted connections and equipment mountings shall utilize a flat washer, lock washer and hex head ASTM A325 bolting hardware.

Unless noted otherwise, all wire sizes are based on a 135 degrees F (75 degrees C), XHHW THWN-2 600 volt insulation, copper conductors, not more than three single insulated conductors, in raceway, in free air. The conduit sizes are based on the use of XHHW THWN-2 600 volt insulated conductors. The Contractor shall make the necessary increase in conduit sizes for other types of wire insulation. In no case shall the conduit size be reduced. The minimum wire size shall be #12 AWG.

All electrical conductors, windings, busbars, etc. shall be high conductivity (98% conductivity) copper.

The Contractor shall furnish and install all required motor overcurrent protection required by the NEC and these drawings and specifications. The overcurrent protection shall be sized according to the motor nameplate data.

100-3.2 ELECTRICAL REFERENCE SYMBOLS. Symbols used on the plans are defined in the Electrical Legend on the Drawings. Not necessarily will all symbols scheduled be applicable to the project.

100-3.3 ACTIVE SERVICES. Existing active services i.e., water, gas, sewer, electric, communications, etc. when encountered, shall be protected against damage. Do not prevent or disturb operation of active services, which are to remain. If active services are encountered which require relocation, the Contractor shall make a written request to the Engineer for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality or Authority having jurisdiction.

100-3.4 ELECTRIC SERVICE INTERRUPTIONS

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

b. The Contractor shall notify the Engineer of the intent to perform any work requiring service interruptions and shall proceed with such work only after receiving a time schedule approved by the Engineer. The Engineer shall have the right to cancel or delay the time of any service interruption. The Contractor shall provide personnel and equipment to assist in the proper coordination of service interruptions. The Contractor shall not leave the job site until resumption of normal service is satisfactory to the Engineer.
c. Coordinate required facility shutdowns through the Engineer.

d. When service interruptions are required to perform the contract work on transformers, circuit breakers or feeder cables, the Contractor shall arrange the distribution system from dual service to single service. In the event that service interruptions cannot be accomplished by supplying single line utility service, the Contractor shall provide reliable and adequate capacity generators including all temporary connections, secondary distribution equipment, disconnections, cables, safety devices and fuel unless otherwise noted. The use of temporary transformers and substation equipment will be considered by the Engineer.

e. Shutdown times must be minimized where entire building or sections of buildings are to be shut down. Shut down periods shall occur between 0100 and 0500 hours. Onsite generators will be necessary in areas where facilities are out of service for more than ½ hour. All switching and change-overs will be performed by the Contractor and witnessed by the Engineer. Coordination of all service interruptions will be performed by the Engineer.

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

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

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

i. Contractor shall fully examine all areas of demolition in this contract. Contractor shall identify all services related to its trades. Contractor shall provide protection of such service to prevent disruption of service. Contractor shall reroute all services to remain as required to approved locations without extra cost to the Owner.

100-3.5 TEMPORARY SERVICES. Contractor shall provide temporary electrical services throughout the entire work area where required whether indicated or not. Existing roadway lighting circuit integrity shall remain until new traffic patterns are established. Coordinate with all Contractors and Subcontractors. Contractor shall revise temporary services as many times as necessary for all Contractors and Subcontractors work to occur through the completion of the project.

100-3.6 CODES AND FEES. Install in accordance with latest edition of FAA Advisory Circulars, the National Electrical Code and the regulations of governing Federal, State, County, local and other applicable codes, including the Utilities Company. Where a conflict in code requirements occurs the most stringent requirement shall govern. The Contractor shall be responsible and pay all required permits, licenses, services, fees and inspections including meter installation fee. The cost for such shall be included in the bid price.
Deliver to the Engineer, prior to the start of construction, a copy of all permits and licenses required for the work. At the completion of the work, secure and deliver to the Engineer all certificates of compliance of local authorities.

The work shall meet the requirements and recommendations of applicable portions of the latest editions of these standards:

a. National Electrical Code (NFPA 70)
b. Life Safety Code (NFPA 101)
d. National Electrical Manufacturers’ Association Standards (NEMA)
e. Underwriter’s Laboratories (UL)
f. Institute of Electrical and Electronics Engineers (IEEE)
g. Lightning Protection Code (NFPA) 780 and UL 96A
h. AWS D1.1
i. ANSI
j. NFPA
k. Federal Aviation Administration Advisory Circulars (AC)
l. Applicable Local Building Code
m. Certified Ballast Manufacturers (CBM)

The above is not all inclusive of applicable codes and standards, but is presented for the Contractor’s convenience.

100-3.7 STANDARDS. All materials shall be new and free of defects and shall be UL listed, bear the UL label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards. All listed, labeled or approved material shall be used only for the intended purpose.

100-3.8 UTILITY COMPANY FEES, CHARGES, AND COSTS. It is the Contractor’s responsibility to contact the applicable Utility Company(s) to determine if any fees, charges or costs will be due the Utility Company(s) as required by the Utility Company(s) for temporary power, installations, hook-ups, etc. The associated fee, charge or cost for each utility shall be included in the Contractor’s bid price.

100-3.9 TESTS. Systems shall be tested by the Contractor and placed in proper working order prior to demonstrating systems to the Engineer. Refer to the requirements in each section for other applicable standards.
After work is completed a load balance test shall be made, as required, to demonstrate that with full lighting and mechanical load the balance between phases is within 5%. Unbalance load beyond this limit shall be corrected.

Perform such tests as required by any Authorities having jurisdiction over the site. Refer to Item L-131, Demonstrations, Tests, and Performance Verification.

Testing methods shall be acceptable to the Engineer and shall be submitted to the Engineer for review, a minimum of thirty (30) days prior to the scheduled test.

The Contractor shall supply all labor, materials, instruments and miscellaneous equipment for any examination of work or tests as required. All test results shall be recorded and submitted to the Engineer.

100-3.10 LAMINATED PHENOLIC PLASTIC NAMEPLATES. The Contractor shall provide nameplates for wiring systems and equipment as called for herein. All nameplates shall have beveled edges and one-half inch (1/2") lettering. If equipment is smaller than ten inches by six inches (10" x 6"), one-quarter inch (1/4") lettering may be used. Smaller lettering may be used with permission of the Engineer.

Nameplates shall be laminated phenolic plastic, black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background. Emergency systems shall use red front and back with white core for nameplates. Attach nameplates with 4-40 stainless steel self tapping screws. Where conditions do not warrant piercing the enclosure spray or rolled adhesive may be used with permission of the Engineer.

The following items shall be equipped with nameplates: all constant current regulators, pushbutton stations, control panels, system cabinets, terminal cabinets, disconnect switches, panelboards, circuit breakers, contactors or relays in separate enclosures, high voltage boxes and cabinets whether existing or planned by these specifications. Special electrical systems shall be identified at junction and pull boxes, terminal cabinets and equipment racks. Junction boxes shall comply with paragraph 100-3.12, Junction/Pull Box Color Code.

Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for approval. Nameplates for panelboards and switchboards shall include the panel designation, panel name, circuit designation source of power and voltage and phase of the supply. For example, "Equip YY, Panel A, CKT XX fed from Panel XYZ, 480/277V, 3-phase, 4-wire." The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnects and pull box station nameplates for that machine. Nameplates shall include as a minimum the following:

- a. Equipment Number
- b. Equipment Name
- c. Power Source with Circuit Designation
- d. Voltage Level and Number of Phases
All major pull and junction boxes in service areas, tunnels, above accessible ceilings and in accessible chases shall have nameplates identifying the feeder or system.

Systems with conductors exceeding 100 volts to ground shall have voltage identification nameplates with one-half inch (1/2") high letters on all panels, switches, pull boxes and junction boxes.

**100-3.11 ADHESIVE BACKED CLOTH MARKERS.** All raceways containing conductors exceeding 150 volts to ground shall have adhesive backed cloth/vinyl markers installed at each end and every thirty feet (30') in between identifying the voltage level (Example: "480 VOLTS"). If the conduit is less than ten feet (10') in length one marker is acceptable. The markers shall be installed so they are visible from floors and walkways. Normal power system shall use black letters, emergency systems shall use one-half inch (1/2") red letters.

The markers shall be suitable for the environmental conditions encountered.

**100-3.12 JUNCTION/PULL BOX COLOR CODE.** Circuit numbers and circuit identification shall be printed on junction box and pull box covers using ink markers and shall be plainly visible after paint is applied. Paint shall provide rust protection and adhere to the material being painted. The entire box and cover shall be color coded as listed below:

<table>
<thead>
<tr>
<th>Color Code for Junction Boxes</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Power 480/277 Volt</td>
<td>Brown</td>
</tr>
<tr>
<td>Normal Power 208/120 Volt</td>
<td>Black</td>
</tr>
</tbody>
</table>

**100-3.13 CONCRETE WORK.** Concrete bases and pads for all equipment furnished by the Contractor shall be the responsibility of the Contractor unless noted otherwise.

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

**100-3.14 EXCAVATING, TRENCHING AND BACKFILLING.** The Contractor shall do excavating necessary for light bases, underground wiring, conduit and ductbanks and shall backfill trenches and excavations after work has been inspected. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way, except where lines must cross under a wall footing. Where a line must pass under a footing, the crossing shall be made by the smallest possible trench to accommodate the conduit. Excavations shall be kept free from water. No greater length of trench shall be left open in advance of conduit laying than that, which is authorized or directed by the Engineer.

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

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

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

**100-3.15 WELDING.** All welding and weld procedures shall be in accordance with AWS D1.1, Latest Edition. Qualifications of welders and welding operators shall be in accordance with AWS D1.1, Latest Edition. The welder qualification test shall be performed on a 1" A36 Test Coupon in the 3G and 4G positions. The welder qualification shall be current within 12 months of the work being performed. Weld inspections shall be per the criteria set forth in AWS D1.1 for visual weld inspection.

**DESIGNATION OF MATERIALS**

**100-4.1 CRITERION DESIGNATION OF MATERIALS AND EQUIPMENT.** Where a criterion specification is designated for any material or equipment to be installed by the name or catalog number of one specific manufacturer, such designation is intended only for the purpose of establishing the style, quality, performance characteristics, etc., and is not intended to limit acceptability of competitive products. Products of other manufacturers which are approved by the Engineer as similar and equal will be equally acceptable unless specifically otherwise stated.

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

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

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

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

Each Bidder represents their bid is based upon the materials and equipment described in these specifications. Substitutions will not be considered unless a written request has been submitted to the Engineer in accordance with Item L-106, Submittals, Record Documents and Maintenance Manuals.

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

b. Represents that it will provide a warranty for the substitution identical in all respects to the warranty for the specified method or equipment;

c. Represents that it will coordinate the installation of the accepted substitute, making changes as may be required for the work to be complete in all respects at no additional cost to the Owner.

**PROTECTION OF MATERIALS, EQUIPMENT AND WORK**

100-5.1 **REQUIREMENT FOR THE PROTECTION OF MATERIALS, EQUIPMENT AND WORK.** Materials shall be stored so as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall be subject to re-inspection prior to their use in the work. The Contractor shall coordinate the storage of all materials with the Engineer.

Owner-furnished materials, if any, shall be made available to the Contractor at the location specified herein. All costs of handling, transportation from the specified location to the site of the work, storage and installation of Owner-furnished materials shall be included in the Total Contract Price. All risk of loss or damage to Owner-furnished materials shall pass to the Contractor after delivery of said material to the site of the work. The Owner shall be entitled to deduct from any monies due or to become due to the Contractor any cost incurred by the Owner resulting directly or indirectly from a loss caused in whole or in part by the Contractor's handling, storage or use of Owner-furnished materials.

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

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

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

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

All cut edges of galvanized materials and marred or scratched galvanized surfaces shall be repaired using a cold galvanizing compound.
All threaded conduit joints shall use conductive anti-corrosion surface compound that is compatible with the type of metallic conduits that are installed.

**GENERAL CONSTRUCTION REQUIREMENTS**

100-6.1 **ADDITIONAL REQUIREMENTS.** Provide the bracing, shoring, rails, guards, and covers necessary to prevent damage or injury. Do not leave energized electrical items unnecessarily exposed or unprotected. Protect personnel from exposure to contact with electricity. Deliver equipment and materials to the job site in their original, unopened, labeled containers. Store ferrous materials so as to prevent rusting. Store finished materials and equipment so as to prevent staining and discoloring.

All materials stored prior to installation, shall be stored in a bonded and secured facility.

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

**METHOD OF MEASUREMENT**

100-7.1 The items described in this section are incidental to other sections and shall not be measured for payment.

**BASIS OF PAYMENT**

100-8.1 No direct payment shall be made for the work described in this specification. The work described in this specification is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

**END OF ITEM L-100**
ITEM L-103 TEMPORARY LIGHTING, SIGNING, AND NAVAIDS

DESCRIPTION

103-1.1 GENERAL. This work shall include but is not limited to the following:

a. Installing, protecting and maintaining temporary airfield lighting and signing.

b. Coordinating with the FAA and Airfield Operations to maintain their systems according to construction phasing or work area.

c. Removal, modifying, disposal and/or salvage of temporary airfield lighting, signing and NAVAID systems.

103-1.2 RELATED DOCUMENTS. The General Provisions, Special Provisions and Supplementary Conditions apply to work specified in this Item.

103-1.3 APPLICABLE DOCUMENTS. The publications listed at the end of this Item are incorporated herein by reference and form a part of this Item to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of this solicitation shall be applicable. In the text of this Item, such publications are referred to by basic designation only. Additional details and specifications pertaining to a specific system are contained in these documents and are to be considered as part of this Item. Perform all work in accordance with these documents except as specified herein. In the event of a conflict between contract documents and the referenced documents, the more stringent rule shall be applied.

MATERIALS

103-2.1 GENERAL. Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20590, and shall be listed in Advisory Circular 150/5345-53, Airport Lighting Equipment Certification Program, current edition. All equipment and materials not listed in Advisory Circular 150/5345-53 shall be suitable for their intended purpose and will be adequately protected against corrosion. Any plastic components exposed to sunlight shall be made of UV stabilized material. All fasteners shall have corrosion protection. Copper bearing hardware in contact with aluminum shall be plated with cadmium, nickel, and zinc. All hardware used for access for maintenance shall be stainless steel.

103-2.2 LIGHT BASE. The contractor shall provide the temporary light base as described in the plans.

103-2.3 ISOLATION TRANSFORMER. Existing isolation transformers which are removed as part of this project are to be used for temporary lighting. The transformer current and wattage rating shall be appropriate for the fixture.

103-2.4 HARDWARE. All bolts, nuts, washers and lock-washers shall be stainless steel.
103-2.5 **PLUG AND RECEPTACLE CABLE CONNECTORS.** L-823, Type I, Class A, meeting the requirements of FAA AC 150/5345-26 as required.

103-2.6 **CONCRETE.** Concrete shall meet the requirements of Item P-610.

103-2.7 **UNDERGROUND ELECTRICAL CONDUIT AND DUCT.** Equipment and materials shall be in accordance with Item L-110.

103-2.8 **CABLE.** Equipment and materials shall be in accordance with Item L-108. The Contractor has the option to reuse cable for temporary circuit use only. Any cable to be reused must have been initially installed as temporary cable on this project. This cable is to be used within the cable rating requirements and in accordance with Item L-108.

103-2.9 **GROUNDING.** Equipment and materials shall be as described on the plans and details.

103-2.10 **GROUND RODS.** Ground rods shall be in accordance with Item L-108.

103-2.11 **BLANK COVER PLATES.** Equipment and materials shall be in accordance with Item L-867 and L-868 as described in AC 150/5345-42.

103-2.12 **TEMPORARY SIGN COVER.** Sign cover shall be blank legend panels to match existing sign manufacturer as described in AC 150/5345-44 and indicated in the drawings.

103-2.13 **TEMPORARY JUNCTION BOXES.** Temporary junction boxes shall be existing light base cans salvaged from the project site.

103-2.14 **TEMPORARY AIRFIELD AND NAVAID CABLE.** The temporary airfield and NAVAID cable shall meet the requirements of Item L-108 for the specific cables.

103-2.15 **TEMPORARY CONDUIT.** Conduit for temporary lighting and signing circuits shall be Rigid Galvanized Steel (RGS) Conduit minimum size 1.5 inch.

**CONSTRUCTION METHODS**

103-3.1 **EXISTING UTILITIES.** Prior to any excavation or trenching the Contractor shall verify any existing cables and utilities, which will be crossed by the trench. The Contractor shall use extreme care while digging in this area and it is the Contractors’ responsibility to repair any damage, which occurs at no additional cost to the Owner.

103-3.2 **NOTIFICATION OF TESTING.** The Contractor shall notify the Engineer a minimum of 48 hours in advance of system, or partial system testing, including but not limited to, installed cable megger testing, operational testing of any modified lighting circuit and fixture testing.

103-3.3 **TESTING.** Testing shall be in accordance with applicable sections of Items L-108 and L-125.

103-3.4 **TEMPORARY CABLE REMOVAL.** Once a temporary circuit or portion thereof is no longer required, the cable for that circuit shall be removed for reuse or disposal. All cables in a single conduit shall be removed in a single pull.
103-3.5 **REUSED TEMPORARY CABLE.** Cable previously installed under this project as temporary cable may be reused for other temporary circuits only. All cables shall be inspected for damage before reuse. The cable shall be installed and tested in accordance with Item L-108. If for any reason the reused cable fails, it shall be replaced at the Contractor’s expense.

103-3.6 **ELECTRICAL REQUIREMENTS.** Conform to applicable sections of the NEC and local codes. All electrical connections shall be made via watertight plugs and receptacles to allow the unit to pull free in the event it is struck by aircraft. Install all underground cable in accordance with Item L-108. Use splices or appropriate plugs for cable connections as specified in Item L-108.

All wiring entering the NAVAIDS must be through plugs and receptacles that will separate if the box is struck by an aircraft. The receptacles are located and held at the frangible point on the breakable coupling. All underground connections will be made with FAA approved splices or plugs and receptacles intended for that use.

103-3.7 **INSTALLATION OF TEMPORARY ELECTRICAL SYSTEMS**

a. **Lighting.** Connect temporary circuits as shown on the plans and test fixtures.

b. **Signing.** Remove legend panels directing aircraft toward closed pavement. The Contractor will be required to procure and install blank sign panels that are compatible with existing sign manufacturer as shown on the drawings.

103-3.8 **RESTORATION OF TEMPORARY EQUIPMENT.** Temporary electrical equipment is to be removed or restored to its original arrangement when it is no longer required. The blank sign panels shall be turned over to the Airport, as directed by the Engineer.

All temporary cable and exposed conduit are to be removed from the site and disposed of properly. Restoration of temporary items as described above shall be considered incidental to the various associated pay items; there will be no separate pay items for this work.

103-3.9 **TEMPORARY JUNCTION BOXES.** Handholes for the by-pass ducts shall be installed as described in section L-115 of the specifications and as shown on the plans. Extreme care shall be used to prevent interrupting the existing buried cables. Coordinate with the proposed drainage and pavement section installation in the area as shown on the plans.

103-3.10 **BY-PASS DUCTBANK.** The ductbank shall be installed as described in section L-110 of the specifications and as shown on the plans. Backfill material shall be select backfill as described in Item P-152.

103-3.11 **TEMPORARY NAVAID CABLE.** The cable installation shall include the cable configuration for the MALSR, ALSF II, and glideslope cable by-pass installation. Included in this item is locating the existing cable, connecting and extending the cable to handhole and duct system. This work must be done in such a manner as to ensure the existing NAVAID circuits are kept in operation as required for the construction phasing.

103-3.12 **TRENCHING FOR DIRECT BURIED CABLES.** Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Road patrols or graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 18 inches below finished grade.
The Contractor shall excavate all cable trenches to a width not less than 6 inches. The trench shall be widened where more than two (2) cables are to be installed parallel in the same trench. Unless otherwise specified in the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

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

103-3.13 CABLE INSTALLATION IN TRENCHES. The Contractor shall not use a cable plow for installing the cable. Mechanical cable-laying equipment may be used and should provide for physical inspection of cable prior to backfilling. Sharp bends or kinks in the cable shall not be permitted. Cables shall be unreeled in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one (1) end.

Where two (2) or more cables are laid parallel in the same trench, they shall be placed laterally a minimum distance of 3 inches apart, and the trench shall be widened sufficiently to accomplish this. Cables crossing over each other shall have a minimum of 3-inch vertical displacement with the topmost cable depth at or below the minimum required depth below finished grade.

Not less than 1 foot of cable slack shall be left on each side of all connections placed in the trench in a series of S curves. Additional slack cable shall be left in handholes, manholes, etc., where it is required to bring the cable above ground level to make connections. The amount of slack cable shall be stipulated by the Engineer, or as shown in the plans and specifications.

103-3.14 TRENCH BACKFILLING AND RESTORATION. After the cable has been installed in the trench the first layer of backfill shall be 3 inches deep, loose measurement, and shall be either earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve. This layer shall not be compacted. The second layer shall be 5 inches deep, loose measurement, and shall contain no particles that would be retained on a 1-inch sieve. The remainder of the backfill shall be excavated or imported mineral and shall not contain stone or aggregate larger than 4 inches maximum diameter. The third and subsequent layers of the backfill shall not exceed 8 inches in maximum depth, loose measurement.

The second, and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent undisturbed soil, and to the satisfaction of the Engineer. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

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

All areas disturbed by the trenching, storing of dirt, cable laying, pad construction, and other work shall be restored to its original condition as soon as possible. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding or mulching. All such work shall be
performed in accordance with Section 32 92 19 of these specifications. The Contractor shall be
held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

103-3.15 Conduit for temporary lighting and signing circuits shall be Rigid Galvanized
Steel (RGS) Conduit minimum size 1.5 inch. This item includes conduit connections, fittings,
modifications to existing equipment and restoration as required.

METHOD OF MEASUREMENT

103-4.1 TEMPORARY SIGN MODIFICATIONS. The quantity of signs modified to be paid
for under this item shall be the number of each sign modified, regardless of the number of sides
or panels as described in this specification, including, but not limited to, providing and installing
blank sign panels, lighting fixture modifications, restoration, and other materials associated with
the temporary work required to complete the temporary signing installations, tested and installed
as complete in accordance with the plans and specifications and as accepted by the RPR.

103-4.2 TEMPORARY CIRCUITING. The quantity to be measured shall be measured by
the linear foot for cable(s) installed in conduit regardless of number of cables or exposed or
buried conduit, in place and accepted by the RPR. This price shall be full compensation for
furnishing all materials, connections, trenching, conduit, preparation, restoration, and all labor,
equipment, tools and incidentals necessary to complete the item.

103-4.3 TEMPORARY LIGHTING AND SIGN WORK. The quantity to be measured shall
be lump sum and shall include all temporary lighting and signage work described in this
specification which is not included in Temporary Signage Work and Temporary Circuiting. This
price shall include, but not limited to, circuit by-pass connections, covering or disconnecting
lights, circuit investigation, restoration, and coordination required to maintain airfield operations
as directed by the construction phasing and the RPR.

BASIS OF PAYMENT

103-5.1 TEMPORARY SIGN MODIFICATION. Payment will be made at the contract per
each price for the completed and accepted temporary sign installations and accepted by the
RPR. This price shall be full compensation for the installation of blank sign panels, light fixture
modifications, furnishing all materials and for all preparation, assembly, mounting hardware, and
installation of the requirements specified in this item, and for all labor, equipment, tools and
incidentals necessary to complete the item.

103-5.2 TEMPORARY CIRCUITING. Payment will be made at the contract linear foot
price for the cable and installed in place and accepted by the RPR. This price shall be full
compensation for furnishing all equipment, materials, connectors, trenching, cable, conduit,
preparation, and all labor, equipment, tools, and incidentals necessary to complete the item.

103-5.3 TEMPORARY LIGHTING AND SIGN WORK. Payment will be made at the
contract lump sum price for the completed and accepted temporary signing and lighting
installations and accepted by the RPR. This price shall be full compensation for furnishing all
materials and for all preparation, storage means, and for all labor, equipment, tools, incidentals,
and appurtenances necessary to maintain these items in new condition in accordance with the
drawings and specifications.

Payment will be made under:
Item L-103-5.1  Temporary Sign Modification – per each
Item L-103-5.2  Temporary Circuiting – per linear foot
Item L-103-5.3  Temporary Lighting and Sign Work – per lump sum

**APPLICABLE FAA SPECIFICATIONS**

AC 150/5345-7  Specification for L-824 Underground Electrical Cables for airport Lighting Circuits
AC 150/5345-26  Specification for L-823 Plug and Receptacle, Cable Connectors (including Changes 1 & 2)
AC 150/5340-23  Supplemental Wind Cone Assemblies
AC 150/5345-27  Specification for Wind Cone Assemblies
AC 150/5340-28  Low Visibility Taxiway Lighting Systems
AC 150/5345-42  Specification for Airport Light Bases, Transformer Housings, Junction Boxes and Accessories (including Change 1)
AC 150/5345-46  Specification for Runway and Taxiway Light Fixtures
AC 150/5345-47  Isolation Transformers for Airport Lighting Systems
AC 150/5345-53  Airport Lighting Equipment Certification Program
AC 150/5345-42  Specification for Light Base and Transformer Housing, Junction Boxes and Accessories (Including Change 1).
AC 150/5345-53  Airport Lighting Equipment Certification Program.

**END OF ITEM L-103**
ITEM L-104 GENERAL ELECTRICAL SAFETY REQUIREMENTS AND TEMPORARY AIRFIELD LIGHTING

DESCRIPTION

104-1.1 PURPOSE. The purpose of this item is to establish the proper safety guidelines necessary to protect aircraft, passengers, crews, the general public, all workers and vehicles involved in their daily tasks. The Contractor is solely responsible for all issues related to the safety program and guidelines and implementation of such programs and guidelines necessary to protect aircraft, passengers, crews, the general public, all workers and vehicles involved in their daily tasks.

104-1.2 FAA ADVISORY CIRCULARS. All applicable requirements of the below listed Advisory Circulars, latest edition, standards and related reading shall be complied with:

150/5210-5 Painting, Marking and Lighting of Vehicles used on an Airport (Latest Edition)
150/5340-30 Design and Installation Details for Airport Visual Aids (Latest Edition)
150/5370-2 Operational Safety on Airports During Construction (Latest Edition)
29 CFR Part 1910 Occupational Safety and Health Standards
29 CFR Part 1926 Occupational Safety and Health Regulations for Construction
NFPA 70 National Electrical Code (Latest Edition)
NFPA 70E Standard for Electrical Safety in the Workplace (Latest Edition)

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

104-1.3 GENERAL SAFETY PROVISIONS. The Contractor shall take safety and health measures in performing work under this contract. The Contractor shall meet with the Engineer to develop a mutual understanding relative to administration of the safety requirements. The Contractor is subject to applicable federal, state and local laws, regulations, ordinances, codes and orders relating to safety and health in effect on the date of this contract. Attention is invited to the regulations issued by the Secretary of Labor pursuant to the Contract Work Hours and Safety Standards Act and the Safety and Health Regulations for construction. The Contractor shall comply with the Secretary's Regulations as applicable and shall comply with specific requirements stated.
As a minimum, work place safety shall comply with NFPA 70E Standard for Electrical Safety in the Workplace, OSHA, federal, state and local requirements. Where a conflict in code requirements occurs the most stringent requirement shall govern.

During the performance of work under this contract, the Contractor shall comply with procedures prescribed for control and safety of persons visiting the project site.

The Contractor is responsible for his personnel and for familiarizing each of his subcontractors with safety requirements.

The Contractor shall advise the Engineer of any special safety restrictions he has established so that the Owner can be notified of these restrictions.

104-1.4 FIRE PREVENTION AND PROTECTION. All tools producing sparks or heat, open-flame heating devices, or operations utilizing such devices, etc., shall be in accordance with the local Fire Department and the Owner’s Burn Permit procedures. Work shall not start until all requirements of the Burn Permit procedures are met.

Open-flame heating devices will not be permitted except by approval in writing. Such permission will not be granted unless the Contractor has taken reasonable precautions to make such devices safe. Burning trash, brush or wood on the project site will not be permitted. Approval for use of open fires and open-flame heating devices will in no way relieve the Contractor from the responsibility for any damage incurred because of fires.

Flammable liquids shall be stored and handled in accordance with the Flammable and Combustible Liquids Code, NFPA 30.

Open fires and salamanders will not be permitted in construction areas.

Smoking will not be permitted within the Air Operations Area (AOA) and in areas such as paint storage, fuel storage, and posted no smoking areas.

Welding, flame cutting, melting and other such operations in all operating areas, shall not be permitted until approved at the beginning of each workday by the Engineer. The Engineer may approve longer periods of time for welding and burning in some operating areas if the detailed safety procedures are established beforehand. Operating open flame devices shall not be left unattended in any area.

The Contractor shall provide the necessary firefighting equipment and fire prevention methods and, before operations begin, clear all welding and cutting operations with the Engineer.

A Contractor's employee shall be assigned as fire watch for every welding and burning operation. He shall be equipped with 2 full 15 pound carbon dioxide fire extinguishers and shall check all areas around and below the welding or burning operation for fires. He shall continue this check for at least 60 minutes after the completion of the welding or burning operation.

The Contractor shall discontinue all burning, welding, or cutting operations, one hour prior to the end of the normal work day. The Contractor shall provide a workman to remain at the site for one hour after discontinuing these operations. This workman shall make a thorough inspection of the area for possible sources of latent combustion. Any unsafe conditions shall be corrected.
During operations involving possible fire hazard, the Contractor shall notify the Engineer and not proceed until clearance is obtained in writing. The Engineer may request a standby from the Aircraft Rescue and Firefighting (ARFF). However, this does not relieve the Contractor of his responsibility for welding and cutting safety.

104-1.5 TEMPORARY EXITS AND ENTRANCES. Such passageways shall provide adequate fire protection and safety of Owner personnel and representatives.

104-1.6 SWITCHING. Electrical switching required for clearance to work on equipment operating from electrical circuits will be performed only by Owner personnel authorized as safety operators for the specific equipment unless otherwise authorized in writing by the Engineer.

104-1.7 REMOVAL OF EQUIPMENT. When permanently removing equipment, the electrical wiring, conduit and control boxes shall be removed to the source of feed, unless otherwise specified or indicated.

After equipment has been removed, the electrical wiring diagrams, schematics, etc., shall be marked to show the change.

Conduit not removed shall have a pull string installed.

104-1.8 OTHER SAFETY REQUIREMENTS. Temporary wiring shall comply with NEC. Indiscriminate use of extension cords, portable cable or junction boxes creating tripping hazards as well as overloaded circuits will not be permitted.

Unplug portable electrical hand tools when not in use. Inadvertent operation of equipment can take place if it is left plugged into an energized receptacle.

Before maintaining or repairing any electrical equipment, it shall be disconnected from the power source.

Do not use any equipment that has frayed cords or three-wire plugs that have had the grounding prongs removed. Faulty equipment and tools shall be repaired by qualified electrical personnel.

Do not use metal ladders when working on electrical equipment.

EXCAVATION

104-2.1 EXCAVATION OPERATIONS. Methods of excavation, means of earth support, and manner of backfill shall be conducted with consideration for the safety of persons and work, and prevention of damage to adjacent pavement, utilities, structures and other facilities, due to settlement, lateral movement, undermining and washout. Excavation shall be performed in a manner to prevent surface water and subsurface or ground water from flowing into excavations, and to prevent water from flooding conduit trench and adjacent or surrounding area.

The Contractor and all his subcontractors performing trench excavation on this contract shall comply with the State Trench Safety Act in which the project is occurring and the Occupational Safety and Health Administration’s (OSHA) trench excavation safety standards, 29 C.F.R., 1926 subpart P, including all subsequent revisions or updates to these standards as adopted by the Department of Labor and Employment Security (DLES). The Contractor shall consider all available geotechnical information in his design of the trench excavation safety system.
Inspections required by OSHA trench excavation safety standards shall be provided by the Contractor.

PROTECTION OF WORK

104-3.1 PROTECTION OF WORK. Provide adequate stand-by mechanical equipment for emergency use.

Excavations shall have substantial barricades and be posted with warning signs for the safety of persons. Warning lights shall be provided during hours of darkness.

Barricades shall be erected immediately around manhole openings when covers are removed or opened.

For personnel safety and to prevent possible interruption of major utility services encountered during excavation, the following procedures shall be followed:

a. Prior to performing any excavation work or any surface penetrations 6-inches or deeper (such as driving stakes more than 6-inches in the ground) on any ground surface, the Contractor shall obtain from the Engineer, local utilities, etc., the current up-to-date subsurface utility drawing of the particular area to be worked on.

b. All Agencies/Utilities, etc. that may be affected by the excavating shall be contacted by the Contractor so that all lines, pipes, etc., can be marked/staked.

c. The Contractor shall stake out all subsurface utilities i.e., high voltage cables, communication cables, pipe lines, etc., indicated within the scope of the work contemplated. All subsurface utilities shall be located by hand digging; hand digging shall extend for 5-feet on both sides of the subsurface utility.

d. After hand exposure of cable or pipelines, the Contractor shall obtain agreement from the Engineer, Agency/Utility on how much closer to cable or pipe the excavations can be permitted.

e. Detectable marker tape, with metalized foil core, printed with the words "CAUTION ELECTRIC LINE BELOW," "CAUTION WATER LINE BELOW," "CAUTION SEWER LINE BELOW," etc., as applicable, shall be installed 8-inches below grade over the underground utility. Tape shall be in accordance with Item L-108, Installation of Underground Cable for Airports.

f. The Contractor shall notify the Engineer, 72 hours prior to the start of excavation work or surface penetration, to enable the Engineer to review measures being taken to prevent hazard to employees and to prevent possible damage to subsurface utilities. Where emergency conditions preclude the 72 hours advance notification, the Contractor shall nevertheless inform the Engineer of his intention to initiate work.

g. After all existing utilities have been located and marked or staked, the Contractor shall proceed with excavating work, or other surface penetration work. The Contractor however, shall temporarily halt any machine excavation work or other surface penetration when approaching within 5-feet of the staked out subsurface utility until the Contractor has hand excavated down to expose the utility to exactly fix its location.
h. No digging, dirt moving or other heavy equipment shall enter physically any approved construction area before all utilities have been located and properly staked out. It is the Contractor's responsibility to locate all utilities before digging, sawing, coring, boring, etc. Any damage caused by digging, sawing, boring, coring, etc., is the Contractor's responsibility for repair. Any damage must be reported immediately to the Engineer. No repair shall be attempted without approval.

i. All high voltage cables shall be disconnected before excavation is attempted.

j. To protect subsurface utilities, provide as a minimum, a 1-inch thick steel plate cover over electrical duct, cables and other subsurface utilities when heavy equipment is being used in the area.

k. The requirements listed above shall be considered incidental to the item for which the excavation is required.

SAFETY TAGGING AND LOCKOUT

104-4.1 SAFETY WITH ELECTRICAL CIRCUITS AND EQUIPMENT. No one may work on an energized circuit without written permission from the Contractor's project manager. The Contractor's project manager shall review the circumstances and the necessary safety precautions with the Engineer prior to giving permission for the "hot" work. The Contractor assumes all liability in connection with any work on energized circuits.

No one may disconnect or cause to be disconnected any electrical circuit before permission is requested from and granted by Airport Operations or the Engineer.

Identification markings on building light and power distribution circuits shall not be relied on for established safe work conditions. Always verify the proper safe "deenergized" conditions with properly operating test equipment.

Before any circuit supplying radar, ILS, weather, VORTAC, airport beacon, runway/taxiway lighting equipment or any other equipment is disconnected, permission must first be granted by Airport Operations or the Engineer, and, if applicable, FAA Airways Facilities Office.

Work shall not commence on any circuit until:

a. The circuit is correctly identified in the presence of the electrical contractor's superintendent or foreman, the Engineer, or Airport Operations.

b. After identity of the circuit is established, and the circuit disconnected, the time and date shall be recorded by the Engineer.

c. The switch shall be locked in the open position or opened in a manner, which will prevent accidental restoration.

d. The circuit shall be tagged with an approved warning tag by the electrical contractor's superintendent. The tag shall state, the company's name, the electrician's name responsible for the disconnection, date and time and the project name and project number.

Restoration shall be accomplished and tags removed only by the electrical contractor's superintendent in the presence of Airport Operations or the Engineer.
The Engineer shall record time, date and operational status of circuit after restoration.

No circuit shall be disconnected or unplugged before color code identification by taping.

No circuit shall be disconnected at power source before proper safety precautions are taken to prevent accidental restoration.

When possible, circuits shall be restored by the same person who disconnected the circuit.

As a minimum, the Lock/Tag/Try procedure shall comply with NFPA 70E and the Owner's requirements.

**TEMPORARY AIRFIELD LIGHTING**

104-5.1 TEMPORARY AIRFIELD LIGHTING. Temporary electrical fixtures and conductors are allowable when necessary, but shall be installed as follows:

a. Where temporary lights are to be installed on a paved surface, temporary lights shall be bolted to the pavement in a manner rendering the light stationery and allowing space for conductors to enter or exit and to be spliced.

b. When the above is not practical, lights shall be fastened to a weighted object adaptable for the purpose and of sufficient weight to inhibit movement by jet engine blast.

c. Temporary conductors supplying temporary lights shall be installed in a rigid galvanized steel conduit system and secured every five feet to prevent movement by jet engine blast.

d. All joints or splices in temporary conductors shall have heat shrink tubing with integral sealant applied to secure mechanical and electrical connection and prevent water entry.

e. All plug-in connections shall have heat shrink tubing with integral sealant applied to prevent accidental disconnection and shall be color code taped to expedite quick, efficient disconnection and restoration.

f. Temporary airfield lighting and signage shall conform as closely as possible to permanent locations normally on the taxiway or runway and that shall guide aircraft in a safe path away from all possible accident prone areas.

The Contractor shall provide four sets of marked-up, ‘As-Built’ temporary lighting plans to the Engineer prior to final temporary lighting and signage connections.

Closed taxiways and runways shall be so marked in a manner acceptable to FAA and the Engineer and said marking shall be kept in acceptable condition. This item shall include, at the Engineer’s discretion the temporary removal or black-out of airfield signage.

**CAUTION:** The series lighting circuit must always be complete before a regulator is energized. Normal circuit voltage is less than 5,000 volts, open circuit voltage can be more than 10,000 volts. All personnel shall be instructed to protect the integrity of the lighting circuit. Turn off, lock out and tag the constant current regulator at the vault before opening the circuit. Continuity of the circuit shall be checked before the regulator is reconnected and reenergized.
The installation and/or removal of lighting equipment may be critical to airport operations; therefore, the Contractor shall follow work schedules established in the plans and specifications or as directed by the Engineer. The temporary system shall be installed in accordance with the contract documents, FAA Advisory Circulars and if applicable the National Electrical Code and/or local code requirements.

The Contractor shall provide temporary wiring as required to reconnect existing airfield lighting and signage to provide guidance for aircraft to pass through the construction areas on those taxiways/runways, which must remain open.

It shall be the Contractor’s responsibility to determine that all airfield lighting circuits, except those that are serving closed taxiways or runways, are completely operational, using tower controls (if applicable), at the end of each work shift and shall so certify to the Engineer before leaving the work site. Day shift report of system operation shall be at 4 p.m. Second shift report shall be 1 hour before dark. Any other shift shall report 1 hour prior to the need for airfield lighting or as determined by the Engineer. Should bad weather cause poor visibility, the Engineer may require additional status reports of system operability and may call for the operation of the lighting system at any time. In the event of lighting system failure, the Contractor shall immediately take the necessary steps to restore proper operation.

Whenever the scope of work requires connection to an existing circuit, the circuit’s insulation resistance shall be tested, in the presence of the Engineer. This test shall be performed prior to any activity affecting the respective circuit. The Contractor shall record the results on the forms included in Item L-131 Demonstrations, Tests and Performance Verification. When the circuit is returned to its final condition, the circuit’s insulation resistance shall be checked again in the presence of the Engineer. The Contractor shall record the results on the forms included in Item L-131. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs, to the circuit, to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, etc. if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance Manuals, see Item L-106, Submittals, Record Documents and Maintenance Manuals.

**TEMPORARY AREA/BUILDING LIGHTING**

**104-6.1 TEMPORARY ELECTRICAL AND LIGHTING INSTALLATION.** Temporary electrical and/or lighting fixtures shall be provided in operational areas of buildings, where required, to maintain public safety and continued airport operations.

Temporary lighting must be installed to ANSI/OSHA standards for impacted area.

Temporary installations shall be approved by the Engineer.

The cost of temporary area/building lighting shall be absorbed in and considered incidental to the various work items.

**104-6.2 MISCELLANEOUS REGULATIONS.** Draw-out type breakers, regardless of operating voltage must be drawn completely out to open position and tagged and locked out per paragraph 104-4.1.

In hazardous locations, regardless of class, all electrical tools and extension cords shall be of a type approved for use in such areas.
No counterpoise conductors (or any other conductors) may be joined, connected, or affixed to any terminal, grounding electrode, or other point or attachment by any method except those approved by the Engineer.

All counterpoise or grounding systems, when severed or damaged, shall be immediately repaired by the Contractor in accordance with Item L-108, Underground Power Cable for Airports and inspected by the Engineer.

No high voltage switch shall be engaged or disengaged under load.

All backhoes, cranes, etc., shall be enclosed by safety pylons or other approved markers and rope festooned between the pylons, where applicable.

All security gates in use by contractors are the responsibility of the Contractor, and must be used in a fully secure manner. Any damage to a security gate shall be reported immediately to the Engineer.

**METHOD OF MEASUREMENT**

**104-7.1** The items described in this section are incidental to other sections and shall not be measured for payment.

**BASIS OF PAYMENT**

**104-8.1** No direct payment shall be made for the work described in this specification. The work described in this specification is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

**END OF ITEM L-104**
ITEM L-105 DEMOLITION, REMOVAL, AND RELOCATION

GENERAL

105-1.1 DEFINITIONS. Alterations shall mean any change or rearrangement in the component parts, including structural, mechanical, electrical systems, or internal or external arrangements of an existing structure.

Removal shall mean the dismantling of existing materials, components, equipment, and utilities. Removed items shall be handled, prepared for storage, transported to storage areas as specified.

Relocation shall mean the removal and salvaging, transporting and storing of items to be relocated as shown on the contract drawings. Relocated items shall be handled, prepared for storage, and transported to storage as required, and relocated to their new location as shown on the plans.

Demolition shall mean the dismantling and disposal of existing materials, components, equipment, and utilities which cannot or will not be reused or which will have no salvage value, or which cannot be reused due to unreparable damage caused by age, non-demolition related reasons, etc. All demolished items not designated to be turned over to the Owner shall be disposed of in a safe manner and at a location acceptable to the RPR.

All items to be salvaged and turned over to the Owner shall be properly enclosed or boxed to protect the items from damage and transported by the Contractor to a location on the Owner’s property, designated by the RPR.

The installation and/or removal of lighting equipment may be critical to airport operations; therefore, the Contractor shall follow the work schedule established in the plans and specifications or as directed by the RPR. The system shall be installed in accordance with the National Electrical Code and/or local code requirements.

The Contractor shall provide temporary wiring as required to reconnect existing circuits to provide guidance for aircraft to pass through the construction areas on those taxiways/runways which must remain open. The Contractor shall check all temporary circuits before dark each day to assure that they are operational. In the event of failure, the Contractor shall immediately take steps to restore operation. The cost of temporary and reconnected lighting shall be absorbed in the various work items.

105-1.2 CONDITION OF EXISTING FACILITIES. The Contractor shall verify the areas, conditions, and features necessary to tie into existing construction. This verification shall be done prior to submittal of shop drawings, fabrication or erection, construction or installation. The Contractor shall be responsible for the accurate tie-in of the new work to existing facilities.

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

Whenever the scope of work requires connection to an existing circuit, the circuit’s insulation resistance shall be tested, in the presence of the RPR. The Contractor shall record the results on the forms included in these specifications. When the circuit is returned to its final condition, the circuit’s insulation resistance shall be checked again in the presence of the RPR. The Contractor shall record the results on the forms included in these specifications. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance Manuals as described in Item L-106, Submittals, Record Documents and Maintenance Manuals.

105-1.3 OCCUPANCY AND USE OF EXISTING FACILITIES. The Owner will occupy and use the facilities within the areas of work during the entire construction period. The Contractor shall be required to plan and coordinate his/her activities in order to provide all necessary controls for the abatement of dust, noise, and inconvenience to the Owner personnel during all phases of the work.

105-1.4 VACATING OCCUPIED AREAS. The Owner will remove all portable items of furniture, equipment, and fixtures prior to the start of work. The FAA will remove all electronics and salvageable equipment from the NAVAID equipment shelters to be demolished or salvaged on the project.

105-1.5 SAFETY REQUIREMENTS. The Contractor shall conduct alterations and removal operations in a manner that will ensure the safety of persons in accordance with the requirements of CFR 29 PART 1926 and 1910.

105-1.6 CLASSIFICATION OF REMOVED/DEMOLISHED ITEMS. Existing materials and equipment indicated to be removed will be classified as "salvageable" and shall remain the property of the Owner or will be classified as "debris" and shall be disposed of legally off the airport.

Reusable salvaged items and equipment shall be reused in the work as described on the Contract Drawings, unless noted otherwise.

Items classified as debris shall be legally disposed of off the airport property. The cost of such disposal shall be included in the cost of other items of work.

Retained salvaged items such as items to be relocated and equipment to be retained by the Owner or the FAA but not reused in the work shall be turned over to the Owner at a facility to be determined by the RPR or the FAA. Retained salvaged items shall be stored on Owner property where indicated by the RPR or the FAA.

105-1.7 TEMPORARY PROTECTION. The Contractor shall provide and maintain the following requirements.

Protection of persons and property shall be provided throughout the progress of the work in accordance with these specifications.
Provide temporary enclosures and partitions prior to starting alterations and removal of work. Such items shall protect existing materials, equipment, and other remaining building or system components from damage by weather and construction operations.

Provide temporary enclosures to isolate space utilized by equipment during construction, from dirt, dust, noise, and unauthorized entry.

Provide temporary exits, entrances, and protected passages where work prevents the use of existing facilities.

Provide weathertight temporary enclosures over and around openings to be made in existing exterior construction prior to the start of work. The Contractor shall maintain such temporary enclosures until new construction will protect the interior of existing facilities from the elements.

Provide temporary exterior wall construction which will be designed and fabricated to resist an applied horizontal wind pressure of not less than 130 mph.

Design and fabricate temporary enclosures to maintain temperatures inside the existing facilities within a range of plus-or-minus 5 degrees F of normal operating conditions.

Provide temporary jet blast structures which will withstand the jet blast with a safety factor of 2.

**EXECUTION**

**105-2.1 DISCONNECTING UTILITIES.** Prior to the start of work, the necessary utilities serving each area of alteration or removal will be shut off by the Contractor and shall be disconnected and sealed by the Contractor, as required. Coordinate shut off with RPR. Lockout/Tag/Try procedures shall be utilized in accordance with Item L-104, General Electrical Safety Requirements and Temporary Airfield Lighting.

**105-2.2 TEMPORARY UTILITY SERVICES.** The Contractor shall install temporary utility services, if required, in satisfactory operating condition before disconnecting existing utilities. Such temporary services shall be maintained during the period of construction and removed only after new permanent services have been tested and are in operation.

**105-2.3 REMOVAL WORK.** The Contractor shall not disturb the existing construction beyond that indicated or necessary for installation of new work. Temporary shoring and bracing for support of building components to prevent settlement or other movement shall be as indicated and as required to protect the work.

The Contractor shall provide protective measures to control accumulation and migration of dust and dirt in all areas of work, particularly those adjacent to occupied areas. The Contractor shall remove dust, dirt, and debris from the areas of work daily.

**105-2.4 SALVAGEABLE MATERIALS AND EQUIPMENT.** The Contractor shall remove all salvageable materials and equipment in a manner that will cause the least possible damage thereto. Removed items which are to be retained by the Owner or the FAA shall be carefully handled, stored, and protected.

The Contractor shall provide identification tags on all items boxed or placed in containers, indicating the type, size, and quantity of materials.

The following FAA equipment, shelters and facilities are to be removed by the Contractor.

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CONTRACT No. 9500723
Permit No. A20-111B
NE-EAT Package II

ITEM L-105-3
Demolition, Removal and Relocation
Issued for Bid
April 23, 2020
Existing combination 35L Localizer/17R MALSR System and associated equipment shall be removed demolished or salvaged as determined by the FAA SSC.

105-2.5 BUILDINGS AND STRUCTURES. The Contractor shall perform removal operations in existing FAA equipment shelter as indicated and as otherwise required to complete the work.

105-2.6 ELECTRICAL EQUIPMENT AND FIXTURES. The Contractor shall coordinate with the FAA to determine equipment deemed by the FAA as salvageable. All components determined to be salvageable shall be boxed and tagged for identification.

All equipment determined not to be salvageable to the FAA shall be removed from the site and disposed of in a safe and acceptable manner.

The Contractor shall remove and dispose of conductors and conduits not used in the finished work and shown to be demolished on the plans.

DEMOLITION

105-3.1 DEMOLITION OPERATIONS. Demolition operations shall be conducted to ensure the safe passage of persons to and from facilities occupied and used by the Owner and to prevent damage by falling debris or other cause to adjacent buildings, structures, and other facilities.

The sequence of operations shall be such that maximum protection from inclement weather will be provided for materials and equipment located in partially dismantled structures.

105-3.2 MAINTAINING TRAFFIC. Demolition operations and removal of debris to disposal areas shall be conducted to ensure minimum interference with runways, taxiways, aprons, roads, streets, walks, and other facilities occupied and used by the Owner.

Streets, walks, runways, taxiways and other facilities occupied and used by the Owner shall not be closed or obstructed without written permission from the RPR.

105-3.3 REFERENCE STANDARDS REQUIREMENTS. Demolition operations shall be conducted to ensure the safety of persons in accordance with ANSI A 10.6 Safety Requirements for Demolition.

Demolition shall be conducted in accordance with OSHA, State and local requirements.

105-3.4 DISPOSAL OF DEMOLISHED MATERIALS.

a. GENERAL. The Contractor shall dispose of debris, rubbish, scrap, and other non-salvageable materials resulting from demolition operations off airport property. Demolished materials shall not be stored or disposed of on Airport property.

b. REMOVAL FROM OWNER PROPERTY. Materials classified as debris shall be transported from Owner property and legally disposed of at no additional cost to the Owner. Permits and fees for disposal shall be paid by the Contractor.

105-3.5 ALTERATION WORK. Cutting, patching, repairing, and other alteration work shall be done by tradesman skilled in the particular trade or work required.
Where required to patch or extend existing construction, or both, such alteration work shall match existing exposed surface materials in finish, color, texture, and pattern.

Salvaged items for reuse shall be as approved by the RPR.

**METHOD OF MEASUREMENT**

105-4.1 Removal of existing in-pavement lights, edge lights and transformers, guidance sign modules, and deicing indicator light shall be measured per each item removed, salvaged and stored at the location designated by the RPR. This item includes all materials, labor, transportation, incidentals and services required for the airfield electrical relocations as shown on the plans.

105-4.2 Removal of cable shall be measured per linear foot of pull between structures, all cables removed from a single conduit would considered as a single pull.

**BASIS OF PAYMENT**

105-5.1 Payment shall be made at the contract unit price for each item completed in accordance with the plans and specifications that is demolished and disposed of off airport property by the Contractor and accepted by the RPR. This price shall be full compensation for furnishing all materials, labor, equipment, tools, incidentals to demolish items, haul away and dispose of waste materials.

105-5.2 Payment will be made at the contract unit price for removal of cable from buried duct or conduit by the Contractor and accepted by the RPR. This price shall be full compensation for furnishing all materials and for all preparation, and for all labor, equipment, tools and incidentals necessary to complete this item.

Payment will be made under:

Item L-105-5.1 Remove Elevated Edge Light – per each
Item L-105-5.2 Remove Taxiway Centerline Light – per each
Item L-105-5.3 Remove Guidance Sign – per each
Item L-105-5.4 Remove Taxiway Edge Retroreflector – per each
Item L-105-5.5 Remove Airfield Lighting or FAA Facilities Cable from Buried Conduit – per linear foot

**SAFETY REQUIREMENTS**

CFR 29 Part 1926 Safety and Health Regulations for Construction
CFR 29 Part 1910 Occupational Safety and Health Standards

**END OF ITEM L-105**
ITEM L-106 SUBMITTALS, RECORD DOCUMENTS, AND MAINTENANCE MANUALS

DESCRIPTION

106-1.1 GENERAL. The items described in this section are applicable to all electrical work by the Contractor. Where the contract special conditions or general provisions also apply, the stricter of the documents shall apply.

106-1.2 SCOPE. This section includes the requirements for submittals, record documents and maintenance manuals. All submittals and O&M Manuals shall be submitted in book form as described in this item.

SHOP DRAWINGS AND SAMPLES

106-2.1 REQUIREMENTS FOR SHOP DRAWINGS AND SAMPLES. Shop drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor, and which illustrate some portion of the work.

Submittal data for electrical materials and equipment shall consist of shop drawings and/or catalog cuts showing technical data as necessary to evaluate the material or equipment, to include dimensions, wiring diagrams, performance curves, ratings, control sequence and other descriptive data necessary to describe fully the item proposed and its operating characteristics.

Samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship, and to establish standards by which the work will be judged. Each sample shall be accompanied by the manufacturer’s instructions regarding installation, operation and maintenance and shall be identified by item number, and specification.

The Contractor shall review, stamp with his approval and submit to the Engineer, one (1) reproducible and seven (7) prints of shop drawings, seven (7) copies of submittal books and three (3) sets of samples where required, as described in this item, within fifteen (15) days of notice to proceed.

If the Contractor desires to deviate from the requirements of the contract documents, the Contractor shall separately submit all deviations from the requirements of the contract documents in shop drawings or samples. The submission shall direct in writing the specific attention of the Engineer to the deviations and shall contain all required data and supporting documentation necessary for an evaluation of the proposed deviation. Any submission or deviation not identified as heretofore mentioned shall be rejected and require resubmission. Separate written approval of all deviations by the Engineer for all design related deviations and by the Owner for all other deviations is required before the Contractor may perform the work covered by such deviation. By requesting a deviation, the Contractor makes the representations contained in this section.

If approval is given, the Contractor will not be excused from producing work in conformity with contract requirements. If a trial use establishes the work does not meet the contract requirements, the Contractor shall take such action as the Engineer determines necessary to
meet the contract requirements. No change in contract time will be made as a result of changes made under this subparagraph. By requesting a deviation, the Contractor makes the representations contained in this section.

a. **SUBSTITUTIONS.** Substitutions will only be considered after bid date only if the following conditions are met and allowed by other sections of these specifications.

   (1) Request for substitution is submitted no later than 15 days after notice to proceed for construction is awarded to the Contractor.

   (2) Request for substitution includes appropriate credit to the project cost. This credit must be submitted with request for substitution in order for substitution to receive any consideration.

   (3) Samples are to be submitted for all substituted light fixtures, wiring devices and other items deemed necessary by the Engineer to determine that the substituted item meets all specifications and requirements before approval of substitutions can be made.

   (4) Samples shall be submitted within 15 days after the award of the contract.

   (5) Request for substitution shall include the name of the material or equipment for which it is to be substituted, drawings, cuts, performance and that data or any other data or information necessary for the Engineer to determine that the equipment meets all specifications and requirements.

   (6) Where permitted and approved, the substitution must conform to space requirements. Substitutions that cannot meet space requirements, which is the substitution Installer's responsibility whether approved or not, shall be replaced at the Contractor's expense. Any substitution modifications of related systems, as a result of the substitution, shall be made at the Contractor's expense.

   (7) The Contractor represents that it has personally investigated the proposed substitution and determined that the proposed substitution is equal or superior in all respects to the specified method or equipment.

   (8) The Contractor represents that it will provide a warranty for the substitution identical in all respects to the warranty for the specified method or equipment.

   (9) The Contractor represents that it will coordinate the installation of the accepted substitute, making changes as may be required for the work to be complete in all respects at no additional costs to the Owner.

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

b. Substitutions will be considered prior to bid date only if all the following conditions are met:

   (1) A written request has been submitted to the Engineer for approval at least 10 days prior to the bid date.
Samples are to be submitted for all substituted light fixtures, wiring devices and other items deemed necessary by the Engineer to determine that the substituted item meets all specifications and requirements before approval of substitutions can be made.

Samples shall be submitted within 15 days after the award of the contract.

Request for substitution shall include the name of the material or equipment for which it is to be substituted, drawings, cuts, performance and that data or any other data or information necessary for the Engineer to determine that the equipment meets all specifications and requirements.

Substitution is approved and included in an addendum.

By approving and submitting shop drawings and samples, the Contractor thereby represents that he/she has determined and verified all field measurements, field construction criteria, materials, catalog numbers and similar data and that the Contractor, has checked and coordinated each shop drawing and sample with the requirements of the work of the contract documents.

Unless otherwise stated in the contract documents, the Engineer will review and approve shop drawings and samples within fifteen (15) days after receipt, but only for conformance with the design concept of the project and with the information given in the contract documents. The Engineer’s approval of a separate item shall not indicate approval of an assembly in which the item functions.

The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected shop drawings or new samples until approved. The Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Engineer on previous submissions.

The Engineer’s approval of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the contract documents unless the Contractor has informed the Engineer in writing of such deviation at the time of submission and the Engineer has given written approval to the specific deviation. The Engineer’s approval shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

The submittals will be reviewed for design intent and general compliance with the information contained in the drawings and specifications. The Contractor is responsible for dimensions, quantities, fabrication processes and methods of construction, coordination of the Contractor’s work with that of all trades. The Contractor shall be responsible for satisfactory performance of his work and supplying a complete and operational system.

No portion of the work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Engineer. All such portions of the work shall be in accordance with approved shop drawings and samples.

Samples, upon request, shall be submitted after written notice of acceptance and approval has been made of each substitution. The Engineer reserves the right to reject the sample should the sample not meet the requirement of the contract documents.

106-2.2 SUBMITTAL BOOKS. Submittal books shall consist of a hard cover, view type, 3-ring binder sized to hold 8 1/2" x 11" sheets.
Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals). Each binder shall be adequately sized to hold the submittal information plus an additional 25% of the submittal sheet count.

Binder covers to have outer clear vinyl pocket on front and back cover (to hold 8 ½" x 11" sheet) and on spline (to hold spline width x 11" sheet). Provide correct designation of project in each pocket, see "EXAMPLES" Appendix A Figures 1 and 2 included at the end of this section. Description sheet is to be white with black letters, maximum sheet height of 11" high and full width of pocket. Description is to describe project and match project drawing/specification description. Description to include submittal type. One (1) for the Airfield Lighting System materials (black) and one (1) for the Airfield Lighting Control System (blue).

106-2.3 SUBMITTAL BOOK CONTENTS. Submittal books to include:

a. First sheet(s) in book shall be a photocopy of the cover sheet see Appendix A Figure 1.

b. The second sheet shall be a table of contents.

c. Third sheet shall be prepared and filled out by the Contractor and shall list project addresses, see Appendix A Figure 3.

d. Fourth sheet shall also be filled out by Contractor and list project information for project, Appendix A Figure 4.

e. Provide reinforced clear, ring binder indexes, with the appropriate specification section number, and a typed index for each section.

f. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable).

g. Shop Drawings: Drawings to include identification of project and name of Engineer, Contractor, subcontractors and suppliers, data, number sequentially and indicate the following:

(1) Fabrication and erection dimensions.

(2) Arrangements and sectional views.

(3) Necessary details, including complete information for making connections with other work.

(4) Kinds of materials and finishes.

(5) Descriptive names of equipment.
(6) Modifications and options to standard equipment required by the work.

(7) Leave blank area, size approximately 4 x 2 ½ inches, near title block (Engineer’s stamp imprint).

(8) Point-to-point wiring diagrams.

(9) Conduit/raceway rough-in drawings.

(10) See specific sections of specifications for further requirements.

106-2.4 SUBMITTAL BOOKS PRODUCT DATA. Technical data is required for all items as called for in the specifications regardless if item furnished is as specified.

a. Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer’s name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.

In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where item(s) occur in the contract documents. At the end of each section insert a copy of the applicable specification.

When specified in individual specification sections, submit manufacturers’ printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing in quantities specified for product data. Identify conflicts between manufacturers’ instructions and contract documents. The Engineer shall make the decision on which procedure will be followed.

When specified in individual specification sections, submit manufacturers’ certificate to the Engineer for review in quantities specified for product data. Indicate that material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits and certifications as appropriate. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

See specific sections of specifications for further requirements.

106-2.5 PROCESSING SUBMITTALS. Submit a minimum of seven (7) submittal books with separate tag marking on each copy for the Owner (1), Engineer (4), Contractor and Subcontractor (See other sections of these specifications for additional quantity requirements.)

The Contractor shall review the submittal books before submitting to the Engineer. No request for payment will be considered until the submittal book has been reviewed and submitted for approval.

Submit under provisions Section 1. of the Special Conditions and this section of the specifications, whichever is the strictest.

Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per book). If submittal is rejected, the resubmittal shall contain same quantity of new data.
Shop Drawings: For custom fabricated items and systems shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made there from. When submittal is acceptable, furnish one (1) print per book made from the accepted transparency.

Acceptance: When returned to Contractor, the front of each submittal section will be marked with the Engineer's stamp. If box marked “Submit Specified Item”, or “Rejected” or “Revise and Resubmit” is checked, submittal is not accepted and Contractor is to correct and resubmit as noted. Contractor is to comply with notation making necessary corrections on submittal and resubmit for final record. If submittal is marked “Make Correction Noted” Contractor may begin construction utilizing the submitted item with corrections made. However, the corrected submittal must be resubmitted for record keeping purposes. Contractor is to comply with notation making necessary corrections on submittal and resubmit for final record.

If the submittal is marked “No Exception Taken” the Engineer took no exceptions to the submitted.

If the submittal is marked “See Transmittal Letter Comments”, the Contractor shall make or note any corrections or requirements identified in the comments. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with requirements of the drawings and specifications. This check is only for review of the general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for; confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his or her work with that of all other trades and performing all work in a safe and satisfactory manner.

Note that the approval of shop drawings or other information submitted in accordance with the requirements herein before specified, does not assure that the Engineer, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the mechanical/electrical performance of equipment. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such a change is submitted and approved on the Engineer’s letterhead.

106-2.6 DELAYS. The Contractor is responsible for delays in project time accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

106-2.7 RE-SUBMITTALS. The Engineer shall be reimbursed the cost to review resubmittals subsequent to the second submittal.

RECORD DOCUMENTS

106-3.1 PROGRESS AND RECORD DRAWINGS. Keep one set of blue line prints on the job and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. All items on progress drawings shall be shown in actual location installed. Drawings shall be inspected weekly for compliance and accuracy. Progress payments shall be withheld if the marked-up drawings are not current.

All underground ducts, conduits, drains, ground grids, force mains, etc., (all underground utilities) installed by the Contractor or located by the Contractor during the construction of this project shall be surveyed. The data shall be sufficient to accurately relocate the utility at a later date. The data shall include North-South and East-West coordinates and an elevation. This data shall be recorded on the as-built drawings.
All manholes and other structures installed by the Contractor shall be surveyed. The center of the structure shall be located by a North-South and East-West coordinate and an elevation. This data shall be recorded on the as-built drawings.

Change the equipment schedules to agree with items actually furnished. At the end of the project, all changes shall be transferred to a set of reproducible transparencies of the design drawings marked "As Built" and dated and stamped by the Contractor.

Prior to request for final payment, furnish a set of "As Built" sepia originals and four sets of prints along with the marked set defined above to the Engineer for approval. The final sepia originals shall be professionally drafted to indicate "As Built" conditions to the Engineer. The prints shall be stamped "As-Built", signed and dated by the electrical contractor.

The Contractor's failure to produce representative "As Built" drawings in accordance with requirements specified herein, shall be cause for the Engineer to produce such "As-built" drawings and the Contractor shall reimburse the Engineer for all costs to produce a set of "Record" drawings to the Owner's satisfaction.

Complete and sign the Progress and Record Document Certification Form in Appendix A Figure 5 and submit with the Operation and Maintenance Manuals. Submit one form for each Contractor/Subcontractor providing as-built information, include a copy of each form in the O&M Manuals.

106-3.2 REQUIREMENTS FOR DISPLAY DRAWINGS. An "as built" control and field wiring diagram shall be displayed in the vault. Size D minimum framed and installed. In addition to the wiring diagram (showing actual connections between the system components), a "schematic" diagram shall be provided. A schematic diagram to show the electrical interrelation among the different systems components in the simplest way possible without being cluttered with actual wiring. It should show the path of the signal flow or the power flow. These drawings shall be submitted to the Engineer for approval. The Contractor shall coordinate the requirements with the Engineer and provide the above at no additional cost to the Owner.

OPERATION AND MAINTENANCE MANUALS

106-4.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS. Within each major division of work, each specification section in the contract documents which require submission of O&M information shall be individually identified by a typed index tab. The Contractor shall provide four (4) copies of manufacturer's manuals for all installed equipment. As a minimum, it shall contain the following:

a. Safety precautions used while maintaining the equipment.

b. Theory of circuit and system operation.

c. Complete schematic and interconnecting wiring diagrams

d. Complete parts list with each circuit component keyed to designations assigned on schematics and wiring diagrams. Complete information shall be given for each part to permit ordering for replacement purposes. This information shall include the components rating, name of manufacturer and the manufacturer's part number in addition to the following:

e. Recommended preventive maintenance, including care, cleaning, lubrication, service schedules, etc.
f. Troubleshooting procedures.
g. Physical characteristics (weight, size, mounting dimensions, etc.).
h. Installation instructions.
i. Operating instructions.
j. Recommended spare parts and usage for a 1 year period.
k. Submit for checking purposes a specific set of written operating instructions on each item which requires instructions to operate. After approval, provide one copy for insertion in each Operation and Maintenance Manual.
l. Submit for approval maintenance information consisting of manufacturer’s printed instructions and parts list for each major item of equipment. After approval, insert information in each Operations and Maintenance Manual. Detailed schematic diagrams shall be furnished for all electrical/electronic equipment.
m. Bill of materials.
n. Physical layout plans.
o. Equipment supplier list.
p. Panel schedules shall be submitted with the respective panel data.
q. Special instructions.
r. Service maintenance contracts including the name, address and 24 hour phone number and contact of manufacturers authorized repair company.

There shall be no "Black Boxes" for which there are no schematic/wiring diagrams.

106-4.2 OPERATION AND MAINTENANCE MANUALS. O&M Manuals shall consist of hard cover, view type, 3-ring binders sized to hold 8 ½” x 11” sheets.

Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1”, maximum spline size to be 3” (provide additional binders if 3” size is not sufficient to properly hold submittals). Each binder shall be adequately sized to hold the submittal information plus an additional 25% of the submittal sheet count.

Binder covers to have outer clear vinyl pocket on front and back cover (to hold 8 ½” x 11” sheet) and on spline (to hold spline width x 11” sheet). Provide correct designation of project in each pocket, see "EXAMPLES" Appendix A Figures 6 and 7 included at the end of this section. Description sheet is to be white with black letters, maximum sheet height of 11” high and full width of pocket. Description is to describe project and match pocket drawing/specification description. Description to include submittal type. One (1) for Airfield Lighting System Materials (black) and one (1) for the Airfield Lighting Control System (blue).

106-4.3 OPERATION AND MAINTENANCE MANUAL CONTENTS. O&M Manuals to include:
a. First sheet in binder shall be a photocopy of the cover sheet see Appendix A Figure 6.

b. The second sheet shall be a table of contents.

c. The third sheet shall be filled out by the Contractor and shall list project addresses, see Appendix A Figure 3.

d. The fourth sheet shall also be filled out by the Contractor and list project information for project, see Appendix A Figure 4.

e. Provide reinforced, clear, ring binder indexes, with the appropriate specification section number, and typed index for each section.

f. Shop Drawings: Shop drawings shall be a copy of the final and approved shop drawings submitted as required in Item L-106-2, Shop Drawings and Samples. These shall be inserted in the binder in proper order. Each catalog sheet shall clearly identify where the product is used and the drawing identification for equipment. Clear vinyl pockets shall be provided for insertion of shop drawings.

g. Product data and/or catalog sheets shall be a copy of the final and approved submittal submitted as required in Item L-106-2, Shop Drawings and Samples. These shall be inserted in the binder proper order. Each catalog sheet shall clearly identify where the product is used and the drawing identification for equipment.

h. Warranty/Guarantee: Provide a copy of the warranty/guarantee and letters of certification, in respective locations in the O&M Manual binder. Original warranty/guarantee is to be incorporated into a separate project warranty book with warranty/guarantees provided for other sections and divisions of the specifications and submitted for Engineer approval.

i. Performance Verification and Demonstration to Engineer (See Appendix A Figure 2 form in L-131, Demonstrations, Tests and Performance Verification).

j. Tabulated Data (as required in L-131, Demonstrations, Tests and Performance Verification).

k. Required Check-Out Memos (see Appendix A Figure 1 form in Item L-131, Demonstrations, Tests and Performance Verification).

l. Progress and Record Drawing Certification (Appendix A Figure 5)

m. Ground Test Information (See Appendix A Figure 3 form in Item L-131, Demonstrations, Tests and Performance Verification).

106-4.4 PROCESSING O&M MANUALS. Submit four (4) sets of O&M Manuals. The Contractor shall review the manuals before submitting them to the Engineer.

106-4.5 DELAYS. The Contractor is responsible for delays in project time accruing directly or indirectly from late submissions or resubmissions of the Operation and Maintenance Manuals.

106-4.6 RE-SUBMITTALS. The AOR shall be reimbursed the cost to review Operation and Maintenance Manuals, re-submittals subsequent to the second submittal.
METHOD OF MEASUREMENT

106-5.1 The items described in this section are incidental to other sections and not shall be measured for payment.

BASIS OF PAYMENT

106-6.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF ITEM L-106
APPENDIX A - FIGURE 1

"EXAMPLE"

AIRPORT OWNER
AIRPORT LOCATION

AIRPORT NAME

PROJECT NAME

AIRFIELD LIGHTING SUBMITTAL BOOK
APPENDIX A - FIGURE 3

PROJECT ADDRESSES

OWNER:                     PHONES:

CONSULTING ENGINEERS:

GENERAL CONTRACTOR:

SUBCONTRACTORS:

SUPPLIERS:
APPENDIX A - FIGURE 4

PROJECT INFORMATION

Contractor shall fill in the blanks below and insert in the Submittal Books and the Operating and Maintenance Manuals. Submit one (1) sheet for each major division of Work.

Project Name: ________________________________________________________________

Specification Division Number & Name: __________________________________________

Subcontractor: ________________________________________________________________

Contact: ___________________ Phone Number: _________________________________

Date Project Bid: _____________________________________________________________

Project Start Date: ____________________________________________________________

Days Allowed for Construction: ________________________________________________

Target Completion: ____________________________________________________________

Substantial Completion: ________________________________________________________

Certification Date: _____________________________________________________________

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<tr>
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<td>Closeout Documentation Manual:</td>
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<td>Operating &amp; Maintenance Manual:</td>
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<td>Owner Performance Verification</td>
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<td>Record Documents:</td>
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PROGRESS AND RECORD DRAWING CERTIFICATION

This form shall be completed and submitted with the Record Documents. Submit one form for each Contractor/Subcontractor providing as-built information. Include a copy of this form in the Closeout Documentation Manual.

Project Name:__________________________________________________________

Specification Division Number & Name:_____________________________________

The Contractor's and Subcontractor's signatures below certify that the attached drawings and specifications were marked and revised as items were installed/changed, during the course of construction, and that these documents represent an accurate "Record-As Built" condition of the work as actually installed.

(Name of General Contractor)

(Signature, Title, Date)

(Name of Subcontractor)

(Signature, Title, Date)
"EXAMPLE"

AIRPORT OWNER
AIRPORT LOCATION

AIRPORT NAME

PROJECT NAME

AIRFIELD LIGHTING OPERATION AND MAINTENANCE MANUALS
"EXAMPLE"

AIRPORT OWNER
AIRPORT LOCATION

AIRPORT NAME

PROJECT NAME

OPERATION AND MAINTENANCE MANUAL
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 enough, in the opinion of the RPR, to determine compliance with the plans and specifications, electronically submitted in pdf format. The RPR reserves the right to reject all equipment, materials, or procedures that do not meet the system design and the standards and codes, specified in this document.
All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner. The Contractor shall maintain a minimum insulation resistance in accordance with paragraph 108-3.10e with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period when tested in accordance with AC 150/5340-26, Maintenance Airport Visual Aid Facilities, paragraph 5.1.3.1, Insulation Resistance Test.

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

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

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

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

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

108-2.3 BARE COPPER WIRE (counterpoise, bare copper wire ground and ground rods). Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare TINNED 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 per ASTM B33. For voltage powered circuits, the equipment grounding conductor shall comply with NEC Article 250.
Ground rods shall be solid stainless steel. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than 10 feet long and 3/4 inch in diameter.

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

a. **The cast splice.** 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-wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch wide), as manufactured by the Minnesota Mining and Manufacturing Company (3M™), or an approved equivalent.

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

108-2.11 EXISTING CIRCUITS. Whenever the scope of work requires connection to an existing circuit, the existing circuit’s insulation resistance shall be tested, in the presence of the RPR. The test shall be performed per this item and prior to any activity that will affect the respective circuit. The Contractor shall record the results on forms acceptable to the RPR. When the work affecting the circuit is complete, the circuit’s insulation resistance shall be checked again, in the presence of the RPR. The Contractor shall record the results on forms acceptable to the RPR. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the existing circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance (O&M) Manual.

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

CONSTRUCTION METHODS

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

Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor shall be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections unless otherwise authorized in writing by the RPR or shown on the plans.

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

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

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

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

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

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

a. Cast splices. These shall be made by using crimp connectors for jointing
conductors. Molds shall be assembled, and the compound shall be mixed and poured per
the manufacturer’s instructions and to the satisfaction of the RPR.
b. **Field-attached plug-in splices.** These shall be assembled per the manufacturer’s instructions. These splices shall be made by plugging directly into mating connectors. The joint where the connectors come together shall be finished by one of the following methods: (1) wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches on each side of the joint or (3) On connector kits equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

c. **Factory-molded plug-in splices.** These shall be made by plugging directly into mating connectors. The joint where the connectors come together shall be finished by one of the following methods: (1) Wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint. (2) Covered with heat shrinkable tubing with integral sealant extending at least 1-1/2 inches on each side of the joint. or (3) On connector kits so equipped with water seal flap; roll-over water seal flap to sealing position on mating connector.

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

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

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

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

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

108-3.6 BARE COUNTERPOISE WIRE INSTALLATION FOR LIGHTNING PROTECTION AND GROUNDING. If shown on the plans or included in the job specifications, bare TINNED solid #6 AWG copper counterpoise wire shall be installed for lightning protection of the underground cables. The Equipotential Method is to be used on this project.

a. Equipotential (Method to be used on this project). – may be used by the RPR for areas that have high rates of lightning strikes. The counterpoise size is determined by the RPR. 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 minimum or 12 inches 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.

b. **Isolation (Not use in this project)** – used in areas where lightning strikes are not common. Counterpoise size is selected by the RPR. The isolation method is an alternate method for use only with edge lights installed in turf and stabilized soils and raceways installed parallel to and adjacent to the edge of the pavement. NFPA 780 uses 15 feet to define “adjacent to”.

The counterpoise conductor shall be installed halfway between the pavement edge and the light base, mounting stake, raceway, or cable being protected.

The counterpoise conductor shall be installed 8 inches minimum below grade. The counterpoise is not connected to the light base or mounting stake. An additional grounding electrode is required at each light base or mounting stake. The grounding electrode is bonded to the light base or mounting stake with a 6 AWG solid copper conductor.


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

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

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

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

c. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than 100 megohms. Verify continuity of all series airfield lighting circuits prior to energization.

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

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

f. That all affected circuits (existing and new) are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.

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

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

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

**METHOD OF MEASUREMENT**

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

**108-4.2** Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet (meters) 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 include additional quantities required for slack.

**108-4.3** No separate payment will be made for ground rods.
CONTRACT No. 9500723
ITEM L-108-12 Underground Power Cable for Airports
Permit No. A20-111B Issued for Bid
NE-EAT Package II

**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** Procure and Install 1/C #6, 5KV, L-824 Type C in Duct or Conduit – per linear foot
- **Item L-108-5.2** Procure and Install 1/C #6, Tinned Bare Copper Counterpoise - per linear foot
- **Item L-108-5.3** Ground Rod Earth Resistance 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.

**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**


**ASTM International (ASTM)**

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

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

National Fire Protection Association (NFPA)

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

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


Federal Aviation Administration Standard

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

END OF ITEM L-108
ITEM L-110 AIRPORT UNDERGROUND ELECTRICAL DUCT BANKS AND CONDUITS

DESCRIPTION

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

EQUIPMENT AND MATERIALS

110-2.1 GENERAL.

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

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

c. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

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

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e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner.

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

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

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

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

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

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

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

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

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

110-2.4 SPLIT CONDUIT. Split conduit shall be pre-manufactured for the intended purpose and shall be made of steel or plastic.
110-2.5 CONDUIT SPACERS. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads. They shall be designed to accept No. 4 reinforcing bars installed vertically.

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

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

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

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

CONSTRUCTION METHODS

110-3.1 GENERAL. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The RPR shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. Under pavement, the top of the duct bank shall not be less than 18 inches below the subgrade; in other locations, the top of the duct bank or underground conduit shall be not less than 18 inches below finished grade.

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

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

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

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

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

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

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

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve. Flowable backfill may alternatively be used.

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

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

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.
Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the RPR, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Additional duct bank supports shall be installed, as approved by the RPR.

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

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

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

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

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

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

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

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

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

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

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot intervals.

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

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

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

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

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

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

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches apart (measured from outside wall to outside wall) in a horizontal direction and lot less than 6 inches apart in a vertical direction.
Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

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

110-3.4 MARKERS. 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 square and 4 - 6 inches thick extending approximately one inch 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 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 high and 3 inches wide with width of stroke 1/2 inch and 1/4 inch deep or as large as the available space permits. Furnishing and installation of duct markers is incidental to the respective duct pay item.

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

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

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

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

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the RPR.

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

METHOD OF MEASUREMENT

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

BASIS OF PAYMENT

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

Payment will be made under:

| Item L-110-5.1 | 1-Way, 2-Inch, PVC Conduit, (CE) in Turf – per linear foot |
| Item L-110-5.2 | 1-Way, 2-Inch, PVC Conduit, (CE) in Shoulder – per linear foot |
| Item L-110-5.3 | 1-Way, 2-Inch, PVC Conduit, (CE) in Full Strength Pavement – per linear foot |
| Item L-110-5.4 | 1-Way, 2-Inch, PVC Conduit, (CE) in Existing Shoulder Pavement – per linear foot |
| Item L-110-5.5 | 6-Way, 2-Inch, PVC Conduit, (CE) – per linear foot |
| Item L-110-5.6 | 6-Way, 2-Inch, PVC Conduit, (CE), Reinforced – per linear foot |
Item L-110-5.7 2-Inch, PVC Split Duct, (CE) – per linear foot
Item L-110-5.8 2-Inch, PVC Electrical Drain Conduit – per linear foot
Item L-110-5.9 4-Way, 2-Inch, PVC Conduit, (CE) – per linear foot
Item L-110-5.10 4-Way, 2-Inch, PVC Conduit, (CE), Reinforced – per linear foot

REFERENCES

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

Advisory Circular (AC)

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

ASTM International (ASTM)

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

National Fire Protection Association (NFPA)

NFPA-70 National Electrical Code (NEC)

Underwriters Laboratories (UL)

UL Standard 6 Electrical Rigid Metal Conduit - Steel
UL Standard 514B Conduit, Tubing, and Cable Fittings
UL Standard 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL Standard 1242 Electrical Intermediate Metal Conduit Steel
UL Standard 651 Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL Standard 651A Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110
ITEM L-112 DIRECTIONAL DRILL

DESCRIPTION

112-1.1  GENERAL. This item shall consist of furnishing and installing underground raceways using the method of installation commonly referred to as directional drill / directional boring (DD) or jack and bore. This item shall include all services, equipment, materials, tracking and tracing, connection to structure and adjacent raceway and labor for the complete and proper installation, testing and restoration of disturbed ground. A #4 AWG copper counterpoise shall be installed with and external to airfield directional drill duct. Quantity of counterpoise shall be per the details. The counterpoise shall be incidental to the directional drill and shall not be paid separately.

112-1.2  WORK PLAN. Prior to beginning work, the Contractor must submit to the Owner Representative a comprehensive work plan outlining the procedure, duct configuration of each drilling bundle, logistics plan and schedule to be used to execute each drilling location. Prior to the initiation of any installation this work plan must be submitted and accepted by the Owner. The work plan shall define the procedures for accomplishing the directional boring, duct configurations, depths, routes and locating of existing underground utilities and cables of any type, protection of all existing utilities and cables and procedures for connection to electrical structure and base cans at various locations along the directional drill. The Contractor shall also provide documentation of the intended depth of the directional drill along its entire length, and the method used for horizontal vertical control of the directional drilling.

112-1.3  EQUIPMENT. The Contractor shall submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project.

112-1.4  CONTRACTOR QUALITY CONTROL. General requirements for the Contractor's Quality Control Program are outlined in other sections of the specifications.

The following describes the minimum inspection and testing required in the Contractor's Quality Control Program for the work of this section. THE IMPLEMENTATION OF A CONTRACTOR QUALITY CONTROL PROGRAM DOES NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY TO PROVIDE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, APPLICABLE CODES, REGULATIONS, AND GOVERNING AUTHORITIES. The Contractor Quality Control Program shall include, but not be limited to, the elements included herein. These elements are provided only as a minimum starting point for the Contractor to use to generate the complete Contractor's Quality Control Program.

112-1.5  FIELD QUALITY CONTROL. Maintain a positive grade toward the outlet end with no ponding pocket.

112-1.6  SUBMITTALS. Shop drawings of each airfield lighting component, indicating FAA approval, shall be submitted to the Engineer for review and approval and be approved prior to ordering any materials for this item. This submittal shall include the proposed...
method of installation for all airfield lighting components. The submittal shall include data on all component parts of the item or system, and shall include the manufacturers list of recommended spare parts for one years use. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the contract documents. The Contractor's submittals shall be in accordance with Item L-106, Submittals, Record Documents and Maintenance Manuals.

**EQUIPMENT AND CONSTRUCTION**

112-2.1 **GENERAL.** The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of the project.

112-2.2 **GUIDANCE & TRACKING SYSTEM.** The guidance tracking systems shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. Directional drilling operations shall not take place unless the Contractor is actively scanning and tracking the bore. The Contractor shall track both lateral location and bore head depth throughout the entire length of the bore. The operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system. The Contractor shall maintain record documents for each bore indicating the depth of the run on 25' intervals and at any significant change in depth or direction.

112-2.3 **DIRECTIONAL CONDUIT.** The conduit shall be HDPE SDR 11 conduit in accordance with Item L-110, Underground Electrical Duct Banks and Conduits. The Contractor is responsible for the selection of pulling hardware, couplings, connectors, fittings and terminations in the electrical structures. All material shall comply with manufacturer recommendations and shall be compatible with the proposed directional drill method and equipment used during the installation.

112-2.4 **CASING PIPE.** Steel pipe casing shall be manufactured from ductile iron conforming to ASTM A 536 as amended to date, with a minimum yield strength of 35,000 psi. Pipe may be straight seam or spiral welded. A protective coat will not be required. Standard wall thickness shall be provided.

112-2.5 **SPACERS.** Spacers shall be ¾ to 1 inch thick HDPE with a minimum tensile strength of 3,500 psi and a minimum elongation of 400%. Spacers shall provide 2 inches of separation between the conduit.

112-2.6 **CASING PIPE CONDUIT.** The conduit shall be Schedule 80 PVC conduit in accordance with Item L-110, Underground Electrical Duct Banks and Conduits.

112-2.7 **CASING PIPE GROUT.** Grout shall be in accordance with Item P-153, Controlled Low Strength Material (CLSM).

112-2.8 **MATERIAL.** Materials proposed for the specific tunnel construction method shall be as specified by the directional driller as described in the approved written procedure and work plan and shall be approved by the Engineer. The material shall include the pipe,
conduit, fittings, spacers and any other items which are to be an installed component of the project.

Directional drill equipment and pressurized drilling fluid, must be of adequate strength to withstand all loads imposed during and after construction. Construction loads are those imposed by tunneling equipment and soil loads including influence from Group V aircraft using the runways or taxiways above.

a. **Installer Qualifications.** Engage an experienced installing subcontractor with at least five (5) years’ experience performing work of a similar nature to assume engineering responsibility and perform work of this Section who has specialized in engineering and constructing tunneling systems similar to those required for this Project and with a record of successful in-service performance.

b. **Professional Engineer Qualifications.** A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.

c. **Drilling Fluids.**

1. The Contractor shall use a, high quality bentonite drilling fluid or equivalent to ensure hole stabilization, cuttings transport, bit and electronics cooling and hole lubrication to reduce drag on the drill pipe and the telecommunication conduits. Oil based drilling fluids or fluids containing additives that can contaminate the soil or ground water will not be considered acceptable substitutes. Composition of the fluid must comply with all federal and local environmental regulations.

2. Contractor is responsible for obtaining, transporting and storing water required for drilling fluids. The airport at its option may secure a water source for the Contractor. Drilling fluids shall be mixed with potable water to ensure no contamination is introduced into the soil during the drilling, reaming or the conduit installation process.

3. Drilling fluids shall be mixed with potable water to ensure no contamination is introduced into the soil during the drilling, reaming or the conduit installation process.

4. Design mix for grout shall have a minimum compressive strength of 100 psi attained within 24 hours. Grout shall be fluid enough to allow the duct assemblies to be pulled through the bore and to fill all voids within the bore and between individual ducts and spacers.

5. Disposal of drilling fluids shall be the responsibility of the Contractor and shall be conducted in compliance with all relative environmental regulations, airport workspace agreements, and permit requirements.

6. Drilling fluid returns can be collected in the entrance pit, exit pit or spoils recovery pit. The Contractor shall immediately clean up any drilling fluid spills or overflows from these pits.

d. **Subsurface Settlement Indicator.** Subsurface settlement indicator shall be fabricated from 2.5 inch diameter schedule 40 steel pipe sleeve installed to the specified
depth with a threaded plug mounted flush at the surface. An inner one-inch diameter extra strong steel pipe with a pipe cap and ¼-inch diameter round head stainless steel bolt shall be inserted in the 2.5 inch pipe in such as manner as to indicate subsidence at the specified depth.

e. **Ducts.** Ducts shall be Schedule 80 PVC conduit in accordance with Item L-110, Underground Electrical Duct Banks and Conduits.

f. **Surface Settlement Markers.** Surface settlement markers within pavement areas shall be chiseled marks in the concrete pavement (2"x2" minimum) and p.k. nails in the asphalt shoulder. Surface settlement markers within non-paved areas shall be wooden hubs.

112-2.9 **EXECUTION.** The Engineer must be notified 72 hours in advance of starting work to allow for the coordination of safety and operations. The directional drill shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer’s approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. Repair of any damage to existing pavements, sub grades or existing facilities as a result of boring operations shall be the responsibility of the contractor.

The Contractor shall provide documentation that all underground utilities and cable systems have been located, staked and depths confirmed. No work shall begin until the Engineer is assured that the directional boring operation will not result in any utilities or cable system being cut or damaged. The Contractor shall perform soft dig /potholing of the existing underground utilities and/or cable systems that are in potential conflict with the proposed installations to accurately establish their depths.

In directional drill installations of ductbanks greater than 6-way, the Contractor may elect, for his convenience, to pull multiple bundles in close lateral proximity in lieu of a single bundle consisting of one large pull. As part of the work plan, the Contractor shall designate the proposed duct configurations, depths and bundle separation for each crossing for approval by the Engineer. If the Contractor elects to drill in multiple bundles, the payment shall be made on the total quantity pulled at that crossing, not as multiple crossings of smaller configuration.

112-2.10 **INSTALLER QUALIFICATIONS.** Installing subcontractor shall have at least five (5) years’ experience performing work of a similar nature to assume engineering responsibility and perform work of this Section who has specialized in engineering and constructing tunneling systems similar to those required for this Project and with a record of successful in-service performance.

Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.

a. **Qualification Data.** For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of at least three (3) completed projects of similar scope with project names and addresses, names and addresses of architects and Owner, and other information specified.
Submit the following Contractor's drawings in accordance with Division 1 Sections:

1) Design mixes for concrete and grout.

2) Method of Construction:

   a) The Contractor has the option to select the tunnel method including ground water control he will use.

   b) Submit engineering calculations and written procedure and work plan describing in detail the proposed tunnel method and entire operation. This shall include but not be limited to:

      1) **Drilling Operations.** Number and size of construction crew, hours to be worked, pilot hole drilling procedure, reaming procedure, method of monitoring the drilling head, method of verifying conduit location for as built drawing, and schedule for completing major activities. Contractor shall supply this information including the telecommunication conduit assembly and installation: number and size of construction crew, assembly procedure, joining procedure for conduits, and installation pullback procedure.

      2) Emergency procedures for blowholes or breakouts of drilling fluids and other types of problems that may be experienced on this project.

   c) Emergency stabilization plan indicating proposed actions should excessive settlement occur.

   d) Detailed subsurface monitoring plan including procedures, materials and shop drawings.

   e) Installation instructions for duct spacers and ducts including alignment methods, grouting methods and strapping configuration.

   f) Equipment - Supply full details of the Horizontal Directional Drilling system to be utilized including:

      1) Technical specifications and manufacturer of Horizontal Directional Drilling System. Date of manufacture of the Horizontal Directional system.

      2) Technical specifications and manufacturer for guidance control system.

   g) **Site Plan.** Supply a site plan for the following:

      1) Sample set-up for proposed entry of drilling rig

      2) Sample set-up for proposed exit area including laydown area for conduit.

      3) Proposed conduit storage areas.

      4) Any other off-site areas that will be utilized.
5) Provide descriptions for all downhole components and ensure all downhole drilling components are appropriate for the work to be performed.

6) Provide drawings of the proposed horizontal and vertical directional drilling installation alignment throughout the alignment for approval by the Engineer.

**(h) Daily Logs.** Maintain and submit a complete set of project records. Maintain a daily activity log during Horizontal Directional Drilling operations. A copy of the log shall be submitted to the Engineer for record purposes on a daily basis. These documents shall include but not limited to:

1) Start and finish time of each section of drill pipe for pilot hole drilling and reaming.

2) For pilot hole drilling, drill bit location at least every 30 feet along the drill path. Contractor will mark the as-built drawings on a daily basis with drilling progress.

3) General description for each ground condition drilled.

4) Details and perceived reasons for delays greater than one hour other than normal breaks and shift changes.

5) Details of any unusual conditions or events.

6) Provide As-Built Location plan and profile of the finished in conduits along with connections to manholes and/or concrete encased conduit.

**b.** Submit certified test reports and/or manufacturers data for all materials to be used in tunnel construction before delivery of materials.

### 112-2.11 DELIVERY, STORAGE AND HANDLING.

Materials shall be unloaded and handled with equipment of adequate capacity, equipped with slings to protect the materials from damage. Storage of materials on the site shall be in a reasonably level well drained area free from poison oak or ivy and brush. Individual pieces and bundles shall be stored with safe walking space between to allow full view for inspection purposes.

### CONSTRUCTION METHODS

**112-3.1 GENERAL.** Site soil investigation reports and data obtained for design of the tunnel will be available to the Contractor. Interpretation of this material and making his own investigation and determination of the work site soil conditions prior to bidding is the sole responsibility of the Contractor. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.

When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24-hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soils particles are held to a minimum.

Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to...
dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.

   a. **Drilling Liquid Disposal.** Disposal of surplus drilling liquid shall be performed in accordance with Federal, State, and Local regulations. Transport via tanker truck to an approved disposal site. Comply with the City of Dallas requirements.

**112-3.2 SITE CONDITIONS.** Tunnel construction shall be performed so as not to interfere with, interrupt or endanger surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the tunnel. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the tunnel, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from tunnel operations and shall repair and restore damaged property to its condition prior to being disturbed to the satisfaction of the Engineer at no cost to the Authority.

Comply with applicable ordinances, codes, statutes, rules and regulations of the State of Pennsylvania, applicable County building codes, and regulations of the Federal Government, OSHA 29 CFR 1926 and criteria of ANSI A10.16-95, “Safety Requirements for Construction of Tunnel Shafts and Caissons”.

**112-3.3 PREPARATION.**

   a. **Surface Settlement Markers.** Install surface settlement markers placed as specified or as directed by the Engineer for directional drilling, including jack and bore installations. Tie settlement markers to benchmarks and indices sufficiently remove as not to be affected by the tunnel operations. Take readings and permanently record prior to start of dewatering operations and/or shaft excavation. Make all elevation measurements to the nearest 0.01-foot.

      (1) Settlement markers for crossing runway or taxiway shall be located to coincide with subsurface settlement indicators and other locations as directed by the Engineer.

   b. **Subsurface Settlement Indicators.** Install groups of subsurface settlement indicators at the centerlines of the north and south tunnels at the depths and tunnel stations specified or as directed by the Engineer once the construction sequence has been determined.

      (1) Settlement indicators shall be monitored daily when within 50 feet of the tunnel heading. Indicators shall be monitored every other day when within 100 feet of the tunnel heading. All indicators shall be monitored weekly until such time as all crossings are completed to the satisfaction of the Engineer. Monitoring data shall be turned over to the Engineer within 24 hours data collection.

      (2) The following limits shall be in effect:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Maximum Allowable Settlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 feet</td>
<td>0.5 inches</td>
</tr>
<tr>
<td>5.0 feet</td>
<td>1.0 inches</td>
</tr>
<tr>
<td>7.5 feet</td>
<td>1.5 inches</td>
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</table>

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Exceeding these settlement limits at any location shall be cause to immediately stop tunneling operations and initiate emergency remedial action in accordance with the approved Emergency Stabilization Plan. Emergency stabilization actions shall be performed to the satisfaction of the Engineer and at no cost to the Authority.

(3) In the event of excessive settlement, the Contractor may be directed to install additional monitoring points at no cost to the Authority.

(4) Remove subsurface settlement indicators at the conclusion of construction upon approval by the Engineer. Fill indicators that are located in runway or taxiway pavements with grout.

(5) The Contractor shall mobilize all necessary personnel, equipment and materials to construct an entry area for drilling operations and exit area for drilling operations.

(6) Contractor shall provide appropriate supports to maintain safe working conditions; ensure stability of the entry, exit, settlement and containment pits; minimize loosening, deterioration and disturbance of the surrounding ground, sidewalks, landscaped areas and roads.

(7) All personnel requiring access to the runways and taxiways shall undergo safety training program and obtain a valid identification card.

112-3.4 PIT CONSTRUCTION.

a. Design, construction, maintenance and removal including any damage attributed to the entrance and exit pit construction are the responsibility of the Contractor and shall be approved by the Engineer prior to any excavation. Tunnel shafts and the ingress and egress to the tunnel shall meet requirements of OSHA.

(1) The boring pit shall be solid sheeted, braced, and shored as necessary to provide a safe operation.

(2) Perform excavation, backfill and grading in accordance with appropriate specification sections.

(3) Jacking pits will not be paid for as a separate pay item. All associated costs for Jacking pits shall be included in the price bid for “Jack & Bore” of the size specified.

112-3.5 TUNNEL EQUIPMENT/DD EQUIPMENT.

a. Drill Size. A directional drill is specified for this project, suitably sized for the specified conduit size, length, and configuration.

(1) Contractor must provide project specific installation load calculations that support the use of the particular drill rig with an adequate margin of safety to perform the installation.

(2) Documented experience in comparable rock, depths, and length of installation and diameter must be supplied along with customer verification of satisfactory performance on comparable projects.
b. **Instrumentation.**

(1) Contractor shall at times provide and maintain instrumentation that will accurately locate the pilot hole, measure drill string axial and torsional loads, and measure drilling fluid discharge rate and pressure. The Engineer shall have access to these instruments, readings and written output at all times.

(2) The Contractor shall monitor the position of the drill string with either an aboveground locator or "walkover" system. Contractor shall compute the position in the x, y and z axis relative to the ground surface from downhole survey data at a of 50’ intervals. Deviation between the recorded position of the drill string and the specified position of the drill string shall be documented and immediately brought to the attention of the Engineer.

(3) The Contractor shall provide continuous competent monitoring as is necessary to install the telecommunication conduits along the designated HDD alignment.

112-3.6 **TUNNEL OPERATIONS.**

a. Control the tunnel face at all times. Utilize target boring technology to monitor and maintain location of cutting head. Maintain 8’ minimum cover below runway pavements.

b. When using liner plates, advance excavation in increments sufficient for the placement of one ring of liners and install liner plates immediately after each increment of excavation. Excavate in such a manner that voids behind the liner plates are held to a minimum. Completely fill such voids with grout followed immediately by grout placed under pressure.

c. Whenever the tunnel operation is suspended, support the tunnel face by positive means and keep dewatering system operating. Have qualified personnel periodically check conditions that might threaten the stability of the tunnel.

d. Maintain 8’ minimum clear separation for separate HDD bores.

e. **Pilot Hole and Back reaming.** A smoothly curved pilot hole shall be drilled along the HDD alignment as proposed by the Contractor as shown on the approved drawings. The directional tolerance of the hole will be as follows:

(1) **Vertical tolerances.** Plus 1.0 foot or minus 1.5 feet from the centerline of the conduits shown on the approved drawings. However, the crown of the conduits shall be installed at a minimum depth of at least 8.0 feet.

(2) **Horizontal tolerances.** Plus or minus 1.5 feet from the centerline of the conduits shown on the approved drawings or agreed upon with the Engineer.

(3) **Horizontal separation from adjacent HDD installed conduits.** 8.0 feet minimum from the centerline of the polyethylene conduits shown on the approved drawings or agreed upon with the Engineer.

(4) **Curve radius.** At no point in the drilled profile shall the radius of curvature be less than 400-feet.

(5) **Entry point location.** Contractor may choose where the pilot hole shall enter the ground as agreed upon with the Engineer.
(6) **Exit Point/Drill Target.** The Contractor may choose where the pilot hole shall exit within the routes as identified on the approved drawings or agreed upon with the Engineer.

(7) When crossing under or over existing utility piping, maintain a minimum of 18 inches clearance between outside of the existing utility and the conduit.

(8) Back ream pilot hole to a minimum diameter of 16-inches in order to accept conduit bundle.

### 112-3.7 JACK AND BORE

Installation of steel pipe casing shall be by the dry bore method at locations shown on the plans. Installation of steel pipe casing shall be in accordance with the applicable regulations of the Texas Department of Transportation (TxDOT) and these specifications.

**a.** Line and Grade: The Contractor shall set the boring rig so that after the casing is complete, and the casing pipe is installed, the invert of the pipe shall conform to grade and alignment as shown on the Contract Drawings. As the casing is installed, Contractor shall check the horizontal and vertical alignment frequently.

**b.** Boring: Boring and jacking of the casing pipe shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring. The hole shall be bored and cased through the soil by a cutting head on a continuous auger mounted inside the casing pipe. The boring of the hole and installation of the casing pipe shall be simultaneous. Lengths of the casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedure. Water jetting will not be permitted for excavation of material ahead of the casing or for the removal of spoil from the casing.

**c.** Diameter of Hole: Bored installations shall have a bored hole diameter essentially the same as the outside diameter of the casing pipe to be installed.

**d.** Casing Pipe Length: Lengths of casing pipe shall be as long as practical for site conditions. Joints between sections shall be completely welded in accordance with AWS recommended procedures. Prior to welding joints, the Contractor shall ensure that both ends of the casing sections being welded are square.

**e.** The Contractor shall plan to use a casing lubricant in the event excessive frictional forces jeopardize the successful completion of the casing installation.

**f.** Once the jacking procedure has begun, it should be continued without stopping until completed.

**g.** Installation of the Ductbank Conduit: Each 2-inch conduit shall be spaced a minimum of 2 inches from adjacent conduit.

### 112-3.8 INSTALLATION OF SPACERS

Use one bore spacer for every 5 feet of duct bank. The casing inner diameter shall be smooth and free from ridges, projections and seams that might impede the rolling of the spacer wheels. Install bore spacers perpendicular to conduits to reduce the tendency of duct bank to rotate (corkscrew). Use “stabilization cables” to further reduce the potential of conduit rotation. The movement of the pipe string and the pulling load on the polyethylene pipe shall be monitored and a weak link device shall be used to ensure that the pipe is not damaged during installation.
The bore spacers shall be held in place relative to the conduit as the grout is pumped into the casing. Additionally, the duct bank must be held in position at both ends to accommodate possible uneven thrust loads that may be generated during the grouting operation. When filling the area between the conduits and casing with grout, take care not to exceed the hydraulic collapse pressure of the conduit.

112-3.9 GROUTING. Grouting shall be required as indicated on plans. Grouting effectiveness shall be measured by grout takes and increasing grout pressures.

The grout pump and injection system shall be of a type that will deliver the grout without surging. The grouting circuit shall contain a return line to allow return of the grout from the nozzle to the supply tanks. The grouting equipment shall be capable of developing a uniform pressure at the grout hole connection sufficient to fill voids without disturbing the tunnel lining, adjacent utilities, structures or pavements.

112-3.10 INSTALLATION OF DUCTS.

a. Install ducts per manufacturer's instructions, the approved Method of Construction plan, and as shown on the Drawings.

b. Backfill interstitial space between casing and bore with drilling fluid. Measure and record quantity of drilling fluid used to ensure all interstitial space is filled.

c. During conduit installation and pullback operation, the Contractor shall monitor the conduit roller system and use of any other equipment to control damage to the conduits. Contractor shall cease installation operations if damage to the conduits occurs. Damaged conduits should be repaired or replaced immediately. Pulling operations may not resume until the conduit is repaired or replaced.

d. Contractor shall ensure that the conduit is not distorted from a circular cross section. During pullback of the casing, care shall be taken to prevent conduit buckling and bending beyond the manufacturer's recommended bending radius. Contractor shall monitor pulling tensions during the installation process.

e. The HDPE casing may be installed by pulling or a combination of pulling and pushing. At all times the push/pull load applied to the casing shall be continually monitored by calibrated load measuring devices.

f. The Contractor shall attach a pulling head to the front section of the casing being installed. Prior to commencement of pull back operations the pulling head design shall be submitted to the Engineer for approval.

g. During pullback of the HDPE casing the pulling load shall not exceed the safe pull force calculated for the segment to be installed.

112-3.11 DIRECTIONAL DRILLING – ENVIRONMENTAL CLEAN-UP. Waste cuttings and drilling mud shall be dewatered and dried by Contractor to the extent necessary for disposal in offsite landfills.

"Blow holes" or “breakouts” of drilling fluid to the surface must be cleaned up immediately and the surface area washed and returned to original condition. All drilling fluids, spoils and separated material will be disposed of in compliance of local environmental regulations. If the amount of surface returns exceeds that which can be contained and collected using
small sumps, drilling operations shall be discontinued until surface return volumes can be brought under control. Equipment and materials for cleanup and contingencies must be provided by the Contractor and stored onsite.

112-3.12  **LOCATING WIRE.** Contractor shall install a tracer wire along the entire length. Contractor shall install a tracer wire adjacent to the Conduit drawing the horizontal drilling process. Electrical continuity of the tracer wire is essential and, therefore, it should be free of splices. The tracer wire may be attached to the leading end of the Conduit or the pulling head and inserted with the Conduit during the horizontal directional drilling process. The wire shall terminate in a manhole and shall be accessible without entering the manhole. The tracer wire shall be copper clad steel 10 gauge or larger, 45mil high density, high molecular weight, polyethylene (HDPE) insulation.

112-3.13  **COUNTERPOISE CABLE.** Contractor shall install a counterpoise cable the entire length. Counterpoise gauge shall be #4 for lightning protection. Counterpoise shall be terminated at each end of the directional drilling via a ground rod. For jack and bore installations, a ground rod shall be exothermically welded to each end of the steel casing pipe and the direct earth buried counterpoise shall be bonded at the same location on the casing pipe. The casing pipe shall serve as the counterpoise and no additional counterpoise wire shall be installed at the crossing.

**METHOD OF MEASUREMENT**

112-4.1  The quantity of directional drill and jack and bore to be paid for shall be the number of linear feet installed, all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

**BASIS OF PAYMENT**

112-5.1  Payment shall be made at the contract unit price for each type and size of directional drill, complete and accepted. The price shall be full compensation for furnishing all material and for all preparation assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item. This shall include but is not limited to all excavation, backfill and seeding/sodding, mobilization of equipment, casing and duct material, reinforcement, grout, conduit supports, ground rods, counterpoise and tracer wire.

Payment will be made under:

- Item L-112-5.1  6-Way, 2-Inch, PVC Directional Drill – per linear foot
- Item L-112-5.2  4-Way, 2-Inch, PVC Directional Drill – per linear foot

**REFERENCE DOCUMENTS**

- OSHA 29 CFR 1926  Safety and Health Regulations for Construction
- ANSI A10.16-95  Safety Requirements for Construction of Tunnel Shafts and Caissons”.

**END OF ITEM L-112**
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.

EQUIPMENT AND MATERIALS

115-2.1 GENERAL.

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

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

c. All materials and equipment used to construct this item shall be submitted to the RPR for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

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

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner.
115-2.2 **CONCRETE STRUCTURES.** Concrete shall be proportioned, placed, and cured per Item P-610, Concrete for Miscellaneous Structures. Cast-in-place concrete structures shall be as shown on the plans.

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

Precast concrete structures shall be an approved standard design of the manufacturer. Precast units shall have mortar or bitumastic sealer placed between all joints to make them watertight. The structure shall be designed to withstand 200,000 lb aircraft loads, unless otherwise shown on the plans. Openings or knockouts shall be provided in the structure as detailed on the plans.

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

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

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

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

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

115-2.7 **FRAMES AND COVERS.** The frames shall conform to one of the following requirements:

- **a.** ASTM A48 Gray iron castings
- **b.** ASTM A47 Malleable iron castings
- **c.** ASTM A27 Steel castings
- **d.** ASTM A283, Grade D Structural steel for grates and frames
CONTRACT No. 9500723
ITEM L-115-3 Electrical Manholes and Junction Structures

Permit No. A20-111B  Issued for Bid
NE-EAT Package II

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

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

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

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

115-2.12 CABLE TRAYS. Cable trays shall be of galvanized steel, plastic or aluminum. Cable trays shall be located as shown on the plans.

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

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

115-2.15 PULLING-IN IRONS. Pulling-in irons shall be manufactured with 7/8-inch diameter hot-dipped galvanized steel or stress-relieved carbon steel roping designed for concrete applications (7 strand, 1/2-inch diameter with an ultimate strength of 270,000 psi (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 ROUND RODS. Ground rods shall be one piece, solid stainless steel. The ground rods shall be of the length and diameter specified on the plans, but in no case shall they be less than 10 feet long nor less than 3/4 inch in diameter.

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 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 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 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 above the floor. The ground rod shall be installed within one foot of a corner of the concrete structure. Ground rods shall be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor shall drill a 4-inch diameter hole into the earth to receive the ground rod. The hole around the ground rod shall be filled throughout its length, below slab, with Portland cement grout. Ground rods shall be installed in precast bottom slab of structures by drilling a hole through bottom slab and installing the ground rod. Bottom slab penetration shall be sealed watertight with Portland cement grout around the ground rod.

A grounding bus of 4/0 bare stranded copper shall be exothermically bonded to the ground rod and loop the concrete structure walls. The ground bus shall be a minimum of one foot 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. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. 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, dewatering; sheeting and bracing; all required backfilling with on-site materials; restoration of all surfaces and finished grading and turfing; all required connections; temporary cables and connections; and ground rod testing.
BASIS OF PAYMENT

115-5.1 The accepted quantity of electrical manholes 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.

Payment will be made under:

- Item L-115-5.1 Junction Can Plaza, 6 Cans – per each
- Item L-115-5.2 Junction Can Plaza, 4 Cans – 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 A283  Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536  Standard Specification for Ductile Iron Castings
ASTM A615  Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A897  Standard Specification for Austempered Ductile Iron Castings
ASTM C144  Standard Specification for Aggregate for Masonry Mortar
ASTM C150  Standard Specification for Portland Cement
ASTM C206  Standard Specification for Finishing Hydrated Lime

FAA Engineering Brief (EB)

EB #83  In Pavement Light Fixture Bolts

Mil Spec

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

National Fire Protection Association (NFPA)

NFPA-70  National Electrical Code (NEC)

END OF ITEM L-115
ITEM L-125 INSTALLATION OF AIRPORT LIGHTING SYSTEMS

DESCRIPTION

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

This item shall also include installing Owner supplied signs, transformers, mounting assemblies, cable connectors, lamps, and Contractor furnished light bases, base plates, adapter rings, concrete work, and all incidentals and appurtenances necessary to place the systems in operation as completed units to the satisfaction of the RPR. This item will also include the testing of the system to ensure correct operation.

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 in electronic PDF format, tabbed by specification section. The RPR reserves the right to
reject any or all equipment, materials or procedures, which, in the RPR’s opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. Except, LED fixtures shall be provided with a warranty period of 48 months. The defective materials and/or equipment shall be repaired or replaced, at the Owner’s discretion, with no additional cost to the Owner.

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. Retroreflective markers shall be type L-853 and shall conform to the requirements of AC 150/5345-39.

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.

### Lights

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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.

### Signs

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125-2.9 Circuit Selector Cabinet. The circuit selector cabinet shall meet the requirements of AC 150/5345-5, Type L-847, two circuit control, Class indoor, Rating 1, for 6.6 amperes.

125-2.10 Light Base and Transformer Housings. Light Base and Transformer Housings should conform to the requirements of AC 150/5345-42. Light bases for in-pavement fixtures 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. Light bases for fixtures installed in turf or shoulder areas shall be Type L-867, 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.

Base can for guidance sign installation shall be type L-867, Class 1B, Size D with ½” galvanized steel coverplate as shown on the Drawings.

125-2.11 Isolation Transformers. Isolation Transformers shall be Type L-830, size as required for each installation. Transformer shall conform to AC 150/5345-47.

125-2.12 RECEIVING, STORAGE AND HANDLING OWNER FURNISHED MATERIALS: Deliver materials and equipment disassembled only to the extent necessary for reasons of shipping limitations, handling facilities, and to avoid damage during shipment. Store and maintain materials and equipment in new condition. The duration of storage will be from the time the Owner turns them over to the Contractor, which may be as early in construction as Contractors NTP. This shall include the use of heat lamps, suitable coverings, indoor storage, etc. to properly protect the equipment and materials. Any equipment or materials, in the opinion of the Owner or RPR, damaged during construction or storage periods shall be replaced by and at the expense of the Contractor.

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.

Correct placement of the lights is of prime importance; to achieve this, careful attention to detail is required. Survey instruments may be used to accurately position all fixtures for their
precise location, elevation, and azimuth. The tolerances required in other FAA Advisory Circulars, this specification, and the plans must not be exceeded. The light beam must be aligned as described in the lighting system manual with a tolerance of ±1 degree. The lighting fixture must be level, and the top of the fixture edge must be between +0 inch and -1/16 inch from the pavement top.

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.

125-3.5 Activating and Testing of Taxiway N1 Lighting and signing: The activating and testing of Taxiway N1 signing and lighting will include energizing the Taxiway N1 centerline light circuit, replacing panels and energizing taxiway guidance signs and installing elevated taxiway edge lights on existing bases as described on the drawings and below.

Taxiway N1 Centerline Lights: The Contractor is to locate the existing disconnected circuit on the airfield. Prior to energizing the existing circuit, The Contractor is to test the existing centerline light circuit cables according to Specification Section L-108 and confirm with the RPR that the circuit cable is safe to energize. Test the lights according to this specification.

Taxiway N1 guidance signs: The Contractor is to locate the signs and replace the existing panels with Airport supplied panels as described on the drawings. Existing removed panels are to be turned over to the Airport or disposed of as directed by the RPR. Signs are to be tested per this specification and accepted by the RPR prior to being energized. Signs are to be energized at the local switch at each sign location.

Taxiway N1 Edge Lights: Prior to edge light fixture installation the Contractor is to test the existing edge light circuit cables according to Specification Section L-108 and confirm with the RPR that the circuit cable is safe to energize. The Contractor is to remove the existing coverplate and install an owner provided edge light at each location show on the drawings. The edge light fixtures are to be connected to the existing transformers and installed as detailed in the drawings. Test the lights according to this specification.

April 23, 2020
125-3.6 **Existing Sign Modifications:** Contractor is to locate existing sign and verify sign manufacturer, type and size to provide proper equipment for the revised legend. Existing removed panels are to be turned over to the Airport or disposed of as directed by the RPR. Signs are to be tested per this specification and accepted by the RPR prior to being energized.

**METHOD OF MEASUREMENT**

125-4.1 Airfield lighting units procured shall be measured per each for each type provided, stored, protected, and accepted by the RPR.

125-4.2 The quantity of guidance sign units to be paid for under this item shall be the number of each type installed complete and accepted by the RPR. Each guidance sign unit shall include the installation of an identification plate or tag as detailed in the plans.

125-4.3 Light bases for airfield lighting units shall be measured per each for each type provided, installed, in place, completed and accepted by the RPR. Each airfield lighting base shall include base assembly, alignment, leveling, coverplate, conduit connections, epoxy, grounding, ground rod, and the installation of an identification plate or tag as detailed in the plans.

125-4.4 Reflective markers will be measured by the number installed as completed units in place, ready for operation, and accepted by the RPR. 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. Guidance signs will be measured by the number of each type and size 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 type of light unit procured. This payment will be full compensation for furnishing all materials and for all preparation, storage means, and for all labor, equipment, tools, incidentals, and appurtenances necessary to maintain these items in new condition in accordance with the drawings and specifications.

125-5.2 Payment will be made at the Contract unit price for each complete runway or taxiway light, guidance sign, reflective marker, 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-125-5.1 Procure L-852C(L) LED Taxiway Centerline Light, Bi-Directional, Green/Green – per each

Item L-125-5.2 Procure L-852C(L) LED Taxiway Centerline Light, Bi-Directional, Yellow/Yellow – per each

Item L-125-5.3 Procure L-852K(L) LED Taxiway Centerline Light, Bi-Directional, Green/Green – per each
Item L-125-5.4  Procure L-852K(L) LED Taxiway Centerline Light, Bi-Directional, Yellow/Yellow – per each

Item L-125-5.5  Procure L-852T(L) LED Flush Taxiway Edge Light, Blue – per each

Item L-125-5.6  Procure L-861T(L) LED Elevated Taxiway Edge Light, Blue – per each

Item L-125-5.7  Procure L-852T(L) LED Taxiway Centerline Light, Omni Directional, Yellow – per each

Item L-125-5.8  Install In-pavement Light and Base – per each

Item L-125-5.9  Install Elevated Edge Light and Base – per each

Item L-125-5.10 Install In-pavement Light on Existing Base – per each

Item L-125-5.11 Install Elevated Edge Light on Existing Base – per each

Item L-125-5.12 Install Elevated Edge Light and Base in Existing Shoulder – per each

Item L-125-5.13 Base Can – per each

Item L-125-5.14 L-853 Taxiway Retroreflective Edge Marker in Shoulder – per each

Item L-125-5.15 Procure and Install L-858 Guidance Sign, 1 Module – per each

Item L-125-5.16 Procure and Install L-858 Guidance Sign, 2 Module – per each

Item L-125-5.17 Procure and Install L-858 Guidance Sign, 3 Module – per each

Item L-125-5.18 Procure and Install L-858 Guidance Sign, 4 Module – per each

Item L-125-5.19 Procure and Install L-858 Approach Guidance Sign – per each

Item L-125-5.20 Modify Existing L-858 Guidance Sign – per each

Item L-125-5.21 Activating and Testing of Taxiway N1 Lighting and Signing – per lump sum

Item L-125-5.22 Install Coverplate on Existing Light Base – per each

Item L-125-5.23 Procure L-852C(L) LED Taxiway Centerline Light, Bi-Directional, Green/Yellow – per each

Item L-125-5.24 Procure L-852K(L) LED Taxiway Centerline Light, Bi-Directional, Green/Yellow – 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
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ITEM L-131 DEMONSTRATIONS, TESTS AND PERFORMANCE VERIFICATION

DESCRIPTION

131-1.1 GENERAL. This item includes the furnishing of all labor, materials, equipment and services necessary to provide demonstrations, testing and performance verification necessary to show electrical system compliance to these specifications.

DEMONSTRATIONS

131-2.1 CHECK-OUT MEMO. Where required by the plans and specifications, provide manufacturer assistance during the testing, start-up, performance verification, demonstrations and Owner training. Complete the Check-Out Memo contained in Appendix A, Figure 1.

Demonstrate the essential features of the following electrical systems:

(1) Alarms and bells
(2) Circuit breakers
(3) Fuses and fuseholders
(4) Metering/Monitoring
(5) Electrical systems controls and equipment
(6) Electrical power equipment
(7) Relays
(8) Special transformers
(9) Panelboards
(10) Distribution panels
(11) Main panels, power panels
(12) Circuit Breakers
(13) Wiring devices
(14) Wiring systems
(15) Grounding systems
(16) Face plates
(17) Low-voltage controls
(18) Outlets: convenience, special purpose
(19) Switches: regular, time
(20) Voltage stabilizers
(21) Airfield lighting fixtures
(22) Constant Current Regulators
(23) Local Control Panel
(24) Airfield Lighting Control System
(25) ATCT Control Panel
(26) L-854 Radio Controller
(27) Runway End Identifier Lights (REILS)
(28) Precision Approach Path Indicator (PAPI)

The demonstration shall be held upon completion of all systems, including testing, at a date to
be agreed upon in writing by the Engineer. The demonstration shall be held by the Contractor in
the presence of the Engineer and the Manufacturer's Representative.

Prior to acceptance of the work, the Contractor shall demonstrate to the Engineer, all features
and functions of all systems and shall instruct the Owner in the proper operation of the systems.
After testing is completed satisfactorily, each system shall be demonstrated once.

The demonstration shall consist of not less than the following:

a. Point out the actual location of each component of the system and demonstrate
   its function and its relationship to other components within the system.

b. Demonstrate the electrical systems by actual "start-stop" operation showing how
   to work controls, how to reset protective devices, how to replace fuses, and what to do in an
   emergency. Indicate each item's relationship to the riser diagrams and drawings.

c. Demonstrate communication, signal, alarm and detection systems by actual
   operation of the systems and show how to reset signal, alarm and detection devices.

The Contractor shall furnish the necessary trained personnel to perform the demonstration and
instructions, and shall arrange to have the manufacturer's representatives present to assist with
the demonstrations.

All functional and operational testing of protective interlocking, automatic controls,
instrumentation, alarm systems, and all other field testing of the main systems will be completed
before the systems are demonstrated.
Submit six (6) copies of the Performance Verification and Demonstration to Owner Form (Appendix A, Figure 2), signed by the Contractor, subcontractor and Owner and insert one copy in each Operation and Maintenance Manual and the original shall be inserted in the Project Closeout Documentation Manual.

TESTS AND PERFORMANCE

131-3.1 TESTS AND PERFORMANCE VERIFICATION. Operate system for a 3 day period. Do performance verification work as required to show that the system is operating correctly in accordance with design. Supply instruments required to read data. Adjust system to operate at the required performance levels. Tabulate data for submission. Submit data on 8-1/2-inch x 11-inch sheets with time and name of checker. Where specific performance verification information is called for in the specifications, use copies of the sheets provided for recording readings. Data shall be submitted and approved before Check-Out Memos are signed or a request for final inspection is made. Submit data in Operation and Maintenance Manuals.

At completion of construction after all performance verification and testing information has been gathered, submitted, and approved, provide one copy of this information to the Manufacturer's representative of the equipment. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is operating, and sign a Check-Out Memo for a record. Submit six (6) copies of the Check-Out Memo on each major item of equipment. Approved memos shall be inserted in each Operation and Maintenance Manual with the performance verification information. Memos shall be submitted and approved before instruction to the Engineer or a request for final inspection.

131-3.2 TESTS. After cables are in place, but before being connected to devices and equipment, the system shall be tested for shorts, opens, intentional and unintentional grounds by means of an approved type of "megger." Airfield lighting cables shall be tested in accordance with Item L-108 Underground Power Cable for Airports.

The tests shall be performed and recorded in the presence of the Engineer and the test results shall be placed in the Operation and Maintenance Manuals. All wires in conduit that are shorted or unintentionally grounded shall be replaced.

Take readings of voltage and amperage at building main disconnect switch and at main for each panel, at primary side of each lighting transformer and at the end of the longest branch circuit at each panel. The above readings shall be taken (1) “no load” conditions and (2) at “full load” conditions with all equipment using electricity. Tabulate readings, complete "Voltage and Amperage Readings/Tabulated Data" form (see Appendix A, Figure 3) and submit in the O&M Manuals.

The resistance between ground and absolute earth shall be measured by the Contractor before equipment is placed in operation. Record data on the Ground Test Information form contained in Appendix A, Figure 4. All ground rods shall be tested.

Perform such tests as required by authorities having jurisdiction over the site, or other tests/inspections as required by other sections of this specification.

There are no approved "repair" procedures for items that have failed testing other than complete replacement. Any other corrective measures shall be approved by the Engineer. The addition of ground rod sections to the ground rods shall be considered replacement for this item.
131-3.3 CORRECTION OF ERRORS. The Contractor shall immediately correct any errors or omissions in his work which are discovered during testing. This shall include but not be limited to, improper phasing resulting in reverse rotation, misinterpretations, incomplete grounding, damaged equipment or materials, or incomplete work the Contractor has already verified as being complete. The Contractor shall immediately replace, repair, or complete these errors and omissions as soon as they are brought to his attention, even if this requires disruption of his scheduled construction activities or work on an overtime basis. Failure to take immediate action or an excessive number of errors or omissions shall make the Contractor liable for the time lost by the Owner's operating forces, and any other personnel.

METHOD OF MEASUREMENT

131-4.1 The items described in this section are incidental to other sections and shall not be measured for payment.

BASIS OF PAYMENT

131-5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF ITEM L-131
CHECK-OUT MEMO

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of the O & M Manual for the equipment checked.

Project Name: __________________________
Type of Equipment Checked: __________________________
Equipment Number: __________________________
Name of Manufacturer: __________________________

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test Data and Performance Verification information was used to evaluate the equipment installation and operation.

2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below.*

3. Written operating and maintenance information has been presented to the Contractor, and gone over with him in detail.

4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operating and Maintenance Manuals.

Checked By: __________________________
(Print or Type Name of Manufacturer's Representative)

________________________
(Address and Phone No. of Representative)

________________________
(Signature and Title of Representative)

(Date Checked)

Witnessed By: __________________________
(Signature and Title of Contractor Representative)

* Exceptions noted at time of check-out (use additional page if necessary):
APPENDIX A, FIGURE 1
PERFORMANCE VERIFICATION AND DEMONSTRATION TO OWNER

This form verifies that the Owner has been given a demonstration of the proper operation on the equipment or systems noted below:

Project Name: _____________________________________________________________
Specification Division Number & Name: ________________________________________
Equipment/System Demonstrated: ____________________________________________

Along with a complete demonstration of the equipment/system, these items have been reviewed at this demonstration and shall be included in the Operating and Maintenance Manuals, under the appropriate specification section:

1) Written operating instructions.
2) Test data and performance verification information as required by the installer and/or manufacturer.
3) Maintenance information published by manufacturer or equipment.
4) Check-out Memo signed by manufacturer's representative.
5) Printed warranties by manufacturer of equipment.
6) Explanation of the warranty/guarantee on the system.
7) Prints showing actual "As Built" conditions.

(Name of Contractor)
(Signature, Title, Date)

(Name of Subcontractor)
(Signature, Title, Date)

Demonstration of the system/equipment in operation and of the maintenance procedures has been successfully completed.

OWNER
(Signature, Date)
(Owner's Department)
APPENDIX A, FIGURE 2
VOLTAGE AND AMPERAGE READINGS/TABULATED DATA

This form may be used to record voltage and amperage readings (within the panel and from the farthest point, please check the appropriate item below). Copy of this completed form shall be included in the specification section of the O & M Manual for the equipment from which readings are taken.

Project Name:________________________________________________________
Specification Division Number & Name:____________________________________
Switchgear/Panel Number:_______________________________________________
Readings taken within panel:_________________________ from farthest point:_______

Full Load Amperage Readings:

Date:______________  Time: __________
Phase: A_______  B __________
          C __________  N __________

Full Load Voltage Readings:

Date:______________  Time: __________
Phase: A to N_______  A to B __________
          B to N __________  A to C __________
          C to N __________  B to C __________

No Load Voltage Readings:

Date:______________  Time: __________
Phase: A to N_______  A to B __________
          B to N __________  A to C __________
          C to N __________  B to C __________

Contractor's Representative:_____________________________________________
Engineer's Representative:______________________________________________
Owner's Representative:_________________________________________________
GROUND LOCATION: __________________________________________________________

PRIOR TO CONNECTION TO SYSTEM:
GROUND: ___________________________ (OHMS)
WEATHER CONDITIONS FOR PREVIOUS WEEK: _________________________________

AFTER CONNECTION TO SYSTEM:
GROUND: ___________________________ (OHMS)
CONTRACTOR’S REPRESENTATIVE: _________________________________
DATE: _________________________________
### APPENDIX A, FIGURE 4
### MOTOR TEST INFORMATION
### NOT USED

<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Project Name:</td>
</tr>
<tr>
<td>Description of Motor:</td>
</tr>
<tr>
<td>Checked By:</td>
</tr>
<tr>
<td>Date Checked:</td>
</tr>
<tr>
<td>a) Name and Identifying Mark of Motor</td>
</tr>
<tr>
<td>b) Manufacturer</td>
</tr>
<tr>
<td>c) Model Number</td>
</tr>
<tr>
<td>d) Serial Number</td>
</tr>
<tr>
<td>e) RPM</td>
</tr>
<tr>
<td>f) Frame Size</td>
</tr>
<tr>
<td>g) Code Letter</td>
</tr>
<tr>
<td>h) Horsepower</td>
</tr>
<tr>
<td>i) Nameplate Voltage and Phase</td>
</tr>
<tr>
<td>j) Nameplate Amps</td>
</tr>
<tr>
<td>k) Actual Voltage</td>
</tr>
<tr>
<td>l) Actual Amps</td>
</tr>
<tr>
<td>m) Starter Manufacturer</td>
</tr>
<tr>
<td>n) Starter Size</td>
</tr>
<tr>
<td>o) Heater Size, Catalog No. and AMP Rating</td>
</tr>
<tr>
<td>p) Manufacturer of Dual-Element Fuse</td>
</tr>
<tr>
<td>q) Amp Rating of Fuse</td>
</tr>
<tr>
<td>r) Power Factor</td>
</tr>
</tbody>
</table>

(Signature of Checker)

(Print or Type Name of Checker)

(Company Name of Checker)

(Signature of Contractor Representative)

(Print or Type Name of Contractor Representative)

(Company Name of Contractor Representative)
**APPENDIX A, FIGURE 5**
**CABLE INSULATION RESISTANCE TEST RECORD**

Circuit Description: 

<table>
<thead>
<tr>
<th>Phase</th>
<th>Resistance (Megohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A to Ground</td>
<td></td>
</tr>
<tr>
<td>B to Ground</td>
<td></td>
</tr>
<tr>
<td>C to Ground</td>
<td></td>
</tr>
<tr>
<td>Neutral to Ground</td>
<td></td>
</tr>
<tr>
<td>A to B</td>
<td></td>
</tr>
<tr>
<td>A to Neutral</td>
<td></td>
</tr>
<tr>
<td>A to C</td>
<td></td>
</tr>
<tr>
<td>B to Neutral</td>
<td></td>
</tr>
<tr>
<td>B to C</td>
<td></td>
</tr>
<tr>
<td>C to Neutral</td>
<td></td>
</tr>
</tbody>
</table>

Weather Conditions: 

Temperature: 

Circuit Condition Prior to Test: 

Tested By: ____________________ Date: ____________________

Witnessed By: ____________________

Owner's Authorized Representative: ____________________

Date: ____________________
ITEM M-003 ROADWAY PAVING, MARKING, AND SIGNAGE

DESCRIPTION

003-1.1 This item shall consist of the paving, marking, and signage of the FAA access and ARFF roadways. This item does not include any temporary signs required for the maintenance of traffic during construction, which are covered in Section 01 55 26.

MATERIALS

003-2.1 CONTINUALLY REINFORCED CONCRETE PAVEMENT. All materials related to the construction of the continually reinforced concrete pavement shall meet the requirements of TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 360.

003-2.2 FLEXIBLE BASE. All materials related to the installation of the flexible base shall meet the requirements of TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 247 for Grade 1-2, Type D aggregate.

003-2.3 ROADWAY SIGN. All materials related to the roadway signage shall meet the requirements of TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 636 and be of the type indicated on the Plans. The concrete for the sign foundations shall be in accordance with Item P-610.

003-2.4 SEPARATION GEOTEXTILE. Separation Geotextile shall be class 2, 0.02 sec-1 permittivity per ASTM D4491, Apparent opening size of 0.60-mm maximum average per roo per ASTM D4751.

003-2.5 REFLECTORIZED PAVEMENT Markers. All materials related to the installation of the reflectorized pavement markers meet the requirements of TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 672 for type II-C-R and of the colors indicated on the plans.

003-2.6 ROADWAY MARKING. The materials related to the roadway markings shall meet the requirements of Item P-620 for waterborne paint and of the colors indicated on the plans. All white paint shall be reflectorized by using glass beads that meet the requirements of Item P-620.

CONSTRUCTION METHODS

003-3.1 CONTINUALLY REINFORCED CONCRETE PAVEMENT. The construction and acceptance of the continually reinforced concrete pavement shall be in accordance with TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 360.
003-3.2  FLEXIBLE BASE. The construction of the flexible base shall be in accordance with TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 247.

003-3.3  ROADWAY SIGN. The construction of the continually reinforced concrete pavement shall be in accordance with TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 636. The concrete shall be placed in accordance with Item P-610.

003-3.4  REFLECTORIZED PAVEMENT MARKERS. The installation of the reflectorized pavement markers shall be in accordance with TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 672.

003-3.5  ROADWAY MARKING. The construction of the roadway markings shall be in accordance with Item P-620.

METHOD OF MEASUREMENT

003-4.1  CONTINUALLY REINFORCED CONCRETE PAVEMENT. The measurement for the continually reinforced concrete pavement will be measured by the number of square yards installed and accepted by the RPR.

003-4.2  FLEXIBLE BASE. The measurement for the flexible base will be measured by the number of square yards installed and accepted by the RPR.

003-4.3  ROADWAY SIGNS. The quantity of roadway signs will be determined by measurement for each sign installed and accepted by the RPR as complying with the plans and specifications.

003-4.4  REFLECTORIZED PAVEMENT MARKERS. The quantity of roadway signs will be determined by measurement for each sign installed and accepted by the RPR as complying with the plans and specifications. No separate measurement will be made based on color.

003-4.5  ROADWAY MARKING. The quantity of roadway markings will be determined by measurement of the number of square feet of marking performed and accepted by the RPR as complying with the plans and specifications. No separate measurement will be made for reflective and non-reflective markings.

BASIS OF PAYMENT

003-5.1  CONTINUALLY REINFORCED CONCRETE PAVEMENT. The basis of payment will be made at the contract unit price per square yard of continually reinforced concrete pavement measured and accepted in accordance with paragraph 008-4.1. Where the thickness of the pavement is more than 0.2-inches but not more than 0.75-inches the payment will be per TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) Item 360. This price shall be full compensation for furnishing all materials, labor, equipment, tools, disposal fees, restoration, hauling, and incidentals necessary to complete the item.
003-5.2 FLEXIBLE BASE. The basis of payment will be made at the contract unit price per square yard of flexible base as measured and accepted in accordance with paragraph 008-4.2. This price shall be full compensation for furnishing all materials, geotextile, labor, equipment, tools, backfill, hauling, and incidentals necessary to complete the item.

003-5.3 ROADWAY SIGN. The basis of payment will be made at the contract unit price for each roadway sign regardless of type measured and accepted in accordance with paragraph 008-4.3. This price shall be full compensation for furnishing all materials, labor, equipment, tools, backfill, hauling, and incidentals necessary to complete this item.

003-5.4 REFLECTORIZED PAVEMENT MARKERS. The basis of payment will be made at the contract unit price for each reflectorized pavement marker measured and accepted in accordance with paragraph 008-4.4. This price shall be full compensation for furnishing all materials, labor, equipment, tools, backfill, hauling, and incidentals necessary to complete this item.

003-5.5 ROADWAY MARKING. The basis of payment will be made at the contract unit price per square foot of roadway marking measured and accepted in accordance with paragraph 008-4.5. This price shall be full compensation for furnishing all materials, labor, equipment, tools, backfill, hauling, and incidentals necessary to complete this item.

Payment will be made under:

Item M-003-5.2 Continuously Reinforced Concrete Pavement (12-Inch) – per square yard
Item M-003-5.3 Flexible Base, Grade 1-2, Type D (10-inch Depth) – per square yard
Item M-003-5.4 Roadway Sign – per each
Item M-003-5.5 Reflectorized Pavement Marker – per each
Item M-003-5.6 Roadway Marking – per square foot

END OF ITEM M-003
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ITEM M-004 JET BLAST DEFLECTING FENCE

DESCRIPTION

004-1.1 Work covered by this item consists of providing all labor, equipment, appliances, and materials, and in performing all operations required for the design, fabrication, and installation of a new jet blast protection fence. Nominal height and the final design of the blast fence will be determined by the manufacturer as per design aircraft data for the taxiway.

MATERIALS

004-2.1 JET BLAST PROTECTION FENCE. The blast fence (structural members, deflecting surfaces and bolted joints), and its foundation must be designed to withstand a load of 50 pounds per square foot (psf) which is equivalent to a 140 miles per hour (mph) horizontal load (which is equivalent to the combined loads of the 50 mph jet blast of a 747-400ER Aircraft and a 90 mph wind load) when tested in accordance with ASTM E72.

004-2.2 FRAME MEMBERS. Frame members must be ASTM A36 steel and hot dip galvanized 2 ounces per square foot per ASTM A123.

004-2.3 DEFLECTING SURFACES. Deflecting surfaces shall be corrugated steel sheets designed to support loads in a single span condition. Minimum thickness 16 GA. per ASTM A929 with a 2 ounces per foot hot dipped galvanized surface per ASTM A924 and a section modulus of 0.1961 cubic inch.

004-2.4 HARDWARE.

A. Fasteners must have adequate locking properties to withstand direct blast, and will be as follows:
   • Bolts: ASTM A449 and/or F3125. Anchor bolts must be zinc-plated expansion type. Where expansion type anchors cannot be used due to concrete conditions, Hilti HDI epoxy anchors may be used.
   • Flat Washers: ASTM F436.
   • Nuts: Self-locking Hex Stover type Grade F
   • All hardware must be cadmium or zinc plated.
   • Half oval washers must be A36 steel hot dipped galvanized per ASTM A123 to 2 ounces per square foot after fabrication.

B. Fasteners must provide adequate locking properties to prevent them from working loose during continued normal operation of the facility.

004-2.5 CONCRETE FOUNDATION.

A. The foundation design must be a pile foundation designed to withstand normal local weather conditions including frost and the required loads. The design of the foundation is the responsibility of the Contractor and Manufacturer. The foundation must be designed for a frost penetration of fourteen (14) inches. The concrete must attain a minimum 28-day compressive strength of 4,000 psi when tested in accordance with the provisions of Section P-610. The foundation must be constructed as a single plane surface with no breaks in
grade. (Note: The foundation may be sloped at a grade of up to 2% to allow for drainage or to meet existing grades.) Any reinforcing steel used must be placed to avoid interference with anchor bolts and must have a yield strength of 60,000 psi, Grade 60.

B. Expansion Joints at 90” o.c. maximum and contraction joints at 30” o.c. maximum shall be provided in the foundation slab as per approval of the Engineer.

C. Install under the foundation and as specified herein but not limited to P-155 stabilization stone.

004-2.6 GROUNDING. Grounding equipment must be provided in accordance with the requirements of NFPA 780 “Standard for the Installation of Lightning Protection Systems” and with the practices of FAA Standard 019F, “Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment.”

004-2.7 CONNECTION TO EXISTING DART FENCE. The Jet Blast Deflector will be connected at both ends to the adjacent Dallas Area Rapid Transit perimeter fence as shown on the design plans.

004-2.8 OBSTRUCTION LIGHTING. Obstruction lights must be solar powered and provided in accordance with FAA AC 150/5345-H, “Specification for obstruction lighting equipment” and FAA AC 70/7460-1L, “Obstruction marking and lighting”. (Note: Obstruction lighting is only required if the height of wall exceeds any obstruction standard contained in 14 CFR Part 77.)

004-2.9 REFLECTIVE TAPE. Reflective tape provided must meet the requirements of ASTM 4956, “Standard Specification for Retroreflective Sheeting for Traffic Control”.

CONSTRUCTION METHODS

004-3.1 GENERAL.

A. All materials must be stored and protected from damage in areas approved by the Engineer. All fasteners must be stored in protected areas. Materials will not be stored in a manner that might cause distortion, deterioration, or damage. Any damaged materials must be repaired or replaced at no additional expense to the Airport.

B. Fabrication and installation of the fence must be supervised by a manufacturer’s representative. At the completion of the fence installation, a written five (5) year guarantee on the workmanship, materials, and installation must be provided to the Engineer by the Contractor and the fence manufacturer.

C. The Contractor must be responsible for obtaining any required building permits for erection of the fence, in accordance with local ordinances.

004-3.2 ASSEMBLING JET BLAST PROTECTION FENCE. The fence must be attached to the completed foundation in accordance with the manufacturer’s instructions. Individual panels must be removable and replaceable. Welding, brazing or burning of holes is not permitted. All fasteners must be tensioned as specified by the manufacturer.

004-3.3 FINISHING OF JET BLAST PROTECTION FENCE. All bolts, nuts, and washers must be cadmium or zinc plated. All structural members, parts, and corrugated metal must be hot dip galvanized with a minimum coating of 1.5 oz. zinc per square foot of surface. Painting of
galvanized surfaces is not required, but any galvanized surface badly scratched or marred, must be re-galvanized or otherwise repaired to the satisfaction of the Engineer.

004-3.4 GROUNDING OF JET BLAST PROTECTION FENCE. After the erection of the blast fence is completed, the fence must be grounded in accordance with the requirements of FAA Standard 019F and NFPA 780.

SUBMITTALS

004-4.1 SHOP DRAWINGS.

A. The Contractor must submit shop drawings detailing erection of the fence, including plans, elevations, sections, structural load calculations and details of all items necessary to erect the fence including the anchor loads and locations along with miscellaneous requirements for the foundation. The shop drawings must be signed and sealed by a Structural Engineer licensed in the State of Texas, responsible for their preparation and must be accepted by the Engineer prior to fabrication.

B. The manufacturer must provide catalog cuts, shop drawings, wind analysis and calculations that demonstrate that the fence must withstand the specified loading and is in accordance with local codes and ordinances. The maximum deflection criteria will be L/180, where L=the span length of any structural member.

QUALITY ASSURANCE

004-5.1 QUALITY CONTROL

A. The blast fence design and its foundation design plans must be signed and sealed by a Structural Engineer licensed in the State of Texas. The blast deflector must be furnished by an experienced manufacturer of blast fences, who must have completed a minimum number of 3 similar blast fence designs which have been in service for a minimum number 3 of years. Certification of such experience must be provided to the Engineer. Such certification must include the following information in order to be approved as an acceptable manufacturer:

- Demonstration that the installation allowed successful taxi breakaway power operation with jet aircraft without harmful exhaust wake velocities behind the structure.
- Results of full scale field proof tests in which the proposed structure was successfully subjected to the specified aircraft or its equivalent and to power loadings equal to or greater than those specified.
- Results of smoke-pot tests behind the fence, demonstrating that smoke and gases are deflected such that there is no evidence of smoke dispersal behind the fence.
- Detailed design analysis showing loads and stresses in structural members, deflecting surfaces and bolted joints, using the worst-case aircraft velocity profiles as the calculated pressure for load calculations.

B. Structural Engineer Qualification: A Texas licensed Structural Engineer who is experienced in providing services similar to that indicated for this Project in material, design, and extent.

C. Perform Work in accordance with the latest edition, of the appropriate divisions, of the following:

April 23, 2020
1. Manufacturer’s printed directions.

2. Submit calculations as described under SUBMITTALS.

D. Delivery, Storage and Handling – Materials must be delivered to the Project in sealed containers and/or bundles bearing manufacturer’s name and material identification. Materials must be stored in strict accordance with the manufacturer’s printed directions, copies of which must be furnished to the Engineer.

E. Protect materials against damage from mechanical abuse, plaster, salts, acids, staining and other foreign matter by an approved means during transportation, storage and erection and until completion of construction work. All unsatisfactory materials must be removed from the premises, and all damaged materials replaced with new materials.

F. White rust or mill markings on galvanized surfaces shall not be cause for rejection surfaces showing iron stain or rust shall be retouched or regalvanized to the satisfaction of the RTR.

G. Access and Storage Areas – All access routes and storage areas must be subject to the approval of the Engineer in order to reduce interference with Airport Operations.

004-5.2 WARRANTIES AND GUARANTEES. Jet Blast Protection Fence and Spare Fence Panels must be covered under the Contractor’s general construction warranty.

004-5.3 SPECIAL REQUIREMENTS.

A. Field Measurements – Before proceeding with fabrication the jet blast protection fence, the supplier/installer must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.

B. Protection – Protect materials against damage from mechanical abuse, plaster, salts, acids, staining and other foreign matter by an approved means during transportation, storage and erection and until completion of construction work. All unsatisfactory materials must be removed from the premises, and all damaged materials replaced with new materials.

C. Coordination – Coordinate Work of this Section with related Work specified in the other divisions/sections of the Contract Documents.

METHOD OF MEASUREMENT

004-6.1 MEASUREMENT.

A. Jet Blast Protection Fence will be measured for payment when completed on a lump sum basis.

BASES OF PAYMENT

004-7.1 PAYMENT.

A. Payment for the blast fence will be made at the Contract lump sum price. This price includes all fencing materials and hardware, reinforced concrete foundation, expansion and...
contraction joints, grounding, geofabric, excavation, backfilling, frost protection material, stabilization stone, or any other items required for the complete installation of the jet blast protection fence with foundation. These prices will be full compensation for furnishing all materials, transporting, design, preparation, erection, and installation of these materials, and for all labor, equipment, tools, and all work necessary to complete the items as described herein.

Payment will be made under

Item M-004-7.1  Jet Blast Deflecting Fence – per lump sum

MATERIAL REQUIREMENTS

ASTM E72  Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

ASTM A36  Standard Specification for Carbon Structural Steel


ASTM F3125  Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions


ASTM F436  Standard Specification for Hardened Steel Washers, Inch and Metric Dimensions

ASTM 4956  Standard Specification for Retroreflective Sheeting for Traffic Control

END OF M-004
ITEM M-005 PIPE JACKING FOR STORM DRAINS AND CULVERTS

DESCRIPTION

005-1.1 This item shall consist of the trenchless construction of pipe culverts and storm drains in accordance with these specifications and in conformity with the lines and grades shown on the plans.

MATERIALS

005-2.1 GENERAL. Materials shall meet the requirements shown on the plans and specified below.

005-2.2 PIPE.

   a. General. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the requirements contained herein.

   b. Marking. Mark the inside barrel of each pipe section in conformance with ASTM requirements, with a unique identification number, prior to delivery. Markings must be indented, or painted with indelible paint.

   c. Design: Design jacking pipe for operational and jacking loads and acceptable fabrication tolerances. Maximum jacking loads applied to the jacking pipe shall not exceed 50 percent of the ultimate compressive strength of the pipe material or the maximum safe jacking load of the pipe as established by the pipe manufacturer, whichever is lower.

      (1) Concrete pipe shall conform to ASTM C 1417 except that dimensional tolerances shall conform to ASCE 27-00.

      (2) Each jacking pipe shall contain at least two (2) threaded grout ports.

      (3) Submit calculations in a neat, legible format. Assumptions used in calculations shall be consistent with information provided in the geotechnical data. All calculations shall be prepared by a Professional Engineer licensed in the State of Texas, who shall stamp and sign calculations.

      (4) Submit an estimate of the maximum jacking force expected to complete each drive, accounting for frictional resistance along the pipe string. Also estimate possible maximum forces after delays (set-up) and highest value of side friction. Confirm that the estimated maximum jacking force for each drive is less than the calculated jacking pipe capacity (with a factor of safety of at least 2) or the jacking pipe manufacturer’s maximum safe jacking load, whichever is lower.

   d. Joints. Joints must conform to ASCE 27-00 Type B or Type C. Joint design must ensure no soil egress into the joint during jacking. Precut cushioning material must be used to provide full circumferential bearing around each joint. Cushioning material must consist of
plywood, chipboard, soft lumber, or equal. Cushioning must be held back from the edges of bearing surfaces to minimize edge distress.

e. Concrete. Concrete and admixtures for pipe shall meet the requirements of Item P-610 and have a minimum compressive strength of 3,000 psi at 28 days.

f. Rubber gaskets. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443.

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

h. Intermediate Jacking Station (IJS) shell. Permanent shell to remain in place shall be of the same grade of steel as the jacking joint collar.

005-2.3 CONTACT GROUT.

a. Provide contact grout consisting of cement and water with optional additives and aggregates. The proposed mix shall be pumpable and suitable to fill all voids outside the tunneled jacking pipe.

b. Minimum Strength: 150 psi.

c. Constituents:

(1) Cement: Type II or Type V portland cement conforming to ASTM C150. Type II cement shall meet Table 4 false set requirements of ASTM C150.

(2) Bentonite: Commercially processed powdered bentonite, Wyoming type, such as Baroid, Imacco-gel, and Black Hills.

(3) Sand: Conform to ASTM C144 except where modified in the following subparagraphs.

(a) Fineness Modulus: Between 1.50 and 2.00.

(b) Grading Requirements:

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(c) Fluidifier: Designed to hold the solid constituents of the grout in colloidal suspension, be compatible with the cement and water used in the grouting work, and comply with the requirements of ASTM C937.

(d) Admixtures: Other admixtures may be used subject to the written approval of Engineer to improve the pumpability, to control set time, to hold sand in suspension, and to prevent segregation and bleeding.

d. Submit details of grout mix proportions, admixtures, including manufacturers’ literature, and laboratory test data verifying the strength of the proposed grout mix.

005-2.4 CONTACT GROUTING EQUIPMENT

a. Satisfactorily mix and agitate the grout and force it into the grout holes, in a continuous flow at the desired pressure.

b. Provide two pressure gauges, one at the grout pump and one at the collar of each hole being grouted. Periodically check the accuracy of the gauges with an accurately calibrated pressure gauge. Have a minimum of two spare pressure gauges available on Site.

c. Equip all gauges with gauge-savers (diaphragm seal) to prevent entry of grout into the gauge.

d. Provide the grouting equipment with a meter to determine the volume of grout injected. Calibrate the meter in cubic feet to the nearest one-tenth of a cubic foot.

e. Maintain the grouting equipment in satisfactory operating condition throughout the course of the Work to ensure continuous and efficient performance during grouting operations.

f. Provide suitable stop valves at the collar of each hole for use in maintaining pressure as required until the grout has set.

g. Provide grout hoses with an inside diameter not less than 1 1/4 inches nor greater than 2 inches and capable of withstanding the maximum water and grout pressures to be used.

CONSTRUCTION METHODS

005-3.1 TUNNELING METHOD. Provide Open Face Rotary Wheel Tunnel Boring Machine (TBM) and pipe jacking equipment suitable for and capable of efficiently advancing through the geologic conditions anticipated. The cutterhead shall have a reversible drive system so that it can rotate in either direction.

a. Lubrication. Provide lubrication injection system to inject pipe lubricant around the TBM and jacking pipe to reduce frictional resistance. Lubrication materials may include a mixture of bentonite and/or polymers and water. Consider the swell potential of the native soils during selection of lubricant.

b. Settlement. Control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities, and improvements. Select radial overcut and limit ground movements (settlement/heave) to values that do not cause damage or distress to surface features, utilities, or improvements. In no case shall settlements exceed the applicable values listed in Section M-006, Geotechnical Instrumentation. Comply with the requirements of Section M-006, Geotechnical Instrumentation.
c. **Thrust block.** Use thrust block to transfer jacking loads to the soil behind the jacking shaft. Construct the thrust block perpendicular to the proposed jacking pipe alignment. Design the thrust block to withstand the maximum jacking forces developed by the main jacks, without excessive deflection or displacement. Forces applied to the soil shall not exceed the allowable passive earth pressure, with a minimum factor of safety of 2.0. Submit calculations demonstrating that the soils behind the thrust block can transfer the maximum planned jacking forces exerted by the main jacks to the ground during pipe installation with the specified factors of safety and without excessive deflection or displacement.

d. **Tunneling Work Plan.** Submit a Tunneling Work Plan with complete construction drawings and written description identifying details of the proposed method of construction and the sequence of operations to be performed during construction, as required by the method of tunneling. The Drawings and descriptions shall be sufficiently detailed to demonstrate whether the proposed materials and procedures will meet the requirements of this section. The Tunneling Work Plan, including Drawings, shall at a minimum include the following items:

(1) Arrangement drawings and technical specifications of the TBM and experience record with this type of machine. Include the following information concerning the TBM:

(a) Dimensions.

(b) Cutterhead arrangement with dimensions.

(c) Cutters.

(d) Horsepower, torque, speed, and thrust.

(e) Procedure for replacing cutters.

(f) Overcut.

(g) Articulation and steering capability.

(h) Cutterhead jets/ports.

(i) Mucking system.

(2) Method of maintaining and controlling line and grade of tunneling operation.

(3) Method and details of spoil removal, including equipment type and numbers, processing, and disposal procedures and locations.

(4) Techniques to be used for lubrication including equipment, pumping and injection procedures, lubrication types, and mixtures, in accordance with the manufacturer’s recommendations.

(5) Details of the TBM operation.

(6) Plans for storage and handling of jacking pipe.

e. Results of line and grade survey to ensure that the thrust block, jacking frame, guide rails, entry seal, and exit seals are installed properly prior to launch of each drive.
f. Contact Grout Work Plan and Methods:

(1) Submit Work plan, for each type of contact grouting required, including contact grouting methods and details of equipment, grouting procedures and sequences, injection pressures, monitoring and recording equipment, pressure gauge calibration data, methods of controlling grout pressure, method of transporting grouting equipment and materials within the pipe, and provisions to protect interior of pipe and shaft supports.


(1) Air monitoring equipment and procedures.
(2) Provisions for lighting, ventilation, and electrical system safeguards.
(3) Protection against soil instability and groundwater inflow.
(4) Safety for tunnel and shaft access and exit including ladders, stairs, walkways, and hoists.
(5) Protection against mechanical and hydraulic equipment operations, and for lifting and hoisting equipment and material.
(6) Monitoring for hazardous gases.
(8) Protection of shaft including traffic barriers, accidental or unauthorized entry, and falling objects.

h. Schedule: Provide a schedule for tunneling work, identifying major construction activities as independent items. Include the work hours and workdays for each activity, and a written description of the construction activities. Update every 2 weeks, or more frequently if requested by Engineer. Include, as a minimum, the following activities:

(1) Mobilization.
(2) “One call” utility locate requests and visual confirmation of all crossing utilities and parallel utilities within 10 feet laterally of the bore centerline.
(3) Groundwater control at jacking and receiving shafts.
(4) Thrust wall construction.
(5) TBM equipment setup.
(6) Entry ring installation for launch of jacking pipe.
(7) Proof probing at the tunnel eye.
(8) Tunneling.
(9) Contact grouting.
(10) Installation of the carrier pipe inside casing pipe, if applicable.
(11) Shaft backfill.

(12) Cleanup.

(13) Demobilization.

005-3.2 QUALITY ASSURANCE.

   a. **Experience:** All TBM tunneling Work shall be performed by an experienced Contractor who has at least 5 years of experience in performing tunneling Work and has completed at least three similar projects involving at least 500 feet of tunneling on each project. At least one of the projects shall have an individual drive equal to or greater in length than the longest planned drive on this Project. The Project Superintendent shall have at least 5 years of experience supervising tunneling operations. The TBM operator(s) shall have technical training in the operation of the proposed open face rotary wheel TBM equipment and shall have completed, as a primary operator, at least three similar tunneling projects involving at least a 500 foot open face rotary wheel TBM tunnel in similar soil on each project. Submit qualifications and detailed qualifying project experience for the tunneling contractor, tunnel contractor’s superintendent, and TBM operator(s), that demonstrate compliance with the requirements.

   b. **Safety Representative:** The Site Safety Representative and personnel responsible for air quality monitoring shall be experienced in tunnel construction and shall have current certification by OSHA. Submit qualifications and detailed qualifying project experience for the site safety representative that demonstrate compliance with the requirements.

   c. **Surveyor.** The surveyor responsible for line-and-grade control shall be a professional Land Surveyor licensed in the State of Texas who has prior experience in similar underground projects. Submit qualifications and detailed qualifying project experience for the surveyor that demonstrate compliance with the requirements.

005-3.3 INTERMEDIATE JACKING STATIONS. Submit drawings and design details for intermediate jacking stations if proposed by the Contractor including shell materials, measures for corrosion protection, proposed spacing, criteria for installing, method of operation, and number of stations and method of jack removal and jacking pipe closure.

TUNNELING

005-4.1 GENERAL

   a. Do not begin tunneling until the following tasks have been completed:

      (1) Required Submittals have been provided, reviewed, and approved.

      (2) Jacking shaft and receiving shaft excavations and support systems have been completed in accordance with approved Submittals. Locations and elevations of shafts shall have been surveyed to confirm that Work can be completed in accordance with alignment and grade shown on Drawings.

      (3) Settlement monitoring points have been installed and baseline measurements established.
The location, orientation and grade of the jacking frame has been surveyed to ensure it is on the proper line and grade and to verify that it is properly supported. Take special care when setting the jacking frame in the jacking shaft to ensure stability and accuracy of the alignment and grade. Securely attach jacking frame to prevent movement or shifting during the Work.

Complete startup inspection of mechanical and hydraulic systems associated with tunneling operations. Test the system on the surface to ensure that the open face rotary wheel TBM and supporting equipment is functioning properly.

b. Properly manage and dispose of groundwater and surface water inflows to the shafts in conformance with approved TPDES Dewatering and Construction Stormwater Discharge Permits. Do not discharge groundwater inflows into storm sewers, sanitary sewers, drainage ditches, water bodies, or streets without an approved discharge permit.

c. Conduct operations such that trucks and other vehicles do not interfere with traffic or create a mud, dust, or noise nuisance in the streets and to adjacent properties. Promptly clean up, remove, and dispose of spoils spillage, and any material discharges.

d. Conduct Work so as not to disturb roadways, railways, adjacent structures, landscaped areas, or existing utilities. Repair damage immediately to original or better condition and to the satisfaction of Engineer.

e. Operate with a full crew 24 hours a day whenever there is a condition that is likely to endanger the stability of the excavation or adjacent structures, including weekends and holidays, without interruption, until those conditions no longer jeopardize stability.

005-4.2 JACKING OPERATIONS

a. Provide a suitable jacking frame and thrust block to carry out the Work. Provide intermediate jacking stations, if required, to complete the tunneling drives indicated on the Drawings. If the Contractor elects to utilize IJSs, they shall be installed and operated in accordance with approved Submittals.

b. Transport the jacking pipe from storage to the jacking shaft without damage. Transport methods shall be acceptable to jacking pipe manufacturer. Do not use damaged jacking pipe in the Work, unless permitted in writing by Engineer. Set the jacking pipe on a properly braced and supported jacking frame.

c. Distribute the axial forces from the thrust jacks to the jacking pipe uniformly through a thrust ring and cushion material, if applicable, to prevent damage to the ends of the pipe. Do not exceed the specified allowable compressive stresses on the jacking pipe.

d. Jack the jacking pipe into position following the design line and grade without damaging the jacking pipe.

005-4.3 OPEN FACE ROTARY WHEEL TBM TUNNELING

a. Complete the open face rotary wheel TBM tunneling in accordance with approved Submittals, and applicable permit conditions.

b. Control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities, and improvements. Repair damage resulting from construction activities.
Contact grout voids caused by or encountered during the shaft construction and tunneling. Modify equipment and procedures as required to avoid recurrence of excessive settlements or damage.

c. Control the advance of the jacking pipe so as to restrict the excavation of the materials to a volume equal to the pipe jacked, plus allowance for the allowable radial overcut, to prevent loss of ground and settlement or possible damage to overlying structures. Control the advance rate and monitor the volume of material excavated and adjust advance rate, as required, to avoid loss of ground, overexcavation, or surface heave.

d. Completely contain, transport, and dispose of fluid additives and lubricants away from the site. Dumping of fluid additives and lubricants on the ground, discharge into sewers or ditches, or discharge into the shafts is not permitted.

e. Transport spoil from each crossing and dispose of in accordance with all state and federal requirements.

005-4.4 CONTROL OF LINE AND GRADE

a. Establish and protect benchmarks as necessary prior to the start of construction.

b. After establishing required benchmarks, use these benchmarks to furnish and maintain reference lines and grades for tunneling. Use these lines and grades to establish the location of the jacking pipe using a laser or theodolite guidance system. Submit to Engineer copies of field notes used to establish all lines and grades and allow Engineer to check guidance system setup prior to beginning each tunneling drive. Provide access for Engineer to perform survey checks of guidance system and line-and-grade of jacking pipe as necessary. Be fully responsible for the accuracy of the Work and the correction of it, as required.

c. Install the jacking pipe in accordance with the following tolerances:

(1) Variations from Design Line: 2 inches maximum.

(2) Variations from Design Grade: 1 inch maximum.

d. Control the jacking pipe advancement to maintain line and grade within the tolerances specified. If the installation is off line or grade, attempt to make the necessary corrections, as identified in the contingency plans.

e. Mount the guidance system independently from the thrust block and jacking frame. Stop tunneling operations and reset guidance system if its alignment shifts or is moved off design alignment and grade. Check guidance system setup at least once per shift. Guidance system should only be reset by experienced, competent surveying personnel in accordance with approved procedures outlined in the Submittals.

f. Monitor line and grade continuously during tunneling operations. Record deviation with respect to design line and grade at least once per foot and submit records to Engineer on a daily basis. Control line and grade of the jacking pipe to within the specified tolerances.

g. Correct the installation including necessary redesign of the pipeline or structures and acquisition of necessary permits if the jacking pipe installation does not meet the specified tolerance.
005-4.5  OBSTRUCTIONS

a. If the tunneling operations should encounter an object or condition that impedes the forward progress of the machine, the Contractor shall notify the Engineer immediately. The Contractor shall submit a plan to correct the condition, and remove, clear, or otherwise make it possible for the tunneling machine and casing pipe to advance past any and all objects or obstructions that impede forward progress of the casing. Upon written notification of the Engineer, the Contractor shall immediately proceed with removal of the object or obstruction by means of an obstruction removal shaft or by other approved methods, as submitted by the Contractor. An obstruction removal shaft shall consist of a small excavation for the purpose of removing the obstruction. The Contractor will receive compensation for removal of obstructions, which consist of metallic debris, reinforced concrete, whole trees, rocks and other hard objects larger than 33 percent of the outer diameter of the shield, cutter head, or cutting shoe, which cannot be broken up by the cutting tools with diligent effort, and that are partially or wholly within the cross-sectional area of the bore. Payment will be negotiated with the Contractor by the Owner on a case-by-case basis. However, any removal process that does not allow direct inspection of the nature and position of the obstruction will not be considered for payment. The Contractor will receive no additional compensation for removing, clearing, or otherwise making it possible to advance past objects consisting of cobbles, boulders, wood, nonreinforced concrete, and other nonmetallic objects or debris with maximum lateral dimensions less than 33 percent of the outer diameter of the shield, cutterhead, or cutting shoe, whichever is larger.

005-4.6  CONTACT GROUTING

a. General

(1) Commence contact grouting outside of the jacking pipe within 24 hours following the completion of each tunneled drive. Grouting operations shall be continuous until completed.

(2) Provide threaded contact grout ports in the jacking pipe. Drilling grout holes through jacking pipe is not permitted.

(3) Seal contact grout ports with screw type plugs no sooner than 24 hours following the completion of grouting. Use dry pack mortar to fill recesses, and to provide a smooth surface.

b. Mixing and Injection of Contact Grout

(1) Provide materials free of lumps when put into the mixer. Continuously agitate the grout mix. Completely fill voids. Do not use grout not injected after 90 minutes of mixing.

(2) Operate and control the grouting process so that the grout will be delivered uniformly and steadily. The locations of contact grout holes in the pipe are shown on Drawings. Drilling grout holes through pipe is not permitted.

(3) Recirculate grout mixes when new mix is batched or after adding water, fluidifier, or sand to mix. Recirculate mix for at least 2 minutes prior to pumping grout into grout hole.

(4) In general, grouting will be considered completed when less than one cubic foot of grout of the accepted mix and consistency can be pumped in 5 minutes under the
specified maximum pressure. After the grouting is finished, close the valve before the grout header is removed and keep closed until grout has set.

(5) Provide maximum sustained grouting pressure of 15 pounds per square inch (psi) or 1/2 psi per foot of earth cover, whichever is less, at the grout hole collar connection unless otherwise approved in writing by Engineer.

c. Contact Grouting of Jacking Pipe

(1) Inject grout through the jacking pipe grout connections in such a manner as to completely fill all voids outside the pipe resulting from, or encountered during, tunneling operations. Control grout pressure so as to avoid damaging the pipe, and to avoid movement of the surrounding ground or improvements.

(2) Grouting shall generally progress sequentially in a constant upgradient direction from one grout port to the next grout port in the sequence indicated in the approved submittals.

(3) Clean sufficient contact grout ports ahead of the port to be grouted to prepare for grouting. Attach valves or other suitable devices and place in the fully open position on ungrouted ports within the maximum grout communication distance. Only close ports when grout issues forth of the same consistency and color, and at the same rate as that being pumped at the fill location.

(4) Grouting operation shall only advance forward to the next open grout port once grouting pressure limits are achieved at the fill location.

MATERIAL ACCEPTANCE

005-5.1 REPORTING.

a. Daily Records: The following daily records shall be submitted by noon on the day following the shift for which the data or records were taken.

(1) Jacking Records: Provide complete jacking records. These records shall include, at a minimum: date, time, name of operator, tunnel crossing identification, installed pipe number and corresponding tunnel length, cutterhead rotation speed and torque, rate of advance for each pipe, jacking forces, spoil feed rates, line and grade offsets, any movement of the guidance system, problems with the TBM or other components or equipment, and durations and reasons for delays. Manually recorded observations should be made at intervals of not less than three feet of advance, as conditions change, and as directed by Engineer. Submit samples of the automated and manual jacking records at least 7 days prior to the start of tunneling. Samples shall include electronic data and any necessary programs to interpret data, and the manual logs or records to be used.

(2) Survey Measurements: Survey measurements of jacking pipe alignment.

b. Contact Grout Reports and Records: Maintain and submit daily logs of grouting operations, including grouting locations, pressures, volumes, and grout mix pumped, and time of pumping. Note any problems or unusual observations on logs.

METHOD OF MEASUREMENT
005-6.1 The length of pipe shall be measured in linear feet of pipe in place, completed, and approved. 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.

BASIS OF PAYMENT

005-7.1 Payment will be made at the contract unit price per linear foot for each kind of pipe of the type and size designated. 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. Payment will be made under:

Item M-005-7.2 60-Inch Reinforced Concrete Flush-Bell Jacking Pipe, Class V – per linear foot
Item M-005-7.3 72-Inch Reinforced Concrete Flush-Bell Jacking Pipe, Class V – per linear foot

MATERIAL REQUIREMENTS

ASCE 27-00, Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction.


ASTM C 1417, Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design.

END ITEM M-005

April 23, 2020
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ITEM M-006 GEOTECHNICAL INSTRUMENTATION

DESCRIPTION

006-1.1 This Work includes furnishing and installing settlement instrumentation to monitor ground movements above the tunneled crossings. The Work includes, but is not limited to, installing surface monitoring points and recording observations and measurements from the monitoring points on a periodic basis before, during, and after tunneling.

MATERIALS

006-2.1 SURFACE MONITORING POINTS.

a. Surface monitoring points shall be established by an inscribed marking or approved surveyor’s nail driven flush with the surface in asphalt or concrete paved areas. In unimproved areas, surface monitoring points shall be established by driving a 5/8 inch diameter by 30 inch long reinforcing bar flush with the ground. Each monitoring point shall have a tag or marking indicating the station and offset from centerline. Each point shall be assigned a unique identification number and shall be protected from damage.

MONITORING PLAN

006-3.1 INSTRUMENTS. Submit drawings showing the actual as-built installed location, the identification number, the type, the installation date and time, the coordinates of the point, and the tip elevation and instrument length. Include details of installed instruments, accessories and protective measures including all dimensions and materials used.

006-3.2 EXISTING CONDITIONS. At least 72 hours prior to commencement of any adjacent construction activities, including dewatering, submit pre-construction survey of existing conditions, documenting any existing damage, distress, settlement, cracking, etc., of streets, roadways, aprons, taxiways, sidewalks, curbs, gutter, utilities, culverts, buildings, and foundations. The survey shall include photographs, video, and written notes for each item or instance of damage or distress existing before construction. Photographs and video shall be submitted in digital format.

006-3.3 MEASUREMENTS. Submit the monitoring results within 24 hours of measurement, tabulated in Microsoft Excel format.

CONSTRUCTION METHODS

006-4.1 Install instrumentation at the locations shown on the Drawings, as described in the specifications, and as approved by the RPR. Perform a baseline survey of all monitoring points at least 7 days prior to the commencement of any adjacent construction activities, including the start of dewatering. Install surface monitoring points within 0.5 foot of the horizontal and vertical locations described herein, shown on the Drawings, or as directed by the RPR. Additional surface monitoring points shall be installed if directed by the RPR.
006-4.2 Should actual field conditions prevent installation of instruments at the locations shown on the Drawings, or specified herein, obtain written acceptance from the RPR for new instrument locations and elevations.

006-4.3 During tunneling survey monitoring points located within 50 feet of the excavation face at least once per day. Once tunneling operations are complete, survey all monitoring points again, and once again at 14 days after tunneling is completed.

006-4.4 Contractor shall provide access and assistance to the RPR for obtaining additional monitoring data, as discussed herein and as requested by RPR.

**RESPONSE VALUES**

006-5.1 Alert RPR to any measurements that exceed the following response values:

<table>
<thead>
<tr>
<th>Site Feature</th>
<th>Threshold Value (Contractor Action Required)</th>
<th>Contractor’s Response Value</th>
<th>Shutdown Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Monitoring Points</td>
<td>0.50 inch H or V</td>
<td>0.90 inch H or V</td>
<td>1.00 inch H or V</td>
</tr>
</tbody>
</table>

a. When the instruments indicate movement equal to 50 percent of the maximum allowable value has occurred, the Threshold Value is said to have been reached. At this time, the Contractor shall meet with the RPR to discuss his construction means and methods to determine what changes, if any, shall be made to better control ground movement. Instrument readings shall be taken by the RPR on a daily basis until five consecutive working days of readings below the Threshold Value are observed, or more often as specified elsewhere in this section.

b. When the instruments indicate movement equal to 90 percent of the maximum allowable value has occurred, the Contractor’s Response Value is said to have been reached. At this time, the Contractor shall actively control ground movement in accordance with the approved plan to prevent reaching the Shutdown Value. Instrument readings shall be taken by the RPR on a daily basis until 5 consecutive working days of readings below the Threshold Value are observed, or more often as specified elsewhere in this section.

c. When the instruments indicate movement equal to 100 percent of the maximum allowable value has occurred, the Shutdown Value is said to have been reached. At this time, the RPR may direct the Contractor to stop all Work immediately, and the Contractor must meet with the RPR to develop a plan of action before Work can be resumed. No standby time will be paid if Work is shut down because the Shutdown Value is reached.

**ABANDONMENT OF INSTRUMENTS**

006-6.1 Surface Monitoring Points: All surface monitoring points on public property shall remain in place at the completion of the Work. Remove all surface monitoring points on private property during the cleanup and restoration work, or as required by the RPR.

**METHOD OF MEASUREMENT**
006-7.1 Geotechnical instrumentation will not be measured separately but will be considered incidental to the items in which it is required.

BASIS OF PAYMENT

006-8.1 PAYMENT. No direct payment will be made for this item, it shall be considered incidental to the items in which it is required.

END ITEM M-006
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ITEM M-007 RIP-RAP

DESCRIPTION

007-1.1 This item shall consist of the installation of rip-rap at the location shown on the plans.

MATERIALS

007-2.1 RIP RAP. The rip rap for the channel shall meet the requirements of TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) specification 432, for protection stone, with a maximum aggregate size of 24 inches.

CONSTRUCTION METHODS

007-3.1 RIP RAP. The rip rap for the channel shall be constructed per the requirements of TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (November 1, 2014) specification 432.

Aggregate larger then 12 inches shall be placed as directed by the RPR in a manner to mitigate the flow velocity.

METHOD OF MEASUREMENT

007-4.1 RIP RAP. The quantity of rip rap will be determined be measurement of the number of square yards of material actually constructed and accepted by the Engineer as complying with the plans and specifications.

BASIS OF PAYMENT

007-5.1 RIP RAP. The basis of payment will be made at the contract unit price per square yard of rip rap installed at a uniform depth as measured and accepted in accordance with paragraph 4.7. This price shall be full compensation for furnishing all materials, geotextile, labor, equipment, tools, backfill, hauling, and incidentals necessary to complete the item.

Payment will be made under:

Item M-007-5.1 Rip-Rap – per square yard

END OF ITEM M-007
008-1 GENERAL

Provide a framework for managing the East Materials Management Site (EMMS). This shall provide an organized location for the storage, and reuse of various earthwork and construction materials generated from projects across the Airport.

008-2 DEFINITIONS AND ROLES AND RESPONSIBILITIES

A. Demolished Asphalt / Asphalt Millings - Unprocessed asphalt and asphalt millings. The EMMS Operator shall break down received unprocessed chunks of asphalt into pieces no greater than 3-inches.

B. EMMS Operator - DFW selected contractor designated to operate and maintain the EMMS. The EMMS Operator shall be responsible for ensuring that materials entering the EMMS meet the definitions listed below. The EMMS operator shall only accept acceptable material per the contract documents.

C. Material Management Form - Environmental Authorization to Transfer Soil Form - Written form giving the project of origin for the material, material type, estimated quantities of each material.

D. Other Project Contractors - DFW selected contractor not designated as EMMS Operator. The Other Project Contractors will haul approved excess materials to the EMMS but are not responsible for maintenance of the sites. The Other Project Contractors may be contracted by any DFW department (DCC, ETAM, CD, etc.).

E. Owner Authorized Representative (OAR) - DFW designated person who will serve as the day-to-day coordinator for all matters associated with the EMMS.

F. Reclaimed Aggregate Base Material - This material originates from demolished airfield and roadway pavement base structures. The material may be received as millings or broken pieces. The EMMS Operator shall break down the material into pieces no greater than 3-inches prior to storing in the stockpile.

G. Recycled Concrete Base (RCB) – Concrete slabs generated from construction projects with dimensions no wider than 25 feet by 12 feet delivered to the EMMS by the project contractor and unloaded by the EMMS Operator. The EMMS Operator shall crush the slabs and the rubble per the X-299 specification or the TXDOT 247 Flex Base specification in quantities as directed by the OAR.

H. Suitable Excavation - Suitable excavation shall consist of the excavation of earth material that is considered suitable for use in the formation of required embankments. Only the following Unified Soil Classification System designations, as defined in ASTM D2487, shall be considered suitable: GW, GP, GM, GC, SW, SP, SM, SC, CL, and CH soils.
I. Topsoil - Topsoil should be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it should be reasonably free from subsoil and stumps, roots, brush, stones (two inches or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations should be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed, but should be thoroughly broken up and intermixed with the soil during handling operations. Topsoil stockpiles shall be organized and managed as directed by the OAR.

J. Unsuitable Excavation - Any material containing vegetable or organic matter, such as muck, peat, organic silt, or slurry from hydro-excavation shall be considered unsuitable for use in embankment construction. Any material meeting the Unified Soil Classification System, as defined by ASTM D2487, for ML, MH, OL, OH, and Pt soil designation shall also be considered unsuitable and not be hauled to the EMMS. This material will be disposed of offsite at a licensed disposal site.

008-3 SCOPE OF WORK

Under this contract, the site will be operational at a minimum of five (5) days a week, Monday through Friday, 7:00 am – 5:00 pm with nights and Saturday to be operated an as needed basis not to exceed forty (40) hours a month.

Site work activities and operations will be outside of the Airport’s Air Operations Area (AOA). The Contractor shall be responsible for reviewing all existing conditions associated with the work prior to commencement of work activities.

A. EAD DCC Coordination - Under the guidance of the OAR, multiple projects will be utilizing the EMMS at a given time both importing and exporting materials. The EMMS Operator must verify classification of incoming materials along with OAR. Other Project Contractors will submit the necessary forms for EAD approval prior to beginning of hauling operations.

B. EAD coordination for the EMMS Operator and Other Project Contractors - Adhere to the CMMP requirements. Prior to placing any material at the EMMS, the Contractor shall have an approved Environmental Authorization to Transfer Soil Form, and sample results below threshold amount for the applicable COC. No contaminated material is allowed at the EMMS.

C. Site Operations - Other project contractors shall haul materials to the designated location within the EMMS and unload it in the appropriate stockpile that is based on material designation verified by the OAR. The EMMS Operator must provide the equipment, and personnel for storing incoming materials and supplying existing materials to different projects. Operations will be such to support other projects needs and schedule. The EMMS Operator may be required to coordinate with other Project Contractors to meet project demand.

D. Site Access and Security: The EMMS Operator will supply a security checkpoint at the EMMS site access point to verify material source project and type of material. After verification, the Contractor will direct other project contractors via signage and onsite personnel to the appropriate stockpile. EMMS Operator is responsible
for ensuring only material with an approved Environmental Authorization to Transfer Soil Form is placed in the EMMS. The EMMS Operator is responsible for all sampling, haul off, and disposal as a result of any illicit hauling. The security checkpoint shall be staffed at all times the EMMS is open. The EMMS shall be locked and secured when not in use. EMMS Operator to provide and maintain a single lock at the EMMS entry gate. The EMMS Operator is responsible for the proper disposal of any illicit dumping that may occur at the site.

E. Site Maintenance - The EMMS Operator will be responsible for maintaining the EMMS with supervision and direction from the OAR, including maintenance of access/security, erosion control, stockpile shaping to slopes no steeper than 3:1, site entrance, site access roads, signage, site drainage, barrier placement, material segregation, associated basins and other maintenance activities as directed by the OAR.

F. Environmental Permits- The EMMS Operator will be responsible for obtaining the applicable air and water permits for operation of the EMMS.

G. Dust Control - The EMMS Operator will be responsible for dust control at all times during the EMMS site operation.

H. Weekly Reporting: The EMMS Operator must submit a weekly report throughout the duration of the contract duration outlining a running quantity of existing materials sorted according to their type and source (project origin). The report should also include photographs of hauling operations, weigh station reading log, major stockpiles, material imported in that week, material exported in that week and a final quantity breakdown based on project source and material type.

I. Quantity Survey: A annual survey will be performed by the EMMS Operator of the quantities of material at the EMMS. This will serve to verify the quantities listed in the material management tracking spreadsheet maintained by the EMMS Operator.

J. 7460 Airspace Study: A 7460 Airspace study has been completed by DFW and approved by the FAA. DFW shall ensure that the 7460 Airspace Application remains current and valid for all EMMS activities during operation. The EMMS Operator must abide by the height restrictions outlined in the 7460 Airspace Application.
Existing and projected (2020 to 2025) material quantities for the EMMS are presented below:

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Existing Material Quantity at EMMS</th>
<th>Material Quantity Processed at EMMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable Soil</td>
<td></td>
<td>934,000CY in / 989,000CY out</td>
</tr>
<tr>
<td>Topsoil</td>
<td>Nil</td>
<td>170,000 CY in / 170,000 CY out</td>
</tr>
<tr>
<td>Reclaimed Aggregate Base (RAB)</td>
<td>25,000 tons</td>
<td>150,000 tons in / 50,000 tons out</td>
</tr>
<tr>
<td>Recycled Concrete Base (RCB)</td>
<td>160,000 tons</td>
<td>939,000 tons to be crushed / 950,000 tons out</td>
</tr>
<tr>
<td>Asphalt Millings</td>
<td>40,000 tons</td>
<td>155,000 tons* in / 50,000 tons out</td>
</tr>
</tbody>
</table>

* - Max amount that can be accepted

**008-4 METHOD OF MEASUREMENT**

EMMS Maintenance & Management will be measured by the month.

**008-5.1 BASIS OF PAYMENT**

The work performed and materials furnished in accordance with this item and measured as provided under “Method of Measurement” will be paid for the unit price for EMMS Operation and Maintenance.

The owner reserves the right to terminate the EMMS Operation and Maintenance with a 30 days’ notice and no obligation to fulfil the total contract sum or any particular amount/duration.

**END OF ITEM M-008**
Item M-009 Concrete Crushing

DESCRIPTION

009-1.1 GENERAL. Furnish all labor, materials, equipment, and processes required for the setting up, operating and removal of a portable crushing plant and associated equipment capable of producing crushed recycled concrete pavement in accordance with this specification. This work will include site restoration at the end of operations.

009-1.2 DESCRIPTION OF WORK. The Contractor will be responsible for setting up a portable crushing plant and associated equipment on or near the project site adjacent to the existing concrete recyclable materials stockpile(s), at a location as determined by the Engineer; crushing the concrete to the specified gradation, and leaving properly constructed separate stockpiles of the products for utilization. Only concrete from the Owner’s supplied recyclable materials stockpile or material delivered from current Airport projects shall be utilized in crushing operations.

Upon completion of the crushing operations, the Contractor shall remove the crushing plant, associated equipment and any necessary site utilities from airport property and restore the site at no additional cost to the Owner.

009-1.3 SUBMITTALS.

a. Prior to beginning the work, the Contractor shall submit a Work Plan at the Pre-Construction conference to the Engineer for approval. The Work Plan shall include a description of all equipment and processes that will be utilized to crush the concrete to the specified gradations, estimated daily production, expected duration of crushing operations, estimated total quantities of each aggregate gradation, estimated duration of mobilization and demobilization, removal of steel and deleterious materials, set up and calibration of weighing equipment, and stockpile management. No work is to commence until the Work Plan has been approved by the Engineer.

b. The Contractor shall submit a Dust Control Plan for the methods for accomplishment for the alleviation and prevention of dust nuisance originating from construction operations within the project limits in accordance with Specification 01 52 13 Dust Control. The Contractor shall have a sufficient number of operating vacuum power sweepers and operators on the job site at all times.

c. The Contractor shall submit a Waste Management Plan and comply with reporting requirements in accordance with Specification 01 74 19 Construction Waste Management and Disposal.

d. Comply with all applicable City, State and Federal governmental regulations regarding crushing operations. The Contractor shall obtain all required permits and submit copies to the Engineer before starting any pre-processing or crushing operations.
009-2.1 RECYCLED CONCRETE BASE. Recycled Concrete Base (RCB) shall consist of clean, sound, durable particles and shall be free from coatings of clay silt, organic material, and other objectional materials. Aggregate shall contain no clay lumps or balls. must meet the following gradation when tested per ASTM C117 and ASTM C136:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by Weight Passing Sieves</th>
<th>OAR to Insert Final “Job Mix” Gradation</th>
<th>“Job Mix” Tolerance Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”</td>
<td>100</td>
<td>--</td>
<td>-</td>
</tr>
<tr>
<td>3”</td>
<td>90 – 100</td>
<td>±5</td>
<td></td>
</tr>
<tr>
<td>¾”</td>
<td>30 – 70</td>
<td>±8</td>
<td></td>
</tr>
<tr>
<td>½”</td>
<td>20 – 60</td>
<td>±8</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>35 maximum</td>
<td>±8</td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td>20 maximum</td>
<td>±5</td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>0 - 5.0</td>
<td>±3</td>
<td></td>
</tr>
</tbody>
</table>

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.

The fraction passing the No. 40 sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than four (4) when tested per ASTM D4318. The fine aggregate shall have a minimum sand equivalent value of 35 when tested per ASTM D2419.

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.

Recycled concrete aggregate shall consist of Portland cement concrete (PCC) or other concrete containing pozzolanic binder material. The recycled concrete material shall be free of reinforcing steel, expansion material, PVC pipes, recycled asphalt pavement, metal, geotextile fabrics and other objectional materials. Asphalt concrete overlays shall be removed from the PCC surface prior to pavement removal and crushing.

009-2.2 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 of this section. 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 Owner’s Authorized Representative (OAR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements of this section. 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 OAR.
c. **Flat and elongated particles.** The amount of flat and elongated particles in recycled concrete aggregate shall not exceed 20% for the fraction retained on the 1/2 inch sieve nor 20% for the fraction passing the 1/2 inch sieve when tested per ASTM D4791. A flat particle is one having a width to thickness ratio greater than 3; an elongated particle is one having a length to width ratio greater than 3.

d. **Percentage wear.** The percentage of wear shall not be greater than 45% when tested per ASTM C131. The sodium sulfate soundness test (ASTM C88) requirement is waived for recycled concrete aggregate.

Material shall meet the requirements in paragraph 299-2.2. 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 OAR.

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**009-2.3 EXISTING PCC STOCKPILES.** The Contractor shall satisfy himself as to the nature of the recyclable (metals) materials located as referenced above and provide all required labor, materials, equipment and processes in order to maximize the amount of coarse aggregate concrete product produced so that the production of the recycled concrete based is optimized.

It is the responsibility of the Contractor to remove such recyclable (metal) material prior to crushing operations. The Contractor shall dispose of the recyclable (metal) unsuitable materials directed by the Engineer, at no additional cost to the Owner.

**009-2.4 EQUIPMENT.** All equipment necessary to mix, transport, place, compact, and finish the recycled concrete aggregate base course shall be furnished by the Contractor. The Contractor shall provide written certification to the Engineer that all equipment meets the requirements for this section. The equipment shall be inspected by the Engineer at the job site prior to the start of construction operations.

**009-2.5 CRUSHING EQUIPMENT.** The Contractor shall provide a portable tracked or wheel mounted jaw type crusher with a minimum size of 32 inches by 58 inches, capable of handling larger sized concrete in order to maximize the amount of coarse product produced. The feed particle size should be sufficiently large enough to be capable of maximizing the percentage of 3 inch material. The Engineer will periodically check the crushing operations and percentages of recycled concrete base gradations produced. A grizzly screen may be required for removals. The Engineer will make the final determination of the adequacy of the Contractor's crushing operations.

Crusher and screen(s) to be track or wheel mounted in order to facilitate quick site movement as directed by the Engineer. The equipment shall be capable of being portable enough to facilitate movements of short distances on site in order to better access the recyclable materials stockpiles and accommodate operational constraints of an active airport, if so directed by the Engineer, without any additional mobilization/demobilization costs to Owner.

A magnetic or other suitable device or method of separating steel from the concrete to be crushed into the aggregate gradation listed shall be used. Hand picking may also be required in order to remove all steel and other metals. The Contractor shall take possession of the steel/metals for legal recycling off the airport property at his discretion. No steel/metals are to
remain on the airport property. Contractor shall comply with the requirements of Specification 01 74 19 Construction Waste Management and Disposal.

Verification of production for payment purposes will be through the means of a belt scale located on the jaw type crusher discharge belt. The scale shall be initially calibrated by a certified outside agency or calibration service utilizing weights traceable to the National Institute of Standards and Technology (NIST) in the presence of the Engineer. Thereafter, the belt scale shall be re-calibrated weekly by the Contractor, in the presence of the Engineer, to ensure accurate measurement. The scale shall have a digital display and be read daily in the presence of the Engineer for verification and be capable of printing weigh tickets for submission to the Engineer daily. Handwritten delivery tickets are not permitted.

If directed by the Engineer, the Contractor shall furnish, set up and calibrate a portable truck scale for Engineer’s use in weighing the finished product for the duration of crushing of the recyclable materials stockpiles. The scale shall be calibrated by the certified outside agency or calibration service utilizing weights traceable to the National Institute of Standards and Technology (NIST) in the presence of the Engineer at the start of operations. The Engineer may request that the portable scale remain for a period of time after crushing operations have ceased. The scale shall have a digital readout display and be capable of printing weigh tickets for submission to the Engineer daily. Handwritten delivery tickets are not permitted.

Impact type crushers may be allowed for producing recycled concrete base at the discretion of the Engineer. The use of impact type crushers shall be submitted to the Engineer for approval prior to use.

**CONSTRUCTION METHODS**

**009-3.1 GENERAL.** The Contractor will be operating his equipment on and near an operating airport. The Contractor shall carry out his operations in a manner that will minimize interference with air traffic, and shall be required to cooperate with the FAA, Airport Operations, the Engineer, the Owner, the airlines, surrounding communities and other contractors working in the area. The Contractor shall not interfere with any public access along any public street at any time and obtain any necessary permits and submit copies to the Engineer. The Contractor shall comply with requirements of Specification 01 35 13.13 Special Project Procedure for Airport Facilities.

**009-3.2 OPERATIONS.** The Engineer will periodically check the crushing operations and percentages and quality of products produced. The Engineer will make the final determination of the adequacy of the Contractor’s operations and the amounts and proportions of products being produced.

The first pass of the jaw type crusher is to be screened over a portable tracked or wheel mounted screen in order to remove deleterious material. Oversized product is to be re-fed through the jaw type crusher. Remove deleterious materials separated in the crushing process. The use of a grizzly screen may be required for this operation. Hand picking may also be required in order to remove deleterious materials such as reinforcing bars, PVC pipes, geotextile fabric, etc.

The Contractor is to visually survey the feed stockpiles and modify his processes as required and furnish equipment and labor capable of removing, minimizing or distributing any deleterious materials.
materials in a random manner in the finished product. Use of a grizzly screen may be required. The Contractor shall maintain stockpiles in order to minimize the incorporation of deleterious material.

The Contractor shall properly manage and secure all stockpiles. Sites for stockpiles shall be cleaned of deleterious materials which could contaminate the stockpiles. Separate free-draining stockpiles free of segregation shall be provided for the various products produced. Stockpiles shall be kept separate to prevent intermingling at the base. If partitions are used, they shall be of sufficient heights to prevent intermingling. Maintain haul roads in the vicinity of access to stockpiles. When loading out of stockpiles, the vertical faces shall be limited to reasonable heights to eliminate segregation due to tumbling. Maintain height of stockpiles to prevent segregation and comply with Airport Operations or FAA height restrictions. Segregation or degradation due to improper handling, stockpiling or loading out of stockpiles will be just cause for rejection of the material. The Engineer will make the final determination as to the acceptability of each product.

The Contractor shall protect any and all existing utilities and facilities to remain on the site. The Contractor shall contact coordinate with the appropriate entities as required to locate and mark all utilities in the vicinity of the Work, prior to any activity.

**009-3.3 ACCEPTANCE SAMPLING AND TESTING.** Samples of recycled concrete aggregate to check gradation shall be taken every 2,500 tons of material produced or a minimum of one test every two weeks; whichever is more frequent. Sampling locations shall be determined on a random basis in accordance with statistical procedures contained in ASTM D3665. Sampling shall be per ASTM D75, and testing shall be per ASTM C136 and ASTM C117.

Crushing operation at the jobsite will be subject to monitoring by the Engineer to ensure that the material is clean and meets the requirements. Uniformity in production of clean recycled concrete and uniformity of placement in the field free of segregation are required. Precautions shall be taken to avoid segregation of material in the stockpile or during placement.

**METHOD OF MEASUREMENT**

**009-4.1 CONCRETE CRUSHING.** Measurement for this item will be per Ton of crushed product placed in the finished product stockpiles through the means of a belt scale located on the jaw crusher discharge belt. The belt scale shall be read daily in presence of the OAR and a printed ticket provided daily to the OAR. Final quantities will be verified by the OAR by means of surveying the product stockpiles by field cross-sections computed by the surface to surface method.

**BASIS OF PAYMENT**

**009-5.1 PAYMENT.** Payment for this item will be made at the contract unit price per ton, which constitutes full compensation for furnishing all equipment and materials; for all preparation and equipment set-up, pre-processing and processing of the recycled materials; removal and disposal of deleterious materials within the Airport; removing and recycling steel /
metals off of the Airport; and for all labor, supervision, equipment, tools and incidentals necessary to complete this item.

The quantity of this bid item is an assumed quantity for bidding purposes. A unit weight of 135 pounds per cubic foot has been utilized to estimate the tonnage of crushed concrete generated by the waste materials in this project. Payment will be made for actual quantities as completed by the Contractor as approved by the OAR.

No additional payment will be made for the double handling of material from project site to the EMMS or delivery of materials between the locations. No additional payment will be made for any necessary site facilities and site restorations at the end of operations.

The owner reserves the right to terminate the concrete crushing operation with a 30 days’ notice and no obligation to fulfil the total contract sum or any particular amount.

END OF ITEM M-009
ITEM P-101 DEMOLITION AND ABANDONMENT

DESCRIPTION

101-1.1 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. The remediation of the asbestos in the existing concrete joints shall be performed in accordance with the Asbestos Inspection Report attached to this specification.

EQUIPMENT AND MATERIALS

101-2.1 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.

101-2.2 All waste material shall be disposed of offsite at a licensed disposal site approved for waste materials in accordance with Section 01 74 19, unless specified otherwise.

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.

a) Concrete pavement removal. Prior to the removal of any concrete pavement the asbestos in the joints must be remediated in accordance with the Asbestos Inspection Report attached to this specification. Full depth saw cuts shall be made perpendicular to the slab surface. The Contractor shall saw through the full depth of the slab including any dowels at the joint, removing the pavement and installing new dowels as shown on the plans and per the specifications. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, the perimeter shall be saw cut the full depth of the pavement. The pavement inside the saw cut shall be removed by methods which will not cause distress in the pavement which is to remain in place. All concrete shall be saw cut into manageable sizes and transported to the East Materials Management Site. Concrete slabs that are damaged by under breaking shall be repaired or removed and replaced as directed by the RPR. Any concrete slurry generated from the sawing and subsequent removal shall be cleaned up immediately and continuously to the satisfaction of the RPR.

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Spall and underbreak repair shall be in accordance with the plans. Any underlaying material that is to remain in place, shall be recompacted and/or replaced as shown on the plans. Adjacent areas damaged during repair shall be repaired or replaced at the Contractor’s expense.

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. If the material is to be wasted on the airport site, it shall be broken to a maximum size of 1.5 inches.

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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.

d) **Stabilized Base.** Stabilized base consists of cement treated/stabilized subbase. The existing stabilized base to be removed shall be freed from the stabilized base to remain by sawing through the complete depth of the stabilized base at final removal limits. The stabilized base within 2 feet of this saw cut shall be carefully broken up and removed using hand-held jackhammers, weighing 30 pounds or less, or other light duty equipment which will not cause distress in the stabilized base that is to remain. Outside of this area the Contractor shall use methods that will not cause damage to the underlying subbase material. Once removed the stabilized base shall be disposed of off airport property. Any damage to the underlying course or stabilized base to remain shall be repaired to the satisfaction of the RPR at no additional cost to the Owner.

101-3.2 **MILLING.** Milling shall be performed with a power-operated milling machine or grinder, capable of producing a finished surface that provides a good bond to the new overlay. The milling machine or grinder shall operate without tearing or gouging the underlying surface. The milling machine or grinder shall be equipped with automatic grade and slope controls. All millings shall be removed and disposed of Airport property, unless otherwise specified. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material that was removed with new material at no additional cost to the Owner.

a) **Clean-up.** The Contractor shall sweep the milled surface daily and immediately after the milling until all residual aggregate and fines are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or below the surface to remove any remaining aggregate or fines.

101-3.3 **REMOVAL OF STORM PIPE AND OTHER UTILITIES.**

a) **Storm pipe removal.** Pipe Removal shall include the demolition of drainage piping as designated on the Plans. Removal shall be performed in a manner that does not disrupt the conveyance of the system that is being demolished. Where the limit of pipe removal is not at a structure it shall be neatly cut from the pipe that is to remain. Where the limit of pipe removal is at a structure that is to remain, the pipe shall be neatly cut at a distance of no more than 12 inches from the structure and capped in a manner that is acceptable to the RPR. The section of pipe remaining shall be filled flush with the interior wall of the structure with CLSM. Any damage to remaining pipes or structures shall be repaired by the Contractor, at no additional cost to the Owner, to the satisfaction of the RPR. The void remaining after the drainage pipe removal shall be restored in accordance with Paragraph 101-3.10. Removed pipe shall be disposed in accordance with Paragraph 101-2.2.

b) **Conduit and Ductbank Removal.** Conduit Removal and Duct Bank shall consist of the removal of electrical conduit or ductbanks as depicted on the Plans. Prior to the removal of any conduit or Duct Bank the Contractor shall insure that all cabling has been removed in accordance with Item L-105. The conduit shall be neatly cut at the limit of removal. Any damage to conduits that are to remain in place shall be repaired by the Contractor to the satisfaction of the RPR, at no additional cost to the Owner. Where the removal limit is indicated at a structure the Contractor shall neatly cut and carefully remove the duct bank or conduit a minimum of 12-inches from the outside face of the structure. All conduits or ducts shall be capped in a manner to allow for future connections. The void remaining following the removal of...
of the conduit or duck bank shall be restored in accordance with Paragraph 101-3.10. All materials removed shall be disposed of in accordance with Paragraph 101-2.2.

101-3.4 REMOVAL OF STRUCTURES.

a) Miscellaneous Structure Removal. Miscellaneous structure removal shall include the demolition of inlets, storm manholes, storm pipe end treatments, airfield guidance sign foundations, transformer foundations, electrical manholes, electrical handholes, and any other structures not defined in this specification as depicted on the plans.

1) Structures less than or equal to five feet below finish grade: For structures that are 5 feet deep or less in relationship to finish grade the Contractor shall remove the entire structure. The void remaining following the removal of the foundation shall be restored in accordance with Paragraph 101-3.10. All materials removed shall be disposed of in accordance with Paragraph 101-2.2.

2) Structures greater than five feet below finish grade: For structures that are deeper than 5 feet below finish grade, the top section of the structure that is within 5 feet of finish grade shall be removed from the structure. The remaining structure shall be broken up into smaller pieces no larger than 2 feet in any dimension. The removed portion of the structure can be disposed of within the structure remaining in place. Following the demolition of the structure the void spaces shall be filled with CLSM. The void remaining following the placement of the CLSM shall be restored in accordance with Paragraph 101-3.10. All materials removed shall be disposed of in accordance with Paragraph 101-2.2.

101-3.5 REMOVAL OF FENCING.

a) AOA Fence and Mow Strip Removal. The removal of the AOA fence and mow stripe shall include the removal of the chain link AOA fencing, barbed wire, razor wire, concrete mow strip at the base of the fence, and any foundations associated with the fence post or CASS post as depicted on the Plans. No removal of the AOA fence shall begin until the new AOA fence and associated connection points have been installed and accepted by the RPR. No break in the fencing will be permitted at any time. All signage on the fence and chain link fabric shall be turned over to the Owner in the same condition as they exist. The void(s) remaining following the removal of the foundations and mow strip shall be restored in accordance with Paragraph 101-3.10. All materials removed that are not turned over to the Owner shall be disposed of in accordance with Paragraph 101-2.2.

b) Non-AOA Fence Removal. The removal of the Non-AOA fence shall include the removal of the chain link fencing, gates, and any foundations associated with the fence post as depicted on the Plans. All signage on the fence shall be turned over to the Owner in the same condition as they exist. The void(s) remaining following the removal of the foundations shall be restored in accordance with Paragraph 101-3.10. All materials removed shall be disposed of in accordance with Paragraph 101-2.2.

c) Cass Removal. The removal of the CASS adjacent to the AOA fence consist of the removal of the post and wire system above the elevation of the concrete mow strip. All material removed shall be disposed of off in accordance with Paragraph 101-2.2.

d) Concrete Barrier Removal. The concrete barriers shall be removed at the locations shown on the plans. All materials removed shall be disposed of in accordance with Paragraph 101-2.2.

101-3.6 BOLLARD REMOVAL. Bollard Removal consist of the removal of bollards and their associated foundations at the locations depicted on the Plans. The removal of the bollards adjacent to the AOA fencing shall not be removed until approved by the RPR. The void remaining following the removal of the bollard shall be restored in accordance with Paragraph 101-3.10. All material shall be disposed of in accordance with Paragraph 101-2.2.
101-3.7 ROADWAY SIGN REMOVAL. The removal of roadway signs consists of the removal of the sign, post, and associated foundation. The void remaining following the removal of the foundation shall be restored in accordance with Paragraph 101-3.10. The sign shall be turned over to the Owner and all other material shall be removed shall be disposed of in accordance with Paragraph 101-2.2.

101-3.8 LIGHT BASE REMOVAL

a) In Asphalt Pavement or Turf. Light Base Removal in Bituminous Pavement or Turf shall consist of the removal of L-867 or L-868 light bases at the locations depicted on the Plans. Prior to the removal of the light base all fixtures, cable, transformers, and any other electrical appurtenances shall be removed from the base can in accordance with Item L-105. Any damage to conduits that are to remain in place shall be repaired by the Contractor, at no additional cost to the Owner, to the satisfaction of the RPR. The void remaining following the removal of the foundation shall be backfilled and compacted in accordance with Paragraph 101-3.10. All materials removed shall be disposed of in accordance with Paragraph 101-2.2.

b) In PCC Pavement. Light Base Removal in PCC Pavement shall consist of the removal of a L-867 or L-868 light bases at the location depicted on the Plans. Prior to the removal of the light base all fixtures, cable, transformers, and any other electrical appurtenances shall be removed from the base can in accordance with Item L-105. Following the removal of the PCC pavement and prior to the removal of the base can the Contractor shall core the stabilized base course a minimum diameter of 3-feet centered on the base can. The void remaining following the removal of the base can shall be filled in accordance with Item L-123. All materials removed shall be disposed of in accordance with Paragraph 101-2.2.

101-3.9 ABANDONMENT OF UTILITIES OR STORM PIPES. When the size of the utility is smaller than 2 inches in diameter, the utility shall be capped in a manner that is acceptable to the RPR and abandoned in place. When the size of the utility is larger than 2 inches in diameter it shall be filled solid by pumping grout or CLSM into the utility and capped. Prior filling the pipe that is to be abandoned the Contractor shall excavate and cap the downstream end of the pipe and core or punch a 6-inch diameter weep holes in the top of the pipe at an interval of no more than 50 feet in turf areas. This interval may be increased as directed by the RPR based on Contractor’s performance. The purpose of the weep hole is to ensure the pipe is filled solid. Upon the completion of the filling of pipes any excavated area shall be restored in accordance with Paragraph 101-3.10.

101-3.10 RESTORATION. Following the removal, demolition, or abandonment of the various items the Contractor shall restore the area as described below:

a) Turf Areas. In turf areas outside of the limits of the site grading the Contractor shall backfill the void created as a result of demolition activities with material that is similar to the surrounding material not affected by the demolition activities. This material shall be placed and compacted in accordance with Item P-152 to the same elevation as the surrounding area. Following the placement of this material the area shall be seeded and mulched in accordance with Section 32 92 19.

In turf areas that are within the limits of the site grading the Contractor shall backfill the void created as a result of the demolition activities with material that is similar to the surrounding material not affected as a result of the demolition activities. This material shall be placed and compacted in accordance with Item P-152 to the elevation of the surrounding area.

b) Under New Paved Areas. In areas that will be paved the void remaining following the demolition activities shall be backfilled with CLSM to the bottom of the over excavation.
c) Gravel Areas. In gravel areas, the void remaining following the demolition activities shall be backfilled with material that is similar to the surrounding material not affected by the demolition activities. This material shall be placed and compacted in accordance with Item P-152 to the bottom elevation of the existing gravel. The gravel shall be replaced in-kind with the material that was removed as part of the demolition activities.

METHOD OF MEASUREMENT

101-4.1 PAVEMENT OR STABILIZED BASE REMOVAL. The measurement for pavement removal shall be per each square yard of pavement removed and accepted by the RPR based on the depth shown on the plan regardless of the in-place depth.

101-4.2 MILLING. Measurement for payment of milling of asphalt and concrete shall be made per square yard based on the area shown on the plans. Any milling of pavement outside the preapproved 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. Milling shall include all sawcutting, hauling and disposal (including disposal fees) of pavement necessary to facilitate removal.

101-4.3 ABANDONMENT OF UTILITIES OR STORM PIPES. The measurement for the abandonment of utilities or storm pipes shall be measured by the linear foot of the utility abandoned in place and accepted by the RPR. Measurement shall be along the centerline of the pipe to the limit shown on the plans. Where the limit is at a structure the measurement shall be to the inside face of the structure.

101-4.4 REMOVAL OF STORM PIPES. The removal of storm pipe shall be measured by the linear foot of storm pipe removed and accepted by the RPR. Measurement shall be made along the centerline of the pipe from the outside face of the adjoining structure(s).

101-4.5 AOA FENCE AND MOW STRIP REMOVAL. The measurement for the removal of the AOA fence and mow strip shall be based on the linear feet of fencing that is removed and accepted by the RPR. Measurement shall be based on the distance along the ground along the centerline of the fence from the center of the post that is to remain or at bends in the fence.

101-4.6 BOLLARD REMOVAL. The measurement of bollards removed shall be per each bollard removed and accepted by the RPR.

101-4.7 REMOVAL OF LIGHT BASE IN BITUMINOUS PAVEMENT OR TURF. The measurement for the removal of light bases in bituminous pavement or turf shall be per each light base removed and accepted by the RPR.

101-4.8 REMOVAL OF LIGHT BASE IN PCC PAVEMENT. The measurement for the removal of light bases from PCC pavement shall be per each light base removed and accepted by the RPR.

101-4.9 REMOVAL OF CONDUIT OR DUCTBANK. The removal of conduit or ductbanks shall be measured by the linear foot for duct bank or conduit removed and accepted by the RPR. Measurement shall be made along the centerline of the conduit or duct bank from the outside face of structures when the limit of removal is at a structure.
101-4.10 ROADWAY SIGN REMOVAL. The measurement for the removal of roadway signs shall be per each sign removed and accepted by the RPR.

101-4.11 REMOVAL OF MISCELLANEOUS STRUCTURES. The measurement of miscellaneous structures shall be made per each miscellaneous structure removed and accepted by the RPR.

101-4.12 REMOVAL OF ASBESTOS JOINT COMPOUND. The measurement of asbestos joint removal shall be made per the linear foot of joint seal containing asbestos that is removed and accepted by the RPR.

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.

Item P-101-5.1 Removal of Reinforced Concrete Pavement (15 to 20-Inch) – per square yard
Item P-101-5.2 Removal of Reinforced Concrete Pavement (6 to 8-Inch) – per square yard
Item P-101-5.3 Removal of Asphalt Pavement (Less Than or Equal To 6-Inch) – per square yard
Item P-101-5.4 Removal of Asphalt Pavement (Greater Than 6-Inch) – per square yard
Item P-101-5.5 Milling of PCC Pavement – per square foot
Item P-101-5.6 Abandonment of Storm Pipe – per linear foot
Item P-101-5.7 Removal of Storm Pipe (Inner Diameter Less Than or Equal To 42-Inch) – per linear foot
Item P-101-5.8 Removal of Storm Pipe (Inner Diameter Greater than 42-Inch) – per linear foot
Item P-101-5.9 CASS Removal – per linear foot
Item P-101-5.10 AOA Fence and Mow Strip Removal – per linear foot
Item P-101-5.11 Bollard Removal – per each
Item P-101-5.12 Light Base Removal in Bituminous Pavement or Turf – per each
Item P-101-5.13 Light Base Removal in PCC Pavement – per each
Item P-101-5.14 Conduit Removal – per linear foot
Item P-101-5.15 Ductbank Removal – per linear foot
Item P-101-5.16 Roadway Sign Removal – per each
Item P-101-5.17 Structure Removal (Less Than or Equal To 5-Foot Depth) – per each
Item P-101-5.18 Structure Removal (Greater Than 5-Foot Depth) – per each
Item P-101-5.19 Asbestos Joint Removal – per linear foot
Item P-101-5.20 Removal of Stabilized Base – 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.

APPENDIX

Appendix A: Limited Asbestos Inspection. A Limited Asbestos Inspection was performed on buildings used for airfield operations in the Airfield Operations Area.

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. This shall include the removal of any aggregate materials in the existing pavement structure, or surface roadway. All excess material (beyond that required for the embankments) shall be placed in the material management site shown on the plans. Only the following Unified Soil Classification System designations, as defined in ASTM D2487, shall be considered suitable: GW, GP, GM, GC, SW, SP, SM, SC, ML, CL, and CH soils.

b. Unsuitable Excavation. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod, or not identified as Unclassified excavation in Paragraph 152-1.2.a shall be considered unsuitable for use in embankment construction. Material that is classified as Unsuitable Excavation may be used for topsoil in the top 4-inches in all proposed green areas when approved by the RPR, per Section 32 92 19, as to minimize required suitable embankment material. Material that is determined to be unsuitable shall be disposed off airport property in accordance with Section 01 74 19.

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

CONSTRUCTION METHODS

152-2.1 GENERAL. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared or cleared and grubbed.

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

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

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

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

   a. **Blasting.** Blasting shall not be allowed.

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

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

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

Existing grades on the design cross sections or DTM’s, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM’s. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within 0.1 foot of the stated elevations for ground surfaces, or within 0.04 foot for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered “no change”. Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's verification identifies discrepancies in the topographic map, Contractor shall notify the RPR in writing at least two weeks before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM’s. Disturbance of existing grade in any area shall constitute acceptance by
the Contractor of the accuracy of the original elevations shown on the topographic map for that area.

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

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

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as directed by the RPR.

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 cubic yard for unclassified excavation. The excavated area shall be backfilled with suitable material obtained from the grading operations 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 in accordance with Item P-101.

e. **Excavation and Sorting of Recyclable Material.** Recyclable material such as large chunks of concrete or asphalt, or materials otherwise considered unsuitable for embankment construction with maximum dimension exceeding two feet in any direction shall be sorted. Concrete and asphalt must be delivered to the East Material Management Site as shown on the drawings or as instructed by the Engineer. All other materials shall be considered refuse and defined below.
Refuse Material. Any material containing trash, bagged refuse, demolition debris, and any material that is by general definition, garbage and is not material defined above as Recyclable Material shall be sorted from other classifications and transported off site to an approved licensed disposal facility per Section 01 74 19. The contractor must submit a licensed disposal facility to the Engineer for approval.

f. **Sulfate Testing.** In areas to receive lime treatment per Item P-155, the Contractor shall test the subgrade to determine the sulfate levels. The sulfate testing shall be performed on a minimum of 50-foot spacings by a geotechnical engineer licensed in the state to Texas. The sulfate tests shall be conducted in accordance with TEX-146-E.

Wherever subgrade soils containing high sulfate concentrations (greater than 3,000 ppm) remain after the placement of the subgrade, these high sulfate soils should be over-excavated to a depth of at least 4 inches below the proposed bottom of lime-treated subgrade and replaced full depth with clay soils containing low sulfate concentrations. The lower 4 inches of clay fill should be compacted at optimum to +3% above optimum moisture to a minimum of 98% Standard Proctor density (ASTM D698). The upper lifts should be compacted during the lime-treatment operations.

g. **Contaminate Media Testing.** In areas identified on the plans, the Contractor shall perform testing in accordance with Item 01 33 29.06.01.

152-2.3 **BORROW EXCAVATION.** Not Used

152-2.4 **DRAINAGE EXCAVATION.** Not Used

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 24 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 D698. 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 24 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 non-cohesive material in each lift shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. If onsite cohesive soils are used for embankment, the material shall be placed at +2% to +5% above optimum moisture content in accordance with ASTM D698. The material shall be moistened or aerated as necessary to achieve a uniform moisture content throughout the lift. Natural drying may be accelerated by blending in dry material or manipulation alone to increase the rate of evaporation.

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

The Contractor will take samples of excavated materials which will be used in embankment for testing to develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with ASTM D698. A new Proctor shall be developed for each soil type based on visual classification.

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

If the material has greater than 30% retained on the 3/4-inch sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.
Rolling operations shall be continued until the embankment is compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D698. Under all areas to be paved, the embankments shall be compacted to a depth of 24 inches and to a density of not less than 100 percent of the maximum density as determined by ASTM D698. 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 or sodding in accordance with Item 32 92 19.

The in-place field density shall be determined in accordance with ASTM D1556 or 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 or other items.

**152-2.9 PROOF ROLLING.** The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. Before start of embankment, and after compaction is completed, the subgrade area shall be proof rolled with
a 20 ton Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to 100 psi in the presence of the RPR. Apply a minimum of 2 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 24 inches and to a density of not less than 100 percent of the maximum dry density as determined by ASTM D698. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D698.

The non-cohesive material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction. If onsite cohesive soils are used for embankment, the material shall be placed at +2% to +5% above optimum moisture content in accordance with ASTM D698. When the material has greater than 30 percent retained on the 3/4-inch sieve, follow the methods in ASTM D698. Tests for moisture content and compaction will be taken at a minimum of 1000 square yards of subgrade. All quality assurance testing 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 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 within 12 months prior to its use on this contract. The gage shall be field standardized daily.

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

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

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

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

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.
152-2.12 HAUL. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

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

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

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

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

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

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

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

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans and as required in Item T-905. No direct payment will be made for topsoil under Item P-152. It shall be considered incidental to the placement of the sodding.
METHOD OF MEASUREMENT

152-3.1 Measurement for payment specified by the cubic yard shall be computed by the comparison of digital terrain model (DTM) surfaces for computation of neat line design quantities. The end area is that bound by the original ground line established by field cross-sections and the final theoretical pay line established by cross-sections shown on the plans, subject to verification by the RPR.

152-3.2 The quantity of excavation to be paid for shall be the number of cubic yards measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

152-3.3 The measurement for the contaminated media testing will be made on a lump sum basis.

BASIS OF PAYMENT

152-4.1 Unclassified excavation Used On-Site 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, hauling on-site, formation of embankments, compaction, proof rolling, testing requirements and other incidentals necessary to complete the item as listed in this specification.

152-4.2 Unclassified excavation Hauled Off-Site 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, hauling offsite as directed by the RPR, and other incidentals necessary to complete the item as listed in this specification.

152-4.3 Payment for unsuitable excavation shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, backfill, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.4 Payment shall be made at the contract unit lump sum price for contaminated media testing. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-152-4.1 Unclassified Excavation Used On-Site – per cubic yard
Item P-152-4.2 Unclassified Excavation Hauled Off-Site – per cubic yard
Item P-152-4.3 Unsuitable Excavation Hauled Off-Site – per cubic yard
Item P-152-4.4 Contaminated Media 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.
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 D2487  Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D6938  Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

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 I/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>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 - 12</td>
</tr>
</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 300 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 at least 35°F and rising. Mixing and placement shall stop when the air temperature is 40°F 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 48 hours or until a compressive strength of 15 psi is obtained. 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 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
ITEM P-155 LIME-TREATED SUBGRADE

DESCRIPTION

155-1.1 This item shall be used for soil modification that require strength gain to a specific level. This item shall consist of constructing one or more courses of a mixture of soil, lime, and water in accordance with this specification, and in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans.

MATERIALS

155-2.1 LIME. Quicklime, hydrated lime, and either high-calcium dolomitic, or magnesium lime, as defined by ASTM C51, shall conform to the requirements of ASTM C977. Lime not produced from calcining limestone is not permitted.

155-2.2 COMMERCIAL LIME SLURRY. Commercial lime slurry shall be a pumpable suspension of solids in water. The water or liquid portion of the slurry shall not contain dissolved material injurious or objectionable for the intended purpose. The solids portion of the mixture, when considered on the basis of “solids content,” shall consist principally of hydrated lime of a quality and fineness sufficient to meet the following chemical composition and residue requirements.

   a. Chemical composition. The “solids content” of the lime slurry shall consist of a minimum of 70%, by weight, of calcium and magnesium oxides.

   b. Residue. The percent by weight of residue retained in the “solids content” of lime slurry shall conform to the following requirements:

   - Residue retained on a No. 6 sieve = maximum 0.0%
   - Residue retained on a No. 10 sieve = maximum 1.0%
   - Residue retained on a No. 30 sieve = maximum 2.5%

   c. Grade. Commercial lime slurry shall conform to one of the following two grades:

   - Grade 1. The “dry solids content” shall be at least 31% by weight, of the slurry.
   - Grade 2. The “dry solids content” shall be at least 35%, by weight, of the slurry.

155-2.3 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.

155-2.4 SOIL. The soil for this work shall consist of on-site materials free of roots, sod, weeds, and stones larger than 2-1/2 inches and have a sulfate content of less than 0.3%.
COMPOSITION

155-3.1 SOIL-LIME MIXTURE. Ten (10) days prior to the commencement of the work, the Contractor shall submit a soil-lime mixture, developed by the Contractor’s laboratory, showing the amount of lime and water required per cubic yard, and procedures for blending the lime/ subgrade mixture for each type of existing soil. The soil-lime mixture shall include process type and number of: lime applications, stages of mixing, slurry injection depths, mixing depths, and depths of compaction lifts. Also, the Contractor shall submit a list of equipment to he used and their relation to method of mix proportioning, spreading, pulverizing and compacting subgrade, slurry injection, jet slurry mixing, and other related work. The soil-lime mixture shall also contain amount of lime, either in sacks or pounds per cubic yard and the amount of water to be used, if slurry method is used. Use the ASTM D 3551 laboratory test method when applicable. Lime material shall be added until a minimum California Bearing Ration (CBR) or 10 is achieved per ASTM D1883.

155-3.2 TOLERANCES. At final compaction, the lime and water content for each course of subgrade treatment shall conform to the following tolerances:

<table>
<thead>
<tr>
<th>Material</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lime</td>
<td>+ 0.5%</td>
</tr>
<tr>
<td>Water</td>
<td>+ 2%, -0%</td>
</tr>
</tbody>
</table>

WEATHER LIMITATIONS

155-4.1 WEATHER LIMITATION. Subgrade shall not be constructed when weather conditions detrimentally affect the quality of the materials. Lime shall not be applied unless the air temperature is at least 40°F and rising. Lime shall not be applied to soils that are frozen or contain frost. Protect completed lime-treated areas by approved methods against the detrimental effects of freezing if the air temperature falls below 35°F. Remove and replace any damaged portion of the completed soil-lime treated area with new soil-lime material in accordance with this specification.

EQUIPMENT

155-5.1 EQUIPMENT. All equipment necessary to grade, scarify, spread, mix and compact the material shall be provided. The Resident Project Representative (RPR) must approve the Contractor’s proposed equipment prior to the start of the treatment.

CONSTRUCTION METHODS

155-6.1 GENERAL. This specification is to construct a subgrade consisting of a uniform lime mixture which shall be free from loose or segregated areas. The subgrade shall be of uniform density and moisture content, well mixed for its full depth, and have a smooth surface suitable for placing subsequent lifts. The Contractor shall be responsible to meet the above requirements.

Prior to any treatment, the subgrade shall be constructed as specified in Item P-152 and shaped to conform to the typical sections, lines, and grades as shown on the plans.
The mixing equipment must give visible indication at all times that it is cutting, pulverizing and mixing the material uniformly to the proper depth over the full width of the cut.

155-6.2 APPLICATION. Lime shall be uniformly spread only over an area where the initial mixing operations can be completed during the same work day. Lime shall not be applied when wind conditions are detrimental to proper application. A motor grader shall not be used to spread the lime. Adequate moisture shall be added to the cement/soil mixture to maintain the proper moisture content. Materials shall be handled, stored, and applied in accordance with all federal, state, and local requirements.

155-6.3 MIXING. The mixing procedure shall be as described below:

a. Preliminary mixing. The full depth of the treated subgrade shall be mixed with an approved mixing machine. Lime shall not be left exposed for more than six (6) hours. The mixing machine shall make two coverages. Water shall be added to the subgrade during mixing to provide a moisture content approximately 3% to 5% above the optimum moisture of the material and to ensure chemical reaction of the lime and subgrade. After mixing, the subgrade shall be lightly rolled to seal the surface and help prevent evaporation of moisture. The water content of the subgrade mixture shall be maintained at a moisture content above the optimum moisture content for a minimum of 4 to 24 hours or until the material becomes friable. During the mellowing period, the material shall be sprinkled as directed by the RPR.

b. Final mixing. After the required mellowing time, the material shall be uniformly mixed by approved methods. Any clods shall be reduced in size by blading, disking, harrowing, scarifying, or by the use of other approved pulverization methods. After curing, pulverize lime treated material until 100% of soil particles pass a one-inch sieve and 60% pass the No. 4 sieve when tested dry by laboratory sieves. If resultant mixture contains clods, reduce their size by scarifying, remixing, or pulverization to meet specified gradation.

155-6.4 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. Control strips that do not meet specification requirements shall be reworked, re-compact ed, or removed and replaced at the Contractor’s expense. Full operations shall not continue until the control strip has been accepted by the RPR. Upon acceptance of the control strip 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.

155-6.5 TREATMENT APPLICATION AND DEPTH CHECKS. The depth and amount of stabilization shall be measured by the Contractor with no less than 2 tests per day of material placed; test shall be witnessed by the RPR. Measurements shall be made in test holes excavated to show the full depth of mixing and the pH checked by spraying the side of the test hole with a pH indicator such as phenolphthalein. Phenolphthalein changes from clear to red between pH 8.3 and 10. The color change indicates the location of the bottom of the mixing zone. pH indicators other than phenolphthalein can be used to measure pH levels. If the pH is not at least 8.3 and/or if the depth of the treated subgrade is more than 1/2 inch deficient, additional lime treatment shall be added and the material remixed. The Contractor shall correct all such areas in a manner satisfactory to the RPR.

155-6.6 COMPACTATION. Compaction of the mixture shall immediately follow the final mixing operation with the mixture compacted within 1 to 4 hours after final mixing. The material
shall be at the moisture content specified in paragraph 155-3.2 during compaction. The field
density of the compacted mixture shall be at least 93% of the maximum density as specified
in paragraph 155-6.10. Perform in-place density test to determine degree of compaction
between 24 and 72 hours after final compaction and the 24-hour moist cure period. If the
material fails to meet the density requirements, it shall be reworked to meet the density
requirements. Maximum density refers to maximum dry density at optimum moisture content
unless otherwise specified.

155-6.7 FINISHING AND CURING. After the final lift or course of lime-treated subgrade
has been compacted, it shall be brought to the required lines and grades in accordance with
the typical sections. The completed section shall then be finished by rolling, as directed by the
RPR, with a pneumatic or other suitable roller sufficiently light to prevent hairline cracking.
The finished surface shall not vary more than 1/2-inch when tested with a 12-foot straightedge
applied parallel with and at right angles to the pavement centerline. Any variations in excess
of this tolerance shall be corrected by the Contractor at the Contractor's expense in a manner
satisfactory to the RPR.

The completed section shall be moist-cured for a minimum of seven (7) days before further
courses are added or any traffic is permitted, unless otherwise directed by the RPR. The final
lift should not be exposed for more than 14 days without protection or the placement of a base
course material.

155-6.8 MAINTENANCE. The Contractor shall protect and maintain the lime-treated
subgrade from yielding until the lime-treated subgrade is covered by placement of the next
lift. 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 meets all
specification requirements. The maintenance cost shall be incidental to this item.

155-6.9 SURFACE TOLERANCE. 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.

155-6.10 ACCEPTANCE SAMPLING AND TESTING. The lime treated subgrade shall
be accepted for density and thickness on an area basis. Testing frequency shall be a
minimum of one compaction and thickness test per 1,000 square yards of lime treated
subgrade, but not less than four (4) tests per day of production. Sampling locations will be
determined on a random basis per ASTM D3665.

a. Density. All testing 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 field density of the compacted mixture shall be at least 93% of the maximum density of laboratory specimens prepared from samples taken from the material in place. The specimens shall be compacted and tested in accordance with ASTM D698 to determine maximum density and optimum moisture content. The in-place field density shall be determined in accordance with ASTM D1556 or ASTM D6938, Procedure A, direct transmission method. If the material fails to meet the density requirements, the area represented by the failed test shall be reworked to meet the density requirements. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

b. **Thickmess.** The thickness of the 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. The Contractor shall replace, at his expense, material where depth tests have been taken.

155-6.11 **HANDLING AND SAFETY.** The Contractor shall obtain and enforce the lime supplier’s instructions for proper safety and handling of the lime to prevent physical eye or skin contact with lime during transport or application.

**METHOD OF MEASUREMENT**

155-7.1 Lime-treated subgrade shall be paid for by the square yard in the completed and accepted work.

155-7.2 Lime shall be paid by the number of tons of Hydrated Lime applied at the application rate specified in paragraph 155-3.1.

a. Hydrated lime delivered to the project in dry form will be measured according to the actual tonnage either spread on the subgrade or batched on site into a slurry, whichever is applicable.

b. Quicklime delivered to the project in dry form will be measured for payment on the basis of the tons of equivalent hydrated lime using the following formula:

Equivalent Hydrated Lime (Ca(OH)₂) = Total Quicklime (CaO) × 1.32

c. Lime delivered to the project in slurry form will be measured for payment in tons, dry weight of hydrated lime or equivalent hydrated lime in accordance with paragraph b above.

**BASIS OF PAYMENT**

155-8.1 Payment shall be made at the contract unit price per square yard for the lime-treated subgrade at the thickness specified. The price shall be full compensation for furnishing all material, except the lime, and for all preparation, delivering, placing and mixing these materials, and all labor, equipment, tools and incidentals necessary to complete this item.

155-8.2 Payment shall be made at the contract unit price per ton. This price shall be full compensation for furnishing, delivery, and placing this material.
Payment will be made under:

- Item P-155-8.1 Lime-Treated Subgrade (12-Inch Depth) – per square yard
- Item P-155-8.2 Lime – per ton

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 C51 Standard Terminology Relating to Lime and Limestone (as used by the Industry)
- ASTM C977 Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization
- ASTM C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- 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 D3551 Standard Practice for Laboratory Preparation of Soil-Lime Mixtures Using Mechanical Mixer
- ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-155
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 Particles¹</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 five (5); 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></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.

219-2.3 Separation Geotextile. Separation Geotextile shall be class 2, 0.02 sec$^{-1}$ permittivity per ASTM D4491, Apparent opening size of 0.60-mm maximum average per roo per ASTM D4751.

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 (300 mm) upon the Contractor’s demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

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

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.

Prior to the placement of the aggregate a separation geotextile shall be placed on the subgrade which has been cleared of all sharp objects. Unroll geotextile fabric on prepared subgrade.

The fabric shall be placed with the machine direction (long dimension) down slope or normal to the natural slope, unless otherwise directed by the Engineer, and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be laid smooth to provide a minimum width of 18 inches, or greater if specified, of overlap for each joint. Overlap Joints and seams shall be measured as a single layer of cloth.

For curves, the geotextile must be folded or cut and overlapped in the direction of the turn. Overlaps must be 12 inches or greater. Folds in geotextile must be stapled or pinned five feet on center.

The fabric shall be secured with Securing pins with washers shall be inserted through both strips of overlapped cloth at not greater than intervals of 5-feet along a line through the midpoint of the overlap.

Additional pins regardless of location shall be installed as necessary to prevent any slippage of the filter fabric. Each securing pin shall be pushed through the fabric until the washer bears against the fabric and secures it firmly to the foundation. Bags of soil or other methods approved by the Engineer shall be used to secure the geotextile during installation.

The recycled concrete base material must be placed onto the geotextile from the edge of the fabric or over previously placed aggregate. It shall be placed in the same direction as the overlap to avoid separation. The first lift of aggregate must be spread and graded down to a minimum depth of 8 inches or to the design thickness, if less than 8 inches. A minimum lift of six inches compacted thickness must be maintained in all cases. Compaction of the first lift must be performed by "tracking" with a dozer, followed by compaction with a smooth-drum roller to the specified density.

Construction equipment other than hauling and paving equipment necessary for placement of the base shall not be allowed on the geotextile. Operate hauling and paving equipment in a manner to prevent damage or displacement of the geotextile. Equipment shall avoid sudden acceleration, hard braking, and sharp turns while on the geotextile, and the paver shall not turn while on the geotextile. Large fabric wrinkles which may develop during the spreading operations shall be folded and flattened in the direction of the spreading. Special care shall be given to maintaining proper overlap and fabric continuity.
The fabric shall be protected at all times during construction from contamination by surface runoff and any fabric so contaminated shall be removed and replaced with uncontaminated fabric.

Any damage to the fabric, such as tears, puncture, or excessive displacement, shall be repaired. The torn or punctured section shall be repaired by clearing of all fill material, a suitable distance from the damaged area, to allow placement of a geotextile patch which extends at least 3 feet in all directions beyond the damaged area. Aggregate removed must be replaced to the specified lift thickness and density. The fabric shall be sewn, secured with pins and washers as described above, or other methods as approved by the RPR.

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.

219-3.1 219-3.4 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.

Each layer of the recycled concrete base course shall be compacted to the required density using the compaction equipment. The moisture content of the material during placing operations shall be within above saturated surface dry but not have any free moisture.

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the material. When the rolling develops irregularities to the recycled concrete base that exceed 1/2-inch when tested with a 12-foot straightedge, the irregular surface must be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required above.

Verification of consolidation and interlocking of the recycled concrete base shall be performed via a rolling pattern procedure. The rolling pattern shall be developed by recording the number of passes of a vibratory roller needed to ensure proper consolidation and interlocking of the recycled concrete base material using survey elevation data. The recycled concrete base shall be rolled an acceptable number of times until survey data shows that the consolidation of the material is negligible and to the acceptance of the Engineer. The specified number of passes, determined by the rolling pattern, shall be the required amount of passes used for the recycled concrete base material and that particular vibratory roller for the project. If the Contractor wishes to change vibratory rollers during the project, then a new rolling pattern shall be developed. The Contractor shall verify the rolling pattern once per week or every time a new piece of equipment is used. The rolling pattern development must be performed in the presence of and to the satisfaction of the Engineer. The Contractor will perform a rolling
pattern verification whenever the Engineer deems it is needed to properly control the process or the Engineer deems the process out of control.

219-3.5 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F (4°C) and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

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 (75 mm), 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.

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. Each lot will be accepted for density when a proof roll is performed with a loaded water truck and there is no measurable deformation in the material.

Consolidation of the recycled concrete base shall be accepted if the proper rolling pattern had been utilized during the installation of the material, all aggregate interlock is complete and the consolidation effort has been checked. The consolidation effort shall be verified every 400 linear feet/lift placed. 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 cubic yards of material actually constructed and accepted as complying with the plans and specifications. No separate measurement will be made for the separation geotextile.

BASIS OF PAYMENT

219-5.1 Payment shall be made at the contract unit price per cubic 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.

Payment will be made under:

Item P-219-5.1 Owner Furnished Recycled Concrete Base Course (Variable Depth) – 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.

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/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))
<table>
<thead>
<tr>
<th>ASTM D3665</th>
<th>Standard Practice for Random Sampling of Construction Materials</th>
</tr>
</thead>
<tbody>
<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
ITEM P-403 ASPHALT MIX PAVEMENT BASE AND 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</td>
<td>Loss after 5 cycles:</td>
<td>ASTM C88</td>
</tr>
<tr>
<td></td>
<td>12% maximum using Sodium sulfate - or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18% maximum using magnesium sulfate</td>
<td></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>Minimum 75% by weight of particles with at least two fractured faces and</td>
<td>ASTM D5821</td>
</tr>
<tr>
<td></td>
<td>85% with at least one fractured face1</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 5:1²</td>
<td>ASTM D4791</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.

<table>
<thead>
<tr>
<th>Fine Aggregate Material Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material Test</strong></td>
</tr>
<tr>
<td>Liquid limit</td>
</tr>
<tr>
<td>Plasticity Index</td>
</tr>
<tr>
<td>Soundness of Aggregates</td>
</tr>
<tr>
<td>Clay lumps and friable particles</td>
</tr>
<tr>
<td>Sand equivalent</td>
</tr>
<tr>
<td>Natural Sand</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.

<table>
<thead>
<tr>
<th>Mineral filler Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material Test</strong></td>
</tr>
<tr>
<td>Plasticity Index</td>
</tr>
</tbody>
</table>

**403-2.3 ASPHALT BINDER.** Asphalt binder shall conform to ASTM D6373 Performance Grade (PG) 64-22.

**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 Texas Department of Transportation.
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.

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 the gyratory compactor in accordance with ASTM D6925.

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.

• Percentage and properties (asphalt content, asphalt binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with paragraph 403-3.4, Reclaimed Hot-Mix Asphalt, if RAP is used.

### 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 gyrations</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Air voids (%)</td>
<td>3.5</td>
<td>ASTM D3203</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Test Property</th>
<th>Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent voids in mineral aggregate (VMA), minimum</td>
<td>See Table 2</td>
<td>ASTM D6995</td>
</tr>
<tr>
<td>TSR¹</td>
<td>not less than 80 at a</td>
<td>ASTM D4867</td>
</tr>
<tr>
<td></td>
<td>saturation of 70-80%</td>
<td></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>3/4 inch</td>
<td>100</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>90-100</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>72-88</td>
</tr>
<tr>
<td>No. 4</td>
<td>53-73</td>
</tr>
<tr>
<td>No. 8</td>
<td>38-60</td>
</tr>
<tr>
<td>No. 16</td>
<td>26-48</td>
</tr>
<tr>
<td>No. 30</td>
<td>18-38</td>
</tr>
<tr>
<td>No. 50</td>
<td>11-27</td>
</tr>
<tr>
<td>No. 100</td>
<td>6-18</td>
</tr>
<tr>
<td>No. 200</td>
<td>3-6</td>
</tr>
</tbody>
</table>

**Voids in Mineral Aggregate (VMA)**

15

**Asphalt Percent:**

| Stone or gravel | 5.0-7.5 |

**Recommended Minimum Construction Lift Thickness**

2-inch

---

1To 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).

Reclaimed asphalt pavement shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt. Recycled asphalt shingles (RAS) shall not be allowed. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 1-1/2 inches. The reclaimed asphalt mix shall be designed using procedures contained in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition. The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D2172 using the appropriate dust correction procedure. The JMF shall meet the requirements of paragraph 403-3.3. RAP should only be used for shoulder surface course mixes and for any intermediate courses. The use of RAP containing Coal Tar shall not be allowed. Coal Tar surface treatments must be removed prior to recycling underlying asphalt material. The amount of RAP shall be limited to 30 percent.

In addition to the requirements of paragraph 403-3.3, the JMF shall indicate the percent of reclaimed asphalt pavement and the percent and grade of new asphalt binder.

For the PG graded asphalt binder selected in paragraph 403-2.3, adjust as follows:
a. For 0-20% RAP, there is no change in virgin asphalt binder content.

b. For >20 to 30% RAP, select asphalt binder one grade softer, i.e., PG 64-22 would soften to PG 58-28.

403-3.5 CONTROL STRIP. Full production shall not begin until an acceptable control strip has been constructed and accepted in writing by the RPR. The Contractor shall prepare and place a quantity of asphalt according to the JMF. The underlying grade or pavement structure upon which the control strip is to be constructed shall be the same as the remainder of the course represented by the control strip.

The Contractor will not be allowed to place the control strip until the Contractor quality control program (CQCP), showing conformance with the requirements of paragraph 403-5.1, has been accepted, in writing, by the RPR.

The control strip will consist of at least 250 tons or 1/2 sublot, whichever is greater. The control strip shall be placed in two lanes of the same width and depth to be used in production with a longitudinal cold joint. The cold joint must be cut back in accordance with paragraph 403-4.13 using the same procedure that will be used during production. The cold joint for the control strip will be an exposed construction joint at least four (4) hours old or when the mat has cooled to less than 160°F. The equipment used in construction of the control strip shall be the same type, configuration and weight to be used on the project.

The control strip shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 403-6.1 and 403-6.2. The control strip shall be divided into equal sublots. As a minimum, the control strip shall consist of three (3) sublots.

The control strip will be considered acceptable by the RPR if the gradation, asphalt content, and VMA are within the action limits specified in paragraph 403-5.5a; and Mat density, air voids, and joint density meet the requirements specified in paragraphs 403-6.2.

If the control strip is unacceptable, necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made and another control strip shall be placed. Unacceptable control strips shall be removed at the Contractor's expense.

Payment will only be made for an acceptable control strip in accordance with paragraph 403-8.1.

403-3.6 PRE-PAVING WORKSHOP. The Contractor shall be required to conduct a pre-paving workshop. The workshop shall be attended by the Contractor (Subcontractors, QC Supervisor, QC Testing Agencies, CMARs, Safety Manager, Project Manager, and the Paving Foreman) and the Owner (Operations, RPR, Inspectors, QA Surveyor, and QA Testing Agencies). The pre-paving workshop shall discuss, at a minimum:

a. Site access/ Security, equipment staging and set up, employee parking, haul route, flagger requirements, waste handling

b. Pre-placement activities including, job mix formula and schedule

c. Control strip requirements

d. Equipment, mixing, and placement
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>3 inches or greater</td>
<td>40</td>
</tr>
<tr>
<td>Greater than 2 inches but less than 3 inches</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.

a. **Material transfer vehicle (MTV).** Material transfer Vehicles shall be required due to the improvement in smoothness and decrease in both physical and thermal segregation. To transfer the material from the hauling equipment to the paver, use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation.

**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.

a. **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 325°F 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 TACK COAT. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.

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.

Contractor shall survey each lift of asphalt surface course and certify to RPR that every lot of each lift meets the grade tolerances of paragraph 401-6.2e before the next lift can be placed.

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 18.75 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.

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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 or contamination 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 long. If an unusual amount of segregation or contaminated material is identified, all production paving shall be stopped until the cause can be identified and corrected.

403-4.12 COMPACTATION 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 ravels, 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.

CONTRACTOR QUALITY CONTROL (CQC)

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 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, a rolling inclinometer meeting the requirements of ASTM E2133, or rolling external reference device that can simulate a 12-foot 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 the FAA profile program, ProFAA, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions.
(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.

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 and 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 1/2-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:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Action Limit</th>
<th>Suspension Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>No. 4</td>
<td>±6%</td>
<td>±9%</td>
</tr>
<tr>
<td>No. 16</td>
<td>±5%</td>
<td>±7.5%</td>
</tr>
<tr>
<td>No. 50</td>
<td>±3%</td>
<td>±4.5%</td>
</tr>
<tr>
<td>No. 200</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</td>
<td>11%</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>11%</td>
</tr>
<tr>
<td>No. 4</td>
<td>11%</td>
</tr>
<tr>
<td>No. 16</td>
<td>9%</td>
</tr>
<tr>
<td>No. 50</td>
<td>6%</td>
</tr>
<tr>
<td>No. 200</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 D6925.

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, 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.

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. Minimum cross-section grade points shall include grade at centerline, and edge of taxiway pavement.

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.
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.

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 tons of asphalt pavement 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 ton 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** Hot Mix Asphalt Surface Course – per ton
- **Item P-403-8.2** Hot Mix Asphalt Base Course – per ton

**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 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 C131** Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- **ASTM C136** Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
- **ASTM C142** Standard Test Method for Clay Lumps and Friable Particles in Aggregates
<table>
<thead>
<tr>
<th>Standard Test Method/Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<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 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 D1461</td>
<td>Standard Test Method for Moisture or Volatile Distillates in 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>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 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>
</tbody>
</table>

ASTM D6995  Standard Test Method for Determining Field VMA based on the Maximum Specific Gravity of the Mix (Gmm)

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 T340  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

END OF ITEM P-403
ITEM P-450 ASPHALT TREATED PERMEABLE BASE COURSE

DESCRIPTION

450-1.1 This item shall consist of an asphalt treated permeable base course (ATPB) 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

450-2.1 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. The source of the coarse aggregate shall be from quarried rock or river gravel. No slag shall be permitted. All aggregates shall have demonstrated a satisfactory service record of at least 10 years duration under similar conditions of service exposure. Coarse aggregate material requirements are given in the table below.

<table>
<thead>
<tr>
<th>Coarse Aggregate Material Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material Test</strong></td>
</tr>
<tr>
<td>Resistance to Degradation</td>
</tr>
<tr>
<td>Soundness of Aggregates</td>
</tr>
<tr>
<td>Clay lumps and friable particles</td>
</tr>
<tr>
<td>Percentage of Fractured Particles</td>
</tr>
<tr>
<td>Flat, Elongated, or Flat and Elongated Particles</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</td>
<td>Loss after 5 cycles:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10% maximum using Sodium sulfate or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>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>30 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.

450-2.2 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>

450-2.3 ASPHALT BINDER. Asphalt binder shall conform to ASTM D6373 Performance Grade (PG) 70-22.

450-2.4 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 Texas Department of Transportation.
450-3.1 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).

450-3.2 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.

450-3.3 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.

The JMF shall be prepared by an accredited laboratory that meets the requirements of paragraph 450-3.2. The submitted JMF shall be dated, and stamped or sealed by the responsible professional Engineer of the laboratory.

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.

For the ATPB, the bituminous mixture shall be a combination of aggregate and bituminous material conforming to the gradation and asphalt content limits specified in Table 1.
Table 1. Aggregate gradation and asphalt for ATPB

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by Weight Passing Sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2 inch</td>
<td>100</td>
</tr>
<tr>
<td>1 inch</td>
<td>95-100</td>
</tr>
<tr>
<td>1/2-inch</td>
<td>25-60</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-10</td>
</tr>
<tr>
<td>No. 8</td>
<td>0-5</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-2</td>
</tr>
<tr>
<td>Asphalt Content</td>
<td>2.0 - 3.5%</td>
</tr>
</tbody>
</table>

The Contractor shall establish the percent of asphalt to be used in the ATPB based on the results of his tests of aggregate and based on the observed performance and plant and field tests on the ATPB during the placement of the control section specified hereinafter. Further, the Engineer reserves the right to vary the percent of asphalt of all bituminous mixtures during production as necessary to provide for full coating of all aggregate particles yet provide minimum drain down of asphalt. The asphalt content may be adjusted within the limits of Table 1 without adjustments in the Contract unit price.

The Contractor shall use an approved heat-stable anti-stripping additive. The anti-stripping additive shall meet the approval of the Engineer based on the results of laboratory tests. The additive shall be added to the asphalt tank at the recommended dosage (0.5 to 1.0% by weight of asphalt cement) and shall be thoroughly mixed by circulation of the asphalt for at least 4 hours prior to being incorporated into the mix. The exact amount of additive to be used shall be determined based on laboratory tests and submitted with the mix design.

A mixing temperature for the bituminous material shall be established where the viscosity is between 150 and 300 centistokes. A tolerance of plus or minus 15°F will be permitted if the application of these tolerances to the mixing temperature maintains the viscosity between 150 and 300 centistokes. In no case will mixing be permitted at a temperature of less than 275°F or greater than 325°F.

**450-3.4 CONTROL STRIP.** Full production shall not begin until an acceptable control strip has been constructed and accepted in writing by the RPR. The Contractor shall prepare and place a quantity of a ATPB according to the JMF. The underlying grade or pavement structure upon which the control strip is to be constructed shall be the same as the remainder of the course represented by the control strip.

The Contractor will not be allowed to place the control strip until the Contractor quality control program (CQCP), showing conformance with the requirements of paragraph 403450-5.1, has been accepted, in writing, by the RPR.

The control strip will consist of at least 250 tons or 1/2 sublot, whichever is greater. The control strip shall be placed in two lanes of the same width and depth to be used in production with a longitudinal cold joint. The cold joint must be cut back in accordance with paragraph 450-4.13 using the same procedure that will be used during production. The cold joint for the control strip will be an exposed construction joint at least four (4) hours old or when the mat

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CONTRACT No. 9500723
Permit No. A20-111B
NE-EAT Package II

ITEM P-450-4 Asphalt Treated Permeable Base Course
Issued for Bid
April 23, 2020
has cooled to less than 160°F. The equipment used in construction of the control strip shall be the same type, configuration and weight to be used on the project.

The control strip shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 403450-6.1 and 450-6.2. The control strip shall be divided into equal sublots. As a minimum, the control strip shall consist of three (3) sublots.

The control strip will be considered acceptable by the RPR if the gradation and asphalt content are within the action limits specified in paragraph 450-5.5a.

If the control strip is unacceptable, necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made and another control strip shall be placed. Unacceptable control strips shall be removed at the Contractor’s expense.

Payment will only be made for an acceptable control strip in accordance with paragraph 450-8.1.

450-3.5 PRE-PAVING WORKSHOP. The Contractor shall be required to conduct a pre-paving workshop. The workshop shall be attended by the Contractor (Subcontractors, QC Supervisor, QC Testing Agencies, CMARs, Safety Manager, Project Manager, and the Paving Foreman) and the Owner (Operations, RPR, Inspectors, QA Surveyor, and QA Testing Agencies). The pre-paving workshop shall discuss, at a minimum:

a. Site access/ Security, equipment staging and set up, employee parking, haul route, flagger requirements, waste handling

b. Pre-placement activities including, job mix formula and schedule

c. Control strip requirements

d. Equipment, mixing, and placement

e. Provisions for cold weather paving

f. Compaction

g. QC and QA Roles and Responsibilities.

CONSTRUCTION METHODS

450-4.1 WEATHER LIMITATIONS. The ATPB 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>
<thead>
<tr>
<th>Mat Thickness</th>
<th>Base Temperature (Minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 inches or greater</td>
<td>40 (F)</td>
</tr>
</tbody>
</table>

Table 4. Surface Temperature Limitations of Underlying Course
450-4.2 **ASPHALT PLANT.** Plants used for the preparation of the JMF 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.

450-4.3 **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.

450-4.4 **HAULING EQUIPMENT.** Trucks used for hauling ATPB 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.

a. **Material transfer vehicle (MTV).** Material transfer Vehicles shall be required due to the improvement in smoothness and decrease in both physical and thermal segregation. To transfer the material from the hauling equipment to the paver, use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation.

450-4.5 **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.

450-4.6 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.

450-4.7 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 325°F when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F when added to the aggregate.

450-4.8 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.

450-4.9 PREPARATION OF ATPB 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%.

450-4.10 APPLICATION OF TACK COAT. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.

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.

450-4.11 LAYDOWN PLAN, TRANSPORTING, PLACING, AND FINISHING. Prior to the placement of the ATPB, 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 mix shall be placed at a temperature of not less than 250°F.

Contractor shall survey each lift of asphalt surface course and certify to RPR that every lot of each lift meets the grade tolerances of paragraph 401-6.2b before the next lift can be placed.

Edges of existing 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 ATPB 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 ATPB 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. ATPB mix shall be placed in consecutive adjacent lanes having a minimum width of 18.75 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 ATPB, 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 or contamination 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. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long. If an unusual amount of segregation or contaminated material is identified, all production paving shall be stopped until the cause can be identified and corrected.

450-4.12 COMPACTION OF ATPB MIXTURE. After placing, and when the temperature of the mixture is less than 150°F the asphalt mixture shall be thoroughly and uniformly compacted by self-propelled rollers. All compaction of the mixture shall be completed prior to the temperature of the mixture falling below 100°F. 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.

Rolling shall be three complete coverages of the specified static roller. The RPR reserves the right to increase or decrease the specified number of roller coverages and the specified temperature limits for rolling during construction based on the test data and observed performance from the control section or production placement of the mixture.

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.

450-4.13 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 ATPB 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 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.

450-4.14 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.

CONTRACTOR QUALITY CONTROL (CQC)

450-5.1 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.
450-5.2 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.

450-5.3 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. 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 1/4-inch in 12 feet. 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 external reference device that can simulate a 12-foot 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 the FAA profile program, ProFAA, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions.

(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.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4-inch shall be removed and replaced at no additional cost to the Owner.

g. 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 and 0.1 feet laterally. The documentation will be provided by the Contractor to the RPR within 24 hours.

The Contractor shall repair low areas by removal of deficient areas to the depth of the final course and replacing with new material. Skin patching is not allowed.

450-5.4 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.

450-5.5 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 and asphalt content.

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. 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:

<table>
<thead>
<tr>
<th>Control Chart Limits for Individual Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>1 1/2 inch</td>
</tr>
<tr>
<td>1 inch</td>
</tr>
<tr>
<td>1/2 inch</td>
</tr>
<tr>
<td>No. 4</td>
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<tr>
<td>No. 8</td>
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<tr>
<td>No. 200</td>
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<tr>
<td>Asphalt Content</td>
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</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 \( n = 4 \).

<table>
<thead>
<tr>
<th>Control Chart Limits Based on Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>(( n = 2 ))</td>
</tr>
<tr>
<td>Sieve</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>1 1/2 inch</td>
</tr>
<tr>
<td>1 inch</td>
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<tr>
<td>1/2 inch</td>
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<td>No. 4</td>
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<tr>
<td>No. 8</td>
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<tr>
<td>No. 200</td>
</tr>
<tr>
<td>Asphalt Content</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
Two points in a row fall outside the Action Limit line for individual measurements.

450-5.6 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

450-6.1 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. 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.

450-6.2 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: grade.

   b. 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. Minimum cross-section grade points shall include grade at centerline, and edge of taxiway pavement.

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%
c. **Visual Inspection.** The visual inspection and observations by the Engineer to determine if the required number of rolling passes have achieved compaction within crushing of the aggregates

d. **Bond.** Each lift of ATPB 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.

e. **Thickness.** Thickness of each lift of ATPB 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 pavement cores. 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.

**METHOD OF MEASUREMENT**

**450-7.1 MEASUREMENT.** Asphalt treated permeable base course shall be measured by the number of square yards of asphalt treated permeable base course used in the accepted work.

**BASIS OF PAYMENT**

**450-8.1 PAYMENT.** Payment for a lot of asphalt treated permeable base course meeting all acceptance criteria as specified in paragraph 450-6.2 shall be made at the contract unit price per square yard for asphalt treated permeable base course. 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-450-8.1 Asphalt Treated Permeable Base Course (6-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)

<table>
<thead>
<tr>
<th>ASTM C88</th>
<th>Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</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 Standard</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
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</tr>
<tr>
<td>C136</td>
<td>Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates</td>
</tr>
<tr>
<td>C142</td>
<td>Standard Test Method for Clay Lumps and Friable Particles in Aggregates</td>
</tr>
<tr>
<td>C183</td>
<td>Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement</td>
</tr>
<tr>
<td>C566</td>
<td>Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying</td>
</tr>
<tr>
<td>D75</td>
<td>Standard Practice for Sampling Aggregates</td>
</tr>
<tr>
<td>D242</td>
<td>Standard Specification for Mineral Filler for Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>D979</td>
<td>Standard Practice for Sampling Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>D1073</td>
<td>Standard Specification for Fine Aggregate for Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>D1461</td>
<td>Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>D2172</td>
<td>Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>D2419</td>
<td>Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate</td>
</tr>
<tr>
<td>D2489</td>
<td>Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures</td>
</tr>
<tr>
<td>D2726</td>
<td>Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures</td>
</tr>
<tr>
<td>D2950</td>
<td>Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods</td>
</tr>
<tr>
<td>D3203</td>
<td>Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures</td>
</tr>
<tr>
<td>D3665</td>
<td>Standard Practice for Random Sampling of Construction Materials</td>
</tr>
<tr>
<td>D3666</td>
<td>Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials</td>
</tr>
<tr>
<td>D4318</td>
<td>Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils</td>
</tr>
<tr>
<td>D4791</td>
<td>Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate</td>
</tr>
<tr>
<td>D4867</td>
<td>Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures</td>
</tr>
</tbody>
</table>
ASTM D5444 Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
ASTM D5821 Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6307 Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
ASTM D6373 Standard Specification for Performance Graded Asphalt Binder
ASTM D6995 Standard Test Method for Determining Field VMA based on the Maximum Specific Gravity of the Mix (Gmm)
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 T340 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

END OF ITEM P-450
ITEM P-501 CEMENT CONCRETE PAVEMENT

DESCRIPTION

501-1.1 This work shall consist of pavement composed of cement concrete with 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. ASTM C1260 and ASTM C1567 tests may be run concurrently.

(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 6 months of the date of the concrete mix submittal.

(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><strong>Soundness of Aggregates</strong></td>
</tr>
<tr>
<td>Loss after 5 cycles:</td>
</tr>
<tr>
<td>10% maximum using Sodium sulfate - or -</td>
</tr>
<tr>
<td>15% maximum using magnesium sulfate</td>
</tr>
<tr>
<td><strong>Sand Equivalent</strong></td>
</tr>
<tr>
<td>45 minimum</td>
</tr>
<tr>
<td><strong>Fineness Modulus (FM)</strong></td>
</tr>
<tr>
<td>$2.50 \leq FM \leq 3.40$</td>
</tr>
</tbody>
</table>

Limits for Deleterious Substances in Fine Aggregate for Concrete

| Clay lumps and friable particles   |
| 1.0% maximum                       |
| Coal and lignite                  |
| 0.5% using a medium with a density of Sp. Gr. of 2.0 |
| 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.

<table>
<thead>
<tr>
<th>Coarse Aggregate Material Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material Test</strong></td>
</tr>
<tr>
<td><strong>Requirement</strong></td>
</tr>
<tr>
<td><strong>Standard</strong></td>
</tr>
<tr>
<td>Resistance to Degradation</td>
</tr>
<tr>
<td>Loss: 40% maximum</td>
</tr>
<tr>
<td>ASTM C131</td>
</tr>
<tr>
<td>Soundness of Aggregates</td>
</tr>
<tr>
<td>Loss after 5 cycles:</td>
</tr>
<tr>
<td>12% maximum using Sodium sulfate - or -</td>
</tr>
<tr>
<td>18% maximum using magnesium sulfate</td>
</tr>
<tr>
<td>ASTM C88</td>
</tr>
<tr>
<td>Flat, Elongated, or Flat and Elongated Particles</td>
</tr>
<tr>
<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>
</tr>
<tr>
<td>ASTM D4791</td>
</tr>
<tr>
<td>D-cracking (Freeze-Thaw)²</td>
</tr>
<tr>
<td>Durability factor ≥ 95</td>
</tr>
<tr>
<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 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</td>
<td>ASTM C117</td>
<td>1.0¹</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>Chert² (less than 2.40 Sp Gr.)</td>
<td>ASTM C123 using a medium with a density of Sp. Gr. of 2.40</td>
<td>1.0</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 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.

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:

   \[
   CF = \frac{(\text{cumulative percent retained on the 3/8-inch sieve})(100)}{(\text{cumulative percent retained on the No. 8 sieve})}
   \]
(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:

<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</td>
<td>*</td>
</tr>
<tr>
<td>1-1/2 inch</td>
<td>*</td>
</tr>
<tr>
<td>1 inch</td>
<td>*</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>*</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>*</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>*</td>
</tr>
<tr>
<td>No. 4</td>
<td>*</td>
</tr>
<tr>
<td>No. 8</td>
<td>*</td>
</tr>
<tr>
<td>No. 16</td>
<td>*</td>
</tr>
<tr>
<td>No. 30</td>
<td>*</td>
</tr>
<tr>
<td>No. 50</td>
<td>*</td>
</tr>
<tr>
<td>No. 100</td>
<td>*</td>
</tr>
</tbody>
</table>

501-2.2 CEMENT. Cement shall conform to the requirements of ASTM C150 Type I/II low alkali (less than 0.6% equivalent alkali, the low reactivity option in ASTM C595).

501-2.3 CEMENTITIOUS MATERIALS.

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium
Oxide (CaO) content of less than 15% and a total 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 as shown on 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 specified 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 welded wire fabric conforming to the requirements of ASTM ASTM A1035. All 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.
b. White polyethylene film for curing concrete shall conform to the requirements of ASTM C171.

c. White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C171.

d. Waterproof paper for curing concrete shall conform to the requirements of ASTM C171.

501-2.10 ADMIXTURES. 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>Lithium Admixture 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 bolts shall be Type IV, Grade 3.

b. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
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.

501-2.12 BOND BREAKER. Fabric shall meet the requirements of AASHTO M288 Class I fabric with elongation less than 50% at the specified strengths. A certificate of compliance (COC) shall be provided by the fabric manufacturer that the material may be used as a bond breaker.

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 470 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, the slump shall not exceed 3 inches. For hand placement, the slump shall not exceed 4 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.

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 percentage of air in the mix shall be 4.5%. Air content shall be determined by testing in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag and other highly porous coarse aggregate.

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.

501-3.7 **PRE-PAVING WORKSHOP.** The Contractor shall be required to conduct a pre-paving workshop. The workshop shall be attended by the Contractor (Subcontractors, QC Supervisor, QC Testing Agencies, CMARs, Safety Manager, Project Manager, and the Paving Foreman) and the Owner (Operations, RPR, Inspectors, QA Surveyor, and QA Testing Agencies). The pre-paving workshop shall discuss, at a minimum:

a **Site access/ Security,** equipment staging and set up, employee parking, haul route, flagger requirements, waste handling

b **Pre-placement activities** including, job mix formula and schedule, batch plant procedures, scale certificate and water meter, and stockpile management.

c **Control strip requirements**

d **Equipment, mixing, and placement**

e **Provisions for hot and cold weather paving**

f **Finishing and curing**

g **QC and QA Roles and Responsibilities,** field cylinder requirements, reporting and PWL computations, survey and smoothness.
CONTRACT No. 9500723
ITEM P-501-10 Cement Concrete Pavement
Permit No. A20-111B Issued for Bid
NE-EAT Package II

h Post Placement Panel Inspection (repair, Removal and Replacement of Slabs) such as shrinkage cracks and full depth cracks.

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. The acceptable control strip shall be paid for in accordance with paragraph 501-6.6.

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 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 placement 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.

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. 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.

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. A bond breaker meeting the requirements of 501-2.12 shall be installed.

The fabric shall be placed with the machine direction (long dimension) down slope or normal to the natural slope, unless otherwise directed by the RPR, and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be laid smooth to provide a minimum width of 18 inches, or greater if specified, of overlap for each joint. Overlap Joints and seams shall be measured as a single layer of fabric.
For curves, the geotextile must be folded or cut and overlapped in the direction of the turn. Overlaps must be 12 inches or greater. Folds in geotextile must be stapled or pinned five feet on center.

The fabric shall be secured to the underlying material sufficiently to prevent it from becoming dislodged by the paving operations. If the fabric becomes dislodged as a result of the paving operations an alternative method of securing the geotextile will be required.

Construction equipment other than hauling and paving equipment necessary for placement of the pavement shall not be allowed on the fabric. Operate hauling and paving equipment in a manner to prevent damage or displacement of the geotextile. Equipment shall avoid sudden acceleration, hard braking, and sharp turns while on the geotextile, and the paver shall not turn while on the geotextile. Large fabric wrinkles which may develop during the spreading operations shall be folded and flattened in the direction of the spreading. Special care shall be given to maintaining proper overlap and fabric continuity.

The fabric shall be protected at all times during construction from contamination by surface runoff and any fabric so contaminated shall be removed and replaced with uncontaminated fabric.

Any damage to the fabric, such as tears, puncture, or excessive displacement, shall be repaired. The torn or punctured section shall be repaired by clearing of all fill material, a suitable distance from the damaged area, to allow placement of a fabric patch which extends at least 3 feet in all directions beyond the damaged area. The fabric shall be sewn, secured with pins and washers as described above, or other methods as approved by the RPR.

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 should 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 tensile strains in the fresh concrete as related to heating and cooling of the concrete material.
2. 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.
3. Anticipated timing of initial sawing of joint.
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 3 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 will 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 can be permitted on adjoining previously constructed pavement when the concrete strength reaches a flexural strength of 550 psi, based on the average of four field cured specimens per 2,000 cubic yards of concrete placed. The Contractor must determine that the above minimum strengths are adequate to protection 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.

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 slip-form 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.

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.

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. Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars / dowel bars where these are specified.

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 12 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.

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.

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. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screed. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor’s expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

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.

   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 expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

   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 required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer’s instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch (3 mm) wide and to the depth shown on the plans.

   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. 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 feet, 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. Do not cut or crimp the dowel basket tie wires.

At the Contractor’s option, dowels and tie bars in contraction joints may be installed by insertion into the plastic concrete using approved equipment and procedures per the paver manufacturer’s design. 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. The dowels shall be held in alignment at the collar of the hole by means of a suitable metal or plastic grout retention ring fitted around the dowel.

e. **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. Curing compound or system shall be reapplied in the initial saw-cut and maintained for the remaining cure period. All slurry generated from the sawing operations shall be removed immediately and continuously with a method approved by the RPR to the satisfaction of the RPR.

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 1/4-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. Fog (mist) sprays or other surface applied finishing aids specified to prevent plastic shrinkage cracking, approved by the RPR, may be used in accordance with the manufacturer’s requirements.

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. Only one pass of the pipe float shall be allowed. Equipment, mixture, and/or procedures which produce more than 1/4-inch of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. 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 7500 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 straightedge. Any excess water and laitance 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 straightedge 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.** Shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface.

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.

When a two-saw-cut method is used to construct the contraction joint, the curing compound shall be applied to the saw-cut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of 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. **White burlap-polyethylene sheets.** The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for seven (7) days after the concrete has been placed.
c. **Water method.** The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.

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. Honeycombed areas that extend into the slab greater than a depth of 1 inch shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-4.19.

501-4.15 **SAW-CUT GROOVING.** Saw-cut grooving is not required.

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.

Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least seven (7) days old, or for a longer period if directed by the RPR.

In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured.
for seven (7) days, the joints are protected, the concrete has attained a minimum field cured flexural strength of 450 psi, and the slab edge is protected.

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 550 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. 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. All slurry generated from the sawing operations shall be removed immediately and continuously with a method approved by the RPR to the satisfaction of the RPR.

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 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 2 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 low slump concrete or mortar or with epoxy resin concrete or mortar.

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 in new slabs only.

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 raveling, 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 material at the contract unit price.

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 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, a rolling inclinometer meeting the requirements of ASTM E2133, or rolling external reference device that can simulate a 12-foot 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 the FAA profile program, ProFAA, using the 12-foot straightedge simulation function.
Smoothness readings shall not be made across grade changes or cross slope transitions.

(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 feet or greater.

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.

a. **Grade.** Grade will be evaluated prior to and after placement of the concrete surface.

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 and 0.1 feet laterally. The documentation will be provided by the Contractor to the RPR within 24 hours.

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.** The Contractor shall maintain a control chart plotting the coarseness factor and workability factor on a chart in accordance with paragraph 501- 2.1d.

### 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>
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<td></td>
<td></td>
</tr>
<tr>
<td>Coarseness Factor (CF)</td>
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<td>±5</td>
<td></td>
</tr>
<tr>
<td>Workability Factor (WF)</td>
<td>±2</td>
<td>±3</td>
<td></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 developed and maintained for each control parameter indicated by the Contactor.
2 Control charts shall be developed and maintained for each sieve size but the Contractor.
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. **Coarseness and Workability factor.** When the CF or WF reaches the applicable suspension limits, the Contractor, immediate steps, including a halt to production, shall be taken to correct the CF and WF.

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.

   (a) 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 2,000 cubic yards. Each lot will be divided into approximately equal sublots with individual sublots between 400 to 600 cubic 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. Each core shall be photographed, and the photograph included with the test report.

(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
   (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. Acceptance for profilograph smoothness will be based on the criteria contained in paragraph 501-6.6b(4).

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 pavement. 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:

<table>
<thead>
<tr>
<th>Lower Specification Tolerance Limit (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
</tr>
<tr>
<td>0.93 × strength specified in paragraph 501-3.3</td>
</tr>
<tr>
<td>Thickness</td>
</tr>
<tr>
<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. Payment for sublots that do not meet grade for over 25% of the sublot shall reduced by 5% and not be more than 95%.

(4) **Profilograph roughness for QA Acceptance.** The final profilograph shall be the full length of the project to facilitate testing of roughness between lots. The Contractor, in the presence of the RPR shall perform a profilograph roughness test on the completed project with a profilograph meeting the requirements of ASTM E1274 or a Class I inertial profiler meeting ASTM E950. Data and results shall be provided within 48 hrs of profilograph roughness tests.

The pavement shall have an average profile index less than 15 inches per mile per 1/10-mile. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2-inch blanking band. The bump template must span one inch with an offset of 0.4 inches. The profilograph must be calibrated prior to use and operated by a factory or State DOT approved, trained operator. Profilograms shall be recorded on a longitudinal scale of one-inch equals 25 feet and a vertical scale of one inch equals one inch. Profilograph shall be performed one foot right and left of project centerline and 15 feet right and left of project centerline. Any areas that indicate “must grind” shall be corrected with diamond grinding per paragraph 501-4.19f or by removing and replacing full depth of surface course. as directed by the RPR. Where corrections are necessary, a second profilograph run shall be performed to verify that the corrections produced an average profile index of 15 inches per mile per 1/10 mile or less.

(5) **Adjustments for repair.** Sublots with spall repairs, crack repairs, or partial panel replacement, 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.

501-7.2 Patching of existing concrete pavement shall be measured by the number of square feet of pavement patching performed regardless of depth and accepted by the RPR. No measurement will be made for patching of pavements constructed as part of this project.

**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%.

<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 20% 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. The Contractor will receive full payment when the profilograph average profile index is in accordance with paragraph 501-6.6b(4). When the final average profile index for the entire length of pavement does not exceed 15 inches per mile per 1/10-mile, payment will be made at the contract unit price for the completed pavement.

501-8.2 PATCHING OF EXISTING CONCRETE PAVEMENT. Payment for the patching of existing pavement shall be made at the contract unit price per square foot of patching performed. No payment will be made for patching of pavement constructed as part of this project.

Payment. Payment shall be made under:

- Item P-501-8.1 Portland Cement Concrete Pavement (16-inch), Reinforced – per square yard
- Item P-501-8.3 Portland Cement Concrete Pavement (19-Inch), Non-Reinforced – per square yard
- Item P-501-8.4 Portland Cement Concrete Pavement (19-Inch), Reinforced – per square yard
- Item P-501-8.5 Patching of Existing Pavement – 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 A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- ASTM A1035 Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement
- 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 C70 Standard Test Method for Surface Moisture in Fine Aggregate
<table>
<thead>
<tr>
<th>Standard Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C78</td>
<td>Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)</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>ASTM C94</td>
<td>Standard Specification for Ready-Mixed Concrete</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 C123</td>
<td>Standard Test Method for Lightweight Particles in 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 C138</td>
<td>Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete</td>
</tr>
<tr>
<td>ASTM C142</td>
<td>Standard Test Method for Clay Lumps and Friable Particles in Aggregates</td>
</tr>
<tr>
<td>ASTM C143</td>
<td>Standard Test Method for Slump of Hydraulic-Cement Concrete</td>
</tr>
<tr>
<td>ASTM C150</td>
<td>Standard Specification for Portland Cement</td>
</tr>
<tr>
<td>ASTM C171</td>
<td>Standard Specification for Sheet Materials for Curing Concrete</td>
</tr>
<tr>
<td>ASTM C172</td>
<td>Standard Practice for Sampling Freshly Mixed Concrete</td>
</tr>
<tr>
<td>ASTM C173</td>
<td>Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method</td>
</tr>
<tr>
<td>ASTM C174</td>
<td>Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores</td>
</tr>
<tr>
<td>ASTM C231</td>
<td>Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method</td>
</tr>
<tr>
<td>ASTM C260</td>
<td>Standard Specification for Air-Entraining Admixtures for Concrete</td>
</tr>
<tr>
<td>ASTM C309</td>
<td>Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete</td>
</tr>
<tr>
<td>ASTM C311</td>
<td>Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete</td>
</tr>
<tr>
<td>ASTM C494</td>
<td>Standard Specification for Chemical Admixtures for Concrete</td>
</tr>
<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>
</tbody>
</table>
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 C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989 Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1064 Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75 Standard Practice for Sampling Aggregates
ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752 Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D3665 Standard Practice for Random Sampling of Construction Materials
ASTM D4791 Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM E178 Standard Practice for Dealing with Outlying Observations
ASTM E1274 Standard Test Method for Measuring Pavement Roughness Using a Profilograph
ASTM E2133 Standard Test Method for Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface

American Concrete Institute (ACI)

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

Federal Highway Administration (FHWA)

HIPERPAV 3, version 3.2

Portland Concrete Association (PCA)

PCA  Design and Control of Concrete Mixtures, 16th Edition

U.S. Army Corps of Engineers (USACE) Concrete Research Division (CRD)

CRD C662  Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

United States Air Force Engineering Technical Letter (ETL)

ETL 97-5  Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements

END ITEM P-501
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 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/yd²</th>
<th>Emulsion Application Bar Rate, gal/yd²</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. This period shall be determined by the RPR. 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 The emulsified asphalt material for tack coat shall be measured by the gallon. Volume shall be corrected to the volume at 60°F in accordance with ASTM D1250. The emulsified asphalt material paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10% over the specified application rate. Any amount of emulsified asphalt material more than 10% over the specified application rate for
each application will be deducted from the measured quantities, except for irregular areas where hand spraying of the emulsified asphalt material is necessary. Water added to emulsified asphalt will not be measured for payment.

**Basis of Payment**

**603-5.1** Payment shall be made at the contract unit price per gallon of emulsified asphalt material. This price shall be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

- Item P-603-5.1 Emulsified Asphalt Tack Coat - per gallon

**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 joint seal shall be a labyrinth type seal. The uncompressed depth of the face of the compression seal (that is to be bonded to the joint wall) shall be greater than the uncompressed width of the seal, except that for seals one inch or greater in width, the depth need be only one inch or greater. The actual width of the uncompressed seal shall be as recommended by the joint seal manufacturer for the type and width of joints as shown on the plans. The tolerance on the seal shall be +1/8 inch or -1/16 inch, below the top of the pavement surface or bottom of groove for grooved pavement.

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 always be maintained by the Contractor in satisfactory condition.

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 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 (psi) at which the equipment is operating.

(3) **Sandblasting equipment.** Sandblasting equipment shall include an air compressor, hose, and a long-wearing venturi-type nozzle of proper size, shape, and opening. The maximum nozzle opening should not exceed 1/4 inch. The air compressor shall be portable and shall be capable of furnishing not less than 150 cubic feet per minute and maintaining a line pressure of not less than 90 psi at the nozzle while in use. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint about one inch above the pavement surface and will direct the blast to clean the joint walls. The height, angle of inclination, and the size of the nozzle shall be adjusted as necessary to ensure satisfactory results.

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.

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. All slurry generated from the sawing operations shall be removed immediately and continuously with a method approved by the RPR to the satisfaction of the RPR. 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 30° and 110° 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.

2. If a nominal one-inch wide compression seal is furnished, the nominal width of the saw cut shall be 9/16 inches when the pavement temperature at the time of sawing is between 30° and 170° 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. 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.** The concrete joint faces and pavement surfaces extending at least 1/2 inch from the joint edges shall be sandblasted 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.

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 manufacturer's representative shall be on site for the first 2 days of compression joint seal installation. The manufacture shall provide a warranty on the materials furnished for a minimum of 5 years from the date of acceptance from the RPR. The Contractor shall provide a warranty on the installation for a minimum of 2 years from the date of acceptance by the RPR.

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.** 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 placed at a uniform depth within the tolerances specified. The compression joint seal shall be placed to a depth of 3/16 inch, ±1/8 inch, below the pavement surface or below the depth of the groove unless otherwise directed by the RPR.

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. Compression joint seal shall be considered incidental to P-501 and no separate measurement shall be made

BASIS OF PAYMENT

604-6.1 PAYMENT. Compression joint seal shall be considered incidental to P-501 and no separate payment shall be made.

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 D2628 Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D2835 Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete 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

605-2.2 JOINT SEALANTS. Joint sealant materials shall meet the requirements of ASTM D5893 for the joints between concrete and concrete and ASTM 6690 for joints between asphalt and concrete.

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.

605-2.3 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.

605-2.4 BOND BREAKING TAPES. Provide a bond breaking tape or separating material that is a flexible, non-shrinkable, non-absorbing, non-staining, and non-reacting adhesive-backed tape. The material shall have a melting point at least 5°F (3°C) greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The bond breaker tape shall be approximately 1/8 inch (3 mm) wider than the nominal width of the joint and shall not bond to the joint sealant.

CONSTRUCTION METHODS

605-3.1 TIME OF APPLICATION. Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be 50°F and rising at the time of application of the poured joint sealing material. Do not apply sealant if moisture is observed in the joint. Where placed on top of P-606, such as a light can installation, the joint seal shall not be applied until the P-606 has fully cured.

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 always started and maintained in satisfactory condition. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 15 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.** The Contractor must demonstrate sandblasting equipment including the air compressor, hose, guide and nozzle size, under job conditions, before approval in accordance with paragraph 605-3.3. The Contractor shall demonstrate, in the presence of the Resident Project Representative (RPR), that the method cleans the joint and does not damage the joint.

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.

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

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

a. **Sawing.** All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary. All slurry generated from the sawing operations shall be removed immediately and continuously with a method approved by the RPR to the satisfaction of the RPR.

b. **Sealing.** Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, filler, protrusions of hardened concrete, old sealant and other foreign material from the sides and upper edges of the joint space to be sealed. Cleaning shall be accomplished by sandblasting, concrete saw, or waterblaster as specified in paragraph 605-3.2. The newly exposed concrete joint faces and the pavement surface extending a minimum of 1/2 inch 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 considered incidental to the item in which it is used and no separate measurement shall be made

**BASIS OF PAYMENT**

605-5.1 Joint sealing material shall considered incidental to the item in which it is used and no separate payment shall be made.

**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-606 ADHESIVE COMPOUNDS, TWO-COMPONENT FOR SEALING WIRE AND LIGHTS IN PAVEMENT

DESCRIPTION

606-1.1 This specification covers two types of material; a liquid suitable for sealing electrical wire in saw cuts in pavement and for sealing light fixtures or bases in pavement, and a paste suitable for embedding light fixtures in the pavement. Both types of material are two-component filled formulas with the characteristics specified in paragraph 606-2.4. Materials supplied for use with asphalt and/or concrete pavements must be formulated so they are compatible with the asphalt and/or concrete.

MATERIALS

606-2.1 CURING. When pre-warmed to 77° F, mixed, and placed in accordance with manufacturer’s directions, the materials shall cure at temperatures of 45° F or above without the application of external heat.

606-2.2 STORAGE. The adhesive components shall not be stored at temperatures over 86° F, unless otherwise specified by the manufacturer.

606-2.3 CAUTION. Installation and use shall be in accordance with the manufacturer’s recommended procedures. Avoid prolonged or repeated contact with skin. In case of contact, wash with soap and flush with water. If taken internally, call doctor. Keep away from heat or flame. Avoid vapor. Use in well-ventilated areas. Keep in cool place. Keep away from children.

606-2.4 CHARACTERISTICS. When mixed and cured in accordance with the manufacturer’s directions, the materials shall have the following properties shown in Table 1.

Table 1. Property Requirements

<table>
<thead>
<tr>
<th>Physical or Electrical Property</th>
<th>Minimum</th>
<th>Maximum</th>
<th>ASTM Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland cement concrete</td>
<td>1,000 psi</td>
<td></td>
<td>D638</td>
</tr>
<tr>
<td>Asphalt concrete</td>
<td>500 psi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland cement concrete</td>
<td></td>
<td>See note 1</td>
<td>D638</td>
</tr>
<tr>
<td>Asphalt concrete</td>
<td>50%</td>
<td></td>
<td>D638</td>
</tr>
<tr>
<td>Coef. of cub. exp. (cu. cm/cu. cm/°C)</td>
<td>0.00090</td>
<td>0.00120</td>
<td>D1168</td>
</tr>
<tr>
<td>Coef. of lin. exp. (cm/cm/°C)</td>
<td>0.000030</td>
<td>0.000040</td>
<td>D1168</td>
</tr>
<tr>
<td>Dielectric strength, short time test</td>
<td>350 volts/mil.</td>
<td></td>
<td>D149</td>
</tr>
<tr>
<td>Arc resistance</td>
<td>125 sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical or Electrical Property</td>
<td>Minimum</td>
<td>Maximum</td>
<td>ASTM Method</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Pull-off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesion to steel</td>
<td>1,000 psi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesion to Portland cement concrete</td>
<td>200 psi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesion to asphalt concrete</td>
<td>No test available.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesion to aluminum</td>
<td>250 psi</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 20% or more (without filler) for formulations to be supplied for areas subject to freezing.

**SAMPLING, INSPECTION, AND TEST PROCEDURES**

606-3.1 **TENSILE PROPERTIES.** Tests for tensile strength and elongation shall be conducted in accordance with ASTM D638.

606-3.2 **EXPANSION.** Tests for coefficients of linear and cubical expansion shall be conducted in accordance with, Method B, except that mercury shall be used instead of glycerine. The test specimen shall be mixed in the proportions specified by the manufacturer and cured in a glass tub approximately 2-inch long by 3/8 inch in diameter. The interior of the tube shall be precoated with a silicone mold release agent. The hardened sample shall be removed from the tube and aged at room temperature for one (1) week before conducting the test. The test temperature range shall be from 35°F to 140°F.

606-3.3 **TEST FOR DIELECTRIC STRENGTH.** Test for dielectric strength shall be conducted in accordance with ASTM D149 for sealing compounds to be furnished for sealing electrical wires in pavement.

606-3.4 **TEST FOR ARC RESISTANCE.** Test for arc resistance shall be conducted for sealing compounds to be furnished for sealing electrical wires in pavement.

606-3.5 **TEST FOR ADHESION TO STEEL.** The ends of two smooth, clean, steel specimens of convenient size (1 inch by 1 inch by 6 inch) would be satisfactory when bonded together with adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure on a Riehle (or similar) tensile tester. The thickness of adhesive to be tested shall be 1/4 inch.

606-3.6 **ADHESION TO PORTLAND CEMENT CONCRETE**

a. **Concrete test block preparation.** The aggregate grading shall be as shown in Table 2.

The coarse aggregate shall consist of crushed rock having a minimum of 75% of the particles with at least one fractured face and having a water absorption of not more than 1.5%. The fine aggregate shall consist of crushed sand manufactured from the same parent rock as the coarse aggregate. The concrete shall have a water-cement ratio of 5.5 gallons of water per bag of cement, a cement factor of 6, ±0.5, bags of cement per cubic yard of concrete, and a slump of 2-1/2 inch, ±1/2 inch. The ratio of fine aggregate to total aggregate shall be approximately 40% by solid volume. The air content shall be 5.0%, ±0.5%, and it shall be obtained by the addition to the batch of an air-entraining admixture such as Vinsol® resin. The mold shall be of metal and shall be provided with a metal base plate.
Means shall be provided for securing the base plate to the mold. The assembled mold and base plate shall be watertight and shall be oiled with mineral oil before use. The inside measurement of the mold shall be such that several 1-inch by 2-inch by 3-inch test blocks can be cut from the specimen with a concrete saw having a diamond blade. The concrete shall be prepared and cured in accordance with ASTM C192.

<table>
<thead>
<tr>
<th>Type</th>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Aggregate</td>
<td>3/4 inch</td>
<td>97 to 100</td>
</tr>
<tr>
<td></td>
<td>1/2 inch</td>
<td>63 to 69</td>
</tr>
<tr>
<td></td>
<td>3/8 inch</td>
<td>30 to 36</td>
</tr>
<tr>
<td></td>
<td>No. 4</td>
<td>0 to 3</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>No. 4</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>No. 8</td>
<td>82 to 88</td>
</tr>
<tr>
<td></td>
<td>No. 16</td>
<td>60 to 70</td>
</tr>
<tr>
<td></td>
<td>No. 30</td>
<td>40 to 50</td>
</tr>
<tr>
<td></td>
<td>No. 50</td>
<td>16 to 26</td>
</tr>
<tr>
<td></td>
<td>No. 100</td>
<td>5 to 9</td>
</tr>
</tbody>
</table>

b. **Bond test.** Prior to use, oven-dry the test blocks to constant weight at a temperature of 220°F to 230°F, cool to room temperature, 73.4°F ±3°F, in a desiccator, and clean the surface of the blocks of film or powder by vigorous brushing with a stiff-bristled fiber brush. Two test blocks shall be bonded together on the one inch by 3-inch sawed face with the adhesive mixture and allowed to cure at room temperature for a period of time to meet formulation requirements and then tested to failure in a Riehle (or similar) tensile tester. The thickness of the adhesive to be tested shall be 1/4 inch.

606-3.7 **COMPATIBILITY WITH ASPHALT MIX.** Test for compatibility with asphalt in accordance with ASTM D5329.

606-3.8 **ADHESIVE COMPOUNDS - CONTRACTOR’S RESPONSIBILITY.** THE Contractor shall furnish the vendor’s certified test reports for each batch of material delivered to the project. The report shall certify that the material meets specification requirements and is suitable for use with concrete and asphalt concrete pavements. The report shall be provided to and accepted by the Resident Project Representative (RPR) before use of the material. In addition, the Contractor shall obtain a statement from the supplier or manufacturer that guarantees the material for one year. The supplier or manufacturer shall furnish evidence that the material has performed satisfactorily on other projects.

606-3.9 **APPLICATION.** Adhesive shall be applied on a dry, clean surface, free of grease, dust, and other loose particles. The method of mixing and application shall be in strict accordance with the manufacturer’s recommendations. When used with Item P-605, such as light can installation, Item P-605 shall not be applied until the Item P-606 has fully cured.
METHOD OF MEASUREMENT

606-4.1 Two-component adhesive compounds shall be considered incidental to the item which it is used and no separate measurement shall be made.

BASIS OF PAYMENT

606-5.1 Two-component adhesive compounds shall be considered incidental to the item in which they are used, and no separate payment shall be made

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 C192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

ASTM D149 Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D638 Standard Test Method for Tensile Properties of Plastics

ASTM D1168 Standard Test Method for Hydrocarbon Waxes Used for Electrical Insulation

ASTM D5329 Standard Test Methods for Sealants and Fillers, Hot-applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements

END OF ITEM P-606
ITEM P-608 EMULSIFIED ASPHALT SEAL COAT

DESCRIPTION

608-1.1 This item shall consist of the application of an emulsified asphalt surface treatment composed of an emulsion of natural and refined asphalt materials, water and a polymer additive, for taxiways and runways with the application of a suitable aggregate to maintain adequate surface friction; and airfield secondary and tertiary pavements including low-speed taxiways, shoulders, overruns, roads, parking areas, and other general applications with or without aggregate applied as designated on the plans. The terms seal coat, asphalt sealer, and asphalt material are interchangeable throughout this specification. The term emulsified asphalt means an emulsion of natural and refined asphalt materials.

MATERIALS

608-2.1 AGGREGATE. The aggregate material shall be a dry, clean, dust and dirt free, sound, durable, angular shaped manufactured specialty sand, such as that used as an abrasive, with a Mohs hardness of 6 to 8. The Contractor shall submit the specialty sand manufacturer’s technical data and a manufacturer’s Certificate of Analysis (COA) indicating that the specialty sand meets the requirements of the specification to the RPR prior to start of construction. The sand must be approved for use by the RPR and shall meet the following gradation limits when tested in accordance with ASTM C136 and ASTM C117:

<table>
<thead>
<tr>
<th>Aggregate Material Gradation Requirements 1</th>
<th>Sieve Designation (square openings)</th>
<th>Individual Percentage Retained by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 10</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>No. 14</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>No. 16</td>
<td>0-8</td>
<td></td>
</tr>
<tr>
<td>No. 20</td>
<td>0-35</td>
<td></td>
</tr>
<tr>
<td>No. 30</td>
<td>20-50</td>
<td></td>
</tr>
<tr>
<td>No. 40</td>
<td>10-45</td>
<td></td>
</tr>
<tr>
<td>No. 50</td>
<td>0-20</td>
<td></td>
</tr>
<tr>
<td>No. 70</td>
<td>0-5</td>
<td></td>
</tr>
<tr>
<td>No. 100</td>
<td>0-2</td>
<td></td>
</tr>
<tr>
<td>No. 200 (75 µm)</td>
<td>0-2</td>
<td></td>
</tr>
</tbody>
</table>

1 Locally available sand or abrasive material that is slightly outside of the gradation requirements may be approved by the RPR with concurrence by the seal coat manufacturer for the use of locally available sand or abrasive material. The RPR and manufacturer’s field representative should verify acceptance during application of Control strips indicated under paragraph 608-3.2.
The Contractor shall provide a certification showing particle size analysis and properties of the material delivered for use on the project. The Contractor’s certification may be subject to verification by testing the material delivered for use on the project.

608-2.2 ASPHALT EMULSION. The asphalt emulsion shall meet the properties in the following table:

<table>
<thead>
<tr>
<th>Concentrated Asphalt Emulsion Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Properties</strong></td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol at 77°F</td>
</tr>
<tr>
<td>Residue by Distillation or Evaporation</td>
</tr>
<tr>
<td>Sieve Test</td>
</tr>
<tr>
<td>24-hour Stability</td>
</tr>
<tr>
<td>5-day Settlement Test</td>
</tr>
<tr>
<td>Particle Charge¹</td>
</tr>
<tr>
<td><strong>Specification</strong></td>
</tr>
<tr>
<td>ASTM D7496</td>
</tr>
<tr>
<td>ASTM D6997 or ASTM D6934</td>
</tr>
<tr>
<td>ASTM D6933</td>
</tr>
<tr>
<td>ASTM D6930</td>
</tr>
<tr>
<td>ASTM D7402</td>
</tr>
<tr>
<td><strong>Limits</strong></td>
</tr>
<tr>
<td>20 – 100 seconds</td>
</tr>
<tr>
<td>57% minimum</td>
</tr>
<tr>
<td>0.1% maximum</td>
</tr>
<tr>
<td>1% maximum</td>
</tr>
<tr>
<td>5.0% maximum</td>
</tr>
<tr>
<td>Positive</td>
</tr>
<tr>
<td>6.5 maximum pH</td>
</tr>
</tbody>
</table>

¹ pH may be used in lieu of the particle charge test which is sometimes inconclusive in slow setting asphalt emulsions.

The asphalt material base residue shall contain not less than 20% gilsonite, or uintaite and shall not contain any tall oil pitch or coal tar material and shall contain no less than one percent (1%) polymer.

<table>
<thead>
<tr>
<th>Tests on Residue from Distillation or Evaporation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Properties</strong></td>
</tr>
<tr>
<td>Viscosity at 275°F</td>
</tr>
<tr>
<td>Solubility in 1, 1, 1 trichloroethylene</td>
</tr>
<tr>
<td>Penetration</td>
</tr>
<tr>
<td>Asphaltenes</td>
</tr>
<tr>
<td>Saturates</td>
</tr>
<tr>
<td>Polar Compounds</td>
</tr>
<tr>
<td>Aromatics</td>
</tr>
<tr>
<td><strong>Specification</strong></td>
</tr>
<tr>
<td>ASTM D4402</td>
</tr>
<tr>
<td>ASTM D2042</td>
</tr>
<tr>
<td>ASTM D5</td>
</tr>
<tr>
<td>ASTM D2007</td>
</tr>
<tr>
<td>ASTM D2007</td>
</tr>
<tr>
<td>ASTM D2007</td>
</tr>
<tr>
<td><strong>Limits</strong></td>
</tr>
<tr>
<td>1750 cts maximum</td>
</tr>
<tr>
<td>97.5% minimum</td>
</tr>
<tr>
<td>50 dmm maximum</td>
</tr>
<tr>
<td>15% minimum</td>
</tr>
<tr>
<td>15% maximum</td>
</tr>
<tr>
<td>25% minimum</td>
</tr>
<tr>
<td>15% minimum</td>
</tr>
</tbody>
</table>

The asphalt emulsion, when diluted in the volumetric proportion of one-part concentrated asphalt material to one-part hot water shall have the following properties:
One-to-One Dilution Emulsion Properties

<table>
<thead>
<tr>
<th>Properties</th>
<th>Specification</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Ready-to-Apply Form, one-part concentrate to one-part water, by volume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol at 77°F (25°C)</td>
<td>ASTM D7496</td>
<td>5 – 50 seconds</td>
</tr>
<tr>
<td>Residue by Distillation or Evaporation</td>
<td>ASTM D6997 or</td>
<td>28.5% minimum</td>
</tr>
<tr>
<td></td>
<td>ASTM D6934</td>
<td></td>
</tr>
<tr>
<td>Pumping Stability 1</td>
<td>Pass</td>
<td></td>
</tr>
</tbody>
</table>

1 Pumping stability is tested by pumping one-pint of seal coat diluted one (1) part concentrate to one (1) part water, at 77°F, through a 1/4-inch gear pump operating 1750 rpm for 10 minutes with no significant separation or coagulation.

The Contractor shall provide a copy of the manufacturer’s Certificate of Analysis (COA) for the emulsified asphalt delivered to the project. If the asphalt emulsion is diluted at other than the manufacturer’s facility, the Contractor shall provide a supplemental COA from an independent laboratory verifying the asphalt emulsion properties.

The COA shall be provided to and approved by the RPR before the emulsified asphalt is applied. The furnishing of the vendor’s certified test report 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.

The asphalt material storage and handling temperature shall be between 50°F - 160°F and the material shall be protected from freezing, or whenever outside temperature drops below 40°F for prolonged time periods.

Contractor shall provide a list of airport pavement projects, exposed to similar climate conditions, where this product has been successfully applied within at least 5 years of the project.

608-2.3 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. Water used in making and diluting the emulsion shall be potable, with a maximum hardness of 90ppm calcium and 15ppm magnesium; deleterious iron, sulfates, and phosphates maximum 7ppm, and less than 1ppm of organic byproducts. Water shall be a minimum of 140°F prior to adding to emulsion.

608-2.4 POLYMER. The polymer shall meet the properties in the following table:
Polymer Properties

<table>
<thead>
<tr>
<th>Properties</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids Content</td>
<td>47% to 65%, Percent by Weight</td>
</tr>
<tr>
<td>Weight</td>
<td>8.0 to 9.0 pounds/gallon</td>
</tr>
<tr>
<td>pH</td>
<td>3.0 to 8.0</td>
</tr>
<tr>
<td>Particle Charge</td>
<td>Nonionic/Cationic</td>
</tr>
<tr>
<td>Mechanical Stability</td>
<td>Excellent</td>
</tr>
<tr>
<td>Film Forming Temperature, °C</td>
<td>+5°C, minimum</td>
</tr>
<tr>
<td>Tg, °C</td>
<td>22°C, maximum</td>
</tr>
</tbody>
</table>

The manufacturer shall provide a copy of the Certificate of Analysis (COA) for the polymer used in the seal coat; and the Contractor shall include the COA with the emulsified asphalt COA when submitting to the RPR.

608-2.5 SEAL COAT WITH AGGREGATE. The Contractor shall submit friction test data from no less than one of the airport projects identified under 608-2.2. The test data must be from the same project and include technical details on application rates, aggregate rates, and point of contact at the airport to confirm use and success of sealer with aggregate.

Friction test data in accordance with AC 150/5320-12, at 40 or 60 mph wet, must include as a minimum; the friction value prior to sealant application; two values, between 24 and 96 hours after application, with a minimum of 24 hours between tests; and one value between 180 days and 360 days after the application. The results of the tests between 24 and 96 hours shall indicate friction is increasing at a rate to obtain similar friction value of the pavement surface prior to application, and the long-term test shall indicate no apparent adverse effect with time relative to friction values and existing pavement surface.

Seal coat material submittal without required friction performance will not be approved. Friction tests performed on this project cannot be used as a substitute of this requirement.

COMPOSITION AND APPLICATION RATE

608-3.1 APPLICATION RATE. The approximate amounts of materials per square yard (square meter) for the asphalt surface treatment shall be as provided in the table for the treatment area(s) at the specified dilution rate(s) as noted on the plans. The actual application rates will vary within the range specified to suit field conditions and will be recommended by the manufacturer’s representative and approved by the RPR from the test area/sections evaluation.

<table>
<thead>
<tr>
<th>Application Rate</th>
<th>Dilution Rate</th>
<th>Quantity of Emulsion gal/yd²</th>
<th>Quantity of Aggregate lb/yd²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1:1</td>
<td>0.10-0.17</td>
<td>0.20-0.50</td>
</tr>
</tbody>
</table>
608-3.2 CONTROL AREAS AND CONTROL STRIPS. Prior to full application, the control strip must be accepted by the RPR. The surface preparation, personnel, equipment, and method of operation used on the test area(s) and control strip(s) shall be the same as used on the remainder of the work.

A qualified manufacturer’s representative shall be present in the field to assist the Contractor in applying control areas and/or control strips to determine the appropriate application rate of both emulsion and aggregate to be approved by the RPR.

A test area(s) and control strip(s) shall be applied for each differing asphalt pavement surface identified in the project. The test area(s) and control strip(s) shall be used to determine the material application rate(s) of both emulsion and sand prior to full production.

a. For taxiway, taxilane and apron surfaces. Prior to full application, the Contractor shall place test areas at varying application rates as recommended by the Contractor’s manufacturer’s representative to determine appropriate application rate(s). The test areas will be located on representative section(s) of the pavement to receive the asphalt surface treatment designated by the RPR.

b. For runway and high-speed exit taxiway surfaces. Prior to full application, the Contractor shall place a series of control strips a minimum of 300 feet long by 12 feet wide, or width of anticipated application, whichever is greater, at varying application rates as recommended by the manufacturer’s representative and acceptable to the RPR to determine appropriate application rate(s). The control strips should be separated by a minimum of 200 feet between control strips. The area to be tested will be located on a representative section of the pavement to receive the asphalt surface treatment designated by the RPR. The control strips should be placed under similar field conditions as anticipated for the actual application. The skid resistance of the existing pavement shall be determined for each control strip with a continuous friction measuring equipment (CFME). The skid resistance of existing pavement can be immediately adjacent to the control strip or at the same location as the control strip if testing prior to application. The Contractor may begin testing the skid resistance of runway and high-speed exit taxiway control strips after application of the asphalt surface treatment has fully cured, generally 8 to 36 hours after application of the control strips depending on site and environmental conditions. Aircraft shall not be permitted on the runway or high-speed exit taxiway control strips until such time as the Contractor validates that its surface friction meets the maintenance planning friction levels in AC 150/5320-12, Table 3-2 when tested at speeds of 40 and 60 mph (65 and 95 km/h) wet with approved CFME.

If the control strip should prove to be unsatisfactory, necessary adjustments to the application rate, placement operations, and equipment shall be made. Additional control strips shall be placed, and additional skid resistance tests performed and evaluated. Full production shall not begin without the RPR’s approval of an appropriate application rate(s). Acceptable control strips shall be paid for in accordance with paragraph 608-8.1.

CONSTRUCTION METHODS

608-4.1 WORKER SAFETY. The Contractor shall obtain a Safety Data Sheet (SDS) for both the asphalt emulsion product and sand and require workmen to follow the manufacturer’s recommended safety precautions.

608-4.2 WEATHER LIMITATIONS. The asphalt emulsion shall be applied only when the existing pavement surface is dry and when the weather is not foggy, rainy, or when the wind velocity will prevent the uniform application of the material. No material shall be applied...
in strong winds that interfere with the uniform application of the material(s), or when dust or sand is blowing or when rain is anticipated within eight (8) hours of application completion. The atmospheric temperature and the pavement surface temperature shall both be at, or above 60°F and rising. Seal coat shall not be applied when pavement temperatures are expected to exceed 130°F within the subsequent 72 hours if traffic will be opened on pavement within those 72 hours. During application, account for wind drift. Cover existing buildings, structures, runway edge lights, taxiway edge lights, informational signs, retro-reflective marking and in-pavement duct markers as necessary to protect against overspray before applying the emulsion. Should emulsion get on any light or marker fixture, promptly clean the fixture. If cleaning is not satisfactory to the RPR, the Contractor shall replace any light, sign or marker with equivalent equipment at no cost to the Owner.

608-4.3 EQUIPMENT AND TOOLS. The Contractor shall furnish all equipment, tools, and machinery necessary for the performance of the work.

a. Pressure distributor. 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 hundred (700) feet per minute. The equipment will be tested under pressure for leaks and to ensure proper set-up before use. The Contractor will provide verification of truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application per nozzle manufacturer, spray-bar height and pressure and pump speed appropriate for the viscosity and temperature of sealer material, 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 12-foot, minimum, spray bar with individual nozzle control. The distributor truck shall be capable of specific application rates in the range of 0.05 to 0.25 gallons per square yard. These rates shall be computer-controlled rather than mechanical. 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.

The distributor truck shall effectively heat and mix the material to the required temperature prior to application in accordance with the manufacturer’s recommendations.

The distributor shall be equipped with a hand sprayer to spray the emulsion in areas not accessible to the distributor truck.

b. Aggregate spreader. The asphalt distributor truck will be equipped with an aggregate spreader mounted to the distributor truck that can apply sand to the emulsion in a single pass operation without driving through wet emulsion. The aggregate spreader shall be equipped with a variable control system capable of uniformly distributing the sand at the specified rate at varying application widths and speeds. The aggregate spreader must be adjusted to produce an even and accurate application of specified aggregate. Prior to any seal coat application, the aggregate spreader will be calibrated onsite to ensure acceptable uniformity of spread. The RPR will observe the calibration and verify the results. The aggregate spreader will be re-calibrated each time the aggregate rate is changed either during the application of test strips or production. The Contractor may consult the seal coat manufacturer representative for procedure and guidance. The sander shall have a minimum
hopper capacity of 3,000 pounds of sand. Push-type hand sanders will be allowed for use around lights, signs and other obstructions, if necessary.

c. Power broom/blower. A power broom and/or blower shall be provided for removing loose material from the surface to be treated.

d. Equipment calibration. Asphalt distributors must be calibrated within the same construction season 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.

608-4.4 PREPARATION OF ASPHALT PAVEMENT SURFACES. Clean pavement surface immediately prior to placing the seal coat so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film. Remove oil or grease from the asphalt pavement by scrubbing with a detergent, washing thoroughly with clean water, and then treat these areas with a spot primer.

a. New asphalt pavement surfaces. Allow new asphalt pavement surfaces to cure so that there is no concentration of oils on the surface. A period of at least 30 days at 70°F daytime temperatures shall elapse between the placement of a hot mixed asphalt concrete surface course and the application of the surface treatment.

Perform a water-break-free test to confirm that the surface oils have degraded and dissipated. (Cast approximately one gallon of clean water out over the surface. The water should sheet out and wet the surface uniformly without crawling or showing oil rings.) If signs of crawling or oil rings are apparent on the pavement surface, additional time must be allowed for additional curing and retesting of the pavement surface prior to treatment.

608-4.5 EMULSION MIXING. The application emulsion shall be obtained by blending asphalt material concentrate, water and polymer, if specified. Always add heated water to the asphalt material concentrate, never add asphalt material concentrate to heated water. Mix one-part heated water to one part asphalt material concentrate, by volume.

Add 1% polymer, by volume, to the emulsion mix. If the polymer is added to the emulsion mix at the plant, submit weight scale tickets to the RPR. As an option, the polymer may be added to the emulsion mix at the job site provided the polymer is added slowly while the asphalt distributor truck circulating pump is running. The mix must be agitated for a minimum of 15 minutes or until the polymer is mixed to the satisfaction of the RPR.

608-4.6 APPLICATION OF ASPHALT EMULSION. The asphalt emulsion shall be applied using a pressure distributor upon the properly prepared, clean and dry surface at the application rate recommended by the manufacturer’s representative and approved by the RPR from the test area/sections evaluation for each designated treatment area. The asphalt emulsion should be applied at a temperature between 130°F and 160°F or in accordance with the manufacturer's recommendation.

If low spots and depressions greater than 1/2 inch in depth in the pavement surface cause ponding or puddling of the applied materials, the pavement surface shall be lightly broomed with a broom or brush type squeegee until the pavement surface is free of any pools of excess material.

During all applications, the surfaces of adjacent structures shall be protected to prevent their being spattered or marred.
608-4.7 APPLICATION OF AGGREGATE MATERIAL. Immediately following the application of the asphalt emulsion, friction sand at the rate recommended by the manufacturer’s representative and approved by the RPR from the test area/sections evaluation for each designated application area, shall be spread uniformly over the asphalt emulsion in a single-pass operation simultaneous with the sealer application. The aggregate shall be spread to the same width of application as the asphalt material and shall not be applied in such thickness as to cause blanketing.

Sprinkling of additional aggregate material and spraying additional asphalt material over areas that show up having insufficient cover or bitumen, shall be done by hand whenever necessary. In areas where hand work is necessitated, the sand shall be applied before the sealant begins to break.

Minimize aggregate from being broadcast and accumulating on the untreated pavement adjacent to an application pass. Prior to the next application pass, the Contractor shall clean areas of excess or loose aggregate and remove from project site.

QUALITY CONTROL (QC)

608-5.1 MANUFACTURER’S REPRESENTATION. The manufacturer’s representative knowledgeable of the material, procedures, and equipment described in the specification is responsible to assist the Contractor and RPR in determining the appropriate application rates of the emulsion and aggregate, as well as recommendations for proper preparation and start-up of seal coat application. Documentation of the manufacturer representative’s experience and knowledge for applying the seal coat product shall be furnished to the RPR a minimum of 10 work days prior to placement of the control strips. The cost of the manufacturer’s representative shall be included in the Contractor’s bid price.

608-5.2 CONTRACTOR QUALIFICATIONS. The Contractor shall provide documentation to the RPR that the seal coat Contractor is qualified to apply the seal coat, including personnel, and equipment, and has made at least three (3) applications similar to this project in the past two (2) years.

MATERIAL ACCEPTANCE

608-6.1 APPLICATION RATE. The rate of application of the asphalt emulsion shall be verified at least twice per day.

608-6.2 FRICTION TESTS. Friction tests in accordance with AC 150/5320-12, Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces, shall be performed on all runway and high-speed taxiways that received a seal coat. Each test includes performing friction tests at 40 mph and 60 mph both wet, 15 feet to each side of runway centerline with approved continuous friction measuring equipment (CFME). The Contractor shall coordinate testing with the RPR and provide the RPR a written report of friction test results. The RPR shall be present for testing.

METHOD OF MEASUREMENT

608-7.1 Asphalt surface treatment shall be considered incidental to Item P-403 and no separate measurement shall be made.
BASIS OF PAYMENT

608-8.1 Asphalt surface treatment shall be considered incidental to Item P-403 and no separate payment shall be made.

REFERENCES

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

ASTM International (ASTM)

ASTM C117 Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D5 Standard Test Method for Penetration of Asphalt Materials
ASTM D2995 Standard Practice for Estimating Application Rate of Bituminous Distributors

Advisory Circulars (AC)

AC 150/5320-12 Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces

END OF ITEM P-608
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 the P-501 reactivity test requirements may be utilized.

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

<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>

**a. 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.

**610-2.4 CEMENT.** Cement shall conform to the requirements of ASTM C150 Type I or II.

**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 6% 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 **ADMIIXTURES.** The Contractor shall submit certificates indicating that the material to be furnished meets all 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 conforming to the requirements of ASTM A615, ASTM A706, ASTM A775, or ASTM A934; or welded deformed steel fabric conforming to the requirements of ASTM A1064.

610-2.11 **MATERIALS FOR CURING CONCRETE.** Curing materials shall conform to white-pigmented liquid membrane-forming compound conforming to ASTM C309, Type 2, Class B, conforming to ASTM C309.

**CONSTRUCTION METHODS**

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

610-3.2 **CONCRETE MIXTURE.** The concrete shall develop a compressive strength of 4,000 psi in 28 days, unless otherwise noted on the plans or specifications, 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 of the concrete shall be 5% +/- 1.2% as determined by ASTM C231 and shall have a slump of not more than 4 inches as determined by ASTM C143.
610-3.3 MIXING. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C94 or ASTM C685.

The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F 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 100°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.

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

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

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

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

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

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

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

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

610-3.13 COLD WEATHER PLACING. When concrete is placed at temperatures below 40°F, follow the cold weather concreting recommendations found in ACI 306R, Cold Weather Concreting.

610-3.14 HOT WEATHER PLACING. When concrete is placed in hot weather greater than 85°F, follow the hot weather concreting recommendations found in ACI 305R, Hot Weather Concreting.

QUALITY ASSURANCE (QA)

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

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

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

610-5.1 Concrete shall be considered incidental to the item which it is used, and no separate measurement shall be made.

BASIS OF PAYMENT

610-6.1 Concrete shall be considered incidental to the item which it is used, and no separate payment shall be made.

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 A615 Standard Specification for Deformed and Plain Carbon-Steel Bars 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 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 C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
- ASTM C150 Standard Specification for Portland Cement
- 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
<table>
<thead>
<tr>
<th>Standard Specification/Method/Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C311</td>
<td>Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete</td>
</tr>
<tr>
<td>ASTM C494</td>
<td>Chemical Admixtures for Concrete</td>
</tr>
<tr>
<td>ASTM C618</td>
<td>Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete</td>
</tr>
<tr>
<td>ASTM C666</td>
<td>Resistance of Concrete to Rapid Freezing and Thawing</td>
</tr>
<tr>
<td>ASTM C685</td>
<td>Concrete Made by Volumetric Batching and Continuous Mixing</td>
</tr>
<tr>
<td>ASTM C989</td>
<td>Slag Cement for Use in Concrete and Mortars</td>
</tr>
<tr>
<td>ASTM C1017</td>
<td>Chemical Admixtures for Use in Producing Flowing Concrete</td>
</tr>
<tr>
<td>ASTM C1077</td>
<td>Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation</td>
</tr>
<tr>
<td>ASTM C1260</td>
<td>Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)</td>
</tr>
<tr>
<td>ASTM D1751</td>
<td>Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)</td>
</tr>
</tbody>
</table>

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, 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.

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>Waterborne</td>
</tr>
<tr>
<td>Waterborne</td>
</tr>
<tr>
<td>Waterborne</td>
</tr>
<tr>
<td>Waterborne</td>
</tr>
</tbody>
</table>

1 See paragraph 620-2.2a
2 See paragraph 620-2.2b

Paint. Paint shall be waterborne in accordance with the requirements of this paragraph. Paint colors shall comply with Federal Standard No. 595. Paint shall meet the requirements of Federal Specification TT-P-1952F, Type I. 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, yellow, and red paint shall meet the requirements for Federal Specification TT-B-1325D and be of the type shown in Table 1.

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 or in any temporary paint.

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.

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 contaminates 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.

b. Preparation of pavement to remove existing markings. Existing pavement markings shall be removed by rotary grinding, water blasting, or by other methods approved 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. Any damage to the existing joint seal shall be repaired in accordance with P-605 or P-604 to the satisfaction of the RPR. Wastes associated with paint removal activities should be tested for lead and chromium content prior to disposal.
c. 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. Any damage to the pavement joint seals shall be repaired in accordance with P-605 to the satisfaction of the RPR prior to remarking.

Prior to the application of markings, the Contractor shall certify in writing 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 manufactures application and surface preparation requirements must be submitted to the RPR prior to the initial application of markings.

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 30 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.

Temporary markings shall be applied where indicated on the drawings and when a pavement will open to traffic prior to the 30-day period above. All temporary markings shall be applied at double the application rate shown in Table 1. No black outline or glass beads are required for temporary markings.

The edges of the markings shall not vary from a straight line more than 1/2-inch in 50 feet, and marking dimensions and spacing shall be within the following tolerances:

<table>
<thead>
<tr>
<th>Dimension and Spacing</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>36-inch or less</td>
<td>±1/2-inch</td>
</tr>
<tr>
<td>greater than 36-inch to 6 feet</td>
<td>±1 inch</td>
</tr>
<tr>
<td>greater than 6 feet to 60 feet</td>
<td>±2-inch</td>
</tr>
<tr>
<td>greater than 60 feet</td>
<td>±3-inch</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 full application of airfield markings, the Contractor shall prepare a control strip in the presence of the RPR. The Contractor shall demonstrate the surface preparation method and all striping equipment to be used on the project. The marking equipment must achieve the prescribed application rate of paint and population of glass beads (per Table 1) that are properly embedded and evenly distributed across the full width of the marking. Prior to acceptance of the control strip, markings must be evaluated during darkness to ensure a uniform appearance.

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.

<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, Gradation A</td>
<td>-</td>
</tr>
<tr>
<td>Initial Type III</td>
<td>600</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.

620-3.10 MARKING REMOVAL. Existing markings must be completely removed as shown on the plans in a manner that will minimize damage to the pavement surface, with a method approved by the RPR. After removal, the surface shall be cleaned of all residue or debris. Any damage to the pavement joint seals shall be repaired in accordance with P-605 to the satisfaction of the RPR.

METHOD OF MEASUREMENT

620-4.1 The quantity of markings to be paid for shall be measured by the number of square feet of painting.

620-4.2 The quantity of temporary markings to be paid for shall be the number of square feet of painting performed in accordance with the specifications and accepted by the RPR. Temporary marking includes surface preparation, application and complete removal of the temporary marking.
620-4.3  The quantity of marking removal to be paid for shall be measured by the number of square feet of markings removed in accordance with the specifications and accepted by the RPR.

620-4.4  The quantity of surface painted signs to be paid for shall be measured by each surface painted sign marked in accordance with the specifications and accepted by the RPR.

BASIS OF PAYMENT

620-5.1  Payment for markings shall be made at the contract price for the number of square feet of painting. 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.

620-5.2  Payment for temporary markings shall be made at the contract price for the number of square feet of painting. 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.

620-5.3  Payment for marking removal shall be made at the contract price for the number of square feet of markings removed. 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.

620-5.4  Payment for surface painted signs shall be made at the contract price for each surface painted sign painted. 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.

Payment will be made under:

- Item P-620-5.1 Reflective Marking – per square foot
- Item P-620-5.2 Non-Reflective Marking – per square foot
- Item P-620-5.3 Temporary Marking – per square foot
- Item P-620-5.4 Marking Removal – per square foot
- Item P-620-5.5 Surface Painted Sign – 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)


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

END OF ITEM P-620
ITEM T-905 TOPSOIL

DESCRIPTION

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

MATERIALS

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

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

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

CONSTRUCTION METHODS

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

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the RPR before the various operations are started.
905-3.2 PREPARING THE GROUND SURFACE. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the RPR, to a minimum depth of 2 inches to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

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

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

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

905-3.4 PLACING TOPSOIL. The topsoil shall be evenly spread on the prepared areas to a uniform depth of 4 inches after compaction, unless otherwise shown on the plans. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

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

METHOD OF MEASUREMENT

905-4.1 No additional measurement will be made for topsoil, it shall be incidental to the placement of sod.

BASIS OF PAYMENT

905-5.1 No separate payment will be made for the placement of topsoil. It shall be considered incidental to the placement of the sodding.
REFERENCES

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

ASTM International (ASTM)

ASTM C117  Materials Finer than 75 \( \mu \text{m} \) (No. 200) Sieve in Mineral Aggregates by Washing

Advisory Circulars (AC)

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

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-905
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ITEM SS-C-1391B INSTALLATION AND SPLICING OF FAA CABLES FOR DFW AIRPORT

DESCRIPTION

1391B-1.1 This item shall consist of furnishing all equipment and materials for installation of electrical cables buried directly in the earth or installed in underground duct or conduit. It shall also include trenching, backfilling, installation, splicing or other joining of cables, mandreling, installation of cable and duct markers, and testing of cables for acceptability.

EQUIPMENT AND MATERIALS

1391B-2.1 GENERAL. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturers’ certification of compliance with the applicable specification when so requested by the Owner’s Authorized Representative (OAR). The requirements of this specification shall be considered as minimum requirements and shall not relieve the contractor from furnishing and installing higher grades of materials than specified therein when so required by the contract drawings and specifications. The installation shall conform to the applicable rules of the National Electrical Code or local code, whichever requires the highest quality of materials.

1391B-2.2 GOVERNMENT FURNISHED CABLE. Government furnished cable will be delivered to the contractor in accordance with the provisions of the contract. The contractor shall test the cable in accordance with paragraph 4.1 and report electrical or physical cable defects within two weeks of cable receipt. If adequate cable lengths are unavailable for testing on the reel, a visual inspection shall be made and any damage reported to the OAR. The required tests shall then be made immediately after unreeling. Hidden defects discovered when installing the cable shall be reported to the OAR in accordance with the contract provisions.

1391B-2.3 CONTRACTOR-FURNISHED CABLE. Single and multi-conductor power, control and signal cables furnished by the contractor shall conform to the following FAA specifications where applicable.

- FAA-E-2013 for single-and multi-conductor power cables used in 600 to 5,000 volt applications;
- FAA-E-2042 for use in electrical control applications;
- FAA-E-2072 for use in telephone communications;
- FAA-E-2171, -2271, -2524, -2619 as appropriate for coaxial communications cables;
- FAA-E-2793 for single and multi-conductor power cables used in 5,000 to 25,000 volt applications;
- L-824 Class C, 5 kV for airport single-conductor series lighting cable.

For applications where no FAA specification is appropriate, the cable shall meet the following minimum requirements:
a. Copper conductors.

b. Thermoplastic, thermosetting, or silicon rubber insulation.

c. Neoprene, polyethylene, or vinyl jacket for normal areas and PTFE (Teflon) jacket in areas exposed to fuel, oil, solvent or chemical leakage, excessive ground water or extremely acidic soil.

d. For rated voltages to 8 kV, insulation shall have a minimum continuous voltage withstanding a capability of 4 times rated voltage (but not less than 150 volts). For rated voltages above 8 kV, insulation shall have a minimum continuous voltage withstanding capability of 3 times rated voltage. Cable voltage surge capabilities shall be 15 times rated voltage for voltages to 8 kV, 9 times rated voltage for voltages above 8 kV through 15 kV, and 7 times rated voltage for voltages above 15 kV through 25 kV.

e. The pull strength of the completed cable(s) shall exceed the expected installation forces by a minimum of 50 percent.

**CONSTRUCTION METHODS**

1391B-3.1 **GENERAL.** All work shall be done by experienced personnel regularly engaged in this type of work. All cable splices shall be performed only by experienced and qualified cable splicers. Before any cable splices are made, the OAR or the FAA may request an example splice be made to demonstrate their qualifications. The workers shall be properly licensed where required by law.

1391B-3.2 **TRENCHING PRECAUTIONS.** The contractor shall take all reasonable precautions to protect existing underground equipment and utilities such as fuel tanks, water lines, and buried control and power cables. All known FAA power and control cables leading to and from any operating facility will be marked in the field by the FAA for the information of the contractor before starting work in the general vicinity. It is the intent of the FAA to only mark these cables one time for the contractor. It is the contractor’s responsibility to maintain these markings throughout the course of the project by whatever means available to him. This may mean that he will need to survey the pin flags or find another method of marking that will be more permanent and will not be mowed down by airport mowers. The contractor shall contact utility companies and the OAR for the location of existing utility lines and FAA cables. Thereafter, through the entire construction period, buried equipment and utilities shall be protected from damage. The contractor shall immediately repair, with equal material by skilled workmen, any underground cables damaged by contract workers, equipment or work. Prior approval from OAR shall be obtained for the materials, workers, time of day or night for making repairs, method of repairs, and for any permanent repairs the contractor proposes to make. In the event of an inadvertent cable cut, the contractor shall immediately stop work and notify the OAR. Upon completion, any repair work shall be inspected and approved by OAR with the concurrence of the affected utility company or FAA.

1391B-3.3 **EXCAVATION.** Where turf is well established and sod can be removed, it shall be carefully stripped and properly stored. The contractor shall excavate all trenches for direct-earth burial cable as follows:

(1) At the depth specified in paragraph 3.3b.
(2) To a width of not less than six (6) inches for single or multiple runs of power, or control and signal cable.

(3) To a width and depth which will provide horizontal or vertical separation of power cables as specified in paragraph 3.7a.(1). from other power cables or different voltage ratings, or from power cable and any control or signal cable.

(4) Backfill shall be firmly tamped in the separation area.

Unless otherwise specified, all cables in the same location and running in the same general direction shall be installed in the same trench. Trenches for cables may be excavated manually or with powered trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, trenches shall be opened only for the time required to install and inspect cables. The trench shall be closed in the same working day or marked, barricaded and/or lighted according to current D/FW Airport specifications and requirements.

a. Rock. Where rock is encountered, it shall be removed to a depth of 3 inches below the required cable depth and shall be replaced with a bedding material of earth or sand containing no material aggregate particles that would be retained on a ¼ inch sieve. When ledge is encountered, the OAR shall be consulted regarding alternatives such as rerouting, transition to overhead lines, or installation in rigid-metal conduit.

b. Cable Location and Depth Requirements. Unless otherwise specified, all cables, ducts, and conduits shall be installed as follows:

(1) Direct-earth burial cables shall be a minimum of 24 inches below finished grade when on airport or government controlled property, and 36 inches below finished grade when off airport or government property. If finished grade has not been established before the cable trenches are excavated it will be the contractors responsibility to determine what the final finished grade elevation will be and excavate the trench deep enough to meet the depth requirements at the end of the project. Cables shall not be direct buried under paved areas, roadways, railroad tracks, or ditches.

(2) Underground ducts shall be installed so that the tops of all such ducts are at least 18 inches below finished grade. Underground ducts, except rigid steel conduit and concrete-encased PVC or steel conduits, shall not be installed under paved areas, roadways, railroad tracks, or ditches.

(3) Concrete-encased duct or rigid steel conduit shall be installed so that the top of the concrete envelope or conduit is not less than 18 inches below the bottom of paving when installed under runways, taxiways, and other paved areas; and not less than 18 inches below finished grade when installed in unpaved areas.

(4) When cable is routed under railroad tracks, it shall be rigid-steel conduit or concrete encased duct with the top of the duct not less than 42 inches below the base of the rail.

1391B-3.4 BACKFILLING. Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations. Trenches shall be completely backfilled and tamped level with the adjacent surface. If necessary to obtain the desired compaction, backfill material shall be moistened or aerated. When sod is to be placed over a trench,
backfill shall be stopped at a depth equal to the thickness of the sod to be used. Any excess excavated material shall be removed in accordance with instructions of the OAR.

**a. Underground Cable.** After underground cable has been installed, the trench shall be backfilled. The first layer of backfill shall be 3 inches deep, loose measurement, and shall be either earth or natural sand containing no material aggregate particles that would be retained on a ¼ inch sieve. This layer shall not be compacted, except as noted in paragraph 3.6i. The second layer shall be 9 inches deep, loose measurement, and shall contain no particles that would remain on a 1 inch sieve. The remainder of the backfill shall be excavated or imported material and shall not contain stone aggregate larger than 4 inches maximum diameter. The second and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent undisturbed soil and to the satisfaction of the OAR.

1391B-3.5 **RESTORATION.** Where soil has been removed it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction, and other work shall be restored to the original condition. Restoration shall include any necessary grading, fertilizing, liming, seeding, sodding, sprigging or hydro-mulching as required to restore the disturbed area to match the adjacent area. Where trenching cuts through paved areas, the surface shall be properly backfilled and resurfaced with paving similar to the original paving. Resurfaced areas shall be level with original paving, free from cracks and capable of withstanding full traffic loads without settling or cracking. The contractor shall be held responsible for maintaining all disturbed and restored surfaces until final acceptance by the OAR.

1391B-3.6 **INSTALLATION FOR UNDERGROUND DUCTS.** All underground ducts shall be: (a) PVC coated (inside and outside) rigid-metal conduit (heavy wall) conforming to Federal Specification WW-C-581, or (b) Rigid non-metallic conduit (duct) conforming to UL 651 or NEMA TC 6.

**a. Conduit Burial.** Rigid-metal conduits may be direct earth buried. Rigid non-metallic conduits shall be concrete encased unless direct burial without concrete encasing is specified on applicable drawings. All rigid-metal conduit shall terminate with an O.Z. Type BLG insulated ground bushing and double locknut at each underground or cabinet box termination. In exterior locations, exposed threads of metal conduit shall be protected using a zinc-rich cold galvanizing compound.

**b. Duct Size, Material, and Installation.** Ducts shall be of the size, material, and type indicated on the drawings or specifications. Standard precast spacers shall be used for duct support and alignment. Where no size is indicated on the drawings or specifications, the ducts shall not be less than 4 inches inside diameter. All duct lines shall be laid to slope toward handholes, manholes and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to maintain the slope all one way, the duct line shall be sloped from the center in both directions toward manholes, handholes or duct ends. Pockets or traps where moisture may accumulate shall be avoided.

**c. Access Penetrations.** Where a steel conduit penetrates a wall of a manhole or handhole, a grounding bushing shall be installed. These grounding bushings shall be connected to each other and to the earth ground system with No. 6 AWG bare copper conductors. All conduits entering a junction box or other electrical cabinets from underground shall be sealed with 3M “Ductseal” or equal conduit sealant. Expanding foam...
sealant such as “Great-Stuff” will not be allowed for this purpose. All conduit connections to exterior boxes, electrical cabinets or switches shall be made with weatherproof hub fittings.

d. Mandrel Requirements. The contractor shall mandrel each duct he installs and each existing duct in which he installs or replaces cable. An iron-shod mandrel, not more than ¼-inch smaller than the bore of the duct shall be pushed through each duct with jointed conduit rods. The mandrel shall have a leather or rubber gasket slightly larger than the duct hole.

e. Spare Ducts. All spare ducts installed by the contractor shall be provided with No. 10 AWG copper-clad steel pull wires for metal conduit or polyolefin pull lines with a minimum tensile strength of 200 pounds for non-metallic conduit. The open ends of the spare ducts shall be sealed with removable tapered plugs, of a type recommended by the duct manufacturers. The plug shall be adapted to firmly secure the pull wire.

f. Boring Conduit or Casing. Conduit or castings required under roadways or railroads shall be installed by boring. Jacking of conduit will not be allowed. Conduits to be bored under roads off airport property shall be a minimum of 36 inches below finished grade.

g. Duct Protection. All ducts shall be securely fastened in place during construction and progress of the work, and shall be plugged to prevent entrance of foreign material. Any duct section having a defective joint shall not be installed.

h. Ducts Encased in Concrete. All concrete encased ducts shall be placed on a layer of concrete not less than 3 inches thick prior to its initial set. Where two or more ducts are encased in concrete the contractor shall space them not less than 1-1/2 inches apart (measured from outside wall to outside wall) using spacers applicable to the type of duct. As the duct laying progresses, concrete not less than 3 inches thick shall be placed around the sides and top of the duct bank. End bells or couplings shall be installed flush with the concrete encasement where required. Interlock spacers shall be used every 5 feet to ensure a uniform spacing between ducts.

All bottom spacers shall be secured to 1-inch boards to prevent sinking and overturning. All joints in adjacent ducts shall be staggered a minimum of 24 inches apart and shall be made completely waterproof prior to covering with concrete.

i. Ducts Without Concrete Encasement. Trenches for single-duct lines shall be no less than 6 inches or more than 12 inches wide, and the trench for two or more ducts installed at the same level shall be proportionally wider. Trench bottoms for ducts without concrete encasement shall be made to conform accurately to grade to provide uniform support for the duct along its entire length. A 3-inch layer of bedding material shall be placed around the ducts. The bedding material shall contain no particles that would be retained on a 1-inch sieve. The bedding material shall be tamped until firm. When two or more ducts are installed in the same trench without concrete encasement, they shall be spaced not less than 2 inches apart (outside wall to outside wall) in a horizontal direction or not less than 6 inches apart (outside wall to outside wall) in a vertical direction.

1391B-3.7 INSTALLATION OF CABLES. Wherever possible, cable shall be run in one piece, without splices, from connection to connection. The number of splices shall be minimized. The contractor shall provide a schedule for laying each reel of cable and splice locations for approval of the FAA and the OAR prior to installing any of the cable. The
schedule shall be predicated on the use of the longest practical lengths of cable to minimize the number of splices.

When cable cutting is required, cable ends shall be effectively sealed against moisture immediately after cutting. The OAR shall approve the method of sealing. Bends of a radius less than eight times the diameter for rubber-covered or plastic-covered cable, or twelve times the diameter for metallic armored cable, shall not be made. Cable that has been kinked shall not be installed.

When unreeling, an observer shall be stationed at the reel to report any cable irregularities. Unless specifically stated in the plans, non-armored cable shall be used in duct and armored cable used for direct earth burial. Non-armored coaxial and series lighting cable may be direct earth buried when not otherwise specified. Grounding conductors, where required, shall be No. 6 AWG bare copper wire, minimum.

a. Direct Earth Burial. Direct earth burial cable shall be unreeled in place in the open trench or adjacent to the trench, and carefully placed in the trench bottom. Pulling the cable into the trench or dragging it over the ground will not be permitted.

(1) Separation. Separation between direct earth burial cables shall be as follows:

(a) Power cables may be laid together in the trench without separation except cables rated for 5kV and above. Cables rated for 5kV shall be separated a minimum of 6 inches from all other power cables rated 600 volts and below. Cables rated above 5kV shall be separated a minimum of 12 inches from all cables rated 5kV and below.

(b) Power cables shall be separated a minimum of 6 inches from all control and signal cables.

(c) Control and signal cables may be in the same trench without separation from each other.

(d) Backfill separating cables shall be firmly tamped.

(e) Where cables of different types (i.e., power and control or signal) or different voltages are jointly installed as stated in (a) through (c) above, the individual cables or groups of the same type cables shall be clearly and unambiguously identified by installing metal tags indicating the type (power, control or signal) and voltage for power cables. These tags should be installed in accordance with paragraph 3.8.

(2) Cable Slack Loop, Direct Earth Burial. A cable slack loop of 3 feet diameter shall be left on each end of the cable runs, at all splices, and at all ductbank entries or exits. The slack loop shall be installed at the same minimum depth as the cable run. Loops shall have no bends with an inner radius less than twelve times the outside diameter of the cable. Where cable is brought above ground, additional slack left above ground shall be as shown by the drawings or as directed by the OAR. Cable loops shall not be installed on coaxial cable. Joints in coaxial cables shall be made in accordance with the contract specification.

b. Cable Installation in Duct. The contractor shall verify that the duct is open, continuous, and clear of debris or blockage before installing cable. Cable shall be installed
in a manner to prevent harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering or conductor insulation. All cable ends shall be sealed until connections are made. Where more than one cable is to be installed in one duct, all cable shall be pulled at the same time. In no case shall a splice be pulled into a duct.

(1) **Cable Pulling.** The apparatus used to pull cable at the entrance to a manhole shall be a pulling tube or shall consist of a framework and two sheaves, the diameter of the sheaves being at least ten times that of the diameter of the largest cable. Cable installation in the duct may be pulled by a power winch or by hand. Adequate cable pulling compound shall be used. The OAR shall approve the type of pulling compound. Petroleum grease shall not be used.

The surface of any cable sheath or jacket shall not be damaged to a depth greater than 1/10th the original thickness or be flattened out-of-round more than 1/10th of the outside diameter

(a) Table I lists maximum pulling tensions for commonly installed cables. Maximum pulling tensions for cables not listed in this table shall be obtained from the cable manufacturer.

(b) The limitations in Table I do not preclude the use of steel or wire rope for cable pulling. A dynamometer graduated to indicate the tension on the cable being pulled can be used, or the contractor shall adapt a rope harness properly sized to limit pull tension to the value indicated. Any combination of a group of cables to be pulled into a duct shall not exceed the sum of individual allowable tension of each cable plus 15 percent.

(c) To minimize splicing, the longest practicable lengths of cable shall be pulled into the ducts at one time. Unless otherwise specified, manholes and handholes should be as far apart as practicable for the type of cable installed. Under no condition should the distance between handholes or manholes exceed 600 feet. The maximum cable length to be pulled shall be obtained from the cable manufacturer.

<table>
<thead>
<tr>
<th>CABLE</th>
<th>TENSION [Pounds]</th>
<th>ROPE DIAMETER [Inches]</th>
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</thead>
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<tr>
<td></td>
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<td>4 - 1/C #8 Solid</td>
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<tr>
<td>1 - 4/C #8 Stranded</td>
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### Table: CABLE TENSION and ROPE DIAMETER

<table>
<thead>
<tr>
<th>CABLE</th>
<th>TENSION [Pounds]</th>
<th>ROPE DIAMETER [Inches]</th>
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<tbody>
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<tr>
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<td>1/4</td>
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<tr>
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<td>RG-218/U (RG-17/U)</td>
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</table>

(2) **Separation.** Separation of cables, installed in conduit or duct shall be as follows:

(a) Power cables of the same circuit shall be installed in the same duct.

(b) Power cables of less than 600 volts for different circuits may be installed in the same duct.

(c) Power cables shall not be installed in the same duct with control and signal cables.

(d) Power cables shall not be installed in the same duct with power cables of a lower voltage rating.

(e) Control and signal cables may be installed in the same duct.

(f) Power cables may be installed in the same duct systems with control and signal cables, but power cable shall be installed in a different duct separated a minimum of 3 inches (outside wall to outside wall) from ducts that encase control and signal cables. Power cables rated more than 600 volts shall be separated from control and signal cables to the maximum extent possible in the duct system.
c. **Cable Installation in Manholes.** Power and control cables shall be installed in separate manholes unless otherwise specified on the job plans. If space is available, cable slack sufficient for one splice for each cable shall be left in each manhole. Elimination or shortening of slack lengths shall require approval by the OAR.

(1) **Separation of Cables in Manholes.** When it is not possible to install power and other cable types in separate manholes, they shall be installed on opposite sides of the manhole. In addition, the entire exposed length of all control and signal cables shall be fireproofed by applying a 1/4 inch minimum thickness of arc-proofing 3M No. 7700 or equal, in accordance with the manufacturer’s instructions.

(a) Where cables of different types (i.e., power and control or signal) or different voltages are jointly installed as stated in (a) through (e) of paragraph 3.7a.(1), the individual cables or groups of same type cables shall be clearly and unambiguously identified by installing metal tags indicating the cable type (power, control or signal), number of conductors, and voltage for power cables.

(b) Where it is suspected that interference to signal or control lines may be caused by their proximity to power cables, the control or signal cables and/or the power cables shall be shielded. These shields shall be grounded in accordance with paragraph 3.7e.

(2) **Cable Racking.** Cable racks in manholes and handholes are furnished under manhole/handhole specifications. These racks shall be either made of plastic or galvanized steel provided with porcelain insulators. Cables shall be carefully formed on the racks around the interior of manholes or handholes, avoiding sharp bends or kinks. All splices and cables shall be tied to cable racks using 1/8 inch nylon line. Splices shall be a minimum of 2 feet from the mouth of the duct opening into the manhole or handhole. Where this is not possible, splices shall be located as advised in the manhole/handhole specification or drawing. Splices in different cables shall be staggered.

d. **Cable Terminations.** All control and signal cables shall be terminated as specified. All power cable terminations rated above 4,000 volts shall be made with a stress-relief device. Where potheads are used, the contractor shall strictly conform with the manufacturer’s installation recommendations. Where terminations are made at transformer bushings, both high and low voltage exposed conducting surfaces shall be taped for full rated voltage, e.g., for full primary voltage on the primary side and for full secondary voltage on the secondary side, and coated with Glyptal red enamel or equal.

e. **Cable Grounding.** Cable grounding shall be performed in accordance with FAA-STD-19e par. 4.1.2.3.2 and 4.1.2.3.3 and as follows:

(1) Shields on shielded power cables shall be grounded at each end. The grounding conductor shall be No. 2 AWG bare copper and connected to a ¾ inch by 10 foot long stainless steel ground rod by exothermic welding, hydraulic crimping, or explosive crimping using a tap connector. Exothermic weld connections and hydraulic crimping connections may be direct buried. Explosive crimped connections shall be located in access wells. The shields or armor on direct earth buried power cables shall be grounded on each end, but not at each splice.

(2) Control cable shields shall be grounded at each end. Intermediate splices in control cables shall be insulated from ground to values equal to that of the original cable.
(3) Telephone cable shields shall be grounded at one end only. The shield shall be insulated from ground equal to that of the original cable at each splice.

(4) Coaxial cable shields shall be insulated from ground throughout the length of the cable run, or as shown on the drawings. These cable shields shall terminate at connectors mounted on metal bulkhead connector plates. These connector plates shall be a minimum of 1/4 inch thick and shall be constructed of tinned copper or other material compatible with the cable line connectors. The connectors shall provide a path to ground for cable shields except when the shield must be isolated for proper equipment operation. If external and internal cables are of a different size, the feed-through connectors at the plate may accomplish the connector size change. The bulkhead connector plate shall be bonded to the earth electrode system with a No. 2/0 AWG insulated copper cable, colored green with a red tracer. The bulkhead connector plate shall also be bonded to building steel, where building steel is properly bonded to the earth electrode system. Exothermic welds or FAA approved pressure connectors shall be used for these connections.

f. **Cable Guard Wires.** Where indicated on the drawings, the contractor shall install cable guard wires to protect underground conductors from the effects of lightning discharges. Guard wires may be direct earth buried or installed in nonmetallic ducts. Each guard wire shall be a bare 1/0 AWG tinned copper conductor installed not less than 10 inches above the buried conductors or ducts. One guard wire shall be installed above the centerline of conductor or duct runs of 3 feet or less in width. Two guard wires shall be installed for conductor or duct runs greater than 3 feet in width. The guard wires shall be spaced at least 12 inches apart and be not less that 12 inches nor more than 18 inches inside the outermost wires or the edges of the duct. Guard wires shall be bonded to the Earth Electrode System (EES) by exothermic welds at each end of the cable run and to 3/4 inch by 10-foot long stainless steel ground rods driven at intervals of approximately 90 foot and not less than 12 inches below grade. The spacing between ground rods must vary by 10% to 20%. Ground rods shall be installed 6 feet from the cable or duct installation and shall be connected to the guard wires with minimum No. 2 AWG bare copper conductors. All connections to the ground rods, EES, and guard wires shall be exothermic welds.

1391B-3.8 **CABLE TAGGING.** All cables shall be tagged in each manhole, or hand hole, junction box, demarcation cabinet or other such device with not less than two tags per cable, one near each duct entrance hole. Tags shall be attached to cable immediately after installation. Cable terminations and potheads shall be tagged as to function, i.e., facility, which it serves, or other pertinent data. Tags shall be circular in shape, 2-inch minimum diameter and of not less than 0.020-inch thick copper or 0.0625 inch thick lead. Steel lettering dies, ¼ inch minimum size or the equivalent engraving process, shall be used to mark the tags. Each tag shall be securely attached to the cable using 1/8 inch nylon cord. Tags shall be marked with an abbreviation of the name of the facility or facilities served by the cable plus an appropriate letter. “P”, “T”, “C”, or “R” (Power, Telephone, Control, or Radio Frequency respectively). Where telephone type cable is used for control functions it shall be marked “T” instead of “C”. Where more than one identical cable is used to serve the same facility, they may be bundled under one tag unless job plans state otherwise.

1391B-3.9 **TRENCH MARKING TAPE.** All buried cable shall be marked with trench marking tape. Tape shall be 6 inches wide minimum and shall run continuous in the cable trench 6 inches below the surface or as indicated on the project plans. Marking tape shall be bright red, orange, or yellow “Terra Tape” as manufactured by Reef Industries, Houston, Texas or approved equal.
1391B-3.10 ELECTRONIC CABLE MARKERS. All underground cable trenches shall be marked using a 4-inch electronic ball marker system as manufactured by 3M Corporation.

a. **Control, Communications and Coaxial Cable Markers.** The cable route shall be marked by an electronic marker using ScotchMark 4-inch ball markers, model 1401 (orange) manufactured by 3M Corp. The ball markers shall be placed at intervals not to exceed 200 feet and at points 4 feet before, 4 feet after and in the middle of each change of direction. All ball markers shall be placed in the trench while backfilling. All ball markers shall be placed at depth of 12 inches below finished grade and directly above the cable. When control, communications or coaxial cables are installed in the same trench as power cables, the trench shall be marked utilizing the markers for power cables. Text on the drawings will indicate the separate cables contained in each trench. All ball markers shall be placed in the trench while backfilling. All ball markers shall be placed at depth of 12 inches below finished grade and centered above the cables.

b. **Power Cable Markers.** Power cable trenches shall be marked by an electronic marker system using ScotchMark 4-inch ball markers model 1402 (red) manufactured by 3M Corp. The ball markers shall be placed at intervals not to exceed 200 feet and at points 4 feet before, 4 feet after and in the middle of each change of direction. All ball markers shall be placed in the trench while backfilling. All ball markers shall be placed at depth of 12 inches below finished grade and directly above the cable.

c. **Special Purpose Markers.** Special Purpose markers are used to indicate points of additional information. At a minimum, markers shall indicate the location of buried splices and the entrances of duct banks. Other significant points will be required at the discretion of the OAR. Special purpose points shall be marked using a ScotchMark 4 inch ball marker model 1403 (blue) manufactured by 3M Corp. All ball markers shall be placed at a depth of 12 inches below finished grade and directly above the cable splice or duct entrance.

1391B-3.11 SPLICES. Whenever possible, splices are to be avoided, and cable shall be continuous run between end connections. Splices on multiple cables in a trench shall be staggered. Cable ends to be spliced shall be kept free from moisture by using tape or caps. All cable runs shall be given continuity and insulation resistance tests per this specification at the completion of each splice. Splices shall not be permitted to be drawn inside of any conduit or duct.

1391B-3.12 CABLE SPLICING. Splices outside of manholes and handholes shall be direct earth buried unless otherwise specified in the project plans. Each cable splicer shall be qualified in making cable splices and in the use of specified cable splicing kits. The OAR may request a test splice of each type and voltage rating from each cable splicer. The contractor shall obtain approval of the splice and cable splicer from the OAR prior to making any field splices. All cable splicing methods and materials shall be of a type recommended by the splicing materials manufacturer for the cable to be spliced. All splices shall be as follows.

a. **Power cables above 5,000 volts.** Use standard splicing kits HVS-1520 and HVS-2520 manufactured by Raychem Corporation, Energy Division, or approved equal.

b. **Power cables 601 to 5,000 volts**
### TABLE II. Suggested Power Cable Splice Kits and Repair Sleeves

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<thead>
<tr>
<th>CABLE TYPE</th>
<th>KIT NUMBER</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>3C 5KV #6-#1 NON-SHIELDED ARMORED</td>
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<tr>
<td>1C 5KV #8-#2</td>
<td>WCSM-20/6-150-S</td>
<td>6” 50 PER BOX</td>
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<td>1C 5KV #8-#2</td>
<td>WCSM-20/6-225-S</td>
<td>9” 50 PER BOX</td>
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<td>1C 5KV #8-#2</td>
<td>WCSM-20/6-300-S</td>
<td>12” 50 PER BOX</td>
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<td>3C 1KV</td>
<td>LVSA-3-1</td>
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<tr>
<td>WRAP AROUND REPAIR SLEEVE</td>
<td>MBSM-75/15-1200</td>
<td>0.65”-2.65” 48” LENGTH</td>
</tr>
</tbody>
</table>

NOTE: (The contractor is responsible to insure splice kits are the correct kits for the application. The kit numbers supplied in Table II may change from time to time. Contact Raychem or go to the Raychem web site.)

Use standard splicing kits as manufactured by Raychem Corporation, Energy Division, or approved equal. Table III above is provided to assist the contractor in selecting splice kits. However it is the contractors responsibility to verify the kit numbers with Raychem as kit numbers change periodically. For unshielded series lighting power cables, a field-installed plug-in splice in accordance with FAA specification L-823. “Plug and Receptacle Cable Connectors”, shall be used. When plug and receptacle are subject to water submersion, such as in threshold fixture cans, an “APC” Raychem, or approved equal splice cover shall be added.

c. **Power cables 600 volts and below.** Use heavy-wall self-sealing heat-shrinkable tubing manufacturing by Raychem Corporation, Energy Division, Part No. “WCSM”, or approved equal. This product shall meet ANSI-C119.1-1974.

d. **Control and telephone cables.** Use standard splicing kits as manufactured by Raychem Corporation. Telecommunications Division, “XAGA 1650 series ” heat shrinkable joint closure (Refer to Table III), or approved equal. Type “D” polyurethane re-enterable encapsulant shall be used for sealing the wire bundle and cable core moisture blockage. An approved encapsulant is 8882-D 3M and is available from Graybar Supply Co. Also needed to complete the splice is shield connectors 4460-D 3M which are also available from Graybar Supply Co. Amp Picabond type connectors #61292-2 are preferred for splicing telephone pair conductors, because of their small size. Cable preparation shall include, and particular attention shall be given to cleaning the grease filling from the splice area. Use a trichloroethane type solvent. The products used shall meet Specification ATT Publication #55004.

### TABLE III. Suggested Control Cable Splice Kits

<table>
<thead>
<tr>
<th>CABLE SIZE</th>
<th>JOINT CLOSURE KIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 PAIR</td>
<td>XAGA-1650-S</td>
</tr>
<tr>
<td>12 PAIR</td>
<td>XAGA-1650-S</td>
</tr>
<tr>
<td>25 PAIR</td>
<td>XAGA-1650-A2</td>
</tr>
<tr>
<td>50 PAIR</td>
<td>XAGA-1650-A2</td>
</tr>
</tbody>
</table>
CABLE SIZE | JOINT CLOSURE KIT
---|---
100 PAIR | XAGA-1650-B2

The contractor is responsible to insure splice kits are the correct kits for the application. The kit numbers supplied in Table III may change from time to time. Contact Raychem or go to the Raychem web site.)

e. Coaxial cable (nonpressurized). No splices will be allowed in coaxial cables.

f. Connectors, power cable. Connections of cable conductors shall be made using crimp connectors utilizing a crimping tool designed to make a complete crimp before the tool can be removed.

g. Connectors, control and telephone cable. Amp Picabond type connectors #61292-2 are preferred for splicing telephone pair conductors, because of their small size. Type UR or ULG connectors, as manufactured by 3M, may also be used. Other connectors may be used with prior approval. Control cable connectors shall be crimp or solder type. If crimp connectors are used, they must be installed with a ratchet type tool, which requires full compression before it releases. Insulation for connectors may be either factory applied or field taped.

h. Cable armor and shields. Armor and shield may be folded back prior to splicing, then reinstalled across the splice and bonded by the use of approved bonding clips, or soldering when copper material is used. If the armor is galvanized material, it shall be bolted. Excess threads should be cut from bolts and wrapped with butyl tape so there are no sharp projections prior to using heat-shrink tubing.

i. Evaluation of equivalent products. If the contractor proposes to use equivalent products, the contractor shall submit samples of the product drawings showing details of the splicing methods, and a statement of the experience the contractor has in making splices with the proposed product. In addition, products shall meet the standards in Table IV, “Cable Splicing Specification Equivalents”.

Table IV. Cable Splicing Specification Equivalents

<table>
<thead>
<tr>
<th>Product Identified in Paragraph</th>
<th>Application Standard</th>
<th>Level of Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6.2a</td>
<td>1. IEEE-404-1977, Standard for Power Cable Joints</td>
<td>Meet or Exceed</td>
</tr>
<tr>
<td></td>
<td>2. IEEE-48-1975, Standard for Cable Terminations</td>
<td>Meet or Exceed</td>
</tr>
<tr>
<td></td>
<td>3. ANSI C 119.2-1974 Water Immersion Test</td>
<td>Meet or Exceed</td>
</tr>
<tr>
<td>3.6.2b</td>
<td>Same as 3.6.2a</td>
<td>Meet or Exceed</td>
</tr>
<tr>
<td>3.6.2c</td>
<td>ANSI C 119.1-1974, Sealed Insulated Underground Connector System Rated 600 Volts</td>
<td>Meet or Exceed</td>
</tr>
</tbody>
</table>

Samples shall be submitted to the OAR at least one week prior to installation of permanent splices.
QUALITY ASSURANCE PROVISIONS

1391B-4.1 CABLE TESTING. All cable testing shall be performed by the contractor in the presence of the RE. The contractor shall furnish all necessary test instruments, except where otherwise indicated in the project plans. All instruments shall have been calibrated within a two-year period preceding cable testing by a laboratory approved by the measurement instrument manufacturer. All cables shall be tested before installation, after each splice, and again upon completion of the installation. All testing shall be completed on contractor-installed cable before connection is made to any existing cables. The FAA will test existing cables and provide the results to the contractor through the OAR prior to the contractor splicing or connecting cables he has installed to existing cables.

1391B-4.2 POWER CABLES, 5,000 VOLTS. Conductors, splices and other contractor-performed connections shall be tested at 10,000 volts. Tests shall be made between conductors and from each conductor to ground with the cable shield and armor grounded. To assure that the cable is completely charged, each test shall continue for a period of not less than 1 minute after instrument readings stabilize. Minimum acceptable insulation resistance value of the cable is 50 megohms. Unless cable length exceeds 10,000 feet, no reduction in the specified insulation resistance will be allowed. In cases where cable length exceeds 10,000 feet, the minimum allowable insulation resistance may be corrected downward based on the total number of 10,000 foot cable segments (i.e., up to 10,000 feet, 50 megohms; 10,000 to 20,000 feet, 50 x 2 megohms; 20,000 to 30,000 feet, 50 x 3 megohms, etc).

Tests shall be made for continuity of cable shield armor. An ohmmeter-type instrument shall be used. The contractor shall demonstrate that circuits are properly connected, including operation of each lighting and power circuit for not less than one-half hour.

   a. Power Cables Above 5,000 Volts. Power cables rated above 5,000 volts shall be tested as in paragraph 4.2., except that the test voltage shall be twice the cable voltage rating plus 1,000 volts.

1391B-4.3 CABLES 5,000 VOLTS SERIES LIGHTING. After completing installation, each series loop with its connectors and lighting transformers shall be tested for insulation resistance. Test shall be conducted in accordance with paragraph 4.2 with both ends of each loop disconnected from the series cutouts at the substation, except for the following:

   a. If the transformers cannot withstand a DC voltage of 10,000 volts, the test shall be performed at the highest allowable transformer voltage.

   b. Depending upon the number of lighting transformers in the loop and their individual insulation resistances, the allowable loop insulation resistance may be reduced, based on the parallel summation of the cable and transformer insulation resistances. However, the cable insulation resistance shall never be less than the minimum value allowed in paragraph 4.2.

With both ends of each loop disconnected from the series cutouts at the substation, each loop will also be tested for loop resistance with the lighting transformers installed. The DC circuit resistance of each series loop shall be calculated as directed by the OAR. (Note to OAR: Refer to specification FAA-C-1391b par. 4.3(b) or order 6950.22 par 52.b(3) for instructions on calculating series lighting cable insulation resistance).
The loop resistance shall be measured with a low resistance ohm meter or equivalent instrument and recorded. The measured resistance value shall not exceed the calculated resistance by more than 20 percent.

1391B-4.4 POWER CABLES 600 VOLTS AND BELOW. All power cables shall measure not less than 50 megohms resistance between conductors, and between conductors and ground. Measurements shall be taken at not less than 500 volts DC.

1391B-4.5 CONTROL AND TELEPHONE CABLES. After installation these cables shall comply with the requirements of Table V.

Table V. Control and Telephone Cable Conductors.

<table>
<thead>
<tr>
<th>CABLE SIZE</th>
<th>MINIMUM NUMBER OF ACCEPTABLE CONDUCTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 pair or less</td>
<td>All</td>
</tr>
<tr>
<td>13 - 25 pair</td>
<td>All, except 1 pair</td>
</tr>
<tr>
<td>Over 25 pair</td>
<td>All, except 2 pair</td>
</tr>
</tbody>
</table>

a. Conductors. Acceptable conductors satisfactorily pass tests for (a) continuity, (b) freedom from short circuits, and (c) a minimum of 50 megohms resistance between conductors and from each conductor to grounded shield when tested at not less than 500 volts DC.

b. Cable Testing. The contractor shall test the cable prior to installation and tag any defective conductor pairs that are found. The contractor shall notify the OAR of any unusable conductors found. These may be subtracted from the allowable number of accepted conductors specified in Table III, if the cable is government furnished.

Tests between unpaired conductors showing an insulation resistance below infinity on a 500-volt, 100-megohm, or equivalent insulation-measuring instrument shall be tabulated by the contractor and furnished to the OAR. This report shall indicate measured resistance values.

Should telephone cables include an extra conductor pair, and have one pair tagged as defective by the manufacturer, this extra conductor pair shall not be included in the minimum number of acceptable pairs listed in Table V.

1391B-4.6 COAXIAL CABLES. The insulation and loop resistance of radio frequency cables shall be measured prior to installation. The results shall be recorded and furnished to the OAR. The insulation test shall be made between the center conductor and shield with a 500-volt DC instrument. The loop resistance test shall also be made in the same way, but with the center conductors shorted to the shield at the far end of the cable. This test shall be made with a bridge, ohmmeter, or other suitable instrument.

a. Testing After Installation. After installation, the conductor-to-shield and conductor-to-ground resistance shall exceed 50 megohms when measured at 500 volts DC. Loop resistance shall be within 10 percent of the measured values prior to installation, e.g., measured resistance per 1,000 feet of cable on a reel, multiplied by each 1,000 feet and fraction thereof of installed cable. Shield-to-ground insulation shall be measured and the results furnished to the OAR.
1391B-4.7 FAILURE OF CABLE UNDER TEST. If the contractor-furnished cable fails to meet test requirements after installation, the contractor shall repair or replace, at his expense, the sections of cable proven defective. If the cable is government furnished and the failure results from a manufacturer’s defect not detectable prior to installation, the government will repair or replace the cable. If the government-furnished cable fails to meet test requirements after installation, due to faulty installation practices, the contractor shall repair or replace the sections of cable proven defective.

DOCUMENTATION REQUIREMENTS

1391B-5.1 SURVEY REQUIREMENTS. The contractor shall record all required survey data and deliver to the FAA, through the OAR, a finished survey plotted on survey maps, following the conventions used by the DFW Airport Board. The contractor shall also record and provide data on the types and locations of all cables abandoned in place as part of this contract. The collected data will then be entered into the FAA DFW Environmental SSC photogrammetric map CAD files.

a. Survey Points. The contractor shall survey points along the entire cable route from end to end. In some cases where the contractor splices into an existing cable and reroutes only a portion of the cable run he is only required to survey and provide CAD drawings for the portion that he replaced or rerouted. The points shall be at intervals of not greater than 200 feet. Where the cable changes direction, the OAR may require additional points to accurately describe the cable route. Where the cable terminates to a building, a transformer, an antenna, a light bar, an outside demarcation cabinet or switch rack the survey shall include the four corners of the device or facility where it terminates. A tolerance of plus or minus 5 inches will be acceptable for describing the cable path.

Survey points shall include but are not limited to all electronic ball markers placed in the cable trenches and all duct bank manholes and handholes. All duct banks shall be surveyed and plotted on the drawings whether they have cables installed in them or even if they are installed for future use. Those that installed for future use shall have text box pointing to them indicating as future use duct banks. The ball markers shall be identified on the CAD files by a small circle with a “C” in the center for control cable, “P” for power cable, and “S” for special purpose points. Special purpose points will be used to indicate points such as splices or entrances to duct banks. Splices made in manholes and handholes shall be shown on the cable drawing. In the case of a duct bank where the duct bank is not a straight line between the manholes or handholes enough ball markers of the correct type shall be installed to accurately depict the routing of the duct bank. Survey points shall be taken and plotted on the drawings for each of the ball markers. Manholes shall be identified by a small square with a “MH” in the center. Handholes shall be identified by a small square with a “HH” in the center. Where manhole and handhole numbers are called out on the construction drawings the shall also be called out on the completed cable drawing.

All special purpose points shall be accompanied by accurate text to describe the function of the specific point. All trenches shall be identified with text boxes pointing to the trench indicating what is in the trench. In other words if there are several cables in the trench all cables shall be called out. Power cables shall be identified by the actual voltage of the cable and not by the insulation rating. The number of pairs contained in the cable shall identify control cables. Anything that is unusual or peculiar about the cable runs should also be called out in the CAD drawing. It shall be the installation contractor’s responsibility to insure that the surveying company gets all of the information about the cables and cable trenches to be able to successfully complete the CAD drawings. It is the intent of this specification to produce complete, accurate and factual drawings as an end product.
b. **Government Furnished Materials, Equipment and Services.** The local Federal Aviation Administration, Lone Star SMO, will furnish the contractor the appropriate FAA cable CAD files. The contractor shall use the same conventions (font, symbol library, layering, etc.) as the current CAD files for submission to the FAA.

c. **Special Requirements.** The contractor shall procure the services of ARS Engineers, Inc., a professional survey company thoroughly familiar with the survey used at the DFW Airport and the requirements of the FAA:

ARS Engineers, Inc.
5910 N Central Expressway, Suite 1000
Dallas, Texas 75206
(214) 739-3152

 Additionally, the contractor shall meet the following special requirements:

1. Intergraph Microstation PC - FAA must use version J to directly integrate the collected data into DFW photogrammetric map CAD file provided. Data may not be supplied to the FAA using any other CAD system.

   (a) All survey coordinates will be in DFW Surface 88

   (b) Levels for CAD Drawings will be as is described in Table VI.

<table>
<thead>
<tr>
<th>LVL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Ball Markers</td>
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<tr>
<td>17</td>
<td>Coordinates</td>
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<tr>
<td>19</td>
<td>Navigational Aids</td>
</tr>
<tr>
<td>20</td>
<td>Actual Cables Paths</td>
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<tr>
<td>21</td>
<td>Lines info text</td>
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<tr>
<td>22</td>
<td>Paving</td>
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<tr>
<td>25</td>
<td>Field Dimensions</td>
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<tr>
<td>26</td>
<td>Dimension Lines</td>
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<td>30</td>
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<td>31</td>
<td>Fences</td>
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<td>32</td>
<td>Features Text</td>
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<tr>
<td>37</td>
<td>ILS Critical Areas</td>
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<tr>
<td>50</td>
<td>Details</td>
</tr>
<tr>
<td>61</td>
<td>Abandoned Cables</td>
</tr>
</tbody>
</table>

2. The contractor shall deliver the survey data to the FAA in the following manner:

CONTRACT No. 9500723  ITEM SS-C-1391b-17  Installation and Splicing of FAA Cables
 Permit No. A20-111B  Issued for Bid
 NE-EAT Package II  April 23, 2020
(a) The information on the DFW photogrammetric map CAD files will be layered (in levels that will be specified by the FAA). The cable survey information will be supplied to the FAA a CD ROM disk. Appropriate text in separate levels shall be provided to indicate and accurately reflect the types of cables in each trench. All manholes or handholes shall be accompanied by the number assigned to that manhole or handhole. All cable trenches and duct banks shall have a text box pointing to it and the text box shall contain information that describes what is in the trench and/or ductbank, i.e., 100 pair, 240 v, coaxial cable, etc. On long cable runs these text boxes shall be placed at several locations along the path.

One copy of all modified Microstation photogrammetric CAD files on a CD ROM disk will be submitted to the FAA for review and comments. After review, comments will be developed by the FAA and will be provided back to the contractor so the corrections can be made.

1391B-5.2 SITES ON OPERATING AIRPORT. Since airport runways must remain in operation during certain periods, it will be necessary to coordinate all construction activity so as not to interfere with the functions of the airport. The contractor shall perform all work with a minimum disruption to the FAA and airport operations. Any work performed within 500 feet of any active runway may require its closing. Advance notice of at least 24 hours of proposed work near an active runway must be given to the OAR. All work shall be coordinated with the Airport Manager, Airport Traffic Control Tower, Airport Security and other contractors through the OAR.

1391B-5.3 CONTRACT CLOSEOUT. At the completion of the project, the contractor shall provide the following to the FAA through the OAR:

a. Transmittal letter containing the following:

   (1) Date
   (2) Project title and number
   (3) Contractor’s name and address
   (4) Title and number of each record document
   (5) Certification that each document as submitted is complete and accurate
   (6) Signature of the survey contractor, or his designated representative

b. One copy of all modified and corrected Microstation photogrammetric CAD files

APPLICABLE STANDARDS

1391B-6.1 GENERAL. Current issues of the following documents in effect on the date of the invitation-for-bids or request-for-proposals form a part of this specification.

1391B-6.2 FEDERAL AVIATION ADMINISTRATION SPECIFICATIONS.

L-823 Plug and Receptacles, Cable Connectors
L-824 Underground Electrical Cables for Airport Lighting Circuits
FAA-E-2793  Cable, Electrical Power, 500 to 25,000 Volts
FAA-E-2013  Cable, Electrical Power, 600 to 15,000 Volts
FAA-E-2042  Cable, Electrical Control, Exterior
FAA-E-2072  Cable, Telephone, Exterior
FAA-E-2171  Cable, Coaxial, Armored, M17/6-RG11
FAA-E-2271  Cable, Coaxial, 50-Ohm, Foam Dielectric, 1/2 and 7/8 Inch
FAA-E-2524  Cable, Radio Frequency, Foam Dielectric, 1/2 and 7/8 Inch, Corrugated Type
FAA-E-2619  Cable, Coaxial, RG-35/U, Armored
FAA-STD-019e Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment

1391B-6.3 NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION (NEMA) STANDARDS.
TC 6 Plastic Utilities Duct for Underground Installation.

1391B-6.4 UNDERWRITERS’ LABORATORIES (UL) INC., STANDARDS.
UL 651 Rigid Non-metallic Conduit

1391B-6.5 INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) STANDARDS.
IEEE-404-1977 Standard for Power Cable Joints
IEEE-48-1975 Standard for Cable Terminations

6.6 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS.
ANSI C119.2-1974 Water Immersion Test
ANSI C119.1-1974 Sealed Insulated Underground Connector System Rated 600 Volts

END OF ITEM SS-C-1391B