ATTACHMENT A - Technical Specifications Revisions
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. Anticipated construction phase durations and sequencing are shown below. Milestone dates shall govern.

<table>
<thead>
<tr>
<th>CONSTRUCTION PHASE (BASE+ALT)</th>
<th>DURATION (Calendar Days)</th>
<th>ANTICIPATED/FIXED</th>
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</thead>
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<tr>
<td>Mob</td>
<td>4530</td>
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<tr>
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<td>Phase 2 Taxiway N South of Taxiway Z, Taxiway N North of Taxiway Y.</td>
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<td>Phase 4 Taxiway N Within Taxiway Y Object Free Area</td>
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<tr>
<td>Phase 6 Taxiway N and Taxiway EE and ARFF Road (North Staging Area Work)</td>
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<td>Phase 7 ARFF Road, Taxiway Y Widening and Taxiway N Widening</td>
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<td>Phase 8 ARFF Road</td>
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<tr>
<td>Closeout</td>
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<tr>
<td>Total</td>
<td>585645600</td>
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1. Liquidated Damages are associated with this phase as defined in Special Provisions 1.0
2. Phase occurs within another phase duration and should not contribute to the overall project duration.
<table>
<thead>
<tr>
<th>CONSTRUCTION PHASE (BASE)</th>
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<td>Total</td>
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1. Liquidated Damages are associated with this phase as defined in Special Provisions 1.0
2. Phase occurs within another phase duration and should not contribute to the overall project duration.

**C. Phase 1 (Base+Alt)**

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
   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.

D. Phase 2 (Base+Alt)

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 K
   a. Work Area K is within the Taxiway Y and Taxiway N TOFAs, bounded by the Taxiway N (future Taxiway R) 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 R) 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.
5.4. 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.

6.5. 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.

E. Phase 3 (Base+Alt)
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: Placement of electrical signage and demo of circuitry within 17C-35C RSA. Pavement marking on Taxiway N1 within RSA.

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.

F. Phase 4 (Base+Alt)
   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 R) 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 R) 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.

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

4. Work Area AI
   a. Work Area AI 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 AI 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.

G. Phase 5 (Base+Alt)

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.

H. Phase 6 (Base+Alt)
1. Work Area T-1
   a. Work Area T-1 is bounded includes areas within the Taxiway EF, by Taxiway S (future Taxiway N) TODA on the north and west and as sown on the south and east, and North Air Freight Ramp connector TOFAs. It is partially bounded by the Runway 17C 35C ROFA on the west.
   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
Summary of Work

Section: 01 11 00

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

- Work includes: Construction of proposed ARFF just south of East Pump Station. Work in area T-1 shall be completed in 21 calendar days. Placement of electrical signage and taxiway center line lights. Proposed grading. Demolition of existing ARFF road once portion of proposed has been constructed. Pavement marking.

2. Work Area T

- Work Area T includes Area T-1 and T-2. It is bounded partially by the 17C-35C RSA and as shown
- 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.
- Work includes: Demolition of existing ARFF road, proposed grading, proposed drainage, placement of electrical, signage and taxiway centerline lights, and pavement marking.

2.3 Work Area U

- 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.
- 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.
- Work includes: Placement of electrical signage on Taxiway EF within ROFA.

3.4 Work Area V

- Work Area V is bounded by the North Air Freight Ramp connector TOFA on the south and as shown.
- 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.
4.5. 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.

5.6. 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

7. Work Area Q
   a. Work Area Q is bounded by the Runway 13L-31R ROFA on the northeast, the Runway 13L-31R RSA on the southwest, and as shown on the northwest and southeast.
   b. Restrictions and required closures: Work within Area Q will require the closure of a portion of the ARFF road southeast of Taxiway P. No stockpiles or equipment may be left within the Runway 13L-31R ROFA. The ARFF road between the East Air Freight Ramp and Runway 13L-31R must always be kept open.

8. Work Area R
   a. Work Area R is bounded by the edge of the ARFF road to the northeast, by the Runway 13L-31R ROFA on the southwest, and as shown on the northwest and southeast.
   b. Restrictions and required closures: Work within Area R will require the closure of a portion of the ARFF road southeast of Taxiway P. The ARFF road between the East Air Freight Ramp and Runway 13L-31R must always be kept open.

I. Phase 7 (Base+Alt)
   1. Work Area J
SUMMARY OF WORK
Section: 01 11 00

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.

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.

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.

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.

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.
   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: Pavement marking. Placement and demo of taxiway edge lights and electrical signage. Proposed grading and drainage on Taxiway Q.
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 drainage within Runway 13L-13R RSA.

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: Construction of proposed geometry near intersection of
      Taxiway R1 and Taxiway Q. Placement of taxiway center and edge lights
      and demo of existing. Proposed grading. Pavement marking.

J. Phase 8 (Base+Alt)

1. Work Area Q
   a. Work Area Q is bounded by the Runway 13L-31R ROFA on the northeast,
      the Runway 13L-31R RSA on the southwest, and as shown on the
      northwest and southeast.
   b. Restrictions and required closures: Work within Area Q will require the
      closure of a portion of the ARFF road southeast of Taxiway P. No stockpiles
      or equipment may be left within the Runway 13L-31R ROFA. The ARFF
      road between the East Air Freight Ramp and Runway 13L-31R must
      always be kept open.
   c. Work includes: Proposed construction of 13L ARFF road within RW 13L
      ROFA. Proposed grading. Pavement marking.

2. Work Area R
   a. Work Area R is bounded by the edge of the ARFF road to the northeast, by
      the Runway 13L-31R ROFA on the southwest, and as shown on the
      northwest and southeast.
   b. Restrictions and required closures: Work within Area R will require the
      closure of a portion of the ARFF road southeast of Taxiway P. The ARFF
      road between the East Air Freight Ramp and Runway 13L-31R must
      always be kept open.
SUMMARY OF WORK
Section: 01 11 00

01 11 00 - 13
Summary of Work

K. J. 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
   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.

L. K. 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 K

a. Work Area K is within the Taxiway Y and Taxiway N TOFAs, bounded by the Taxiway N (future Taxiway R) 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 R) 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 100 days.


5. 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.


6. 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.

M.L. Phase 3 (Base)

1. Work Area F
SUMMARY OF WORK
Section: 01 11 00

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

5. **Work Area AH**
SUMMARY OF WORK
Section: 01 11 00

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.

N.M. 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 100 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 R) 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 R) 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 100 days.


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

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.

O-N 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.

**P.O. 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.

1. **Work Area T**
SUMMARY OF WORK
Section: 01 11 00

a. Work Area T includes areas within the Taxiway EF, Taxiway S (future Taxiway N), and North Air Freight Ramp connector TOFAs. It is partially bounded by the Runway 17C-35C ROFA on the west.

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

c. Work includes: Construction of proposed ARFF just south of East Pump Station. Placement of electrical signage and taxiway center lights. Proposed grading. Demolition of existing ARFF road once portion of proposed has been constructed. Pavement marking.

2.3. 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.

3.4. 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.


4.5. 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.

5.6. 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

6.7. Work Area Q

a. Work Area Q is bounded by the Runway 13L-31R ROFA on the northeast, the Runway 13L-31R RSA on the southwest, and as shown on the northwest and southeast.

b. Restrictions and required closures: Work within Area Q will require the closure of a portion of the ARFF road southeast of Taxiway P. No stockpiles or equipment may be left within the Runway 13L-31R ROFA. The ARFF road between the East Air Freight Ramp and Runway 13L-31R must always be kept open.


7.8. Work Area R

a. Work Area R is bounded by the edge of the ARFF road to the northeast, by the Runway 13L-31R ROFA on the southwest, and as shown on the northwest and southeast.

b. Restrictions and required closures: Work within Area R will require the closure of a portion of the ARFF road southeast of Taxiway P. The ARFF road between the East Air Freight Ramp and Runway 13L-31R must always be kept open.


Q.P. Phase 7 (Base)

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.


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.


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.


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.


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.

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: Pavement marking. Placement and demo of taxiway edge lights and electrical signage. Proposed grading and drainage on Taxiway Q.

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 drainage within Runway 13L-13R RSA.

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.
SUMMARY OF WORK
Section: 01 11 00

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.


Phase 8 (Base)

1.11. Work Area Q
a. Work Area Q is bounded by the Runway 13L-31R ROFA on the northeast, the Runway 13L-31R RSA on the southwest, and as shown on the northwest and southeast.

b. Restrictions and required closures: Work within Area Q will require the closure of a portion of the ARFF road southeast of Taxiway P. No stockpiles or equipment may be left within the Runway 13L-31R ROFA. The ARFF road between the East Air Freight Ramp and Runway 13L-31R must always be kept open.


2.12. Work Area R
a. Work Area R is bounded by the edge of the ARFF road to the northeast, by the Runway 13L-31R ROFA on the southwest, and as shown on the northwest and southeast.

b. Restrictions and required closures: Work within Area R will require the closure of a portion of the ARFF road southeast of Taxiway P. The ARFF road between the East Air Freight Ramp and Runway 13L-31R must always be kept open.


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.
SUMMARY OF WORK

Section: 01 11 00

1. **4659580** Consecutive Calendar Days for Substantial Completion of the Base+Alt, from the date set forth in the NTP. **46550** 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+Alt Bid or Base Bid.

2. Total Contract Time = **58561500** Calendar Days for Base+Alt from NTP or **58570** Calendar Days for Base consecutive from NTP.

B. The following milestones apply;

1. **Phase 1. All Work Areas shall be completed within 365 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.**

3-5. Substantial completion. Completion of Phases 1 - 78.

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 the completion of 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. Any Work within an aircraft parking apron and Object Free Area (OFA) of an active Taxiways or Taxi lane 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.

2. 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 Friday night, December 18, 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, June 25 at 00:00 am through Friday, July 10, 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 Thursday, January 7, 2021 at 11:59 pm
- Spring Break – Thursday, Feb 25 at 00:00 am – Monday, March 15, 2021 at 11:59 pm
- Memorial Day – Thursday, May 20 at 00:00 am through Tuesday, May 25, 2021 at 11:59 pm
- July 4 – Thursday, July 1 at 00:00 am through Friday, July 9, 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 Thursday, January 6, 2021 at 11:59 pm

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 https://www.dfwairport.com/operations/ or you may request a form from PowerOutage@dfwairport.com.

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 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.
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* SUTX2011-007 08/03/2011

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<tr>
<td>Front End Loader 3 CY or</td>
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</table>
WAGE RATE REQUIREMENTS
Section: 01 29 85

Less .................................. $ 13.69
Front End Loader, over 3 CY. ........ $ 14.72
Loader/Backhoe .................. $ 15.18
Mechanic ........................... $ 17.68
Milling Machine ................ $ 14.32
Motor Grader, Fine Grade .... $ 17.19
Motor Grader, Rough ......... $ 16.02
Pavement Marking Machine .... $ 13.63
Reclaimer/Pulverizer ....... $ 11.01
Roller, Asphalt .............. $ 13.08
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

1.) Has there been an initial decision in the matter? This can be:

* 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.
WAGE RATE REQUIREMENTS
Section: 01 29 85

END OF GENERAL DECISION

"General Decision Number: TX20190025 01/04/2019

Superseded General Decision Number: TX20180035

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 $10.60 for calendar year 2019 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 $10.60 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 2019. 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
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**TRUCK DRIVER**

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<td>Truck</td>
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<td>Transit-Mix</td>
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**WELDER**

|                     | $14.84    |

**WELDERS**

Receive rate prescribed for craft performing operation to which welding is incidental.
"General Decision Number: TX20190018 01/04/2019

Superseded General Decision Number: TX20180028

State: Texas

Construction Type: Heavy

Counties: Collin, Dallas, Denton, Ellis, Kaufman and Rockwall Counties in Texas.

Water and Sewer Lines/Utilities (Including Related Tunneling Where the Tunnel is 48"" or Less in Diameter)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.60 for calendar year 2019 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 $10.60 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 2019. 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 01/04/2019

* PLUM0100-002 11/01/2017
### WAGE RATE REQUIREMENTS

**Section: 01 29 85**

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<td>TRUCK DRIVER</td>
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**WELDERS** - Receive rate prescribed for craft performing operation to which welding is incidental.

- **END OF SECTION** -
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. If the material is to be wasted on the airport site, it shall be crushed in accordance with Item M-002. 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.
(b) 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.

c) 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 under-laying 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 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 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 Contactor 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 329219, as to minimize required suitable embankment material. Material that is determined to be unsuitable shall be disposed off airport property in accordance with Section 017419.

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 of at other areas. 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/ft$^3$ (600 kN-m/m$^3$))

ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM 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-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. The aggregate will be Owner furnished at the East Material Management Site shown on the plans. Aggregate for recycled concrete base shall meet the gradation shown below requirements of Item M-007.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3&quot;</td>
<td>90 - 100</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>30 - 70</td>
</tr>
<tr>
<td>½&quot;</td>
<td>20 - 60</td>
</tr>
<tr>
<td>#4</td>
<td>35 maximum percent passing</td>
</tr>
<tr>
<td>#40</td>
<td>20 maximum percent passing</td>
</tr>
<tr>
<td>#200</td>
<td>0 - 10.0</td>
</tr>
</tbody>
</table>

219-2.2 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 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.

219-3.4 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 and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

219-3.6 MAINTENANCE. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at their expense.

219-3.7 SURFACE TOLERANCES. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor’s expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

   a. Smoothness. The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

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

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 1,200 square yards. 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.

   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 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))
ASTM D3665 Standard Practice for Random Sampling of Construction Materials
ASTM D4643 Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating
ASTM D4791 Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-219
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.

### Fine Aggregate Material Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soundness of Aggregates</td>
<td>Loss after 5 cycles:</td>
<td>ASTM C88</td>
</tr>
<tr>
<td></td>
<td>10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate</td>
<td></td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>45 minimum</td>
<td>ASTM D2419</td>
</tr>
<tr>
<td>Fineness Modulus (FM)</td>
<td>$2.50 \leq FM \leq 3.40$</td>
<td>ASTM C136</td>
</tr>
</tbody>
</table>

### Limits for Deleterious Substances in Fine Aggregate for Concrete

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay lumps and friable particles</td>
<td>1.0% maximum</td>
<td>ASTM C142</td>
</tr>
<tr>
<td>Coal and lignite</td>
<td>0.5% using a medium with a density of Sp. Gr. of 2.0</td>
<td>ASTM C123</td>
</tr>
<tr>
<td>Total Deleterious Material</td>
<td>1.0% maximum</td>
<td></td>
</tr>
</tbody>
</table>

c. **Coarse aggregate.** The maximum size coarse aggregate shall be 1-1/2-inch.

Aggregates delivered to the mixer shall be clean, hard, uncoated aggregates consisting of crushed stone, crushed or uncrushed gravel, air-cooled iron blast furnace slag, crushed recycled concrete pavement, or a combination. The aggregates shall have no known history of detrimental pavement staining. Steel blast furnace slag shall not be permitted. Coarse aggregate material requirements and deleterious limits are shown in the table below; washing may be required to meet aggregate requirements.

### Coarse Aggregate Material Requirements

<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to Degradation</td>
<td>Loss: 40% maximum</td>
<td>ASTM C131</td>
</tr>
<tr>
<td>Soundness of Aggregates</td>
<td>Loss after 5 cycles:</td>
<td>ASTM C88</td>
</tr>
<tr>
<td></td>
<td>12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate</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 at 5:1 for any size group coarser than 3/8 sieve</td>
<td>ASTM D4791</td>
</tr>
<tr>
<td>D-cracking (Freeze-Thaw)²</td>
<td>Durability factor ≥ 95</td>
<td>ASTM C666</td>
</tr>
</tbody>
</table>

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

2 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:

### Limits for Deleterious Substances in Coarse Aggregate

<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>1.0(^1)</td>
</tr>
<tr>
<td>Lightweight particles</td>
<td>ASTM C123 using a medium with a density of Sp. Gr. of 2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Chert(^2) (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</th>
<th>Constituent</th>
<th>Limit (Percent by Mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LiNO₃ (Lithium Nitrate)</td>
<td>30 ±0.5</td>
<td></td>
</tr>
<tr>
<td>SO₄ (Sulfate Ion)</td>
<td>0.1 (max)</td>
<td></td>
</tr>
<tr>
<td>Cl (Chloride Ion)</td>
<td>0.2 (max)</td>
<td></td>
</tr>
<tr>
<td>Na (Sodium Ion)</td>
<td>0.1 (max)</td>
<td></td>
</tr>
<tr>
<td>K (Potassium Ion)</td>
<td>0.1 (max)</td>
<td></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.
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.

   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 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.

       (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.
(4) Anticipated number and type of saws to be used.

d. Rain. The Contractor shall have available materials for the protection of the concrete during inclement weather. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

501-4.8 CONCRETE PLACEMENT. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 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 foot, except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge. The portion of each dowel intended to move within the concrete or expansion cap shall be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels shall be installed as specified in the following subparagraphs.

(a) Contraction joints. Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. 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 manufacturers 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 ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The depth of diamond grinding shall not exceed 1/2-inch and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified.

Diamond grinding shall be performed with a machine specifically designed for diamond grinding capable of cutting a path at least 3 feet wide. The saw blades shall be 1/8-inch wide with sufficient number of flush cut blades that create grooves between 0.090 and 0.130 inches wide; and peaks and ridges approximately 1/32 inch higher than the bottom of the grinding cut. The Contractor shall determine the number and type of blades based on the hardness of the aggregate. Contractor shall demonstrate to the RPR that the grinding equipment will produce satisfactory results prior to making corrections to surfaces.
Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. All grinding shall be at the expense of the Contractor.

**CONTRACTOR QUALITY CONTROL (CQC)**

**501-5.1 QUALITY CONTROL PROGRAM.** The Contractor shall develop a Quality Control Program in accordance with Item C-100. No partial payment will be made for materials that are subject to specific quality control requirements without an approved quality control program.

**501-5.2 CONTRACTOR QUALITY CONTROL (CQC).** The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor’s QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

**501-5.3 CONTRACTOR QC TESTING.** The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to this specification and as set forth in the CQCP. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content. A QC Testing Plan shall be developed and approved by the RPR as part of the CQCP.

The RPR may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, or improper slump. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the 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.

<table>
<thead>
<tr>
<th>Control Chart Limits¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control Parameter</strong></td>
</tr>
<tr>
<td><strong>Individual Measurements</strong></td>
</tr>
<tr>
<td><strong>Action Limit</strong></td>
</tr>
<tr>
<td>Gradation²</td>
</tr>
<tr>
<td>Coarseness Factor (CF)</td>
</tr>
<tr>
<td>Workability Factor (WF)</td>
</tr>
<tr>
<td>Slump</td>
</tr>
<tr>
<td>Air Content</td>
</tr>
</tbody>
</table>

¹ Control charts shall be developed and maintained for each control parameter indicated by the Contractor.

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.
Slump. The Contractor shall halt production and make appropriate adjustments whenever:

- one point falls outside the Suspension Limit line for individual measurements
  
  OR

- 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:

- one-point falls outside the Suspension Limit line for individual measurements
  
  OR

- 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><strong>Strength</strong></td>
</tr>
<tr>
<td>0.93 × strength specified in paragraph 501-3.3</td>
</tr>
<tr>
<td><strong>Thickness</strong></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 be 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-501-8.2** Portland Cement Concrete Pavement (17-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 C78  Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88  Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94  Standard Specification for Ready-Mixed Concrete
ASTM C117  Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123  Standard Test Method for Lightweight Particles in Aggregate
ASTM C136  Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138  Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142  Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143  Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150  Standard Specification for Portland Cement
ASTM C171  Standard Specification for Sheet Materials for Curing Concrete
ASTM C172  Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173  Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C174  Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C231  Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260  Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309  Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311  Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete
ASTM C494  Standard Specification for Chemical Admixtures for Concrete
ASTM C566  Standard Test Method for Total Evaporable Moisture Content of Aggregates by Drying
ASTM C595  Standard Specification for Blended Hydraulic Cements
ASTM C618  Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C642  Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C666</td>
<td>Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing</td>
</tr>
<tr>
<td>ASTM C685</td>
<td>Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing</td>
</tr>
<tr>
<td>ASTM C881</td>
<td>Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete</td>
</tr>
<tr>
<td>ASTM C989</td>
<td>Standard Specification for Slag Cement for Use in Concrete and Mortars</td>
</tr>
<tr>
<td>ASTM C1064</td>
<td>Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete</td>
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<td>ASTM C1077</td>
<td>Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation</td>
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<td>Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate</td>
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<td>ASTM E2133</td>
<td>Standard Test Method for Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface</td>
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</table>

**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 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 manufacturer 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.
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 20-Foot Permanent Slide Gate Gate 210 and Crash Barrier – per lump sum each
- 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 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 C655** Standard Specification for Reinforced Concrete D-Load 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>
<thead>
<tr>
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<th>Test Method</th>
<th>Test Requirement</th>
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<tr>
<td>Grab Tensile Strength, lbs</td>
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<tr>
<td>Grab Tensile Elongation %</td>
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<td>Burst Strength, psi</td>
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<td>(UV Stability) (Strength Retained - %)</td>
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**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 place 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-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
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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.
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 re-cleaned at the Contractor’s expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing
ducts proposed for use in this project as clear and open. The Contractor shall notify the RPR of any blockage in the existing ducts.

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

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

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

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

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

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve. Flowable backfill may alternatively be used.

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

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

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.
Whether or not specifically indicated on the drawings, where the soil encountered at
established duct bank grade is an unsuitable material, as determined by the RPR, the
unsuitable material shall be removed per Item P-152 and replaced with suitable material.
Additional duct bank supports shall be installed, as approved by the RPR.

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

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

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

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

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

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

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

**110-3.2 DUCT BANKS.** Unless otherwise shown in the plans, duct banks shall be
installed so that the top of the concrete envelope is not less than 18 inches below the
bottom of the base or stabilized base course layers where installed under runways,
taxiways, aprons, or other paved areas, and not less than 18 inches 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 not 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 inch 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
Item L-110-5.11 1-Way, 2-Inch, PVC Conduit, (CE) in Existing PCC Pavement – 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-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.

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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.

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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 a 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.

**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
Item L-125-5.25  Relocate and Install Existing Surface Mounted Sign – per each

Item L-125-5.26  Install Elevated Edge Light and Base in Existing PCC Pavement – 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