TOP SLAB REINFORCING STEEL DIAGRAM

(AlTERNATE A)

SQUARE OPENING WITH CORNER FILLETS

TOP SLAB REINFORCING STEEL DIAGRAM

(AlTERNATE B)

ROUND RISER OPENING

SPECIAL TOP SLAB*

SECTION A-A

(AlTERNATE A)

SECTION B-B

(AlTERNATE B)

TYPICAL SLAB TO WALL DETAILS

FOR PRECAST STRUCTURES

#4 @ 12" BW (CIPL) See Table 1 for Precast

#4 @ 12" Ctrs. (Vertical Bars)

#4 Ties @ 12" O.C.

#4 @ 12" Ctrs. (Vertical Bars)

#5 Peripheral Reinforcement

12" Max. Cover

#4 @ 12" BW (CIPL) See Table 1 for Precast

#4 @ 12" Ctrs. (Vertical Bars)

3" Cl. (Single Layer)

#4 Ties @ 12" O.C.

#5 Peripheral Reinforcement

NOTES:

- When the inside diameter of a round structure is not more than 1'-6" larger than the opening in the riser or top slab, the top of the structure or riser shall be constructed according to the "Special Top Slab" details on this sheet.

- Provide one extra #4 bar reinforcement each side of each opening and two extra #4 bars at 3" min. spacing above each opening.

- Bend Bars As Required to Maintain Cover.

- NOTE: To Achieve Minimum Rebar Embedment Beyond Inside Face of Structure Wall, Refer to Table 7 for Details.

- Extra #5 @ 12" O.C. (Minimum #4 Bars)

- Extra #5 @ 12" O.C. (Minimum #4 Bars)

- Extra #5 @ 12" O.C. (Minimum #4 Bars)

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.

- #4 Ties @ 12" O.C.
### GENERAL NOTES

1. Standard structure bottoms 4'-0" diameter and smaller (Alt. A) and 3'-6" square (Alt. B) are designated Type P. Larger standard structure bottoms are designated Type J. Risers are permitted for all structures. Round risers are designated Type A. Square risers are designated Type B.

2. Walls of circular structures (Alt. A) constructed in place may be of brick or reinforced concrete. Precast and rectangular structures (Alt. B) shall be constructed of reinforced concrete only.

3. Wall thickness and reinforcement are for either reinforced cast-in-place or precast concrete units except that precast circular units may be furnished with walls in accordance with ASTM C478 (see modified wall thicknesses in Table 1).

4. Top and bottom slab thickness and reinforcement are for precast and cast-in-place construction. All concrete shall be of Class II concrete, except use Class IV concrete when shown in the Plans, for special applications of structures located in extremely aggressive environments. Concrete as specified in ASTM C478 (4000 psi) may be used in lieu of Class II concrete for precast items manufactured in accordance with Specifications Section 44B.

5. All reinforcement shown is Grade 60 steel, deformed bar. Equivalent area Grade 40 steel or equivalent area smooth or deformed welded wire reinforcement in accordance with Specification Section 931 may be substituted according to Index No. 201, unless otherwise noted.

6. Alt. A or Alt. B structure bottoms may be used in conjunction with curb inlet tops Types 1, 2, 3, 4, 5, 6, 9, 10, and 10, and any manhole or junction box unless otherwise shown in the plans or other standard drawings. Alt. B structure bottoms may be used in conjunction with curb inlet Types 7 & 8, or any ditch bottom unless otherwise shown in the plans or other standard drawings.

7. Rectangular structures may be rotated as directed by the Engineer in order to facilitate connections between the structure walls and storm sewer pipes.

8. Except when Alt. C hooks are specifically required, reinforcement in top and bottom slab shall be straight embedment.

9. All reinforcement must have 2" minimum cover except for 3'-6" diameter precast circular units manufactured under ASTM C478, keyed construction otherwise shown. Additional bars used to restrain hole formers for precast structures with grouted pipe connections, may be left flush with the hole surface. Curved or bend reinforcement at pipe openings to maintain cover. Exposed ends of reinforcing at precast pipe openings and grouted joints must be removed to 1" below the concrete surface and sealed with a Type II epoxy in accordance with Specification Section 926. Horizontal steel in rectangular structures shall be lapped a minimum of 30 bar diameters or by standard hooks at corners.

10. The corner fillets shown are necessary for rectangular structures used with circular risers and inlet throats and when used in conjunction with rectangular risers, inlet and inlet throats. Fillets will be required in the top slab of the Alt. A structure bottoms when used with the Alt. B risers. Each fillet shall be reinforced with two #5 bars.

11. Inlet walls, throats, risers or manhole tops shall be secured to structures as shown on Index No. 201 (Sheet 3 of 5) Optional Construction Joints.

12. Structures with depths over 14" below the mean high water table are to be checked for flotation by the designer of the drainage project.

13. Units larger than specified standards may be substituted at the contractor's option when these units will not cause or increase the severity of utility conflicts. Such larger units shall be furnished at no additional cost to the Department. Larger Alt. A units cannot replace Alt. B units without approval of the Engineer. This note applies to this Index only.

14. For manhole and junction box tops, for frames and covers, for supplementary details and notes see Index No. 201.

15. Type J structure bottoms must have a minimum 6'-0" wall height when possible, for maintenance access.

---

### TABLE 1 NOTES:

---

### TABLE 1:

<table>
<thead>
<tr>
<th>Structural/Riser Diameter (ft)</th>
<th>Cast-In-Place Items</th>
<th>Class II Concrete</th>
<th>ASTM C478</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t (in.)</td>
<td>t (in.)</td>
<td>A_t (in.^2/ft.)</td>
</tr>
<tr>
<td>P 3'-0&quot;</td>
<td>6</td>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>J 5'-0&quot;</td>
<td>8</td>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>J 6'-0&quot;</td>
<td>8</td>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>J 7'-0&quot;</td>
<td>8</td>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>J 8'-0&quot;</td>
<td>8</td>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>J 9'-0&quot;</td>
<td>8</td>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>J 10'-0&quot;</td>
<td>10</td>
<td>10</td>
<td>0.40##</td>
</tr>
<tr>
<td>J 12'-0&quot;</td>
<td>12</td>
<td>12</td>
<td>0.60##</td>
</tr>
</tbody>
</table>

---

### TABLE 2 NOTES:

---

### TABLE 2:

<table>
<thead>
<tr>
<th>Type</th>
<th>Wall Length (ft)</th>
<th>Max. Depth (ft)</th>
<th>Wall Thickness (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(ft)</td>
<td>(ft)</td>
<td>CIP (in.) Precast (in.)</td>
</tr>
<tr>
<td>P</td>
<td>3'-0&quot;</td>
<td>40</td>
<td>6 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>4'-0&quot;</td>
<td>40</td>
<td>6 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>5'-0&quot;</td>
<td>27</td>
<td>6 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>6'-0&quot;</td>
<td>15</td>
<td>6 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>6'-0&quot; to 9'-0&quot;</td>
<td>40</td>
<td>8 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>10'-0&quot;</td>
<td>26</td>
<td>8 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>10'-0&quot; to 12'-0&quot;</td>
<td>40</td>
<td>10 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>12'-0&quot;</td>
<td>40</td>
<td>10 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>14'-0&quot;</td>
<td>40</td>
<td>10 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>16'-0&quot;</td>
<td>40</td>
<td>10 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>20'-0&quot;</td>
<td>25</td>
<td>9 Riser 6 Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>20'-0&quot;</td>
<td>30</td>
<td>10 Riser 6 Bottom 6</td>
</tr>
</tbody>
</table>
**TABLE 3 MINIMUM STRUCTURE SIZES FOR SINGLE PIPE CONNECTION PER SIDE**

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>Pipe Diameter (in)</th>
<th>Single Pipe Side Dimension (in) with 4'-0&quot; 2 to 4 Pipes Side Dimension (in)</th>
<th>2 to 4 Pipes Side Dimension (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>9 1/2</td>
<td>5 1/2</td>
<td>10</td>
</tr>
<tr>
<td>24</td>
<td>11 1/2</td>
<td>7 1/2</td>
<td>11</td>
</tr>
<tr>
<td>30</td>
<td>1 6/8</td>
<td>7 1/2</td>
<td>11</td>
</tr>
<tr>
<td>36</td>
<td>1 5/8</td>
<td>9 1/2</td>
<td>13</td>
</tr>
<tr>
<td>42</td>
<td>9 1/2</td>
<td>11 1/2</td>
<td>15</td>
</tr>
<tr>
<td>48</td>
<td>11 1/2</td>
<td>7 1/2</td>
<td>11</td>
</tr>
<tr>
<td>60</td>
<td>11 1/2</td>
<td>13 1/2</td>
<td>15</td>
</tr>
<tr>
<td>66</td>
<td>17/8</td>
<td>11 1/2</td>
<td>15</td>
</tr>
<tr>
<td>72</td>
<td>11 1/2</td>
<td>9 1/2</td>
<td>13</td>
</tr>
<tr>
<td>84</td>
<td>13 1/2</td>
<td>11 1/2</td>
<td>15</td>
</tr>
</tbody>
</table>

**TABLE 3 NOTES:**

1. For Round Structures with variable angles between pipes and variable pipe sizes, refer to the DOT Storm Drain Handbook.

2. For 3'-6" Precast Square Structure Bottoms, 30" Pipes with similar invert elevations are not permitted in adjacent walls. Use 4'-0" Side Dimensions when 30" pipe openings are required on adjacent walls and the difference in flow lines is less than 4'-0".

3. For 4'-0" Precast Square Structure Bottoms, 36" Pipes with similar invert elevations are not permitted in adjacent walls. Use 5'-0" Side Dimensions when 36" pipe openings are required on adjacent walls and the difference in flow lines is less than 4'-0".

4. For 7'-0" Precast Square Structure Bottoms, 66" Pipes with similar invert elevations are permitted in adjacent walls. Use 8'-0" Side Dimensions when 66" pipe openings are required on adjacent walls and the difference in flow lines is less than 4'-0".

**TABLE 4 MINIMUM SIZES FOR MULTIPLE PARALLEL PIPE CONNECTIONS FOR RECTANGULAR STRUCTURE BOTTOMS**

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>Pipe Diameter (in)</th>
<th>Pipe Spacing (in)</th>
<th>Minimum Wall Length (L) for Number of Parallel Pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>3 1/2</td>
<td>6 1/2</td>
<td>15.0</td>
</tr>
<tr>
<td>24</td>
<td>4 1/2</td>
<td>6 1/2</td>
<td>18.0</td>
</tr>
<tr>
<td>30</td>
<td>6 1/2</td>
<td>12 1/2</td>
<td>18.0</td>
</tr>
<tr>
<td>36</td>
<td>6 1/2</td>
<td>18 1/2</td>
<td>19.0</td>
</tr>
<tr>
<td>42</td>
<td>9 1/2</td>
<td>12 1/2</td>
<td>19.0</td>
</tr>
<tr>
<td>48</td>
<td>12 1/2</td>
<td>12 1/2</td>
<td>19.0</td>
</tr>
<tr>
<td>60</td>
<td>15 1/2</td>
<td>15 1/2</td>
<td>19.0</td>
</tr>
<tr>
<td>66</td>
<td>18 1/2</td>
<td>18 1/2</td>
<td>19.0</td>
</tr>
<tr>
<td>72</td>
<td>20 1/2</td>
<td>18 1/2</td>
<td>19.0</td>
</tr>
<tr>
<td>84</td>
<td>24 1/2</td>
<td>20 1/2</td>
<td>19.0</td>
</tr>
</tbody>
</table>

**TABLE 4 NOTES:**

1. Minimum wall lengths based on precast structures, using concrete pipe with maximum skew angles per Table 5.

2. Wall lengths exceeding 20'-0" require special designs.

**MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS**

- **PLAN VIEW**
  - Double Layer Horizontal Wall Reinforcement (Vertical Wall Reinforcement Not Shown For Clarity)
  - Provide Extra Reinforcing Each Side Of Opening (See Note Section B-B)

**TABLE 5 - MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS**

<table>
<thead>
<tr>
<th>WALL THICKNESS</th>
<th>Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>14°</td>
<td>19°</td>
</tr>
<tr>
<td>15°</td>
<td>17°</td>
</tr>
<tr>
<td>16°</td>
<td>18°</td>
</tr>
<tr>
<td>17°</td>
<td>19°</td>
</tr>
<tr>
<td>18°</td>
<td>20°</td>
</tr>
<tr>
<td>19°</td>
<td>21°</td>
</tr>
</tbody>
</table>

**TABLE 5 NOTES:**

Maximum pipe skew for precast round openings are based on 2" clearance for precast structures. Larger skews are possible for Cast-In-Place Structures or elliptical pipe openings when approved by the Engineer.

**MULTIPLE PARALLEL PIPE CONNECTIONS DETAIL PLAN VIEW**

- Double Layer Horizontal Wall Reinforcement (Vertical Wall Reinforcement Not Shown For Clarity)
- Provide Extra Reinforcement Each Side Of Opening (See Note Section B-B)
- Masonry Seal for Precast Structures (Typ.)
- Vertical Lap Splice (20 Bar Diameter For Deformed Wire Or Bar, Not Less Than Vertical Wire Spacing Plus 2" For WWR Or 40 Bar Diameters For Smooth Wire)

**STRUCTURE SIZES FOR PIPE CONNECTIONS**

**INDEX NO.** 200
**SHEET NO.** 3 of 5
### SLAB DESIGNS - SQUARE AND RECTANGULAR STRUCTURES (TABLE 6)

**SHORT-WAY**

<table>
<thead>
<tr>
<th>Size: 4' x 8'</th>
<th>Schedule (Bars A)</th>
<th>Schedule (Bars B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25'-40'</td>
<td>D7</td>
<td>E5</td>
</tr>
<tr>
<td>29'-40'</td>
<td>D7</td>
<td>F5</td>
</tr>
</tbody>
</table>

### SLAB DESIGNS - ROUND STRUCTURES (TABLE 7)

**Size: 3'-0" Diameter**

- NO. 6
- NO. 7
- NO. 8

**Size: 4'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

**Size: 5'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

**Size: 6'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

**Size: 7'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

**Size: 8'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

**Size: 9'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

**Size: 10'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

**Size: 12'-0" Diameter**

- NO. 5
- NO. 6
- NO. 7

### DESIGN STANDARDS

1. Size is the inside dimensions of a structure.
2. Slab reinforcement is appropriate for top, intermediate, and bottom slabs.
3. Bottom slabs for precast 3' x 3' rectangular structures at 15' depth or less, may be 6" thick.
4. Slab depth is measured from finished grade to top of slab.
5. Wall depth is measured to the top of the bottom slab for boxes and to the top of the intermediate slab for risers.
6. Wall height is the distance between top of lower slab to bottom of upper slab. Maximum wall height is 12' for wall lengths exceeding 5', or 10 wall lengths exceeding 12.

7. Wall lengths exceeding 6'-0" require two layers of reinforcing (See Table 4) with 2' of cover from the horizontal bars to the inside and outside faces for each layer.
8. Wall lengths exceeding the dimensions or depths shown in Table 6, or 12'-0" diameter require a special design.
9. Wall thickness and reinforcing for rectangular structures is based on the longer wall length.
10. Reinforcing schedules with larger areas of steel may be substituted for schedules with smaller bar or wire spacing, except that Schedule B10 may not be substituted for Schedule 46. See Index 201, Sheet 4 for allowable bar spacing adjustments when larger areas of reinforcing are substituted.
### Wall Designs - Rectangular Structures (Table 8)

#### Vertical Reinforcing Schedule

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-6&quot; RISERS</td>
<td></td>
</tr>
<tr>
<td>21'-7&quot; ≤ 18</td>
<td>6'-9&quot;</td>
</tr>
<tr>
<td>18 ≤ 26</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>26'-40</td>
<td>6'-3&quot;</td>
</tr>
</tbody>
</table>

#### Horizontal Reinforcing Schedule

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-6&quot; RISERS</td>
<td></td>
</tr>
<tr>
<td>21'-7&quot; ≤ 18</td>
<td>6'-9&quot;</td>
</tr>
<tr>
<td>18 ≤ 26</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>26'-40</td>
<td>6'-3&quot;</td>
</tr>
</tbody>
</table>

### Schedule 10'-0" (Precast Only)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside</td>
<td>Outside</td>
</tr>
<tr>
<td>20'-40</td>
<td>6'-7&quot;</td>
</tr>
<tr>
<td>26'-40</td>
<td>5'-5&quot;</td>
</tr>
<tr>
<td>5'-5&quot;</td>
<td>5'-5&quot;</td>
</tr>
</tbody>
</table>

### Reinforcing Schedule

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside</td>
<td>Outside</td>
</tr>
<tr>
<td>10'-0&quot;</td>
<td>5'-5&quot;</td>
</tr>
<tr>
<td>5'-5&quot;</td>
<td>5'-5&quot;</td>
</tr>
</tbody>
</table>

#### Wall Thickness

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside</td>
<td>Outside</td>
</tr>
<tr>
<td>10'-0&quot;</td>
<td>5'-5&quot;</td>
</tr>
<tr>
<td>5'-5&quot;</td>
<td>5'-5&quot;</td>
</tr>
</tbody>
</table>

### Design Standards

- **Size:**
  - **Wall Designs:** Rectangular Structures (Table 8)
  - **Walls:** Double Layer Wall Reinforcing
  - **Options:**
    - Lap Splice Options:
      - Vertical Wire Spacing
      - Horizontal Wire Spacing

#### Reinforcing Details

- **Option 1:** Lap Splice:
  - Option 2:
    - Option 3:
      - Corner Spliced Bar (30 Bar Diameter)

### Structure Bottoms Type J and P

- **Index No.:** 200
- **Sheet No.:** 5 of 5
**Supplementary Details for Manholes & Inlets**

**Notes (Frames, and Cover):**
1. The standard cover is to be used for all frames Types I, II, III and the 2-piece cover, and is the replacement cover for all previous frames with 19" deep seats (traffic type). The 185 lb. cover (non-traffic type), 1984 Roadway and Traffic Design Standards Index No. 201, is the replacement cover for existing frames with 10" deep seats. Installation of frame with 10" deep seats is not permitted.

2. Use the 2'-0" cover, unless the 2-piece cover is called for in the plans, except at inlets and manholes with sump bottoms where manual entry may be required for cleaning. Clearly note the requirement for a 2-piece cover, on the drainage structure sheets in the plans.

**Designer Note:**
Consider using the 2-piece cover where depths exceed 8' and manual entry may be required for cleaning. Clearly note the requirement for a 2-piece cover, on the drainage structure sheets in the plans.

**Weight of Castings (lb):**

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>2' Opening</th>
<th>3' Opening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frame</td>
<td>Cover (Std)</td>
</tr>
<tr>
<td>I</td>
<td>155</td>
<td>190</td>
</tr>
<tr>
<td>II</td>
<td>145</td>
<td>190</td>
</tr>
<tr>
<td>III</td>
<td>90</td>
<td>190</td>
</tr>
</tbody>
</table>

* Includes Type I Adjustable

FDOT Storm Sewer Design Standards FY 2017-18
**EYEBOLT AND CHAIN REQUIREMENTS**

<table>
<thead>
<tr>
<th>Index Number</th>
<th>Inlet</th>
<th>EYE-BOLTS</th>
<th>Handling &amp; Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>217</td>
<td>(MB)</td>
<td>1</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
<tr>
<td>218</td>
<td>(MB)</td>
<td>1</td>
<td>8'-0&quot; Slide Or Slide &amp; Spin</td>
</tr>
<tr>
<td>219</td>
<td>(RW, RG2)</td>
<td>1</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
<tr>
<td>220</td>
<td>S</td>
<td>1</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
<tr>
<td>221</td>
<td>V</td>
<td>1</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
<tr>
<td>223</td>
<td>A</td>
<td>1</td>
<td>8'-0&quot; Slide</td>
</tr>
<tr>
<td>224</td>
<td>C</td>
<td>1</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
<tr>
<td>225</td>
<td>D</td>
<td>1</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
<tr>
<td>226</td>
<td>E</td>
<td>2</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
<tr>
<td>227</td>
<td>H</td>
<td>2</td>
<td>8'-0&quot; Slide &amp; Spin</td>
</tr>
</tbody>
</table>

**EYEBOLT AND CHAIN FOR LOCKING GRATES TO INLETS**

- Bevel Cut Upper Stub To Match Forming For Apron Face
- Prior To Placing Base Material, Remove Riprap, Cement, PVC Cap On Lower Stub And Place Compacted Fill In Entrance.
- Riprap Entrance Top Of Subgrade
- 6" PVC Pipe, 45° Lateral And Stubs
- Grout Seal Or Integral Cast

**SECTION**

**NOTES (TOPS)**

1. Manhole tops Type 7 slabs shall be of Class II concrete. Concrete as specified in ASTM C478 may be used for prestressed units; see General Note No. 3.
2. Manhole top Type 7 slabs may be of cast-in-place or precast construction. The optional key is for precast tops and in lieu of dowels. Frame and slab openings are to be omitted when top is used over a junction box.
3. Manhole top Type 8 may be of cast-in-place or precast concrete construction or brick construction. For precast construction, the concrete and steel reinforcement shall be the same as the supporting wall unit. An eccentric cone may be used.
4. Manhole tops shall be secured to structures by optional construction joints as shown on Sheet 3.
5. Frames can be adjusted a maximum 12" height with brick or precast concrete and steel reinforcement shall be the same as the supporting wall unit.
6. Substitution of manhole top Type 8 for manhole top Type 7 is allowed provided that minimum dimensions shown above are not reduced.
7. Substitution of manhole top Type 7 for Type 8 is allowed if the minimum thickness (h) above pipe opening cannot be maintained with manhole top Type 8.

**DESIGN NOTES**

1. Manhole top Type 8 should be specified in the plans when depths shown above can be maintained.
1. One or more types of joints may be used in a single structure, except brick wall structure. Brick wall construction is permitted in circular units only.

2. All grouted joints are to have a maximum thickness of 1".

3. Keyways are to be a minimum of 1/8" deep.

4. Joint dowels are to be #4 bars, 12" long with a minimum of 6 bars per joint approximately evenly spaced for circular structures or at maximum 12" spacing for rectangular structures. Bars may be either Adhesive Bonded Dowels in accordance with Specification Section 416, or placed approximately 6" into fresh concrete leaving the remainder to extend into the secondary cast. Welded wire reinforcement may be substituted for the dowel bar in accordance with the equivalent steel area table on Sheet 4.

5. Minimum cover on dowel reinforcing bars is 2" to outside face of structure.

6. Joints between wall segments and between wall segments and top or bottom slabs may be sealed either by preformed plastic gasket material using the procedures given in Section 430 of the Specifications or by non-shrink grout, in accordance with Section 934 of the Specifications.

7. Insert products approved by the Engineer may be used in lieu of dowel embedment.

**OPTIONAL CONSTRUCTION JOINTS**

**WALL JOINTS**

- **TOP SLABS TO WALLS**
  - Cold Cast Joint
  - Dowel
  - Grout

- **BOTTOM SLABS TO WALLS**
  - Cold Cast Joint
  - Dowel
  - Grout

**SEPARATE RISER SEGMENTS WITH CONSTRUCTION JOINTS OTHER THAN DOWEL OPTION**

**SEGMENTS FOR SLAB TO WALL DOWEL CONSTRUCTION JOINTS OR MONOLITHICALLY CAST SEGMENTS**

- **NOTE**: h may be less than 6" when approved by the Engineer, but not for inlet segments at finish grade elevation.

**COMPARATIVE SIDE VIEWS**

**MINIMUM DIMENSIONS FOR BOX AND RISER SEGMENTS**

**REBAR STRAIGHT END EMBEDMENT FOR TOP AND BOTTOM SLABS**

**WALL REINFORCING SPLICE DETAILS**

**SEPARATE RISER SEGMENTS WITH CONSTRUCTION JOINTS OTHER THAN DOWEL OPTION**

- **Top or Bottom Segment; h ≥ 2"**
  - Top or Bottom Segment: h ≥ 2" (H (min.) Tabulated Above Do Not Apply)
  - h ≥ 0.75H (min.)
  - 6" ≤ h ≤ 0.75H (min.)
  - h ≥ 0.4H
  - h ≥ H (min.)

- **H (min.) ≤ h < 0.4H**
  - h ≥ 0.75H (min.)

- **h ≥ Zero and h ≥ 6"**
  - h ≥ 0.4H

- **h ≥ H (min.)**

**NOTE**: h may be less than 6" when approved by the Engineer, but not for inlet segments at finish grade elevation.
EXAMPLE TABLE OF EQUIVALENT STEEL AREA

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GRADE 60 REINFORCING BAR</th>
<th>EQUIVALENT GRADE 40 REINFORCING BAR</th>
<th>EQUIVALENT 65 KSI SMOOTH WELDED WIRE REINFORCEMENT</th>
<th>EQUIVALENT 70 KSI DEFORMED WELDED WIRE REINFORCEMENT</th>
<th>Min. Steel Area (in²/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bar Size &amp; Spacing</td>
<td>Steel Area (in²/ft)</td>
<td>Bar Size &amp; Spacing</td>
<td>Style Designation</td>
<td>Min. Steel Area (in²/ft)</td>
</tr>
<tr>
<td>A</td>
<td>#3 85 Cts.</td>
<td>0.20</td>
<td>#4 65 Cts.</td>
<td>3 x #6 15/8 x 16</td>
<td>0.1846</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#5 75 Cts.</td>
<td>5 x #6 15/8 x 15.7</td>
<td>0.2223</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#7 85 Cts.</td>
<td>7 x #6 15/8 x 15.7</td>
<td>0.2463</td>
</tr>
<tr>
<td>B</td>
<td>#3 95 Cts.</td>
<td>0.24</td>
<td>#4 75 Cts.</td>
<td>3 x #6 15/8 x 15.7</td>
<td>0.3600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#6 85 Cts.</td>
<td>6 x #6 15/8 x 15.7</td>
<td>0.5550</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#7 95 Cts.</td>
<td>7 x #6 15/8 x 15.7</td>
<td>0.7950</td>
</tr>
<tr>
<td>Special 1</td>
<td>#3 95 Cts.</td>
<td>0.267</td>
<td>#4 75 Cts.</td>
<td>3 x #6 15/8 x 15.7</td>
<td>0.4000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#5 85 Cts.</td>
<td>5 x #6 15/8 x 15.7</td>
<td>0.6463</td>
</tr>
<tr>
<td>C</td>
<td>#3 85 Cts.</td>
<td>0.37</td>
<td>#4 65 Cts.</td>
<td>3 x #6 15/8 x 15.7</td>
<td>0.8750</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#5 75 Cts.</td>
<td>5 x #6 15/8 x 15.7</td>
<td>1.0950</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#7 85 Cts.</td>
<td>7 x #6 15/8 x 15.7</td>
<td>1.3150</td>
</tr>
<tr>
<td>D</td>
<td>#3 95 Cts.</td>
<td>0.30</td>
<td>#4 75 Cts.</td>
<td>3 x #6 15/8 x 15.7</td>
<td>0.3600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#5 85 Cts.</td>
<td>5 x #6 15/8 x 15.7</td>
<td>0.5550</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#7 95 Cts.</td>
<td>7 x #6 15/8 x 15.7</td>
<td>0.8463</td>
</tr>
<tr>
<td>E</td>
<td>#4 85 Cts.</td>
<td>1.06</td>
<td>#5 75 Cts.</td>
<td>4 x #6 15/8 x 15.7</td>
<td>1.5900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#6 85 Cts.</td>
<td>6 x #6 15/8 x 15.7</td>
<td>2.1900</td>
</tr>
<tr>
<td>Special 2</td>
<td>#3 95 Cts.</td>
<td>1.24</td>
<td>#5 75 Cts.</td>
<td>3 x #6 15/8 x 1.26</td>
<td>1.8600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>#7 85 Cts.</td>
<td>5 x #6 15/8 x 1.26</td>
<td>2.1900</td>
</tr>
<tr>
<td>G</td>
<td>#6 95 Cts.</td>
<td>1.46</td>
<td>#7 85 Cts.</td>
<td>4 x #6 15/8 x 1.26</td>
<td>2.1900</td>
</tr>
</tbody>
</table>

GENERAL NOTES
1. For square or rectangular precast drainage structures, using either deformed or smooth WWR meeting the requirements of Specification Section 931, WWR shall be continuous around the box and lapped in accordance with Option 1 or 3 as shown in the Wall Reinforcing Splice Details.
2. Horizontal steel in the walls of rectangular structures shall be lap spliced in accordance with Option 1 or 3 as shown in the Wall Reinforcing Splice Details.
3. Welding of splices and lags is permitted. The requirements and restrictions placed on welding in AASHTO M259 shall apply.
4. Rebar straight end embedment of peripheral reinforcement may be used in lieu of ACI standard hooks for top and bottom slabs except when hooks are specifically called for in the plans or standard drawings.
5. Concrete as specified in ASTM C479, (4000 psi) may be used in lieu of Class II concrete in precast items manufactured in plants which meet the requirements in accordance with Specification Section 449.
6. Precast opening for pipe shall be the pipe OD plus 6" (2") tolerance). Mortar used to seal the pipe into the opening will be of such a mix that shrinkage will not cause leakage into or out of the structure. Dry-pack mortar may be used in lieu of brick and mortar construction to seal openings less than 2" wide.
7. For pay item purposes, the height used to determine if a drainage structure is greater than 10 feet shall be computed using:
   A. the elevation of the top of the manhole lid.
   B. the grate elevation or the theoretical gutter grade elevation of an inlet, or
   C. the outside top elevation of a junctum box less the flow line elevation of the lowest pipe or to top of sump floor.

NOTES FOR PRECAST OPTIONS AND EQUIVALENT REINFORCEMENT SUBSTITUTION
1. Details for optional precast inlet construction up to depths of 15' are shown on the inlet indexes.
2. When precast units are used in conjunction with All "B" Structure Bottoms, Index No. 200, the interan dimensions of an All "B" Bottom can be adjusted to reflect these inlet interior dimensions.
3. Concrete which meets the requirements of ASTM C479 or Class IV must be used for precast structures constructed with 6" wall or slab thickness.
4. Reinforcement can be either deformed bar reinforcement or welded wire reinforcement. Bar reinforcement other than 60 ksi may be used, however only two grades are recognized: Grade 40 and Grade 60. Smooth welded wire reinforcement, will be recognized as having a design strength of 65 ksi and defomed welded wire reinforcement will be recognized as having a design strength of 70 ksi. The area of reinforcement required may be adjusted in accordance with the Equivalent Steel Area Table provided. Bars and spacings not given, the steel area required can be determined by the following equations:
   A. For Grade 60 Steel Area = A60 = (60 x A60)
   B. Smooth Welded Wire Reinforcement Steel Area = A65 = (60 x A60)
   C. Deformed Welded Wire Reinforcement Steel Area = A70 = (60 x A60)
5. Fiber-reinforced concrete may be substituted for conventional steel reinforcement in accordance with the Structures Design Guidelines. Shop drawings corresponding to an approved fiber-reinforced concrete mix design must be submitted for approval to the State Drainage Engineer.

<table>
<thead>
<tr>
<th>DESCRIPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2017-18</td>
</tr>
<tr>
<td>DESIGN STANDARDS</td>
</tr>
<tr>
<td>INDEX</td>
</tr>
<tr>
<td>SHEET</td>
</tr>
</tbody>
</table>
DESIGNER NOTE: Use only when round structures are not practical; engineer of record approval required.

NOTE:

1. Submit Shop Drawings of corner openings for approval by the Engineer of Record.

2. $h_2$ may be less than 1'-0" when a minimum 1'-0" deep segment, 8" slab or curb inlet is provided above the corner opening.

3. For inlet segments at finish grade elevation substitute a #8 Bar for the top corner bar when 1'-0" ≤ $h_2$ < 2'-0".

RECTANGULAR SEGMENT WITH PIPE OPENING AT CORNER

PLAN VIEW FOR SKEWS ≤ 45° (Not Centered)

PLAN VIEW FOR SKEWS > 45° (Not Centered)

SECTION AA (Pipes Not Shown For Clarity)
PREFORMED POLYETHYLENE ALTERNATE

SEE SHEET 2 FOR TYPICAL LOCATIONS

TYPE I (NON-REMOVABLE GRATE)

1. Trench drain is intended for use in gutters and driveways as shown on the typical locations on Sheet 2. Type I is intended for use in Type E, F and drop curbing, and adjacent to traffic separators and standard barrier walls. The width of the channel grate for Type I Trench Drain shall be 12" throughout varying the depth of the channel neck. Type II may also be used in those locations if an independent laboratory certifies that the grating used has an open area equal to at least 0.27 square feet per linear foot. Type II is primarily intended for use in valley gutter across driveway openings and drop curbing. Type I may also be used in those locations. The width of the channel grate for Type II Trench Drain shall be the same as the width of the channel. The linear slope or gradient for Type II may be manufactured by varying the depth of the channel. Trench Drain shall not be placed in pedestrian paths unless ADA compliant grates are used.

2. Unless shown in the plans, outlet pipes and preformed channel invert shall be sloped 0.6% or steeper toward the outlet regardless of the surface slope.

3. Trench drain may be stubbed directly into drainage structures, or outlet pipes may be used to connect trench drain to drainage structures.

4. A cleanout port compatible with the manufactured system shall be provided for Type I drains at the upstream end and at intervals not to exceed 50 feet. The cleanout port shall provide an opening 6" to 10" wide (transverse to the trench drain length) and 18" to 24" long. Where cleanouts are placed adjacent to raised curb or separator, the curb or separator shall be formed around the cleanout. The cleanout shall have a removable load resistant cover or grate.

5. Trench excavation must allow for a minimum of 6" of concrete to be placed under and alongside the trench drain channel system. Concrete backfill shall meet the requirements of Section 347 of the Standard Specifications. At the end of all units (Type I or II), the concrete backfill shall extend 6" minimum past the end of the drain opening.

6. Transverse bars for Type I Trench Drain shall be spaced 4" to 6" on center.

7. Whenever the work disturbs existing conditions or work already completed, restore the same to its original condition in every detail. All such repair and replacement shall meet the approval of the Engineer.

DESIGN NOTES

1. Where placed adjacent to reinforced concrete barrier wall or median barrier wall, the designer shall detail in the plans the position of the drain relative to the barrier wall to avoid conflicts with the barrier wall footing. See Index No. 410.

2. The designer shall identify the following in the plans:
   (a) The type of drain at each location.
   (b) The begin and end locations of the Trench Drain.
   (c) The type of drain at each location.
   (d) A drain channel. Trench Drain shall not be placed in pedestrian paths unless ADA compliant grates are used.

3. Capture efficiency for Type I Trench Drain may be computed using the equations for slotted drain in FHWA's HEC 12 & 22. Grate Type I and Type II must have at least 30% open area.

4. Round pipe alternate is available in 12, 18, 24 and 36 inch.

5. Type II Preformed Channel with integral anchoring lugs are applicable.
Driveway Slope To Fit Alternate In Driveways
Preformed Polyethylene Grate To Be Used On "Edge Of Grate Frame"

Driveway Shoulder
Exposed Heel

* As Necessary To Provide 6" Of Concrete On This Side Of Drain

WITHIN TYPE E CURB

WITHIN TYPE F CURB

WITHIN DROP CURB

WITHIN DROP CURB

TYPICAL LOCATIONS FOR TYPE I

TYPICAL LOCATIONS FOR TYPE II

ADJACENT TO SHOULDER BARRIER WALL

ADJACENT TO TRAFFIC SEPARATOR

ROUND PIPE ALTERNATE SHOWN, BUT PREFORMED POLYETHYLENE ALTERNATE ACCEPTABLE

WITHIN VALLEY GUTTER

WITHIN DROP CURB

* FY 2017-18 DESIGN STANDARDS

TRENCH DRAIN

INDEX NO. 206

SHEET NO. 2 of 2

REV 07/01/04

DESIGN STANDARDS

REV

DESCRIPTION:

LAST REV 07/01/04

REV

INDEX NO. 206

SHEET NO. 2 of 2

REV

DESCRIPTION:
PLAN (INLET TYPE 2 SYMMETRICAL ABOUT Q)

PLAN (INLET TYPE 4 SYMMETRICAL ABOUT Q)

SECTION BB (INLET TYPE 2 SYMMETRICAL ABOUT Q)

SECTION BB (INLET TYPE 4 SYMMETRICAL ABOUT Q)

INLETS TYPES 1 AND 2

INLETS TYPES 3 AND 4

DIMENSIONAL SECTION

DIMENSIONAL SECTION

REINFORCING SECTION

REINFORCING SECTION

TRANSVERSE SECTIONS FOR INLETS TYPES 1, 2, 3 & 4

GENERAL NOTES

1. The finished grade and slope of the inlet tops are to conform with the finished cross slope and grade of the proposed sidewalk and/or border.

2. When inlets are to be constructed on a curve, refer to the plans to determine the radius and, where necessary, modify the inlet details accordingly. Bend steel when necessary.

3. All steel in inlet top shall have 1½" minimum cover unless otherwise shown. Inlet tops shall be either cast-in-place or precast concrete.

4. For precast units the rear wall and apron may be precast as a separate piece from the top slab. Provide a minimum of 7 ~ #4 dowels in accordance with Index No. 201 "OPTIONAL CONSTRUCTION JOINTS."

5. For supplemental details see Index No. 201.

6. Only round concrete support post will be acceptable.

7. These notes are designed for use with standard curb and gutter Types E and Type F. Locate inlet outside of pedestrian crosswalks.

8. For structure bottoms see Index No. 200.

9. Inlet to be paid for under the contract unit price for inlets (Curb: Type E). Each.

INDEX NO. 210  SHEET NO. 1 of 1
GENERAL NOTES

1. The finished grade and slope of the inlet tops are to conform with the finished cross slope and grade of the proposed sidewalk and/or border.

2. For inlets constructed on a curve, refer to the plans to determine the radius, and modify the inlet details according to the radius when necessary.

3. All reinforcing steel to be Grade 60 bars with 1\% minimum cover unless otherwise shown, see Section 4 for guidelines on reinforcing details. Request for shop drawing approval shall be directed to the State Drainage Engineer.

4. Inlet tops shall be either cast-in-place or precast concrete. Precast units shall conform to the dimensions shown or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer.

5. Concrete meeting the requirements of ASTM C478 (4,000 psi) may be used in lieu of Class III concrete for precast units, manufactured in plants which meet the requirements of Section 449 of the Specifications.

6. Corner fillets are required at inlet opening for precast units or C-I-P units used in conjunction with circular inlet bottoms or skewed rectangular inlet boxes. Finish top of fillets flush with drain throat bottom and match slope.

7. For inlet bottoms see Index No. 200. Inlet tops are to be used with Type P bottoms, or Type J bottoms with 3'-6" square (Type B), 3'-6" or 4' round (Type A) risers or top slab openings.

8. These inlet tops are designed for use with standard curb and gutter Type E and Type F. Locate inlet outside of pedestrian crosswalks. For Type E curb, transition the shape of the curb over the gutter transition length to match the face of the inlet (Type F).

9. See Index No. 201 for supplemental details.

10. All steel used for frame and grate shall meet the requirements of ASTM A36/A36M.

11. Either cast iron grates or steel grates may be used.

12. When Alternate "G" grate is specified in the plans either the cast iron grate and galvanized steel frame or the galvanized steel grate and frame must be used. Grates are to be grouted in accordance with the grouting detail shown on Sheet 5, in lieu of tack welding.

13. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type _), Each.

14. C-I-P Inlets: Precast Inlets

The finished grade and slope of the inlet tops are to conform with the finished cross slope and grade of the proposed sidewalk and/or border. For inlets constructed on a curve, refer to the plans to determine the radius, and modify the inlet details accordingly. Reinforcing steel to be Grade 60 bars with 1\% minimum cover unless otherwise shown, see Section 4 for guidelines on reinforcing details. Request for shop drawing approval shall be directed to the State Drainage Engineer. Concrete meeting the requirements of ASTM C478 (4,000 psi) may be used in lieu of Class III concrete for precast units, manufactured in plants which meet the requirements of Section 449 of the Specifications. Corner fillets are required at inlet opening for precast units or C-I-P units used in conjunction with circular inlet bottoms or skewed rectangular inlet boxes. Finish top of fillets flush with drain throat bottom and match slope. For inlet bottoms see Index No. 200. Inlet tops are to be used with Type P bottoms, or Type J bottoms with 3'-6" square (Type B), 3'-6" or 4' round (Type A) risers or top slab openings. These inlet tops are designed for use with standard curb and gutter Type E and Type F. Locate inlet outside of pedestrian crosswalks. For Type E curb, transition the shape of the curb over the gutter transition length to match the face of the inlet (Type F). See Index No. 201 for supplemental details. All steel used for frame and grate shall meet the requirements of ASTM A36/A36M. Either cast iron grates or steel grates may be used. When Alternate "G" grate is specified in the plans either the cast iron grate and galvanized steel frame or the galvanized steel grate and frame must be used. Grates are to be grouted in accordance with the grouting detail shown on Sheet 5, in lieu of tack welding. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type _).
GENERAL NOTES

1. This inlet is used in Traffic Separators Types 1 and II, or, in separators constructed with Curbs Types A, B and E and sidewalk paving, which cannot accommodate Inlets Types 1, 3, 4, 5, or 6. Use of this Inlet on through traffic side of the separator is not permitted in medians with Curbs Types A and B. Locate inlet outside of pedestrian way.

2. All reinforcing to be Grade 60 bars with 2" min. cover unless otherwise shown. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary. Bars to clear pipe by 1 1/2".

3. Recommended maximum pipe sizes are 24" longitudinal and 30" transverse. For larger pipe, Inlets with All A bottoms, Index No. 200 are recommended.

4. For supplementary details see Index No. 201.

5. All dimensions are for both precast and cast-in-place Inlets unless otherwise shown.

6. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type 7), Each.

6. All dimensions are for both precast and cast-in-place Inlets unless otherwise shown.

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE (IN.²/FT.)</th>
<th>AREA MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 6</td>
<td>A12</td>
<td>0.20</td>
</tr>
<tr>
<td>6 - 10</td>
<td>A6</td>
<td>0.20</td>
</tr>
<tr>
<td>10 - 13</td>
<td>A4</td>
<td>0.20</td>
</tr>
<tr>
<td>10 - 15</td>
<td>85.5</td>
<td>0.24</td>
</tr>
</tbody>
</table>

6" Top Slab of Inlets

For Bottom Slab Rebar Embedment Options See Optional Construction Joints, Index No. 201
GENERAL NOTES

1. This inlet is to be used only in Traffic Separators Types IV and V, or in separators constructed with Curbs Types D and F and sidewalk paving, which cannot accommodate Inlets Types 1, 2, 3, 4, 5 or 6. Use of this inlet on the through traffic side of the separator should be avoided in medians constructed with Curbs Type D (Curb inlets Types 9 or 10 are recommended). Locate inlet outside of pedestrian way.

2. All reinforcing to be Grade 60 bars with 2” min. cover unless otherwise shown. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary. Bars to clear pipe by 12”.

3. Recommended maximum pipe sizes are 24” longitudinal and 30” transverse. For larger pipe, inlets with Alt. B bottoms, Index No. 200 are recommended.

4. For supplemental details and notes see Index No. 201.

5. All dimensions are for both precast and cast-in-place inlets unless otherwise shown.

6. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type 8), Each.

7. This inlet is to be used only in Traffic Separators Types IV and V; or, in separators constructed with Curbs Types D and F and sidewalk paving, which cannot accommodate Inlets Types 1, 2, 3, 4, 5 or 6. Use of this inlet on the through traffic side of the separator should be avoided in medians constructed with Curbs Type D (Curb inlets Types 9 or 10 are recommended). Locate inlet outside of pedestrian way.

8. All reinforcing to be Grade 60 bars with 2” min. cover unless otherwise shown. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary. Bars to clear pipe by 12”.

9. Recommended maximum pipe sizes are 24” longitudinal and 30” transverse. For larger pipe, inlets with Alt. B bottoms, Index No. 200 are recommended.

10. For supplemental details and notes see Index No. 201.

11. All dimensions are for both precast and cast-in-place inlets unless otherwise shown.

12. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type 8), Each.
GENERAL NOTES

1. This inlet is primarily intended for applications with light to moderate flows where right of way does not permit the use of through Curb Inlets Types 1 through 6. The typical application is on curb returns to city streets. The inlet grate is suitable for pedestrian and bicycle traffic.

2. This inlet to be located outside of curb ramp area in vertical faced curbs such as Curb and Gutter Type F. Grate shall be oriented with vanes directed toward Predominant flow.

3. For structure bottoms see Index No. 200. For supplemental details see Index No. 201.

4. All steel in slab tops shall have 1\(\frac{1}{2}\)" minimum cover unless otherwise shown. Tops shall be either cast-in-place or precast concrete.

5. For Alternate B applications, top slab openings shall be placed such that 2 edges of inlet frame will be located directly above bottom wall or riser wall.

6. When used on a structure with dimensions larger than those detailed above and risers are not applied, the top slab shall be constructed using Index No. 200 with the slab opening adjusted to 24"x36". The "Special Top Slabs" on Index No. 200 is permitted.

7. Frame may be adjusted with one to six courses of brick.

8. Vaned grates with approximately equal openings will be permitted that satisfy AASHTO HL-93 loading. Grates shall be reversible, right or left.
Curb Inlet Top Type 10

1. This inlet is primarily intended for locations with light flows where right of way does not permit the use of throated Curb Inlet Types 1 through 6. The typical application is on curb returns to city streets. The inlet grate is suitable for pedestrian and bicycle traffic.

2. This grate to be located outside of curb ramp area in vertical faced curbs such as Curb and Gutter Type F. Grate shall be oriented with vanes directed toward predominant flow.

3. For structure bottoms see Index No. 200. For supplemental details see Index No. 201.

4. All steel in slab tops shall have 1½" minimum cover unless otherwise shown. Tops shall be either cast-in-place or precast concrete.

5. For Alternate B applications, top slab openings shall be placed such that 2 edges of inlet frame will be located directly above bottom or riser walls.

6. When used on a structure with dimensions larger than those detail above and risers are not applied, the top slab shall be constructed using Index No. 200 with the slab opening adjusted to 22"x24". The "Special Top Slab" on Index No. 200 is not permitted.

7. Frame may be adjusted with one to six courses of brick.

8. Vaned grates with approximately equal openings will be permitted that satisfy AASHTO HL-93 loading. Grates shall be reversible.

Approximate Debris Free Capacity

0.02 Pavement Cross Slope

<table>
<thead>
<tr>
<th>Total (CF)</th>
<th>Q(max)</th>
<th>Q(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>1</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>2</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>3</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>4</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>5</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>6</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>7</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>8</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>9</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Efficiency Curve

General Notes

Revision History

Description: FY 2017-18 Design Standards

Curb Inlet Top Type 10

Index No. 215

Sheet No. 1 of 1
**DESIGN NOTES**

1. These inlets are designed for use with Type F curb and gutter only. Locate inlet outside of curb ramp area.

2. Designer must specify Flume Type, “D” dimension, number of barrels and guiderail requirements in plans.

3. Designer must specify where energy dissipating bricks are required.

**GENERAL NOTES**

1. The finished grade and slope of the inlet top are to conform with the finished cross slope and grade of the proposed sidewalk and/or border.

2. When inlets are to be constructed on a curve, refer to the plans to determine the radius and, where necessary, modify the inlet details accordingly. Bend steel when necessary.

3. All steel shall have 2” minimum cover unless otherwise shown. Inlets can be either cast-in-place or precast concrete. Chamfer all exposed edges 1/2.”

4. All reinforcement is ASTM A615/A615M Grade 60 steel, either smooth or deformed. Equivalent area grade 40 steel or 65 ksi welded wire fabric may be substituted.

5. Inlets to be paid for under the contract unit price for Inlets (Closed Flume) EA.
**FLUME W/O SIDEWALK INLET (CLOSED FLUME) TYPE II**

**SINGLE BARREL FLUME DEPICTED**

- **ENDWALL**
  - #4 Steel Tie Bar

- **SECTION AA**
  - Sta/Offset Location
  - 2'-0" (Min)
  - E.P.
  - 2" Typ
  - 6" Thick Concrete Slab
  - Varies

- **SECTION BB**
  - Sta/Offset Location
  - 2'-0" (Min)
  - 3'-0" (Min)
  - 6'-0"
  - 6'-0"

**DESCRIPTION:**
- Curb & Gutter Type "F"
- *Bricks to Dissipate Energy: When Called For In Plans, Bricks To Be Included In The Cost Of The Inlet.
- Sod For Flumes Without Sidewalk
- Curb & Gutter Type "F"
- *Bricks to Dissipate Energy: When Called For In Plans, Bricks To Be Included In The Cost Of The Inlet.

**INDEX:**
- #4 Steel Tie Bar
- #4 Steel Tie Bar

**REVISIOTNO.**
- Sheet No.: 2 of 3
- Index No.: 216

**REVISION:**
- FY 2017-18
- DESIGN STANDARDS

**LAST REVISION:**
- 01/01/16
1. For Shoulder Slope ≥0.07
  1:5 For Shoulder Slope <0.07
Grate Slope

Throat Varies
15° ± 15°

PICTORIAL VIEW OF INLET COLLAR (TYPES 1 & 2)

PICTORIAL VIEW OF INLET COLLAR (TYPES 3, 4, & 5)

TOP VIEW OF INLET COLLAR WITHOUT GRATE

SECTION HH

VIEW KK

PRECAST COLLAR REINFORCING DETAILS (TYPES 3, 4 & 5)
(C-I-P COLLAR REINFORCING DETAILS SIMILAR)

VIEW JJ

SECTION DD

VIEW FF

PRECAST COLLAR REINFORCING DETAILS (TYPES 1 & 2)
(C-I-P COLLAR REINFORCING DETAILS SIMILAR)
GENERAL NOTES

1. This inlet is primarily intended for use adjacent to concrete barrier walls on paved shoulders. Use of the inlet adjacent to other wall types shall be approved by the Drainage Engineer. The inlet is suitable for bicycle and occasional pedestrian traffic, with roller bar installation (see inset B) but should not be placed in a designated pedestrian travel way. It is not intended for use in curb and gutter or other areas where throttled inlets are required, nor areas subject to high debris.

2. Inlets located in embankments constructed with earth anchored retaining wall shall be designed with minimum depths to reduce adverse impact on the anchorage system. Runs of pipe parallel to and near anchored wall shall be avoided wherever practical. Special coordination must be exercised during the design and construction of storm water systems within anchored wall systems.

3. Inlet bottoms and/or tops may be either precast or cast-in-place. Whether cast as a single unit or as multiple segments, and whether precast or cast-in-place, the upper 2'-3" of the inlet shall be reinforced in accordance with sections CC, DD and EE.

4. All exposed edges and corners shall be ¼ chamfer or tooled to ¾" radius.

5. When Alternate C grate is specified in the plans, the grate is to be hot-dip galvanized after fabrication. Field installation of the filter bar called for in inset B shall not be permitted, thereby requiring tolerance adjustment during fabrication and/or casting, or, matching grate to structure prior to galvanizing.

6. All reinforcing is Grade 60 bars. See Index No. 201 for equivalent area of welded wire fabric.

7. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

8. For supplemental details see Index Nos. 200 and 201.

9. Inlets to be paid for under the contract unit for Inlets (Barrier Wall), Each.

PRECAST INLETS:

One layer ASTM 04390 Class S, Type III Organic Felt bond breaker between inlet and barrier, including footings. See Plans for other material details.

CAST-IN-PLACE INLETS:

Joint And Bond Breaker:

- Cast-in-Place Inlets:
  - Organifelt bond breaker between inlet and barrier, including footings.

- Precast Inlets:
  - Joint width 1" max. Seal with backer rod and Department-approved pavement joint sealant. See Plans for other material details.

Note: All B Structure Bottom Only. See Index No. 200.

SECTION BB

INLET WITH STRUCTURE BOTTOM

BARREL WALL INLET

SCHEDULE (TABLE 1)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>BAR TYPE</th>
<th>AREA (sq in)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>A4</td>
<td>0.20</td>
<td>6' 3&quot;</td>
</tr>
<tr>
<td>5-10</td>
<td>A6</td>
<td>0.20</td>
<td>6&quot; 5&quot;</td>
</tr>
<tr>
<td>10-15</td>
<td>B5.5</td>
<td>0.24</td>
<td>5'/5&quot;</td>
</tr>
</tbody>
</table>

Note: All B Structure Bottom Only. See Index No. 200 and 201.

For supplemental details see Index Nos. 200 and 201.

Inlets to be paid for under the contract unit for Inlets (Barrier Wall), Each.
PICTORIAL VIEW OF INLET COLLAR

TOP VIEW OF INLET WITHOUT GRATE

TOP VIEW OF METAL PLATE

SECTION CC

SECTION DD

SECTION EE

SECTION FF

SECTION GG

PICTORIAL VIEW OF INLET COLLAR

TOP VIEW WITH GRATE & PLATE

TRANSVERSE SECTION WITH GRATE & PLATE

TOP VIEW WITHOUT BACK PLATE

BACK VIEW WITHOUT BACK PLATE

TRANSVERSE SECTIONS THRU BACKWALL PLATE

OPTION FOR STUD

OPTION FOR BOLT

OPTION FOR STUD (2 REQUIRED)

OPTION FOR STUD (2 REQUIRED)

OPTION FOR ANCHOR BOLT

INSET A

INSET B

NOTES

1. All bars #4.

2. Anchor bolts shall be either ASTM A307 hex head bolts cast-in-place, or ASTM A36 or F1554 (Grade 36) galvanized fully threaded rod, adhesive bonded anchors installed in accordance with Specification Section 436. Bolts or rods shall be 6" long (4" min. embedment) with one heavy hex head nut (ASTM 194 or A563) and one flat washer (ASTM F436) each. All anchor bolts, nuts and washers shall be hot-dip galvanized.
1. This inlet to be used in conjunction with Concrete Barrier Wall, Curb and Gutter, Index No. 410. The inlet is suitable for bicycle and occasional pedestrian traffic with extended crossbar or bar sub (see KSETS 6 & 8 ALTERNATE). Inlet should not be placed in a pedestrian way.

2. All reinforcing is Grade 60 bars. For equivalent area of welded wire fabric for inlet, see Index 201. Reinforcing shall have 2" min. cover unless otherwise shown. Bars shall be trimmed or bent to provide 3½" clearance around pipe openings. Cost for additional reinforcing in barrier wall to be included in cost of concrete barrier wall.

3. Barrier wall to be Class II Concrete, finished surface in accordance with General Note 1, Sheet 1, Index 410.

4. All exposed edges and corners shall be 3½" chamfer or tooled to 3¼" radius.

5. A flat [BxL/4] drainage slot shall be constructed at the inlet centerline when the inlet is located in a curb sag. For drainage slot construction, no more than two bars shall be trimmed or deleted such as type: AA, 4K, and 4-Bar. On each side of drainage slots, vertical & horizontal bars shall be placed to provide 2" concrete cover.

GENERAL NOTES:

6. Recommended maximum pipe sizes are 18" longitudinal and 30" transverse. For larger pipe, use Alternate B bottoms, Index 200.

7. Grates can be fabricated with reticulated bars or with either 1/2" welded or 3/8" electroforged cross bars and bearing bars as detailed on Sheet 3.

8. When Alternate G grate is specified in plans, the grate is to be hot-dip galvanized after fabrication according to Specification Section 964-9.

9. For Pay Item purposes, the depth of the barrier wall inlet shall be computed using the center of box grate elevation, less the flow line elevation of the lowest pipe flow line or to the top of the sump floor elevation.

10. All dimensions are for both precast and C-1-P Inlets unless otherwise noted.

11. Inlets to be paid for under the contract unit price for Inlets, Barrier Wall, Rigid; Curb & Gutter, Each.

12. Concrete Barrier Wall to be paid for under the contract unit price for Shoulder Concrete Barrier Wall, Rigid-Curb & Gutter, LF.
Desired Steel Grates

PLAN VIEW

- Electroforged Cross Bars: Either 1/8" Welded or 1/8" Electroformed

OPTIONAL STEEL GRATES

- Welded Cross Bars

- Electroformed Cross Bars

PLAN VIEW

- Reticle Bar
- Intermediate Bar
- Bearing Bar

RETICULINE GRATE

- Cross Bars: Either 1/8" Welded or 1/8" Electroformed

- Bar Stubs @ 4" O.C.

SECTION KK

- Cross Bar Grate
- Plan View
- Section FF

SECTION LL

- Top View of Inlet Top Without Grate
- Section JJ

PICTORIAL VIEW OF INLET TOP

- No. 4 Bars @ 9" O.C.

PRECAST INLET TOP REINFORCING DETAILS

- 6" Precast

NOTE:
1. For additional information on Bar 4B, see BAR BENDING DIAGRAMS (Sheet 2).
2. C-I-P Inlet Top Reinforcing Similar

FY 2017-18
DESIGN STANDARDS

CONCRETE BARRIER WALL INLET

INDEX
No. 219

SHEET
No. 3 of 3
Apron To be Constructed At The Most Downstream Inlet In A Run Of Shoulder Gutter

CONCRETE APRON AT TERMINAL INLETS
ALT. A STRUCTURE BOTTOM FOR INLET TYPE S

TOP SLAB OPENINGS

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>OPENING SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'-0&quot; to 8'-0&quot;</td>
<td>2'-11&quot; x 4'-0&quot;</td>
</tr>
<tr>
<td>5'-0&quot; Min. To 8'-0&quot; Max.</td>
<td>(Unless Otherwise Shown In The Plans)</td>
</tr>
</tbody>
</table>

SECTION AA

Top Slab With Centered Opening

Round Structure Bottom
See Index No. 200 For Structure Bottom Details and Hole Reinforcement.

9½" For 5'-0"/6'-0" Structure Bottoms
11½" For 8'-0" Structure Bottoms

#5 Hoop Bar (Peripheral Reinforcement)

#8 Bars

SECTION BB

TOP SLAB REINFORCING DIAGRAM

9½" For 5'-0"/6'-0" Structure Bottoms
11½" For 8'-0" Structure Bottoms

#8 Bars @ 5" Spacing

2 Way Reinforcement
See Tables

#5 Hoop Bar

2 Way Reinforcement
See Tables

#4 Bar Each Corner

(2'-0" Min. Length)

220

ALT. A STRUCTURE BOTTOM FOR INLET TYPE S

GUTTER INLET TYPE S

INDEX No. 220

SHEET No. 3 of 3

REV. 07/01/05

DESIGN STANDARDS

FY 2017-18

GUTTER INLET TYPE S

REVISION

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET

NO.

INDEX

NO.

DESCRIPTION:

REV

NO.

SHEET
**GENERAL NOTES**

1. This inlet is suitable for vehicle swales, ditches, or other areas subject to heavy wheel loads, minimum of soil. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet. This inlet is not for use in a bicycle way.

2. When alternate "CIP" grate is specified in plans, the grate is to be hot dip galvanized after fabrication.

3. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe to clear pipe 1")

4. All exposed edges and corners shall be 1/8" chamfer or tooled to 1/2" radius.

5. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

6. For supplementary details see Index No. 201.

7. Inlet to be paid for under the contract unit price for Inlets (Gutter Type V), EA

---

**RECOMMENDED MAXIMUM PIPE SIZES**

<table>
<thead>
<tr>
<th>Inlet Size Width</th>
<th>Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-11&quot; or 3'-3&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>4'-0&quot; or 3'-10&quot;</td>
<td>30&quot;</td>
</tr>
</tbody>
</table>

*Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe see bottom detail above and Index No. 200.*

**HORIZONTAL WALL REINFORCING**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5'</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 8&quot;</td>
</tr>
<tr>
<td>5 - 9'</td>
<td>A6</td>
<td>0.20</td>
<td>6&quot; 3'</td>
</tr>
<tr>
<td>9 - 12'</td>
<td>A4</td>
<td>0.20</td>
<td>4&quot; 3'</td>
</tr>
<tr>
<td>12' - 15'</td>
<td>B5.5</td>
<td>0.24</td>
<td>5½&quot; 5&quot;</td>
</tr>
</tbody>
</table>

**PLAN**

(CAST-IN-PLACE INLET SHOWN WITHOUT GRATE; PRECAST INLET SIMILAR)

**SECTION BB**

(CAST-IN-PLACE INLET SHOWN PRECAST INLET SIMILAR)

**SECTION AA**

(CAST-IN-PLACE INLET)

**SECTION AA (PRECAST INLET)**

---

**DESIGN STANDARDS**

FY 2017-18

**INDEX NO.**

221

**SHEET NO.**

1 of 2
ALT. A STRUCTURE BOTTOM FOR INLET TYPE V

Top Slab With Centered Opening

Centered Opening-See Table For Dimensions

2 Way Reinforcement
See Tables

#4 Bar Each Corner
(2'-0" Min. Length)

# 5 Hoop Bar
(Peripheral Reinforcement)

Centered Inlet
Structure Bottom

GUTTER INLET TYPE V

SECTION AA

SECTION BB

TOP SLAB OPENINGS

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>OPENING SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'-0&quot; to 8'-0&quot;</td>
<td>2'-11&quot; x 4'-0&quot; 2'-3&quot; x 3'-10&quot;</td>
</tr>
</tbody>
</table>

Top Slab With Centered Opening

Round Structure Bottom
See Index No. 200 For Structure Bottom Details and Hole Reinforcement.

Top Slab

2'-11" to 4'-0"

5'-0" Min. To 8'-6" Max
(Unless Otherwise Shown In The Plans)

TOP SLAB REINFORCING DIAGRAM

2 Way Reinforcement
See Tables

#5 Hoop Bar
Z C1

#4 Bars Each Corner

#8 Bars @ 5" Spacing

TOP SLAB REINFORCING SCHEDULE

<p>| GRADE 66 (BAR) OR #5 KSI &amp; 70 KSI (WIRE FABRIC) |</p>
<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>IN/FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.20</td>
</tr>
<tr>
<td>B</td>
<td>0.24</td>
</tr>
<tr>
<td>C</td>
<td>0.30</td>
</tr>
<tr>
<td>D</td>
<td>0.37</td>
</tr>
<tr>
<td>E</td>
<td>0.33</td>
</tr>
<tr>
<td>F</td>
<td>0.68</td>
</tr>
<tr>
<td>G</td>
<td>1.48</td>
</tr>
</tbody>
</table>

TOP SLAB WITH CENTERED OPENING

<table>
<thead>
<tr>
<th>SLAB DEPTH</th>
<th>SLAB THICKNESS</th>
<th>REINFORCING (2 WAYS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE: 9'-0&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'-0&quot; &lt; D</td>
<td>95°</td>
<td>C</td>
</tr>
<tr>
<td>3'-6&quot; &lt; D</td>
<td>95°</td>
<td>G</td>
</tr>
<tr>
<td>SIZE: 8'-0&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2'-0&quot; &lt; D</td>
<td>95°</td>
<td>C</td>
</tr>
<tr>
<td>2'-0&quot; &lt; D</td>
<td>95°</td>
<td>G</td>
</tr>
</tbody>
</table>

REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>IN/FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.20</td>
</tr>
<tr>
<td>B</td>
<td>0.24</td>
</tr>
<tr>
<td>C</td>
<td>0.30</td>
</tr>
<tr>
<td>D</td>
<td>0.37</td>
</tr>
<tr>
<td>E</td>
<td>0.33</td>
</tr>
<tr>
<td>F</td>
<td>0.68</td>
</tr>
<tr>
<td>G</td>
<td>1.48</td>
</tr>
</tbody>
</table>

ALTERNATE A STRUCTURE BOTTOM FOR INLET TYPE V

GUTTER INLET TYPE V

INDEX NO. 221

SHEET NO. 2 of 2

REV 07/01/16

LAST REVISION
07/01/05

DESCRIPTION:
FY 2017-18 DESIGN STANDARDS
Ditch Bottom Inlet Type A

**Recommended Maximum Pipe Sizes**

<table>
<thead>
<tr>
<th>Inlet Inside Width</th>
<th>Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-0&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>3'-0&quot;</td>
<td>30&quot;</td>
</tr>
</tbody>
</table>

Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe see bottom detail right and Index No. 200.

**General Notes**

1. This inlet is designed for ditches, medians, or other areas subject to heavy wheel loads on limited access facilities where debris may be a problem. This inlet is not for use in areas subject to pedestrian and/or bicycle traffic.

2. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. Cut or bend bars out of way of pipe to clear rebars. Use #4 bars @ 12" cts.

3. All exposed edges and corners shall be 3/16" chamfer or tooled to 1/4" radius.

4. When alternate "G" grate is specified in plans, the grate is to be hot-dip galvanized after fabrication.

5. Cost of ditch paving to be included in the cost of Inlet. Sodding to be paid for under contract unit price for Performance Turf, ST.

6. For supplemental details see Index No. 201.

7. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

8. Inlet to be paid for under the contract unit price for Inlets (Ditch Block) (Low Side of Inlet on Continuous Ditches)

**Horizontal Wall Reinforcing Schedule (Table 1)**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCREED</th>
<th>AREA (in²/ft.)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot;</td>
</tr>
<tr>
<td>10 – 15</td>
<td>A6</td>
<td>0.20</td>
<td>8&quot;</td>
</tr>
<tr>
<td>15 – 20</td>
<td>A6</td>
<td>0.20</td>
<td>5&quot;</td>
</tr>
</tbody>
</table>

---

**Index No. 200**

- **Structure Bottom Only.** See Index No. 200 for Structure Bottom Details and Hole Reinforcement.

---

**SECTION DD**

Ditch Bottom Inlet Type A

**SECTION CC**

Ditch Block (Low Side Of Inlet On Continuous Ditches)

**SECTION AA**

(Pipe Opening Shown)

**SECTION BB**

(Pipe Opening Not Shown)
### TOP SLAB OPENINGS

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>OPENING SIZE</th>
<th>MIN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8'-0&quot; To 8'-0&quot;</td>
<td>2'-0&quot; x 3'-1&quot;</td>
<td></td>
</tr>
</tbody>
</table>

### TOP SLAB REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GRADE 60 (BAR) OR 65 KSI &amp; 70 KSI (WIRE FABRIC)</th>
<th>(IN/FT²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1.45</td>
<td></td>
</tr>
</tbody>
</table>

### TOP SLAB REINFORCING DIAGRAM

- Top Slab With Centered Opening
- Round Structure Bottom
- See Index No. 200 For Structure Bottom Details and Hole Reinforcement.
- 2 Way Reinforcement See Tables
- 

### TOP SLAB WITH CENTERED OPENING

<table>
<thead>
<tr>
<th>SIZE</th>
<th>SLAB DEPTH</th>
<th>SLAB THICKNESS</th>
<th>REINFORCING SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'-0&quot;</td>
<td>0.5'-40'</td>
<td>90°</td>
<td>C</td>
</tr>
<tr>
<td>5'-0&quot;</td>
<td>0.5'-40'</td>
<td>90°</td>
<td>C</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>0.5'-40'</td>
<td>90°</td>
<td>C</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>0.5'-40'</td>
<td>90°</td>
<td>C</td>
</tr>
<tr>
<td>18'-30'</td>
<td>90°</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>30'-37'</td>
<td>90°</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>37'-40'</td>
<td>90°</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>0.5'-40'</td>
<td>110°</td>
<td>C</td>
</tr>
<tr>
<td>9'-15'</td>
<td>110°</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>15'-22'</td>
<td>110°</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>22'-32'</td>
<td>110°</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>33'-40'</td>
<td>110°</td>
<td>G</td>
<td></td>
</tr>
</tbody>
</table>

### ALT. A STRUCTURE BOTTOM FOR INLET TYPE A

- Centered Inlet Structure Bottom
- See Tables 2 Way Reinforcement
- #4 Bar Each Corner (2'-0" Min. Length)
- #5 Hoop Bar (Peripheral Reinforcement)
- #6 Bars
- 2 Way Reinforcement See Tables
- 65 KSI & 70 KSI (WIRE FABRIC)
DITCH BOTTOM INLET TYPE B

RECOMMENDED MAXIMUM PIPE SIZES

<table>
<thead>
<tr>
<th>INLET INSIDE WIDTH</th>
<th>PIPE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-0&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>3'-6&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe see bottom detail above and Index No. 200.

CONCRETE INLET PAVEMENT AND SODDING

SECTION EE
DITCH BLOCK

TRaversable inlet Top
(Single Slot Shown)

Plan

HORIZONTAL WALL REINFORCING

SCHEDULE (TABLE 1)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>AREA (sq ft)</th>
<th>MAX SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>0.20</td>
<td>6&quot; 8&quot;</td>
</tr>
<tr>
<td>3 - 5</td>
<td>0.28</td>
<td>7&quot; 9&quot;</td>
</tr>
<tr>
<td>5 - 7</td>
<td>0.34</td>
<td>8&quot; 10&quot;</td>
</tr>
</tbody>
</table>

INDEX NO.

For Informational Purposes Only

INDEX 201

For larger pipe see bottom detail above and Index No. 200.

Recommended maximum pipe sizes
The general purpose of the inlet top designs are:

1. For ditches, medians or other areas subject to heavy wheel loads. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet. Inlet not suitable for bicycle traffic.

2. Full grate and horizontal slot designs for new construction.

3. Provide full grate and vertical slot tops on existing Inlets Type B and Type X that are in locations subject to occasional pedestrian traffic.

4. Double Slot

5. Cost for constructing traversable tops on new inlet boxes shall be included in the contract unit price for Inlets (DT BOT) (Type B), EA., and shall include the cost for surrounding concrete inlet pavement. Existing Inlets Type B and Inlets Type X that are converted to traversable inlet tops shall be paid for under the contract unit price for Inlets (DT BOT) (Type B) (Partial), EA. Unit price and payment shall be full compensation for inlet conversion and shall include the removal of any existing concrete inlet pavement, the removal and stockpiling or disposal of sufficient material from the existing inlet box, and facilitate construction of the required inlet top; construction of the required inlet conversion; backfill construction; construction of concrete inlet pavement; reusing, supplementing, transferring or replacing grates as required by plans or as directed by the Engineer; any required earthwork for ditch restoration within 30' of the inlet; and, restoration of disturbed turf.

6. Ditch pavement shall be paid for, separate from the inlet and concrete inlet pavement, by pavement types and units as called for in the plans.

7. Sod will be paid for under the contract unit price for Performance Turf, SY.

8. For supplementary details see Index No. 201.

9. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

GENERAL NOTES

1. The type of top (single or double slots) depends on the approach ditch configuration and the hydraulic requirements of the site. The designer will stipulate in the plans the type of top to be constructed at each individual inlet location.

2. On existing inlets, conversion grates shall be constructed at the original grate elevations unless other elevations are called for in the plans. When plans call for the inlet top to be constructed to support storm water detention, details for ditch modifications and underdrains shall be shown in the plans.

MAINTENANCE NOTES

1. Traversable inlet tops that are constructed by maintenance contract or by maintenance forces may reuse the existing grates that are determined by the Maintenance Engineer to be functionally sound, and their reuse is so directed by the Maintenance Engineer. Existing grates approved for reuse and new grates may be mixed, matched or replaced as directed by the Maintenance Engineer.

TRAVERSABLE TOPS FOR INLETS TYPE B AND FOR CONVERSIONS OF EXISTING INLETS TYPE B AND TYPE X

On new boxes the traversable top may be cast as a monolithic unit or cast in segments, and the location of this line may be lower to facilitate handling and placement; however, the slot depth is to remain at 9 inches. See Index No. 201 for top to wall connection. For converting to traversable tops on existing box, remove concrete to this line and expose the existing reinforcement. Reshape or splice in reinforcement to penetrate the rim and returns of the grate seat, and bend the reinforcement into the slot shelf to extend into the abutting throat pavement.

The general purpose of the inlet top designs are:

a. For ditches, medians or other areas subject to heavy wheel loads. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet. Inlet not suitable for bicycle traffic.

b. Provide full grate and horizontal slot designs for new construction.

c. Provide full grate and vertical slot tops on existing Inlets Type B and Type X that are in locations subject to occasional pedestrian traffic.

All reinforcing is Grade 60 bars with 2' min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric. Bars to be cut or bent for min. 1½ clearance around pipe.

All exposed edges and corners shall be ½ chamfer or tooled to ¼ radius.

When Alternate G grates are specified in the plans, the grates are to be hot-dip galvanized after fabrication.

Material for inlet conversion and shall include the removal and stockpiling or disposal of sufficient material from the existing inlet box, and facilitate construction of the required inlet top; construction of the required inlet conversion; backfill construction; construction of concrete inlet pavement; reusing, supplementing, transferring or replacing grates as required by plans or as directed by the Engineer; any required earthwork for ditch restoration within 30' of the inlet; and, restoration of disturbed turf.

Sod will be paid for under the contract unit price for Performance Turf, SY.

For supplementary details see Index No. 201.

All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

The designer will stipulate in the plans the type of top to be constructed at each individual inlet location.

On existing inlets, conversion grates shall be constructed at the original grate elevations unless other elevations are called for in the plans. When plans call for the inlet top to be constructed to support storm water detention, details for ditch modifications and underdrains shall be shown in the plans.

The general purpose of the inlet top designs are:

a. For ditches, medians or other areas subject to heavy wheel loads. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet. Inlet not suitable for bicycle traffic.

b. Provide full grate and horizontal slot designs for new construction.

c. Provide full grate and vertical slot tops on existing Inlets Type B and Type X that are in locations subject to occasional pedestrian traffic.

1. The type of top (single or double slots) depends on the approach ditch configuration and the hydraulic requirements of the site. The designer will stipulate in the plans the type of top to be constructed at each individual inlet location.

2. On existing inlets, conversion grates shall be constructed at the original grate elevations unless other elevations are called for in the plans. When plans call for the inlet top to be constructed to support storm water detention, details for ditch modifications and underdrains shall be shown in the plans.
ALT. A STRUCTURE BOTTOM FOR INLET TYPE B

**TOP SLAB OPENINGS**

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>OPENING SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-0&quot; to 8'-0&quot;</td>
<td>6'-10&quot; x 4'-2&quot;</td>
</tr>
</tbody>
</table>

**TOP SLAB REINFORCING DIAGRAM**

- #5 Hoop Bar (Peripheral Reinforcement)
- #6 Bars @ 5' Spacing
- 2 Way Reinforcement
- See Tables

**TOP SLAB REINFORCING SCHEDULE**

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GRADE 60 (BAR) ON 65 KSI &amp; 70 KSI (WIRE FABRIC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.20</td>
</tr>
<tr>
<td>B</td>
<td>0.24</td>
</tr>
<tr>
<td>C</td>
<td>0.37</td>
</tr>
<tr>
<td>D</td>
<td>0.53</td>
</tr>
<tr>
<td>E</td>
<td>0.73</td>
</tr>
<tr>
<td>F</td>
<td>1.06</td>
</tr>
<tr>
<td>G</td>
<td>1.45</td>
</tr>
</tbody>
</table>

**TOP SLAB WITH CENTERED OPENING**

<table>
<thead>
<tr>
<th>SLAB DEPTH</th>
<th>SLAB THICKNESS</th>
<th>REINFORCING (2 WAYS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5&quot; ≤ D ≤ 2&quot;</td>
<td>9&quot;</td>
<td>B</td>
</tr>
<tr>
<td>2&quot; &lt; D ≤ 3&quot;</td>
<td>9&quot;</td>
<td>C</td>
</tr>
<tr>
<td>3&quot; &lt; D ≤ 4&quot;</td>
<td>9&quot;</td>
<td>D</td>
</tr>
<tr>
<td>4&quot; &lt; D ≤ 5&quot;</td>
<td>9&quot;</td>
<td>E</td>
</tr>
<tr>
<td>5&quot; &lt; D ≤ 6&quot;</td>
<td>9&quot;</td>
<td>F</td>
</tr>
<tr>
<td>6&quot; &lt; D ≤ 10&quot;</td>
<td>9&quot;</td>
<td>G</td>
</tr>
</tbody>
</table>

**SCHEDULE**

<table>
<thead>
<tr>
<th>SIZE: Ø&quot;</th>
<th>MAX.</th>
<th>MIN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-0&quot; to 8'-0&quot;</td>
<td>3'-8&quot; x 4'-2&quot;</td>
<td>3'-10&quot; x 4'-2&quot;</td>
</tr>
</tbody>
</table>

**DIMENSIONS**

- #6 Bars Each Corner
- #5 Hoop Bar
- Centered Inlet
- Structure Bottom
- Top Slab With Centered Opening
- Round Structure Bottom
- See Index No. 200 For Structure Bottom Details and Hole Reinforcement.

**CENTERED OPENING**

- 9/16" For Ø-0" Structure Bottoms
- 11/16" For Ø-0" Structure Bottoms
- See Table For Dimensions

**SECTION AA**

**SECTION BB**

- 2" Cl.
- 2" Cl.
- 2" Cl.
- 2" Cl.
**HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 4)**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-5'</td>
<td>B3.5</td>
<td>0.24</td>
<td>3 1/16 3'</td>
</tr>
<tr>
<td>5'-7'</td>
<td>B6.5</td>
<td>0.37</td>
<td>4 1/16 4'</td>
</tr>
<tr>
<td>7'-10'</td>
<td>B10.5</td>
<td>0.53</td>
<td>4 1/16 4'</td>
</tr>
</tbody>
</table>

**TYPE H (2 & 3-GRATE INLET)**

Recommended Maximum Pipe Size:
- 3'-0" Wall - 24" Pipe
- 5'-7" Wall - 1-18" Pipe
- Or 2-24" Pipe (S=3'-3")

**HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 5)**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-5'</td>
<td>C3.5</td>
<td>0.37</td>
<td>3 1/16 3'</td>
</tr>
<tr>
<td>5'-10'</td>
<td>D4.5</td>
<td>0.53</td>
<td>4 1/16 4'</td>
</tr>
</tbody>
</table>

**TYPE H (4-GRATE INLET)**

Recommended Maximum Pipe Size:
- 3'-0" Wall - 24" Pipe
- 8'-9" Wall - 1-18" Pipe
- Or 2-30" Pipe (S=4'-3")

**GENERAL NOTES**

See Sheet 3 of 7.
1. These inlets are suitable for bicycle traffic and are to be used in ditches, medians and other areas subject to infrequent traffic loadings but are not to be placed in areas subject to any heavy wheel loads. These inlets may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet.

2. Inlets subject to minimal debris should be constructed without slots. Where debris is a problem inlets should be constructed with slots. Slotted inlets located within roadway clear zones and areas subject to pedestrians shall have traversable slots. The traversable slot modification is not adaptable to Inlet Type H. Slots may be constructed at either or both ends as shown on plans. Traversable slots shall not be used in areas subject to occasional bicycle traffic.

3. Steel grates are to be used on all inlets where bicycle traffic is anticipated.

4. Recommended maximum pipe sizes shown are for concrete pipe. Size for other types of pipe must be checked for fit.

5. All exposed edges and corners shall be ¥1/8 chamfer or rounded to ¥1/8 radius.

6. Concrete inlet pavement to be used on inlets without slots and inlets with non-traversable slots only when called for in the plans; but required on all traversable slot inlets. Cost to be included in contract unit price for inlets. Quantities shown are for information only.

7. Traversable slots constructed in existing inlets shall be paid for as inlets partial. For conversion work and method of payment see TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS.

8. Soldering to be used on all inlets not located in paved areas and paid for under contract unit price for Performance Turf, 5Y.

9. For supplementary details see Index No. 201.

10. All reinforcing is Grade 60 bars with 2' min. cover unless otherwise noted. Bars to be cut or bent for ¥1/8 clearance around pipe opening. Provide one additional ¥4 bar above and at each side of pipe opening.

NOTE: Steel Grates Are Required On Inlets With Traversable Slots And On Inlets Where Bicycle Traffic Is Anticipated.

GENERAL NOTES

DITCH BOTTOM INLET TYPES C, D, E AND H
Description:

TRAVERSABLE SLOTS

**Sodding Quantities for Traversable Slots**

<table>
<thead>
<tr>
<th>Inlet</th>
<th>Pavement</th>
<th>Sod</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Slot</td>
<td>Double Slot</td>
</tr>
<tr>
<td></td>
<td>SY</td>
<td>CY</td>
</tr>
<tr>
<td>C</td>
<td>4.87</td>
<td>0.77</td>
</tr>
<tr>
<td>D</td>
<td>3.99</td>
<td>0.91</td>
</tr>
<tr>
<td>E</td>
<td>5.88</td>
<td>0.91</td>
</tr>
</tbody>
</table>

**Design Standards**

DITCH BOTTOM INLET TYPES C, D, E AND H

**Flow Ditch Width**

- Varies (5' Std.)

**Slot Width**

- 2'
- 18"

**Slope Varies**

- 6"
- 8"
- 3"
**DESIGN NOTES FOR TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS**

1. The general purpose of these conversions is to remove the hazard of the protruding inlet top, while not creating a hazard by depressing the top too deeply.

2. The corrective procedure depends on the approach ditch grade and hydraulic requirements of the site. The selection of the appropriate case depends on the relationship between inlet top and ditch elevation, and, on the vertical clearance between the top of the uppermost pipe(s) and the grate. The purpose for the Case 1 conversion is to add the traversable slot to an existing inlet where top removal, change in grate elevation, and ditch transitions are not required. Case 2 will normally be applicable to ditches with tighter grades adjoining the inlet. Case 3 will normally be applicable to ditches with steeper grades adjoining the inlet where build up of the existing ditch is acceptable.

3. The designer shall stipulate in the plans which case is to be constructed at each individual inlet location.

Where the existing inlet top is above the existing ditch (Case 2) but borrow material will be required to adjust the ditch (Case 3), and vertical clearance or other conditions do not prevent removal of the inlet top, the designer should call for Case 3. The designer shall determine whether ditch reconstruction is required more than 35 feet beyond any traversable slot side and shall include separate pay items in the plans to cover the cost for that portion of required ditch reconstruction exceeding the 35 foot limit. The designer shall also determine whether ditch pavement is required for ditch restoration within the 35 foot limit and include that pavement under a pay item separate from the inlets partial.

When the detention ditch concept is to be used with Case 3, the designer shall stipulate Case 3 (Detention) in the plans.

The designer shall determine whether slight soil or other conditions at each individual inlet indicates the need for underdrain in Case 3 conversions and shall call for Underdrain, Type 1 in the plans.

**METHOD OF PAYMENT FOR TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS**

1. Existing inlets converted to traversable slot tops under Cases 1, 2 and 3 shall be paid for as inlets partial, each. Case shall not be included in the pay item description.

2. All ditch reconstruction work within 35 feet of each traversable slot conversion, whether required by these details or as a direct result of the conversion, shall be included as a part of the partial cost. Reconstruction work shall include excavation and removal of surplus materials or borrow materials in place, grading, compaction shaping and restoration of disturbed turf. Sodding, ditch pavement and underdrain are not included as part of the inlet partial cost and are to be paid for separately.

3. Concrete inlet pavement and sodding shall be in accordance with the sections on this detail and with the plans on Sheet 4 and Sections AA, BB and CC. (As Case 1) and tabular quantities on Sheet 5.

4. Unit price and payment shall constitute full compensation for inlet conversion (including concrete inlet paving and replacement grate(s)), ditch reconstruction, restoration of disturbed turf, and shall be paid for under the contract price for inlets (DT Bid/Type 1/Partial), each.

Sodding shall be paid for under the contract unit price for Performance Turf, SY.

Ditch pavement shall be paid for from the inlet by pavement type(s) and units as called for in the plans.
ALT. A STRUCTURE BOTTOM FOR INLETS TYPE C, D AND E

Top Slab with Centered Opening

Section BB

Pipe Opening Schematic

ALT. B STRUCTURE BOTTOM FOR INLETS TYPE C, D & E

See Index No. 200 for structure bottom details and hole reinforcement.

Ditch Bottom INLET TYPES C, D, E AND H

INDEX.

MORE REV.

SYNDICATION.

DATA.

SERIES.

SERIES.
### GENERAL NOTES

1. These inlets are designed for use in ditches, medians, pavement areas, or other areas subject to heavy wheel loads, minimal debris, and bicycle traffic. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet. When inlet is placed in areas subject to bicycle traffic, install filler bar when clearance or gap is greater than 1" as shown in Index 218 Inset B.

2. When Alternate G grate is specified in plans, the grate is to be hot dip galvanized after fabrication.

3. These inlets may be used with Alternate B structure bottoms, Index 200. The inlet and bottom combinations are to be paid for under the contract unit price for inlets (DT Bot) (Type F or G) (Bot, Depth), Ea.

4. All exposed edges and corners shall be 1/4" chamfer or tooled to 1/4" radius.

5. For supplemental details, see Index 201.

6. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. Bars to be cut or bent for 1/2" clearance around pipe opening. Provide one additional #4 bar above and at each side of pipe opening, as shown.

7. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

### RECOMMENDED MAXIMUM PIPE SIZES

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>INLET INSIDE WIDTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-6&quot; (Type F)</td>
<td>18&quot;</td>
</tr>
<tr>
<td>4'-0&quot; (Type F)</td>
<td>30&quot;</td>
</tr>
<tr>
<td>4'-10&quot; / 5'-0&quot; (Type G)</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>

**Note:** Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe sizes see Note 3.

### PAVEMENT AND SODDING

1. Pavement and/or sod to be used only where called for in the plans.
2. Cost of paving to be included in cost of inlet.

### STEEL GRATE

Steel Grating, Straight Bars 3/4" Reticulate Bars 2 7/8"  
**TYPE F**

### SECTION AA

- **PAVT. AND SOD**: Steel Grating, Straight Bars 3/4" Reticulate Bars 2 7/8"
- **SOD ONLY**: Steel Grating, Straight Bars 3/4" Reticulate Bars 2 7/8"
- **Pavement and Sod**: Steel Grating, Straight Bars 3/4" Reticulate Bars 2 7/8"

### SECTION BB

- ** SECTION CC**
- **SECTION DD**

### HORIZONTAL WALL REINF. SCHEDULES TYPE F INLET (TABLE 1)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft²)</th>
<th>MAX SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>θ - Φ</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 6&quot;</td>
</tr>
<tr>
<td>1 - 7</td>
<td>A6</td>
<td>0.20</td>
<td>6&quot; 6&quot;</td>
</tr>
<tr>
<td>7 - 12</td>
<td>B3.5</td>
<td>0.24</td>
<td>90° 3&quot;</td>
</tr>
<tr>
<td>12 - 13</td>
<td>Special F 0.267</td>
<td>5° 4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Referred to as concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe sizes see Note 3.
PLAN
(CAST-IN-PLACE INLET SHOWN, WITHOUT GRATE; PRECAST INLET SIMILAR)

INSET A
(PRECAST OPTION)

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

GENERAL NOTES

1. This inlet is designed for use in ditches, medians, pavement areas or other areas subject to heavy wheel loads with minimal debris. This inlet is not for use in areas subject to bicycle traffic. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet.

2. All reinforcing Grade 60 bars with 2” min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary; bars to clear pipe by 16.65”.

3. All exposed edges and corners shall be 41/2” chamfer or tooled to 43/8” radius.

4. When alternate G grate is specified in plans the grate is to be hot dip galvanized after fabrication.

5. For supplemental details, see Index No. 201.

6. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

7. Cost of ditch paving to be included in cost of inlet. Sodding to be paid for under contract unit price for Performance Turf, SY.
**SECTION CC**

- Ditch Bottom
- Toe Wall Required (Paved or Unpaved Ditches)
- Side Slope

- Side Slope

**SECTION DD**

- Ditch Block (low side of inlet on continuous ditches)
- 1'-6"
- 1:20
- 1:20
- 1:20

**PAVEMENT & SODDING**

- 2' sod all around (Total 9 SF)
- 1'-5"
- 1'-5"
- 1'-5"

**STEEL GRATING**

- 4'-3" out to out
- 1'-5"
- 1'-5"
- 1'-5"

**DETAIL**

- Main Bars 5" x 1/2" (Notched For Cross Bars)
- Cross Bars 1 3/4" x 1/2" (Continuously Welded At Main Bar Notches) Main Bars and Cross Bars Flush On Top.

Note: Two Required Per Inlet
GENERAL NOTES

1. This inlet is to be located at locations having high flow rates, usually where an endwall could not be utilized without hazardous intake.

2. Inlet length (L) shall be set by the designer for the greater of either culvert requirement or inlet pool not to exceed 12’ depth. Structures over 6 feet in depth are to be checked for flotation by the designer of project drainage.

3. This inlet is not intended for use with Index 200 structure bottoms.

4. All exposed edges and corners shall be 1/2” chamfer or tooled to 1/2” radius.

5. Inlet and anti-vortex wall to be Class II Concrete.

6. All reinforcing is Grade 60 with 7” min. cover unless otherwise noted. See Index No. 203 for equivalent area of welded wire fabric (WWF).

7. Channel section C 3x6 at 14” max. bar spacing may be used as an alternate for the C 4x5.4 channel at 15” bar spacing.

8. Channels and bars for grate shall be ASTM A242/A242M, A572/A572M or ASAB/ASRM, Grade 50 steel, and galvanized in accordance with Specification Section 975.

9. Fence enclosure shall be Fence Type B (Index No. 802). All posts to be set in concrete. A minimum of 10 posts required. Corner and approach side posts to be 3” nominal diameter.

10. Cost of ditch paving, anti-vortex wall, grate, concrete, reinforcing steel and fence enclosure to be included in the cost of inlet. Inlet to be paid under the contract unit price for Inlets (DT Bot) (Type K).

11. Anchor Bolts shall be ASTM F1554 Grade 36 fully threaded headless bolts, installed in accordance with Specification Sections 416 and 937. Nuts shall be ASTM A563 or A194 and washers shall be ASTM F436 or Type A plain washers. All nuts, bolts and washers shall be galvanized.

INLET LENGTHS (L) LESS THAN OR EQUAL TO 9’ (SINGLE LAYER WALL REINFORCING)

INLET LENGTHS (L) GREATER THAN OR EQUAL TO 9’ (DOUBLE LAYER WALL REINFORCING)

DESIGN STANDARDS

DITCH BOTTOM INLET TYPE K

INDEX NO. 235

REVISION 1/1/16

DESCRIPTION: FY 2017-18 DESIGN STANDARDS
GENERAL NOTES

1. This skimmer is intended for use on Type C, D, or E Ditch Bottom Inlets that are used as outlet control structures of stormwater management facilities.

2. The side panels are dimensionally symmetric, therefore they may be used on either side of the structure.

3. Two (2) skimmers may be constructed on one structure provided they are on opposite ends.

4. The width of the front panel (dimension W) shall be the same as the outside dimension across the front of the structure.

5. The front panel, side panels, and flat bars are to be hot dip galvanized after fabrication.

6. The location of the reinforcing steel in these structures must conform to the applicable standards to avoid conflict with the expansion anchors used to attach the skimmer.

7. Grates to be used on the inlets unless otherwise specified in the plans.

8. A skimmer consists of two (2) side panels, one front panel, two (2) flat bars, and accessory hardware. The cost of skimmers is to be included in the cost of the inlet.

DESIGN NOTES

1. The designer must specify, in the plans, the skimmer height (dimension H) and the sides where the weir slots and skimmers are located. The skimmer height must be one of the dimensions shown in the table on Sheet 2. The skimmer should not be used on structure sides with outside dimensions greater than 6'-4".

2. To minimize hydraulic losses across the skimmer, the flow area under the skimmer should be three times larger than the flow area of the weir slot. The distance between the pond bottom at the structure and the skimmer shall be not less than 1 foot.

3. The configuration of skimmers may be subject to regulatory requirements. The designer should coordinate the outlet control structure details with the permitting agencies.

4. Where this skimmer is used, the designer should reference this index with the outlet control structure details. Where a different skimmer design is needed, the designer should provide skimmer details in the plans.

5. The designer shall evaluate if a grate is needed for safety reasons. Where a grate is not needed for safety reasons and is not desirable for hydraulic or other reasons, the designer may omit the grate by stating so in the outlet control structure details.

6. The designer must show the configuration of the weir slots in the outlet control structure detail.
**DIMENSIONS**

<table>
<thead>
<tr>
<th>H</th>
<th>D</th>
<th>E</th>
<th>L</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>3 3/16</td>
<td>3</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>3 3/16</td>
<td>3</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>3 3/16</td>
<td>3</td>
<td>28</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>3 3/16</td>
<td>3</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>20</td>
<td>4 3/16</td>
<td>4</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>22</td>
<td>4 3/16</td>
<td>4</td>
<td>31</td>
<td>7</td>
</tr>
<tr>
<td>24</td>
<td>4 3/16</td>
<td>4</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>26</td>
<td>4 3/16</td>
<td>4</td>
<td>31</td>
<td>9</td>
</tr>
<tr>
<td>28</td>
<td>4 3/16</td>
<td>4</td>
<td>31</td>
<td>10</td>
</tr>
<tr>
<td>30</td>
<td>5 3/16</td>
<td>5</td>
<td>31</td>
<td>10</td>
</tr>
<tr>
<td>32</td>
<td>5 3/16</td>
<td>5</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>34</td>
<td>5 3/16</td>
<td>5</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>36</td>
<td>6 3/16</td>
<td>6</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>38</td>
<td>6 3/16</td>
<td>6</td>
<td>31</td>
<td>13</td>
</tr>
<tr>
<td>40</td>
<td>6 3/16</td>
<td>6</td>
<td>31</td>
<td>14</td>
</tr>
</tbody>
</table>

**SKIMMER FOR OUTLET CONTROL STRUCTURES**

**TOP VIEW**

- 6 Holes For Expansion Anchors
- 1/2" Dia. (6 Holes)
- 1/2" Thick x 1 1/2" Wide
- FLAT BAR

**SIDE VIEW**

- 3/16" x 1 1/4" (3 Slots)
- Steel Sheet 0.1345" Thick (10 Gage)
- 1/32" Dia. (6 Holes)

**END VIEW (FRONT)**

- Top Flange (Cut Away)
- Bottom Flange
- Front Panel Width Varies, See General Notes

**SIDE PANEL**

- Top Flange (Cut Away)
- Bottom Flange

**FRONT PANEL**

- Top Flange (Cut Away)
- Bottom Flange
- Front Panel Width Varies, See General Notes
Show, in the plans, the radii required for curved-back skimmers. Applies to both skimmer types.

**GENERAL NOTES**

1. The Frenchdrain Skimmer is a hooded cover, mounted over an outlet in a catchbasin, that prevents oil and floating debris from exiting the basin. Use this skimmer in Frenchdrain Catchbasins and in other locations where there is a need to prevent oil, debris or other floating contaminants from exiting Catchbasins through outlet pipes.

2. Place neoprene gasket material between the skimmer and the catchbasin at all points of contact. Trim the gasket neatly to extend 1/2 inch beyond the joint on all sides.

3. Skimmer baffles, cleanout pipe and angles shall be primarily constructed of either galvanized steel, aluminum, polyvinyl chloride, polyethylene, fiberglass or acrylonitrite butadiene styrene. All steel components, other than stainless, shall be hot-dip galvanized.

4. Mounting hardware, hinges and latches shall all be stainless steel. Loss prevention device shall be either stainless steel chain or riveted nylon strap.

5. Material used in construction of skimmer bodies (baffles) and cleanout pipe shall comply with Standard Specification 943 for steel, 945 for aluminum or 948 for plastics.

6. All costs for furnishing and installing a Frenchdrain skimmer shall be included in the cost of the basin in which it is installed. Retrofit skimmers shall be paid for as 'modify existing structure'.

7. Plastic Skimmers shall contain a minimum of 1.5% by weight of carbon black for UV protection.

**DESIGN NOTES**

1. The contractor may submit an alternative design prefabricated Frenchdrain Skimmer for approval by the Engineer.

2. Show, in the plans, the location of the basin and indicate the interior side(s) of the basin on which a skimmer will be installed.

3. Type I Skimmer dimensions shall be based on the outlet pipe diameter as shown in the dimension table.

4. Type II Skimmers are to be used only with outlet pipe diameters of 15", 18", and 24".
ADT increases chance of the repeated vehicle loadings.

5. Manhole Type P Alternate A, Index No. 200, with Type 1 Frame and Cover, Index No. 203, may be used in lieu of the box detailed on this sheet, and is recommended when high ADT increases chance of the repeated vehicle loadings.
ENDWALL DIMENSIONS (EXCLUSIVE OF MULTIPLE PIPE SPACING)

STANDARD LOCATION CONTROL

GENERAL NOTES
1. Endwall dimensions, locations and positions are for round and elliptical concrete pipe and for round and pipe-arch corrugated metal pipe. Round concrete pipe shown.
2. Front slope and ditch transitions shall be in accordance with Index No. 280.
3. Endwalls may be cast in place or precast concrete. Reinforcing steel shall be Grades 40 or 60. Additional reinforcement necessary for handling precast units shall be determined by the Contractor or the supplier. Cost of reinforcement shall be included in the contract unit price for Concrete (Endwalls).
4. All exposed corners and edges of concrete are to be chamfered 1/8.
5. Concrete shall be Class I, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
6. On outfall ditches with side slopes flatter than 1:1½, provide 20' transitions from the endwall to the flatter side slopes, right of way permitting.
7. For sodding around endwalls see Index No. 281.
8. Payment for concrete quantities for endwalls skewed to the pipe shall be made on the following basis:
   Endwall Skew to Pipe Use Tabulated Value
   0° to 5° 0°
   6° to 10° 10°
   11° to 30° 30°
   31° or over 45°
9. Pipe length plan quantities shall be based on the pipe end locations shown in the standard location control end view, or lengths based on special endwall locations called for in the plans.
10. Payment for pipe in pipe culverts shall be based on plan quantities, adjusted for endwall locations subsequently established by the Engineer.
11. Endwalls to be paid for under the contract unit price for Class I Concrete (Endwalls), CY.
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>S</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
</tbody>
</table>

**Round Concrete and Corrugated Metal Pipe**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>S</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
</tbody>
</table>

**Corrugated Metal Pipe Arch**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>S</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
</tbody>
</table>

**Concrete Elliptical Pipe**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>S</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Note: Use the guidelines of General Note No. 8 for selecting tabular quantities.
1. Straight concrete endwalls are intended for use outside the clear zone.

2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this index. Precast construction which adheres to this index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this index, for precast units, shall require the approval of the State Drainage Engineer prior to construction. For precast construction, see Index No. 201 for opening and grouting details.

3. Rebar shall be either Grade 40 or 60.

4. Concrete shall be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.

5. Chamfer: All exposed edges and corners shall be chamfered 1/2" unless otherwise shown.

6. That portion of corrugated metal pipe in direct contact with the concrete slab and extending 12" beyond shall have a continuous bituminous coating of .004" minimum thickness applied prior to placing of the concrete.

7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Performance Turf, SY.

8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.
1. Straight concrete endwalls are intended for use outside the clear zone.

2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this Index. Precast construction which adheres to this Index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this Index, for precast units, shall require the approval of the State Drainage Engineer prior to construction. For precast construction, see Index No. 201 for opening and grouting details.

3. Reinforcing steel shall be either Grade 40 or 60.

4. Concrete shall be Class II except ASTM C498 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.

5. Chamfer: All exposed edges and corners to be chamfered 6" unless otherwise shown.

6. That portion of corrugated Metal pipe in direct contact with the concrete slab and extending 12" beyond shall have a continuous bituminous coating of 0.004" minimum thickness applied prior to placing of the concrete.

7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Turf, SY.

8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.

**GENERAL NOTES**
STRAIGHT CONCRETE ENDWALLS  
SINGLE AND DOUBLE 66" PIPE 

SECTION BB

PLAN  
(Showing Bars In Footing)

HALF ELEVATION  
(Showing Bars In Back Face Of Wall)

TYPICAL SECTION  
THRU ENDWALL

BILL OF REINFORCING STEEL

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MARK</th>
<th>SIZE</th>
<th>NO. REQD</th>
<th>LOCATION</th>
<th>BENDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>8</td>
<td>Footing</td>
<td>Straight</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>21</td>
<td>Footing</td>
<td>Wall</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>22</td>
<td>Wall</td>
<td>Wall</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>8</td>
<td>Wall</td>
<td>Wall</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>8</td>
<td>Wall</td>
<td>Wall</td>
<td></td>
</tr>
</tbody>
</table>

Note: All bar dimensions are out to out.

PLAN  
(Showing Bars In Footing)

NOTE: Cut and Field Bend Bars B As Shown

SYM-METRICAL ABOUT Q

BENDING DIAGRAMS

| BAR C | 8'1" |

ESTIMATED QUANTITIES

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>RCP</th>
<th>CMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinf. Steel</td>
<td>To A</td>
<td>1,406</td>
<td>1,406</td>
</tr>
</tbody>
</table>
1. Straight concrete endwalls are intended for use outside the clear zone.

2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this Index. Precast construction which adheres to this Index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this Index, for precast units, shall require the approval of the State Drainage Engineer prior to construction. For precast construction, see Index No. 201 for opening and grouting details.

3. Reinforcing steel shall be either Grade 40 or 60.

4. Concrete shall be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.

5. Chamfer all exposed edges and corners to be chamfered 1/8" unless otherwise shown.

6. That portion of corrugated metal pipe in direct contact with the concrete slab and extending 12" beyond shall have a continuous bituminous coating of 0.004" minimum thickness coated applied prior to placing of the concrete.

7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Performance Turf, SY.

8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.
SECTION BB

PLAN
(Showing Bars In Footing)

SYMMETRICAL ABOUT Ø

HALF ELEVATION
(Showing Bars In Back Face Of Wall)

HALF ELEVATION
(Showing Bars In Front Face Of Wall)

TYPICAL SECTION
THRU ENDWALL

BILL OF REINFORCING STEEL

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>NO. REQD.</th>
<th>LENGTH</th>
<th>LOCATION</th>
<th>BENDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9</td>
<td>8</td>
<td>6&quot;-11&quot;</td>
<td>Footing</td>
<td>Straight</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>17</td>
<td>45-Ø</td>
<td>Footing &amp; Wall</td>
<td>Straight</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>38</td>
<td>10'-9&quot;</td>
<td>Wall</td>
<td>Bond</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>23</td>
<td>8'-7&quot;</td>
<td>Wall</td>
<td>Straight</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>8</td>
<td>2'-6&quot;</td>
<td>Wall</td>
<td>Straight</td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>8</td>
<td>1'-6&quot;</td>
<td>Wall</td>
<td>Straight</td>
</tr>
</tbody>
</table>

NOTE: All bar dimensions are out to out

STRAIGHT CONCRETE ENDWALLS
SINGLE AND DOUBLE 72" PIPE

NOTE: See Sheet 1 of 2 for General Notes.
1. Straight concrete endwalls are intended for use outside the clear zone.

2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this index, design specifications AASHTO 1989. Precast construction which adheres to this Index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this Index, for precast units, shall require the approval of the State Drainage Engineer prior to construction.

3. Reinforcing steel shall be either Grade 40 or 60.

4. Concrete shall be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.

5. Chamfer: All exposed edges and corners to be chamfered 45° unless otherwise shown.

6. That portion of corrugated metal pipe in direct contact with the concrete slab and extending 12” beyond shall have a continuous bituminous coating of 0.004” minimum thickness applied prior to placing of the concrete.

7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Performance Turf, SY.

8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.
**SECTION YY**

**FRONT ELEVATION**

**TABLE OF DIMENSIONS AND QUANTITIES FOR ONE ENDWALL**

<table>
<thead>
<tr>
<th>SIZE OF PIPE</th>
<th>H</th>
<th>T</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>F</th>
<th>X</th>
<th>ONE PIPE CULVERTS</th>
<th>TWO PIPE CULVERTS</th>
<th>THREE PIPE CULVERTS</th>
<th>FOUR PIPE CULVERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18&quot;</td>
<td>2'-3&quot;</td>
<td>1'-0&quot;</td>
<td>0'-0&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
<td>8'-6&quot;</td>
<td>1'-10&quot;</td>
<td>8'-6&quot;</td>
<td>1'-10&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>2'-9&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>3'-5&quot;</td>
<td>3'-5&quot;</td>
<td>3'-5&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-4&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>4'-3&quot;</td>
<td>4'-3&quot;</td>
<td>4'-3&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>3'-10&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>5'-1&quot;</td>
<td>5'-1&quot;</td>
<td>5'-1&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>4'-5&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>0'-0&quot;</td>
<td>1'-10&quot;</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>4'-11&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>1'-10&quot;</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>5'-6&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>7'-8&quot;</td>
<td>7'-8&quot;</td>
<td>7'-8&quot;</td>
<td>7'-8&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>6'-0&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>8'-6&quot;</td>
<td>8'-6&quot;</td>
<td>8'-6&quot;</td>
<td>8'-6&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>6'-7&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>9'-3&quot;</td>
<td>9'-3&quot;</td>
<td>9'-3&quot;</td>
<td>9'-3&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>7'-1&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>10'-0&quot;</td>
<td>10'-0&quot;</td>
<td>10'-0&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>7'-8&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>10'-9&quot;</td>
<td>10'-9&quot;</td>
<td>10'-9&quot;</td>
<td>10'-9&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>8'-2&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-0&quot;</td>
<td>11'-9&quot;</td>
<td>11'-9&quot;</td>
<td>11'-9&quot;</td>
<td>11'-9&quot;</td>
</tr>
</tbody>
</table>

**GENERAL NOTES**

1. Straight sand-cement endwalls are intended for use outside the clear zone.

**DESIGN STANDARDS**

**STRAIGHT SAND-CEMENT ENDWALLS**

**INDEX NO.**

**SHEET NO.**
**GENERAL NOTES**

1. This endwall is to be used only in the clear zone for the drainage of medians and other areas having low design velocities and negligible debris.

2. Reinforcing steel: All bars are size #4. Spacings shown are center to center. Laps to be 1'-5" minimum. Cover is 2" except as noted. Square welded wire fabric (two cages max.) having an equivalent cross sectional area (0.20 sq. in.) may be substituted for bar reinforcing.

3. Grates shall be ASTM A242/A242M, A572/A572M or ASTM A588/A588M, Grade 50 steel. When "Alt. G" grates are specified in the plans, grates shall be galvanized in accordance with Section 975 and 425.3.2 of the Standard Specifications.

4. Endwall to be paid for under the contract unit price for U-Endwall, Each. Payment shall include cost of concrete, reinforcing steel, grate, and accessories. Quantities shown are for estimating purposes only.

5. Sod slopes 5' each side and above endwall. Sodding to be paid for under contract unit price for Performance Turf, 5'.

6. Precasting of this endwall will be permitted. Precast units shall conform to the dimensions shown or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index No. 201 for opening and grading details.

7. Concrete shall be Class I except ASTM C488 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
GENERAL NOTES:

1. Baffles to be constructed only when called for in plans.
2. When steel grating is required on endwall see Sheet 3 of 3 for details.
3. All reinforcing No. 4 bars with 2" clearance except as noted.
4. All angles, channels and bars shall be ASTM A242/A242M, A572/A572M or A588/A588M Grade 50 steel. When designated Alternate G in the plans galvanize in accordance with Section 975 and 425-3.2 of the Standard Specifications.
5. Channel section C 3x6 may be substituted for C 4x5.4 channel.
6. Precasting of this endwall will be permitted. Precast units shall conform to the dimensions shown in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index No. 201 for opening and grouting details.
7. Concrete shall be Class I, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 426 of the Specifications.
8. Sodding shall be in accordance with Index No. 281, and paid for under the contract unit price for Performance Turf, SY.
9. Endwall to be paid for under the contract unit price for U-Endwall. Each. Payment shall include cost of concrete, reinforcing steel, and when called for in the plans, steel grating, b baffles and accessories. Quantities shown are for estimating purposes only.

DIMENSIONAL DETAILS

ENDWALLS FOR 1:2 SLOPES

WITH BAFFLES

WITHOUT BAFFLES

ENDVIEW

SECTION AA

ENDVIEW

SECTION BB

PLAN

SIDE VIEW AND BACKWALL SECTION

REINFORCING DETAIL

DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>1.23</td>
<td>5-9</td>
<td>2'-3&quot;</td>
<td>3'-0&quot;</td>
<td>3'-0&quot;</td>
<td>2'-3&quot;</td>
<td>1'-3&quot;</td>
<td>2'-3&quot;</td>
<td>4 4 2 4 2 4 2</td>
<td>2 2</td>
<td>1.66</td>
<td>72</td>
</tr>
<tr>
<td>18&quot;</td>
<td>1.77</td>
<td>8-6</td>
<td>2'-9&quot;</td>
<td>3'-10&quot;</td>
<td>3'-10&quot;</td>
<td>2'-9&quot;</td>
<td>1'-4&quot;</td>
<td>2'-9&quot;</td>
<td>4 4 5 4 3 4 3</td>
<td>2 2</td>
<td>1.89</td>
<td>86</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3.14</td>
<td>12-0</td>
<td>4'-6&quot;</td>
<td>4'-6&quot;</td>
<td>4'-6&quot;</td>
<td>3'-10&quot;</td>
<td>3'-10&quot;</td>
<td>3'-10&quot;</td>
<td>4 4 4 4 4 4 4</td>
<td>2 2</td>
<td>2.52</td>
<td>108</td>
</tr>
<tr>
<td>30&quot;</td>
<td>4.91</td>
<td>18-0</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
<td>5'-9&quot;</td>
<td>5'-9&quot;</td>
<td>5'-9&quot;</td>
<td>5 5 5 5 5 5 5</td>
<td>4 4</td>
<td>3.34</td>
<td>131</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>1.23</td>
<td>5-9</td>
<td>2'-3&quot;</td>
<td>3'-0&quot;</td>
<td>3'-0&quot;</td>
<td>2'-3&quot;</td>
<td>1'-3&quot;</td>
<td>2'-3&quot;</td>
<td>4 4 2 4 2 4 2</td>
<td>2 2</td>
<td>1.66</td>
<td>72</td>
</tr>
<tr>
<td>18&quot;</td>
<td>1.77</td>
<td>8-6</td>
<td>2'-9&quot;</td>
<td>3'-10&quot;</td>
<td>3'-10&quot;</td>
<td>2'-9&quot;</td>
<td>1'-4&quot;</td>
<td>2'-9&quot;</td>
<td>4 4 5 4 3 4 3</td>
<td>2 2</td>
<td>1.89</td>
<td>86</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3.14</td>
<td>12-0</td>
<td>4'-6&quot;</td>
<td>4'-6&quot;</td>
<td>4'-6&quot;</td>
<td>3'-10&quot;</td>
<td>3'-10&quot;</td>
<td>3'-10&quot;</td>
<td>4 4 4 4 4 4 4</td>
<td>2 2</td>
<td>2.52</td>
<td>108</td>
</tr>
<tr>
<td>30&quot;</td>
<td>4.91</td>
<td>18-0</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
<td>6'-0&quot;</td>
<td>5'-9&quot;</td>
<td>5'-9&quot;</td>
<td>5'-9&quot;</td>
<td>5 5 5 5 5 5 5</td>
<td>4 4</td>
<td>3.34</td>
<td>131</td>
</tr>
</tbody>
</table>

U-TYPE CONCRETE ENDWALLS

BAFFLES & GRATE OPTIONAL 15" TO 30" PIPE

REV. 11/01/16

INDEX NO. 261

1 of 3 SHEET
U-TYPE CONCRETE ENDWALLS

BAFFLES & GRATE OPTIONAL 15" TO 30" PIPE

DIMENSIONAL DETAILS

DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL

<table>
<thead>
<tr>
<th>Rate Of Slope</th>
<th>Rate Of Slope</th>
<th>Rate Of Slope</th>
<th>Rate Of Slope</th>
<th>Rate Of Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:3</td>
<td>1:4</td>
<td>1:6</td>
<td>1:3</td>
<td>1:4</td>
</tr>
<tr>
<td>15&quot;</td>
<td>18&quot;</td>
<td>24&quot;</td>
<td>15&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>1.23</td>
<td>1.27</td>
<td>1.04</td>
<td>1.04</td>
<td>1.27</td>
</tr>
<tr>
<td>1.83</td>
<td>1.83</td>
<td>1.27</td>
<td>1.27</td>
<td>1.83</td>
</tr>
<tr>
<td>2.54</td>
<td>2.54</td>
<td>1.83</td>
<td>1.83</td>
<td>2.54</td>
</tr>
<tr>
<td>4.18</td>
<td>4.18</td>
<td>2.54</td>
<td>2.54</td>
<td>4.18</td>
</tr>
<tr>
<td>7.54</td>
<td>7.54</td>
<td>4.18</td>
<td>4.18</td>
<td>7.54</td>
</tr>
<tr>
<td>123</td>
<td>123</td>
<td>123</td>
<td>123</td>
<td>123</td>
</tr>
<tr>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
</tr>
</tbody>
</table>

ENDWALLS WITH AND WITHOUT BAFFLES FOR 1:3, 1:4 AND 1:6 SLOPES

DIMENSIONS AND QUANTITIES FOR BAFFLES

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>D</th>
<th>X Baffle</th>
<th>Y Baffle</th>
<th>Reinf. Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>2-#4, 1-#4</td>
</tr>
<tr>
<td>18&quot;</td>
<td>5&quot;</td>
<td>5&quot;</td>
<td>5&quot;</td>
<td>3-#4, 2-#4</td>
</tr>
<tr>
<td>24&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>4-#4, 3-#4</td>
</tr>
<tr>
<td>30&quot;</td>
<td>7&quot;</td>
<td>7&quot;</td>
<td>7&quot;</td>
<td>4-#4, 5-#4</td>
</tr>
</tbody>
</table>

DIMENSIONAL DETAILS
STEEL GRATING USE CRITERIA

1. Provide positive debris control at all upgradient openings. Do not install grates unless one or more of the following conditions exist:

A. Pipe culvert endwalls are located within the designated clear zone.

B. Drainage area to culvert consists of median or infield areas or areas where debris and/or drift is negligible.

C. Runoff to culvert is by sheet flow or in such ill defined channels that debris transport is not considered a major problem.

D. Runoff to culvert is minor except on an infrequent basis (10 to 15 year frequency); for example a drainage basin in flat sandy terrain with normally low ground water table.

E. Areas where culvert blockage with resultant backwater would not seriously affect roadway embankment, traffic operation or upland property.

2. Steel grating to be used only where called for in plans.

<table>
<thead>
<tr>
<th>Rate Of Slope</th>
<th>Size of Pipe D</th>
<th>G</th>
<th>2 Each Bars @ 3/4 lb/ft</th>
<th>(X) Channels @ 3.62 lb/ft</th>
<th>2 Angles @ 3.62 lb/ft</th>
<th>Total Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:6</td>
<td>15° 2 - 8½&quot;</td>
<td>9&quot;</td>
<td>3 - 3&quot;</td>
<td>85</td>
<td>8</td>
<td>2 - 6½&quot;</td>
</tr>
<tr>
<td></td>
<td>18° 2 - 11½&quot;</td>
<td>10½</td>
<td>3 - 3&quot;</td>
<td>94</td>
<td>9</td>
<td>2 - 9¾&quot;</td>
</tr>
<tr>
<td></td>
<td>24° 3 - 5½&quot;</td>
<td>13&quot;</td>
<td>4 - 0&quot;</td>
<td>117</td>
<td>12</td>
<td>3 - 7½&quot;</td>
</tr>
<tr>
<td></td>
<td>30° 3 - 11½&quot;</td>
<td>18&quot;</td>
<td>4 - 6&quot;</td>
<td>141</td>
<td>15</td>
<td>3 - 9½&quot;</td>
</tr>
<tr>
<td>1:4</td>
<td>15° 2 - 8½&quot;</td>
<td>9&quot;</td>
<td>3 - 3&quot;</td>
<td>85</td>
<td>5</td>
<td>2 - 6½&quot;</td>
</tr>
<tr>
<td></td>
<td>18° 2 - 11½&quot;</td>
<td>10½</td>
<td>3 - 3&quot;</td>
<td>94</td>
<td>6</td>
<td>2 - 9¾&quot;</td>
</tr>
<tr>
<td></td>
<td>24° 3 - 5½&quot;</td>
<td>13&quot;</td>
<td>4 - 0&quot;</td>
<td>117</td>
<td>8</td>
<td>3 - 7½&quot;</td>
</tr>
<tr>
<td></td>
<td>30° 3 - 11½&quot;</td>
<td>18&quot;</td>
<td>4 - 6&quot;</td>
<td>141</td>
<td>10</td>
<td>3 - 9½&quot;</td>
</tr>
<tr>
<td>1:3</td>
<td>15° 2 - 8½&quot;</td>
<td>9&quot;</td>
<td>3 - 3&quot;</td>
<td>85</td>
<td>3</td>
<td>2 - 6½&quot;</td>
</tr>
<tr>
<td></td>
<td>18° 2 - 11½&quot;</td>
<td>10½</td>
<td>3 - 3&quot;</td>
<td>94</td>
<td>4</td>
<td>2 - 9¾&quot;</td>
</tr>
<tr>
<td></td>
<td>24° 3 - 5½&quot;</td>
<td>13&quot;</td>
<td>4 - 0&quot;</td>
<td>117</td>
<td>5</td>
<td>3 - 7½&quot;</td>
</tr>
<tr>
<td></td>
<td>30° 3 - 11½&quot;</td>
<td>18&quot;</td>
<td>4 - 6&quot;</td>
<td>141</td>
<td>7</td>
<td>3 - 9½&quot;</td>
</tr>
</tbody>
</table>
GENERAL NOTES

1. U-type concrete endwall energy dissipators are intended for use outside the clear zone.

2. Chamfer all exposed edges.

3. Concrete shall be Class I, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.

4. Reinforcing steel shall have 2" min. cover.

5. Endwall to be paid for under the contract unit price for Class I Concrete (Endwalls), CY and Riprap (Sand-Cement) (Roadway), CY. Riprap to be paid for under the contract unit price for Riprap (Sand-Cement) (Roadway), CY. Cost of plastic filter fabric to be included in the contract unit price for riprap.

6. Fencing, when called for in the plans, to be paid for under the contract unit price for Fencing, Type B, LF. See Index No. 802 for details of Type B fencing.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Area (SF)</th>
<th>Q (Max.) (CF)</th>
<th>Dimensions</th>
<th>Feet</th>
<th>Inches</th>
<th>Inches</th>
<th>Concrete Class I (CY)</th>
<th>Reinforcing Steel (lb)</th>
<th>Sand-Cement Riprap (Nom.) (CY)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>W</td>
<td>H</td>
<td>L</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>30</td>
<td>4.91</td>
<td>59</td>
<td>6-1</td>
<td>3-4</td>
<td>1-3</td>
<td>2-6</td>
<td>3-0</td>
<td>1-11</td>
<td>6</td>
</tr>
<tr>
<td>36</td>
<td>7.07</td>
<td>85</td>
<td>10-5</td>
<td>7-3</td>
<td>2-3</td>
<td>4-7</td>
<td>6-1</td>
<td>3-4</td>
<td>1-4</td>
</tr>
<tr>
<td>42</td>
<td>8.62</td>
<td>115</td>
<td>17-17</td>
<td>8-6</td>
<td>15-0</td>
<td>6-0</td>
<td>8-0</td>
<td>1-9</td>
<td>1-4</td>
</tr>
<tr>
<td>48</td>
<td>12.27</td>
<td>157</td>
<td>23-12</td>
<td>9-6</td>
<td>15-0</td>
<td>6-0</td>
<td>8-11</td>
<td>4-11</td>
<td>2-0</td>
</tr>
<tr>
<td>54</td>
<td>15.00</td>
<td>191</td>
<td>29-15</td>
<td>11-6</td>
<td>15-0</td>
<td>6-0</td>
<td>8-11</td>
<td>4-11</td>
<td>3-0</td>
</tr>
<tr>
<td>60</td>
<td>16.63</td>
<td>236</td>
<td>35-16</td>
<td>13-6</td>
<td>15-0</td>
<td>6-0</td>
<td>8-11</td>
<td>4-11</td>
<td>4-11</td>
</tr>
<tr>
<td>66</td>
<td>18.76</td>
<td>285</td>
<td>41-17</td>
<td>15-6</td>
<td>15-0</td>
<td>6-0</td>
<td>8-11</td>
<td>4-11</td>
<td>5-8</td>
</tr>
<tr>
<td>72</td>
<td>20.27</td>
<td>339</td>
<td>47-18</td>
<td>17-6</td>
<td>15-0</td>
<td>6-0</td>
<td>8-11</td>
<td>4-11</td>
<td>6-2</td>
</tr>
</tbody>
</table>

U-TYPE CONCRETE ENDWALL
ENERGY DISSIPATOR 30" TO 72" PIPE

DESIGN STANDARDS
FY 2017-18

INDEX NO. 264
SHEET NO. 1 of 2

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>A₁</th>
<th>A₂</th>
<th>A₃</th>
<th>A₄</th>
<th>A₅</th>
<th>C₁</th>
<th>C₂</th>
<th>C₃</th>
<th>D₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>30&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Bars C₁, D₁ (N.S. & T.S.) equivalent in size to C₃.

(cut and bend as required)

SECTION AA

SECTION BB

SECTION CC

SECTION DD

BENDING DIAGRAM
WINGED CONCRETE ENDWALLS SINGLE ROUND PIPE

GENERAL NOTES:
1. Winged concrete endwalls are intended for use outside the clear zone.
2. Chamfer all exposed edges 90°.
3. Concrete shall be Class I, except ASTM C476 (4000 psi). Concrete may be substituted for prestressed items manufactured in plants meeting the requirements of Section 449 of the Specifications.
4. Endwall to be paid for under the contract unit price for Class I Concrete.
5. Sodding to be in accordance with Index No. 281, and paid for under the contract unit price for Performance Turf, SY.

CONCRETE ENDWALL WITH U-TYPE WINGS FOR PIPE CULVERTS

TABLE OF DIMENSIONS AND ESTIMATED QUANTITIES

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>PIPE CULVERT ENDWALLS WITH U-TYPE WINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>D Area (ft²) G H K F I J M L</td>
</tr>
<tr>
<td>12</td>
<td>0.8 3'-0&quot; 3'-0&quot; 1'-0&quot; 1'-0&quot; 2'-2&quot; 2'-2&quot;</td>
</tr>
<tr>
<td>15</td>
<td>1.2 3'-2&quot; 3'-2&quot; 1'-5&quot; 1'-3&quot; 2'-7&quot; 1'-5&quot;</td>
</tr>
<tr>
<td>18</td>
<td>1.8 3'-6&quot; 3'-6&quot; 1'-9&quot; 1'-5&quot; 2'-11&quot; 1'-9&quot;</td>
</tr>
<tr>
<td>24</td>
<td>3.1 4'-0&quot; 4'-0&quot; 2'-6&quot; 1'-6&quot; 3'-8&quot; 1'-6&quot;</td>
</tr>
<tr>
<td>30</td>
<td>4.9 5'-2&quot; 5'-2&quot; 3'-3&quot; 1'-8&quot; 4'-8&quot; 3'-8&quot;</td>
</tr>
<tr>
<td>42</td>
<td>7.1 6'-0&quot; 6'-0&quot; 4'-0&quot; 2'-11&quot; 5'-11&quot; 2'-11&quot;</td>
</tr>
<tr>
<td>48</td>
<td>12.6 6'-0&quot; 6'-0&quot; 5'-0&quot; 5'-0&quot; 6'-0&quot; 6'-0&quot;</td>
</tr>
</tbody>
</table>

CONCRETE ENDWALL WITH 45° WINGS FOR PIPE CULVERTS

TABLE OF DIMENSIONS AND ESTIMATED QUANTITIES

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>PIPE CULVERT ENDWALLS WITH 45° WINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening</td>
<td>D Area (ft²) G H K F I J M L</td>
</tr>
<tr>
<td>15°</td>
<td>1.2 2'-3&quot; 2'-3&quot; 1'-0&quot; 1'-3&quot; 1'-0&quot; 1'-0&quot;</td>
</tr>
<tr>
<td>18°</td>
<td>1.8 2'-6&quot; 2'-6&quot; 1'-3&quot; 2'-3&quot; 1'-3&quot; 1'-3&quot;</td>
</tr>
<tr>
<td>24°</td>
<td>3.1 3'-0&quot; 3'-0&quot; 1'-5&quot; 2'-1&quot; 1'-5&quot; 1'-5&quot;</td>
</tr>
<tr>
<td>30°</td>
<td>4.9 3'-6&quot; 3'-6&quot; 2'-3&quot; 2'-3&quot; 2'-3&quot; 2'-3&quot;</td>
</tr>
<tr>
<td>42°</td>
<td>7.1 4'-6&quot; 4'-6&quot; 3'-6&quot; 3'-6&quot; 3'-6&quot; 3'-6&quot;</td>
</tr>
<tr>
<td>48°</td>
<td>12.6 5'-0&quot; 5'-0&quot; 4'-0&quot; 4'-0&quot; 4'-0&quot; 4'-0&quot;</td>
</tr>
</tbody>
</table>
**GENERAL NOTES**

1. U-Type Sand-Cement Endwalls are Intended For Use Outside The Clear Zone.

**DESIGN STANDARDS**

**DIMENSIONS AND QUANTITIES FOR METAL PIPE ARCH CULVERTS**

<table>
<thead>
<tr>
<th>Pipe Dia.</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot; 2'-7&quot;</td>
<td>6.0&quot; D-4</td>
<td>7'-0&quot; D-4</td>
<td>8'-0&quot; D-4</td>
</tr>
<tr>
<td>18&quot; 2'-10&quot;</td>
<td>9'-7&quot; D-4</td>
<td>10'-0&quot; D-4</td>
<td>11'-0&quot; D-4</td>
</tr>
<tr>
<td>24&quot; 3'-1&quot;</td>
<td>12'-2&quot; D-4</td>
<td>13'-0&quot; D-4</td>
<td>14'-0&quot; D-4</td>
</tr>
<tr>
<td>30&quot; 3'-7&quot;</td>
<td>15'-5&quot; D-4</td>
<td>16'-0&quot; D-4</td>
<td>16'-0&quot; D-4</td>
</tr>
<tr>
<td>36&quot; 4'-1&quot;</td>
<td>18'-1&quot; D-4</td>
<td>18'-6&quot; D-4</td>
<td>19'-0&quot; D-4</td>
</tr>
<tr>
<td>48&quot; 6'-0&quot;</td>
<td>24'-0&quot; D-4</td>
<td>24'-6&quot; D-4</td>
<td>25'-2&quot; D-4</td>
</tr>
<tr>
<td>60&quot; 8'-0&quot;</td>
<td>30'-0&quot; D-4</td>
<td>30'-6&quot; D-4</td>
<td>31'-2&quot; D-4</td>
</tr>
</tbody>
</table>

**DIMENSIONS AND QUANTITIES FOR ROUND PIPE CULVERTS**

<table>
<thead>
<tr>
<th>Pipe Dia.</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; 2'-7&quot;</td>
<td>6.0&quot; D-4</td>
<td>7'-0&quot; D-4</td>
<td>8'-0&quot; D-4</td>
</tr>
<tr>
<td>4&quot; 2'-10&quot;</td>
<td>9'-7&quot; D-4</td>
<td>10'-0&quot; D-4</td>
<td>11'-0&quot; D-4</td>
</tr>
<tr>
<td>6&quot; 3'-1&quot;</td>
<td>12'-2&quot; D-4</td>
<td>13'-0&quot; D-4</td>
<td>14'-0&quot; D-4</td>
</tr>
<tr>
<td>8&quot; 3'-7&quot;</td>
<td>15'-5&quot; D-4</td>
<td>16'-0&quot; D-4</td>
<td>16'-0&quot; D-4</td>
</tr>
<tr>
<td>10&quot; 4'-1&quot;</td>
<td>18'-1&quot; D-4</td>
<td>18'-6&quot; D-4</td>
<td>19'-0&quot; D-4</td>
</tr>
<tr>
<td>12&quot; 6'-0&quot;</td>
<td>24'-0&quot; D-4</td>
<td>24'-6&quot; D-4</td>
<td>25'-2&quot; D-4</td>
</tr>
<tr>
<td>14&quot; 8'-0&quot;</td>
<td>30'-0&quot; D-4</td>
<td>30'-6&quot; D-4</td>
<td>31'-2&quot; D-4</td>
</tr>
</tbody>
</table>

**INDEX NO.** 268
1. Flared end sections shall conform to the requirements of ASTM C776 with the exception that dimensions and reinforcement shall be as prescribed in the table above. Cylindrical reinforcement may consist of either one cage or two cages of steel. Fiber-reinforced concrete may be substituted for conventional reinforcement in accordance with Structures Design Guidelines, Section 3.17. Compressive strength of concrete shall be 4000 psi. Shop drawings for flared end sections having fiber reinforcing or dimensions other than above must be submitted for approval to the State Drainage Engineer.

2. Constructions of the flared end section and the pipe culvert may be any of the following types unless otherwise shown on the plans.

a. Joints meeting the requirements of Section 449 of the Standard Specifications (O-Ring Gasket). Flared end section joint dimensions and tolerances shall be identical or compatible to those used in the pipe culvert joint. When pipe culvert and flared end section manufacturers are different, the compatibility of joint designs shall be certified by the manufacturer of the flared end sections.

b. Joints sealed with preformed plastic gaskets. The gaskets shall meet the requirements of Section 942-2 of the Standard Specifications and the minimum sizes for gaskets shall be as that specified for equivalent sizes of elliptical pipe.

c. Reinforced concrete jackets, as detailed on this drawing. Cost of the reinforced concrete jacket to be included in the contract unit price for the pipe culvert. Bituminous coating shall also be included in the cost of the Flared End Section (Concrete), EA.

3. Toe walls shall be constructed when shown on the plans or at locations designated by the Engineer. Toe walls are to be cast with Class I Concrete and paid for under the contract unit price for Flared End Section (Concrete), EA. Reinforcing steel shall also be included in the cost of the Flared End Section (Concrete), EA.

4. On skewed pipe culverts the flared end sections shall be placed in line with the pipe culvert. Side slopes shall be warped as required to fit the flared end sections.

5. Flared End Section to be paid for under the contract unit price for Flared End Section (Concrete), EA. Sodding shall be in accordance with Index No. 261, and paid for under the contract unit price for Performance Turf, SY.

Design Notes

1. Flared end sections are intended for use outside the clear zone on median drain and cross drain installation, except that flared end sections for pipe sizes 12" and 15" are permitted within the clear zone. When the slope intersection permits, 12" and 15" flared end sections may be located with the culvert opening as close as 8' beyond the outside edge of the shoulder. Flared end sections are not intended for side drain installations.

2. Reinforced concrete jackets shall be used at all locations where high velocities and/or highly erosive soils may cause disjointment. These locations are to be shown on the plans.

3. Toe walls shall be used whenever the anticipated velocity of discharge and soil type are such that erosive action would occur. Toe walls are not required where ditch pavement is provided, except when disjointment would occur if the ditch pavement should fail.
### 1974 AASHTO  
**DIMENSIONS AND QUANTITIES**

<table>
<thead>
<tr>
<th>Section</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
<th>N</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 Slope</td>
<td>3.64</td>
<td>7.00</td>
<td>15.59</td>
<td>32.85</td>
<td>0.04</td>
<td>0.61</td>
<td>0.83</td>
<td>1.05</td>
<td>0.15</td>
</tr>
<tr>
<td>1.4 Slope</td>
<td>3.64</td>
<td>7.00</td>
<td>15.59</td>
<td>32.85</td>
<td>0.04</td>
<td>0.61</td>
<td>0.83</td>
<td>1.05</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**GENERAL NOTES**

1. Beveled or round corners
2. Slope varies. See General Notes Nos. 3 & 4
3. Slope: 0.5' / 10' for all sizes

**DIMENSIONS (FY) & SECTION**

- **Concrete Slab, 3" or 5" Thick**
- **Reinforced with WEF 6x6-W1.4xW1.4**

**DIMENSIONS (FT) & SECTION**

- **Concrete Slab, 3" or 5" Thick**
- **Reinforced with WEF 6x6-W1.4xW1.4**

**NOTES:**

- See Sheet 6 for details and notes.

---

**CONCRETE SLAB (CY)**

1. **General Notes**
2. **See Sheet 5 for 3" Slab Quantities**
3. Values shown for estimating pipe quantities and are for information.

---

**INDEX**

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>272</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO.</td>
<td>3</td>
</tr>
</tbody>
</table>
### Dimensions & Quantities

<table>
<thead>
<tr>
<th>Rise</th>
<th>Span</th>
<th>X</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slope</th>
<th>Rise</th>
<th>Span</th>
<th>X</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slope</th>
<th>Rise</th>
<th>Span</th>
<th>X</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **General Notes No. 3 & 4**
- **Revision**
- **Values shown for estimating pipe quantities and are for information only.**

### Single and Multiple Elliptical Concrete Pipe

**Top View - Single Pipe**

- Concrete Slab, 3" Or 5/8" Thick, Reinforced With WWF 6X6-WI.4XWI.4

**Top View - Multiple Pipe**

- Concrete Slab, 3" Or 5/8" Thick, Reinforced With WWF 6X6-WI.4XWI.4
# Quantiﬁcations for 3" Thick Concrete Slabs (CY)

## Round-Concrete

<table>
<thead>
<tr>
<th>Slope</th>
<th>1:2</th>
<th>1:4</th>
<th>1:4</th>
<th>1:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0°</td>
<td>0.24</td>
<td>0.37</td>
<td>0.51</td>
<td>0.64</td>
</tr>
<tr>
<td>15°</td>
<td>0.26</td>
<td>0.43</td>
<td>0.61</td>
<td>0.78</td>
</tr>
<tr>
<td>30°</td>
<td>0.32</td>
<td>0.52</td>
<td>0.72</td>
<td>0.91</td>
</tr>
<tr>
<td>45°</td>
<td>0.38</td>
<td>0.64</td>
<td>0.91</td>
<td>1.19</td>
</tr>
<tr>
<td>60°</td>
<td>0.44</td>
<td>0.78</td>
<td>1.13</td>
<td>1.48</td>
</tr>
<tr>
<td>75°</td>
<td>0.51</td>
<td>0.86</td>
<td>1.41</td>
<td>1.87</td>
</tr>
<tr>
<td>90°</td>
<td>0.57</td>
<td>1.09</td>
<td>1.93</td>
<td>2.57</td>
</tr>
<tr>
<td>105°</td>
<td>0.63</td>
<td>1.37</td>
<td>2.39</td>
<td>3.07</td>
</tr>
<tr>
<td>120°</td>
<td>0.70</td>
<td>1.59</td>
<td>2.88</td>
<td>3.80</td>
</tr>
</tbody>
</table>

## Round-CMP

<table>
<thead>
<tr>
<th>Slope</th>
<th>1:2</th>
<th>1:4</th>
<th>1:4</th>
<th>1:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0°</td>
<td>0.23</td>
<td>0.40</td>
<td>0.65</td>
<td>0.83</td>
</tr>
<tr>
<td>15°</td>
<td>0.25</td>
<td>0.46</td>
<td>0.70</td>
<td>0.87</td>
</tr>
<tr>
<td>30°</td>
<td>0.30</td>
<td>0.59</td>
<td>0.90</td>
<td>1.07</td>
</tr>
<tr>
<td>45°</td>
<td>0.35</td>
<td>0.67</td>
<td>1.02</td>
<td>1.23</td>
</tr>
<tr>
<td>60°</td>
<td>0.40</td>
<td>0.82</td>
<td>1.35</td>
<td>1.75</td>
</tr>
<tr>
<td>75°</td>
<td>0.45</td>
<td>0.91</td>
<td>1.62</td>
<td>2.16</td>
</tr>
<tr>
<td>90°</td>
<td>0.50</td>
<td>1.10</td>
<td>1.93</td>
<td>2.57</td>
</tr>
<tr>
<td>105°</td>
<td>0.55</td>
<td>1.29</td>
<td>2.39</td>
<td>3.23</td>
</tr>
<tr>
<td>120°</td>
<td>0.60</td>
<td>1.68</td>
<td>3.10</td>
<td>4.44</td>
</tr>
</tbody>
</table>

## CMP-Arch

<table>
<thead>
<tr>
<th>Slope</th>
<th>1:2</th>
<th>1:4</th>
<th>1:4</th>
<th>1:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0°</td>
<td>0.32</td>
<td>0.56</td>
<td>0.82</td>
<td>1.02</td>
</tr>
<tr>
<td>15°</td>
<td>0.35</td>
<td>0.66</td>
<td>1.01</td>
<td>1.24</td>
</tr>
<tr>
<td>30°</td>
<td>0.40</td>
<td>0.78</td>
<td>1.21</td>
<td>1.50</td>
</tr>
<tr>
<td>45°</td>
<td>0.45</td>
<td>0.92</td>
<td>1.53</td>
<td>1.91</td>
</tr>
<tr>
<td>60°</td>
<td>0.50</td>
<td>1.10</td>
<td>1.93</td>
<td>2.41</td>
</tr>
<tr>
<td>75°</td>
<td>0.55</td>
<td>1.30</td>
<td>2.39</td>
<td>3.27</td>
</tr>
<tr>
<td>90°</td>
<td>0.60</td>
<td>1.50</td>
<td>3.10</td>
<td>4.44</td>
</tr>
<tr>
<td>105°</td>
<td>0.65</td>
<td>1.70</td>
<td>4.05</td>
<td>5.57</td>
</tr>
<tr>
<td>120°</td>
<td>0.70</td>
<td>1.90</td>
<td>5.19</td>
<td>7.05</td>
</tr>
</tbody>
</table>

## Elliptical-Concrete

<table>
<thead>
<tr>
<th>Slope</th>
<th>1:2</th>
<th>1:4</th>
<th>1:4</th>
<th>1:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0°</td>
<td>0.32</td>
<td>0.56</td>
<td>0.82</td>
<td>1.02</td>
</tr>
<tr>
<td>15°</td>
<td>0.38</td>
<td>0.69</td>
<td>1.12</td>
<td>1.38</td>
</tr>
<tr>
<td>30°</td>
<td>0.42</td>
<td>0.80</td>
<td>1.35</td>
<td>1.73</td>
</tr>
<tr>
<td>45°</td>
<td>0.47</td>
<td>0.95</td>
<td>1.75</td>
<td>2.35</td>
</tr>
<tr>
<td>60°</td>
<td>0.52</td>
<td>1.10</td>
<td>2.25</td>
<td>3.10</td>
</tr>
<tr>
<td>75°</td>
<td>0.58</td>
<td>1.29</td>
<td>2.92</td>
<td>4.05</td>
</tr>
<tr>
<td>90°</td>
<td>0.64</td>
<td>1.49</td>
<td>3.83</td>
<td>5.57</td>
</tr>
<tr>
<td>105°</td>
<td>0.70</td>
<td>1.68</td>
<td>5.05</td>
<td>7.05</td>
</tr>
<tr>
<td>120°</td>
<td>0.76</td>
<td>1.88</td>
<td>6.88</td>
<td>9.57</td>
</tr>
</tbody>
</table>
GENERAL NOTES

1. Unless otherwise designated in the plans, concrete pipe mitered end sections may be used with any type of side drain pipe; corrugated steel pipe mitered end sections may be used with any type of side drain pipe except aluminum pipe. And, corrugated aluminum mitered end sections may be used with any type of side drain pipe except steel pipe. When bilauminous coated metal pipe is specified for side drain pipe, construct the mitered end sections with like pipe or concrete pipe. When the mitered end section pipe is dissimilar to the side drain pipe, construct a concrete jacket in accordance with Index 280.

2. Use either corrugated metal or concrete mitered end sections for corrugated polyethylene pipe (HDPE), polyvinyl-chloride pipe (PVC) and polypropylene pipe (PP). When used in conjunction with corrugated mitered end sections, make connection using either a formed metal band specifically designated to join HDPE or PVC pipe, with metal pipe or other coupler approved by the State Drainage Engineer. When used in conjunction with a concrete mitered end sections, concrete jacket constructed in accordance with Index 280.

3. Class NS concrete cast-in-place reinforced slabs are required for all sizes of side drain pipes. Unless 3" thickness called for in plans, construct slabs at 5½" thick.

4. Select lengths of concrete pipe that avoid excessive connections in the assembly of the mitered end section.

5. Repair corrugated metal pipe galvanizing that is damaged during bevelling and perforating.

6. Prior to placing concrete slab apply a bituminous coating to any portion of corrugated metal pipe in direct contact with concrete. Extend the coating 12" beyond the concrete slab.

7. When existing multiple side drain pipes are spaced other than the dimensions shown in this Index, have nonparallel axes, or non-uniform sections, either construct the mitered end sections separately as single pipe or collectively as multiple pipe end sections as directed by the Engineer.

8. Conclusions of pipe sections are to be closed using a formed metal band specifically designated to join HDPE or PVC pipe, with metal pipe or other coupler approved by the State Drainage Engineer. When used in conjunction with corrugated mitered end sections, concrete jacket constructed in accordance with Index 280.

9. Edge of shoulder slope and ditch transitions when the normal roadway slope must be flattened to place end section outside clear zone. See Slope and Ditch Transitions detail.

10. Prior to placing concrete slab apply a bituminous coating to any portion of corrugated metal pipe in direct contact with concrete. Extend the coating 12" beyond the concrete slab.

SPECIAL DETAILS AND NOTES

1. Mitered end sections for pipe sizes 15", 18" and 24" round or equivalent pipe arch or elliptical pipe are permitted within the clear zone. When the slope intersection permits, the mitered end section may be located with the culvert opening as close as 8' beyond the outside edge of the shoulder.

2. Include slope and ditch transitions when the normal roadway slope must be flattened to place end section outside clear zone. See Slope and Ditch Transitions detail.

3. All bars, bolts, nuts and washers are to be galvanized steel. Bolt diameters shall be ¾" for 15" to 30" pipe and ⅞" for 42" to 72" pipe.

4. Anchors required for CMP only.

5. Anchor, washer and nuts to be galvanized steel.

ANCHOR DETAIL

Bend anchor where required to center in concrete slab. Damaged surfaces to be repaired after bending. Anchors are to be spaced a distance equal to four (4) corrugations. Place the anchors in the outside crest of corrugation. Flat washers to be placed on inside wall of pipe.

Notes in the mitered end pipe are to be drilled.
DIMENSIONS & QUANTITIES

<table>
<thead>
<tr>
<th>Span</th>
<th>Rise</th>
<th>I</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>M</th>
<th>N</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'</td>
<td>2'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.81</td>
<td>0.85</td>
<td>0.87</td>
<td>0.90</td>
</tr>
<tr>
<td>3'</td>
<td>3'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.81</td>
<td>0.85</td>
<td>0.87</td>
<td>0.90</td>
</tr>
<tr>
<td>4'</td>
<td>4'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.81</td>
<td>0.85</td>
<td>0.87</td>
<td>0.90</td>
</tr>
<tr>
<td>5'</td>
<td>5'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.81</td>
<td>0.85</td>
<td>0.87</td>
<td>0.90</td>
</tr>
<tr>
<td>6'</td>
<td>6'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.81</td>
<td>0.85</td>
<td>0.87</td>
<td>0.90</td>
</tr>
<tr>
<td>7'</td>
<td>7'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.81</td>
<td>0.85</td>
<td>0.87</td>
<td>0.90</td>
</tr>
</tbody>
</table>

INDEX

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>273</td>
<td>SINGLE AND MULTIPLE CORRUGATED METAL PIPE-ARCH</td>
</tr>
</tbody>
</table>

NOTE: See Sheets 6 and 7 for details and general notes.

SIDE DRAIN MITERED END SECTION
#3 Steel Bars

Wire Mesh

**3 1/2" Galvanized Bolt Hex Head Bolt Shown:**
Either Hex Head or Square Head Bolt May Be Used. Only Hex Nut To Be Used.

**The specified weld shall be made when the fabricated unit is subject to hazardous hauls and repeated handling. Tack welds are permitted for local or job site fabrication. Galvanizing over welded surface not required.**

**FOR ALL SIZES OF SINGLE AND MULTIPLE DRAIN PIPE FASTENER UNIT**

**Details for Concrete & Corrugated Metal Pipe**

**Concrete Pipe (Round):**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>la</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td></td>
<td>4</td>
<td>3</td>
<td>4 1/4</td>
</tr>
<tr>
<td>16&quot;</td>
<td></td>
<td>5</td>
<td>3 1/2</td>
<td>4 1/4</td>
</tr>
<tr>
<td>24&quot;</td>
<td></td>
<td>6</td>
<td>3</td>
<td>4 1/4</td>
</tr>
<tr>
<td>30&quot;</td>
<td></td>
<td>7</td>
<td>3 1/4</td>
<td>4 1/4</td>
</tr>
<tr>
<td>36&quot;</td>
<td>9</td>
<td>10</td>
<td>2 1/2</td>
<td>4 1/4</td>
</tr>
<tr>
<td>42&quot;</td>
<td>10</td>
<td>12</td>
<td>3</td>
<td>4 1/4</td>
</tr>
<tr>
<td>48&quot;</td>
<td>13</td>
<td>14</td>
<td>3 1/4</td>
<td>4 1/4</td>
</tr>
<tr>
<td>54&quot;</td>
<td>15</td>
<td>16</td>
<td>3 1/4</td>
<td>4 1/4</td>
</tr>
<tr>
<td>60&quot;</td>
<td>15</td>
<td>16</td>
<td>18-3/4</td>
<td>18-3/4</td>
</tr>
</tbody>
</table>

**Corrugated Metal Pipe (Round):**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>la</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>2</td>
<td>3</td>
<td>2-1/2</td>
<td>3 3/8</td>
</tr>
<tr>
<td>16&quot;</td>
<td>3</td>
<td>4</td>
<td>2-1/2</td>
<td>3 3/8</td>
</tr>
<tr>
<td>24&quot;</td>
<td>4</td>
<td>6</td>
<td>3-3/4</td>
<td>3 3/4</td>
</tr>
<tr>
<td>30&quot;</td>
<td>6</td>
<td>9</td>
<td>4-3/4</td>
<td>4-3/4</td>
</tr>
<tr>
<td>36&quot;</td>
<td>9</td>
<td>12</td>
<td>5-3/4</td>
<td>5-3/4</td>
</tr>
<tr>
<td>42&quot;</td>
<td>10</td>
<td>11</td>
<td>12-2&quot;</td>
<td>13-1&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>11</td>
<td>12</td>
<td>13-5/8</td>
<td>15-5/8</td>
</tr>
<tr>
<td>54&quot;</td>
<td>14</td>
<td>15</td>
<td>16-10&quot;</td>
<td>17-9&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>15</td>
<td>16</td>
<td>18-3/4</td>
<td>18-11/16</td>
</tr>
</tbody>
</table>

**Elliptical Concrete Pipe:**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>la</th>
</tr>
</thead>
<tbody>
<tr>
<td>12'x18&quot;</td>
<td>2</td>
<td>3</td>
<td>2-1/4</td>
<td>3-9/16</td>
</tr>
<tr>
<td>14'x23&quot;</td>
<td>3</td>
<td>4</td>
<td>3-1/2</td>
<td>4-1/2</td>
</tr>
<tr>
<td>16'x29&quot;</td>
<td>4</td>
<td>5</td>
<td>3-3/4</td>
<td>4-3/8</td>
</tr>
<tr>
<td>18'x36&quot;</td>
<td>5</td>
<td>6</td>
<td>4-3/4</td>
<td>5-1/2</td>
</tr>
<tr>
<td>20'x44&quot;</td>
<td>6</td>
<td>8</td>
<td>5-7/8</td>
<td>6-1/2</td>
</tr>
</tbody>
</table>

**Note:** 3/4" x 3" bolts are standard for all grate fasteners, except when the contractor elects to use the slotted upper holes for the intermediate fasteners on multiple drain pipes, which will require the following bolt lengths:

<table>
<thead>
<tr>
<th>Grate Size (Std. &amp; X-Stg.)</th>
<th>Bolt Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>2 1/2&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

**To be used only when grates are called for in the plans.**

**1974 AASHTO Pipe Arch Sizes:**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>la</th>
</tr>
</thead>
<tbody>
<tr>
<td>17&quot;x13&quot;</td>
<td>1</td>
<td>2</td>
<td>1-8&quot;</td>
<td>2-7&quot;</td>
</tr>
<tr>
<td>21&quot;x15&quot;</td>
<td>2</td>
<td>3</td>
<td>2-10&quot;</td>
<td>3-9&quot;</td>
</tr>
<tr>
<td>29&quot;x20&quot;</td>
<td>4</td>
<td>5</td>
<td>5-2&quot;</td>
<td>6-1/2</td>
</tr>
<tr>
<td>35&quot;x24&quot;</td>
<td>6</td>
<td>8</td>
<td>6-4&quot;</td>
<td>7-3&quot;</td>
</tr>
<tr>
<td>42&quot;x28&quot;</td>
<td>7</td>
<td>9</td>
<td>8&quot;</td>
<td>9-2&quot;</td>
</tr>
<tr>
<td>49&quot;x33&quot;</td>
<td>8</td>
<td>10</td>
<td>9-10&quot;</td>
<td>10-9&quot;</td>
</tr>
<tr>
<td>57&quot;x38&quot;</td>
<td>9</td>
<td>10</td>
<td>11-9&quot;</td>
<td>12-11&quot;</td>
</tr>
<tr>
<td>65&quot;x43&quot;</td>
<td>10</td>
<td>11</td>
<td>12-2&quot;</td>
<td>13-12&quot;</td>
</tr>
<tr>
<td>74&quot;x48&quot;</td>
<td>12</td>
<td>13</td>
<td>14-6&quot;</td>
<td>15-5&quot;</td>
</tr>
</tbody>
</table>

**Note:** To be omitted on trailing downstream ends on divided roadways.

**Corrugated Metal Pipe (ARCH):**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>la</th>
</tr>
</thead>
<tbody>
<tr>
<td>17&quot;x13&quot;</td>
<td>1</td>
<td>2</td>
<td>1-8&quot;</td>
<td>2-7&quot;</td>
</tr>
<tr>
<td>21&quot;x15&quot;</td>
<td>2</td>
<td>3</td>
<td>2-10&quot;</td>
<td>3-9&quot;</td>
</tr>
<tr>
<td>29&quot;x20&quot;</td>
<td>4</td>
<td>5</td>
<td>5-2&quot;</td>
<td>6-1/2</td>
</tr>
<tr>
<td>35&quot;x24&quot;</td>
<td>6</td>
<td>8</td>
<td>6-4&quot;</td>
<td>7-3&quot;</td>
</tr>
<tr>
<td>42&quot;x28&quot;</td>
<td>7</td>
<td>9</td>
<td>8&quot;</td>
<td>9-2&quot;</td>
</tr>
<tr>
<td>49&quot;x33&quot;</td>
<td>8</td>
<td>10</td>
<td>9-10&quot;</td>
<td>10-9&quot;</td>
</tr>
<tr>
<td>57&quot;x38&quot;</td>
<td>9</td>
<td>10</td>
<td>11-9&quot;</td>
<td>12-11&quot;</td>
</tr>
<tr>
<td>65&quot;x43&quot;</td>
<td>10</td>
<td>11</td>
<td>12-2&quot;</td>
<td>13-12&quot;</td>
</tr>
<tr>
<td>74&quot;x48&quot;</td>
<td>12</td>
<td>13</td>
<td>14-6&quot;</td>
<td>15-5&quot;</td>
</tr>
</tbody>
</table>

**Note:** To be used only when grates are called for in the plans.

**1974 AASHTO Pipe Arch Sizes:**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>la</th>
</tr>
</thead>
<tbody>
<tr>
<td>17&quot;x13&quot;</td>
<td>1</td>
<td>2</td>
<td>1-8&quot;</td>
<td>2-7&quot;</td>
</tr>
<tr>
<td>21&quot;x15&quot;</td>
<td>2</td>
<td>3</td>
<td>2-10&quot;</td>
<td>3-9&quot;</td>
</tr>
<tr>
<td>29&quot;x20&quot;</td>
<td>4</td>
<td>5</td>
<td>5-2&quot;</td>
<td>6-1/2</td>
</tr>
<tr>
<td>35&quot;x24&quot;</td>
<td>6</td>
<td>8</td>
<td>6-4&quot;</td>
<td>7-3&quot;</td>
</tr>
<tr>
<td>42&quot;x28&quot;</td>
<td>7</td>
<td>9</td>
<td>8&quot;</td>
<td>9-2&quot;</td>
</tr>
<tr>
<td>49&quot;x33&quot;</td>
<td>8</td>
<td>10</td>
<td>9-10&quot;</td>
<td>10-9&quot;</td>
</tr>
<tr>
<td>57&quot;x38&quot;</td>
<td>9</td>
<td>10</td>
<td>11-9&quot;</td>
<td>12-11&quot;</td>
</tr>
<tr>
<td>65&quot;x43&quot;</td>
<td>10</td>
<td>11</td>
<td>12-2&quot;</td>
<td>13-12&quot;</td>
</tr>
<tr>
<td>74&quot;x48&quot;</td>
<td>12</td>
<td>13</td>
<td>14-6&quot;</td>
<td>15-5&quot;</td>
</tr>
</tbody>
</table>

**Note:** To be omitted on trailing downstream ends on divided roadways.
Notes:
- Anchors required for CMP only.
- Anchors, washer and nuts are to be galvanized steel.
- Bend anchor where required to center in concrete slab.
- Damaged surfaces to be repaired after bending.
- Anchors are to be spaced a distance equal to four (4) corrugations.
- Place the anchors in the outside crest of corrugation.
- Flat washer to be placed on inside wall of pipe.
- Holes in the mitered end pipe are to be drilled or punched; burning not permitted.

ANCHOR DETAIL

FOR SINGLE & MULTIPLE DRAIN PIPE

GRATE DETAIL

See General Notes, Sheet 7.

CONCRETE PIPE CONNECTOR DETAIL

DETAILS FOR CONCRETE & CORRUGATED METAL PIPE
GENERAL NOTES

1. Unless otherwise designated in the plans, concrete pipe mitered end sections may be used with any type of side drain pipe; corrugated steel pipe mitered end sections may be used with any type of side drain pipe except aluminum pipe; and, corrugated aluminum mitered end sections may be used with any type of side drain pipe except steel pipe. When bituminous coated metal pipe is specified for side drain pipe, construct the mitered end sections with like pipe or concrete pipe. When the mitered end section pipe is dissimilar to the side drain pipe, construct a concrete jacket in accordance with Index 280.

2. Use either corrugated metal or concrete mitered end sections for corrugated polyethylene pipe (HDPE), polyvinyl-chloride pipe (PVC) and polypropylene pipe (PPP). When used in conjunction with corrugated mitered end sections, make connection using either a formed metal band specifically designed to join HDPE or PVC pipe, with metal pipe or other coupler approved by the State Drainage Engineer. When used in conjunction with a concrete mitered end sections, concrete jacket constructed in accordance with Index 280.

3. Select lengths of concrete pipe that avoid excessive connections in the assembly of the mitered end section.

4. Repair corrugated metal pipe galvanizing that is damaged during beveling and perforating.

5. Prior to placing concrete slab apply a bituminous coating to any portion of corrugated metal pipe in direct contact with concrete. Extend the coating 12" beyond the concrete slab.

6. When constructing multiple side drain pipes are spaced other than the dimensions shown in this Index, nonparallel axes, or non-uniform sections, either construct the mitered and sections separately as single pipe or collectively as multiple pipe end sections as directed by the Engineer.

7. Class NS concrete cast-in-place reinforced slabs are required for all sizes of side drain pipes.

8. Install grates on all round pipes 30" or greater, pipe-arches 35"x24" or greater, and elliptical pipe 19"x30" or greater, unless excluded in the Plans. Install grates on smaller size pipes only when called for in the Plans. Omit the lower grate on the downstream end of mitered end sections along divided highways.

9. Use Schedule 80 pipe for the lower grate on all traffic approach ends and Schedule 40 pipe for all remaining grates. Fabricate the grates from ASTM A53, Grade B, black steel pipe and not dig galvanize after fabrication in accordance with ASTM A123 for all corrosive environments.

DESIGN NOTES

1. Do not use grates until the debris transport potential has been evaluated by the drainage engineer and appropriate adjustments made. Ditch grades in excess of 3% or pipe with less than 1.5' of cover and grades in excess of 1% will require such an evaluation (General Note 10).

2. The design engineer must determine and designate in the plans which alternate types of mitered end section will not be permitted. Restrict use based on corrosive or structural requirements.

3. Contact the District Drainage Engineer for possible alternate treatment of side drain mitered end sections where a minimum spacing of 30' will not result between the low points of the mitered end sections.

4. Provide ditch transitions on all grades in excess of 3%.
**CONCRETE GUTTER AND DRAINS AT RETAINING WALLS**

**PLAN**
- Front Slope (1:2 Std.)
- 4" Pipes
- Retaining Wall
- Expansion Material
- Sidewalk

**SECTION AA**
- Front Slope (1:2 Std.)
- 3" Conc. Ditch Pavt.
- Retaining Wall

**SECTION BB**
- Front Slope (1:2 Std.)

**SECTION CC**
- Front Slope (1:2 Std.)

**SIDE VIEW**
- 3" PVC Pipe Sleeve
- 3/8" x 14" Bolt With Nut And Washers
- Steel Plate
- L 1/4" Anchor with nuts and washers
- 6 1/2" Minimum Embedment:
  - Hex Bolt: Cast-In-Place
  - Adhesive-Bonded Anchor: Fully Threaded Rod Installed In Accordance With Specification Section 416
- 5" Grate (Lbs.)
  - 4" For 18" Pipe
  - 3.5 For 24" & 30" Pipe
  - 3 For 36" Pipe
  - 2.5 For 42" Pipe
- Vert Bars & Plate Make Symmetrical About Pipe:
  - 4 For 18" Pipe
  - 3 For 24" & 30" Pipe
  - 2 For 36" Pipe
  - 1 For 42" Pipe
- Pipe Dia.: 16" 24" 30" 36" 42"
- Grate (Lbs.): 40 58 74 90 117

**NOTES**
- PVC pipe, Schedule 40, to be paid for under the contract unit price for Polyvinyl Chloride Pipe Culvert (4"), 1P.
- Use Larger Value Of Either:
  1. L=10xH (No Maximum)
  2. L=10xDitch Offset (Maximum L=100')

**METHOD FOR SETTING LIMITS OF VARIABLE FRONT SLOPES AT DRAINAGE STRUCTURES**

**GUARD AT PIPE ENDS**

**GUARD AT PIPE ENDS**

Note: Guards to be constructed only at locations specifically called for in plans.
**METHOD FOR DETERMINING THE LENGTH OF SPECIAL PIPE REQUIRED UNDER RAILROADS**

1. **Cost To Be Included in Cost of Pipe**
   - Reinforced Concrete Top: (Top Required When Inlet, Manhole or Junction Box Riser Is Less Than 4 Feet in Diameter; Or When 3'-6", All. B Inlet, Manhole or Junction Box Riser Is Used; Or When Rectangular Inlet Is Used.)
   - Integral Riser Reinforcement: #5 Bars @ 18" Ctrs. Vert. And 6" Ctrs. Horiz.
   - Reinforced Concrete Top: See Plan Above
   - Integral Riser Reinforcement: #5 Bars

2. **PLAN OF TOP**
   - 3'-6" For 54" Pipe
   - 6' For Other Size Pipes
   - #5 Bars
   - 2'-0" For 54" Pipe
   - 1'-0" For All Others

3. **INLETS, MANHOLES OR JUNCTION BOXES ON INTEGRAL PRECAST CONCRETE RISER FOR CONCRETE PIPE**

4. **RAILROAD COMPANY**
   - **CLEARANCE BELOW BOTTOM OF RAIL (FT)**
   - **STRENGTH CLASS**
   - **ASTM (C76)**

- **Alabama & Gulf Coast Railway (Rail America)**
  - 5.5
  - IV

- **All Railway & Bay Line Railroad (Genesee & Wyoming)**
  - 5.5 / 4.5
  - V

- **CSX Transportation**
  - 5.5
  - V

- **First Coast Railroad (Genesee & Wyoming)**
  - 5.5 / 4.5
  - V

- **Florida Midland, Central, and Northern Railroads (Pinellas Railroad)**
  - 5.5
  - V

- **Florida East Coast (FEC) Railway Company**
  - 5.5
  - IV

- **Florida West Coast Railroad Company**
  - 5.5
  - V

- **Georgia & Florida Railway, Inc.**
  - 5.5
  - V

- **Norfolk Southern (NS) Railway Corporation**
  - 5.5 / 4.5
  - V

- **Port of Palm Beach District Railroad**
  - 5.5
  - IV

- **Seminole Gulf Railway (LP)**
  - 6.0
  - V

- **South Central Florida Express**
  - 6.0
  - V

- **Talleyrand Terminal Railroad (Genesee & Wyoming)**
  - 5.5 / 4.3
  - V

- **South Florida Regional Transportation Authority (Tri-County Commuter Rail)**
  - 5.5
  - V

---

1. Distance standard for yard and industrial tracks.
2. Clearance is for casing pipe. All subgrade carrier pipelines and wirelines will be installed within a casing pipe which will extend from Right-of-Way line to Right-of-Way line.

---

<table>
<thead>
<tr>
<th>RAILROAD COMPANY</th>
<th>CLEARANCE BELOW BOTTOM OF RAIL (FT)</th>
<th>STRENGTH CLASS</th>
<th>ASTM (C76)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama &amp; Gulf Coast Railway (Rail America)</td>
<td>5.5</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>All Railway &amp; Bay Line Railroad (Genesee &amp; Wyoming)</td>
<td>5.5 / 4.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>CSX Transportation</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>First Coast Railroad (Genesee &amp; Wyoming)</td>
<td>5.5 / 4.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Florida Midland, Central, and Northern Railroads (Pinellas Railroad)</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Florida East Coast (FEC) Railway Company</td>
<td>5.5</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Florida West Coast Railroad Company</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Georgia &amp; Florida Railway, Inc.</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Norfolk Southern (NS) Railway Corporation</td>
<td>5.5 / 4.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Port of Palm Beach District Railroad</td>
<td>5.5</td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>Seminole Gulf Railway (LP)</td>
<td>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>South Central Florida Express</td>
<td>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Talleyrand Terminal Railroad (Genesee &amp; Wyoming)</td>
<td>5.5 / 4.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>South Florida Regional Transportation Authority (Tri-County Commuter Rail)</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 1: DITCH PAVEMENT

<table>
<thead>
<tr>
<th>Pavement Type</th>
<th>Dimensions</th>
<th>Payment Unit</th>
<th>Basis of Estimate</th>
<th>Filter Fabric Type</th>
<th>Filter Fabric Range</th>
<th>Remarks</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>2' x 2' x 6&quot;</td>
<td>TN</td>
<td>0.25/36&quot;</td>
<td>None</td>
<td>Low-Moderate</td>
<td>Section 539 of the Standard Specifications.</td>
<td></td>
</tr>
<tr>
<td>Gravel (Sand-Cement)</td>
<td>2' x 2' x 6&quot;</td>
<td>24</td>
<td>0.11/18&quot;</td>
<td>Low-Moderate</td>
<td>Section 520 of the Standard Specifications.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riprap (Ditch Lining)</td>
<td>2&quot; x 4&quot;</td>
<td>Tn</td>
<td>Tn</td>
<td>Moderate-Moist</td>
<td>Section 520a</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Filter fabric may be required for ditch pavement on slopes steeper than 1:1.5. See Section 985 for fabric requirements and application.

1. Filter Fabric Required.

PLAN

PAVED DITCH END TREATMENT

GENERAL NOTES

1. Type of ditch pavement shall be as shown on plans.

2. In concrete ditch pavement, contraction joints are to be spaced at 25' minimum intervals, or as directed by the Engineer. Contraction joints may be either formed (construction joint) or left open. No open joints will be permitted in concrete ditch pavement.

3. Lip at end of ditch pavement shall normally be located downstream of DPI or on flatter grades where there is a decrease in ditch velocity.

4. Trenches are to be used with all ditch paving. A trench is not required adjacent to drainage structures.

5. When directed by the Engineer, weep hole spacing may be reduced to 5' minimum.

6. For ditch pavements requiring filter fabric (See Table 1) place filter fabric below the aggregate to form a mat continuous with the pavement filter fabric or underlapping the pavement filter fabric if present.

7. Dwarf ditch pavements requiring filter fabric (See Table 1) place the filter fabric directly beneath the pavement for the entire length and width of the pavement. See Standard Specification Section 985 for fabric requirements and application.

8. When weep holes are used with aggregate, place filter fabric below the aggregate to form a mat continuous with the pavement filter fabric or underlapping the pavement filter fabric, if present.

9. Ditch pavement requiring reinforcement shall be detailed in the plans.

10. Cost of plastic filter fabric to be included in the contract unit price for ditch pavement.

11. Sodding to be paid for as contract unit price for Performance Turf, SY.
### TABLE 2: SOD QUANTITIES (SY)

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>INDEX NO. 250</th>
<th>INDEX NO. 261</th>
<th>INDEX NO. 266</th>
<th>INDEX NO. 270</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOPE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
</tr>
<tr>
<td>13</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
</tr>
<tr>
<td>14</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
<td>1 2 3 1 2 3 1</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ND** Endwall With Baffles

### FILTER FABRIC PLACEMENT AT CONCRETE STRUCTURE

- **Bonded Option**
  - Sand-Cement Or Rubble Riprap
  - Filter Fabric
  - 1"x1" Pressure Treated Timber Nailed To Surface

- **Nailed Option**
  - Note: Either option may be used unless otherwise called for in the plans.

### SOD PLACEMENT AT PIPE/CULVERT END TREATMENTS

- **Sod Fabric Placement at Concrete Structure**
  - Filter Fabric
    - Rubber Infill
    - On Face of Concrete
    - 8" Fold Min.
  - No Adhesive Above Here

- **Sand-Cement Or Rubble Riprap**
  - For Toe Of Slope
  - 6" Fold Min.

### Notes:
- Either option may be used unless otherwise called for in the plans.
- Sodding quantities for each endwall to be determined by the designer from this detail.
REVISION NO.
SHEET NO.
INDEX NO.
DESCRIPTION:
REVISED

1. For additional details see Index No. 232.
2. Inlet to be paid for under the contract unit price for Inlets (Ditch Bottom Type C Modified), EA.

Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.
PLAN

SPECIAL CONCRETE ENDWALL

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Concrete Class 1 (Endwalls). Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

Pipe Size (in) | Concrete Class 1 (CY) | Sand-Cement Riprap (CY)
---|---|---
15 | 4'-0" | 2.3 | 1.1
18 | 5'-3" | 2.6 | 1.3
24 | 6'-3" | 3.3 | 1.8

See Plans For Handrail Requirements

Riprap Slopes Steeper Than 1:1½ (Max. 1:1), And Ditch Bottom (Symmetrical About €)

Sidewalk

Back Of Sidewalk

PLAN

SPECIAL CONCRETE ENDWALL

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Concrete Class 1 (Endwalls). Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

Pipe Size (in) | Concrete Class 1 (CY) | Sand-Cement Riprap (CY)
---|---|---
15 | 4'-0" | 2.3 | 1.1
18 | 5'-3" | 2.6 | 1.3
24 | 6'-3" | 3.3 | 1.8

See Plans For Handrail Requirements

Riprap Slopes Steeper Than 1:1½ (Max. 1:1), And Ditch Bottom (Symmetrical About €)

Sidewalk

Back Of Sidewalk

PLAN

SPECIAL CONCRETE ENDWALL

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Concrete Class 1 (Endwalls). Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

Pipe Size (in) | Concrete Class 1 (CY) | Sand-Cement Riprap (CY)
---|---|---
15 | 4'-0" | 2.3 | 1.1
18 | 5'-3" | 2.6 | 1.3
24 | 6'-3" | 3.3 | 1.8

See Plans For Handrail Requirements

Riprap Slopes Steeper Than 1:1½ (Max. 1:1), And Ditch Bottom (Symmetrical About €)

Sidewalk

Back Of Sidewalk

PLAN

SPECIAL CONCRETE ENDWALL

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Concrete Class 1 (Endwalls). Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

Pipe Size (in) | Concrete Class 1 (CY) | Sand-Cement Riprap (CY)
---|---|---
15 | 4'-0" | 2.3 | 1.1
18 | 5'-3" | 2.6 | 1.3
24 | 6'-3" | 3.3 | 1.8

See Plans For Handrail Requirements

Riprap Slopes Steeper Than 1:1½ (Max. 1:1), And Ditch Bottom (Symmetrical About €)

Sidewalk

Back Of Sidewalk

PLAN

SPECIAL CONCRETE ENDWALL

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Concrete Class 1 (Endwalls). Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

Pipe Size (in) | Concrete Class 1 (CY) | Sand-Cement Riprap (CY)
---|---|---
15 | 4'-0" | 2.3 | 1.1
18 | 5'-3" | 2.6 | 1.3
24 | 6'-3" | 3.3 | 1.8

See Plans For Handrail Requirements

Riprap Slopes Steeper Than 1:1½ (Max. 1:1), And Ditch Bottom (Symmetrical About €)

Sidewalk

Back Of Sidewalk

PLAN

SPECIAL CONCRETE ENDWALL

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Concrete Class 1 (Endwalls). Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

Pipe Size (in) | Concrete Class 1 (CY) | Sand-Cement Riprap (CY)
---|---|---
15 | 4'-0" | 2.3 | 1.1
18 | 5'-3" | 2.6 | 1.3
24 | 6'-3" | 3.3 | 1.8

See Plans For Handrail Requirements

Riprap Slopes Steeper Than 1:1½ (Max. 1:1), And Ditch Bottom (Symmetrical About €)

Sidewalk

Back Of Sidewalk

PLAN

SPECIAL CONCRETE ENDWALL

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Concrete Class 1 (Endwalls). Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

Pipe Size (in) | Concrete Class 1 (CY) | Sand-Cement Riprap (CY)
---|---|---
15 | 4'-0" | 2.3 | 1.1
18 | 5'-3" | 2.6 | 1.3
24 | 6'-3" | 3.3 | 1.8

See Plans For Handrail Requirements

Riprap Slopes Steeper Than 1:1½ (Max. 1:1), And Ditch Bottom (Symmetrical About €)
YARD DRAIN ITEM INCLUDES:

1. 15" x 15" x 12" Concrete or PVC Tee 4' long.

2. Grade diameter = 14:15
   Thickness = 2:5
   Flow area = 45 sq in min
   Light Duty Cast Iron, see Specification Section 962.

3. 12" pipe as necessary.

4. 0.04 Cubic yards concrete for slab.

YARD DRAINS

Notes:
1. Yard drains to be located outside the R/W. Drainage area should not exceed 750 SF (grate flow 0.1 Cfs).
2. Yard drains may be constructed at the option of the property owner as shown on the plans.
3. Cost of plugs and collars to be included in the cost for 15" pipe. For collar and plug details see Index No. 280.
4. Yard drain to be paid for under the contract unit price for Yard Drain, EA.

SHALLOW DITCHES

Notes:
1. To be constructed at locations as directed by the Engineer.
2. Either cast iron pipe or PVC rigid conduit, U.L. listed for direct sunlight exposure, Schedule 40, may be used.
3. Pipe and mitered end to be paid for under the contract unit price for either Cast Iron Soil Pipe (Standard) (4"), 15" or PVC Pipe for Back of Sidewalk Drainage (4"), 15".
4. Miter to slope.

As Yard Drain

As 15" Pipe

To Be Paid For

To Be Paid For

0.5 % Min. Slope

Note:

Flow Lines Of Pipes To Match Gutter Elevations

Curb And Gutter

Proposed Main Line Pipe

24" Varies R/W Collar

Pipe Plug

12" Ø Pipe

Tee

24" Varies

24"x24"x3" Concrete Slab

24"x24"x3" Concrete Slab

Sidewalk

0.5 % Min. Slope

Ditch Bottom

Double 4" Pipe

Mitered End

Class I Concrete

Materials:

- Light Duty Cast Iron, see Specification Section 962.
- 15" x 15" x 12" Concrete or PVC Tee 4' long.
- 12" pipe as necessary.
- 0.04 Cubic yards concrete for slab.

Provide Approximately A Minimum Of 0.20% Grade On Gutter, Slightly Warping The Surface Of The Median Pavement If Necessary. Within Limits Of The Median Curb Or Curb And Gutter. Construct A Drainage Flume Or Flumes At The Point Or Points Of Low Grade. See Details.

Grade To Drain As Shown In The Plans Or As Adjusted By The Engineer During Construction.

Prop. Pavt. Match That Of Adjacent Pavt. (Breakover 0.02 Min., 0.05 Max.)

Prop. Median Pavt., Warp Surface If Necessary To Drain To Prop. Flumes.

Limits Of The Median Curb Or Curb And Gutter. Construct A Drainage Warp The Surface Of The Median Pavement If Necessary, Within.

Provide Approximately A Minimum Of 0.20% Grade On Gutter, Slightly Warping The Surface Of The Median Pavement If Necessary. Within Limits Of The Median Curb Or Curb And Gutter. Construct A Drainage Flume Or Flumes At The Point Or Points Of Low Grade. See Details.

The Engineer During Construction.

Flumes to be located in low point of noses and at other points as designated in the plans. The locations may be adjusted by the Engineer during construction.

1. These details are to apply to projects which provide for the conversion of 2-lane sections to 4-lane divided highway sections and for supereleved sections of new 4-lane divided highways. Layout above is illustration only. Cost of Flumes to be included in the contract price for Curb or Curb and Gutter. Sed to be paid for under the contract unit price for Performance Tuff, SF.

2. Flumes to be located in low point of noses and at other points as designated in the plans. The locations may be adjusted by the Engineer during construction.
1. Spillway to be paid for as Shoulder Gutter, L.F.

2. If spillway empties into an unpaved ditch, the detail should be modified as necessary.

DETAIL OF CONCRETE SPILLWAY AT END OF SHOULDER GUTTER
(TO BE USED WHERE INLETS, PIPES & ENDWALLS ARE IMPRACTICAL)
GENERAL NOTES

1. Pipe shall be any of the optional types permitted in Section 443 of the Specifications unless otherwise restricted in the plans. Dissimilar types of pipe will not be permitted in a continuous run of pipe.

2. Concrete pipe shall be placed with the slots positioned on sides.

3. Alignment joints are standard (gaskets not required). Recorrugation of metal pipe ends not required.

4. The contractor may submit other methods of providing slots having equal or greater area of opening, for approval by the Engineer.

5. Filter fabric shall be Type D-3 meeting the requirements of Section 985. All filter fabric joints shall lap a minimum of one (1) foot.

6. The standard cross section shall be constructed unless other section(s) described or detailed in the plans.

7. For supplemental details see Index No. 280.

8. The contractor shall take the necessary precautions to prevent contamination of the trench with sand, silt and foreign materials.

9. French drains shall be paid for under the contract unit price for French Drains, LF. The unit price shall include the cost of pipe, pipe plugs, pipe fittings, coarse aggregate and filter fabric in place, and the cost for trench excavation, backfill and compaction. The unit price shall also include the cost for disposal of surplus excavated materials and cost for restoration of pavement removed or damaged by French drain construction, but shall not include payments for items paid for elsewhere.

DESIGN NOTES

1. Pipe invert should be at or above the water table whenever possible.

2. French drains with minor dimensional changes or otherwise different from the standard cross-section shall be either described or detailed in the plans. French drains with significantly different cross-sections shall be detailed in the plans.
**SLOTTED PIPE OPTIONS**

**OPTION A - ROUND PIPE**

**SIDE VIEW**

**SECTION AA**

**SECTION BB**

**OPTION B - ROUND OR ELLIPTICAL PIPE**

**SIDE VIEW**

**SIDE VIEW**

**SECTION AA**

**SECTION BB**

**ELLIPSTICAL PIPE**

**ROUND PIPE**

**FRENCH DRAIN**

**DESCRIPTION:**

**REV**

**INDEX NO.**

**SHOWN**

**PICTORIAL VIEW**
GENERAL NOTES

1. The underdrain pipe shall be either 4" smooth or 5" corrugated tubing unless otherwise shown in the plans. The size to be furnished will be based on the nominal internal diameter of a pipe with a smooth interior wall. Except when prohibited by the plans, the special provisions or this standard, pipe with a corrugated interior wall may be provided based on the following size equivalency.

- 4" smooth interior equivalent to 5" corrugated interior
- 5" smooth interior equivalent to 6" corrugated interior
- 6" smooth interior equivalent to 8" corrugated interior
- 8" smooth interior equivalent to 10" corrugated interior

2. Fine aggregate shall be quartz sand meeting the requirements of Sections 902-4 of the Standard Specifications.

3. Coarse aggregate shall be gravel or stone meeting the requirements of Sections 902-2 or 901-3. The gradation shall meet Section 901, Grades 4, 467, 5, 36 or 37 stone unless otherwise shown restricted in the plans.

4. Underdrain Type I, II, III and V shall be in accordance with Section 440.

5. Filter fabric shall be Type D-3 (See Specifications Section 985). The internal filter fabric of Type V underdrain shall have a permittivity of 0.7 /sec. and an AOS of #40 sieve.

6. When Type I is used, a filter fabric sock meeting Section 948 is required.

7. See Index No. 500 for the standard location of Type I, II, and III underdrain. The location of Type V underdrain and nonstandard locations of Type I, II, and III underdrain will be as detailed in the plans.

8. All filter fabric joints shall overlap a minimum of 1'. The internal filter fabric of Type V underdrain shall overlap into the coarse aggregate or the fine aggregate a minimum of 1'.

9. Underdrain outlet pipes shall be nonperforated and all bends shall be made using 90 deg. elbows separated by at least 1' of straight pipe. Outlet pipes stubbed into inlets or other drainage structures shall be not less than 6" above the structure flow line. Outlet pipes discharging to grassed areas shall have concrete aprons, hardware cloth, and bordering sod as shown in Index No. 287 for Edgedrain outlets.

10. Pay Item shall be based on the size of the smooth interior products. The contract unit price for Underdrain, LF, shall include the cost of pipe, fittings, aggregate, sock, filter fabric, underdrain cleanouts, and concrete aprons.

The contract unit price for Underdrain Outlet Pipe, LF, shall be full compensation for trench excavation, pipe and fittings, concrete aprons, hardware cloth for concrete aprons, stubbing into drainage structures, backfill in place, and disposal of excess materials.

The contract unit price for Underdrain Inspection Box, EA, shall be for the number completed and accepted.

DESIGN NOTES

1. The type of underdrain should be selected to meet design water removal rate and soil conditions. Caution is prescribed in the use of these typical sections since special designs may be required to satisfy project conditions.

2. Type I underdrain is intended for minimum water removal conditions.

3. Type II underdrain is intended for moderate water removal conditions. Where reactive conditions may create chemical clogging, the use of an inert material and/or elimination of the filter fabric may be necessary.

4. Type III underdrain is intended for maximum water removal conditions. Filter fabric is required between the coarse aggregate or fine aggregate including those described in general notes 2 and 3. Design note 3 applies for reactive conditions.

5. Type V underdrain is intended for use in detention basins and other locations which require a filtration system. The standard fine aggregate specified for Type V underdrain conforms to filtration gradation requirements of Chapter 62-25 FAC.

6. The designer should detail in the plans the location of:
   - (a) Type V underdrain
   - (b) nonstandard locations of Type I, II, and III underdrain
   - (c) underdrain inspection boxes
   - (d) cleanouts for Type V underdrain
   - (e) underdrain outlet pipes

7. The designer should specify the flow line elevations at the beginning, bends, junctions and ends of underdrain pipes and outlet pipes.

8. The designer should evaluate whether an external filter fabric envelope is required around underdrain Types I and III. When required, fabric shall be specified in the plans.

INDEX NO. 286

FY 2017-18
DESIGN STANDARDS

UNDERDRAIN

1 of 2
GENERAL NOTES FOR CONCRETE PAVEMENT SUBDRAINAGE

1. No trench greater than 2' in depth will be allowed overnight. Trenches shall be backfilled at all times.

2. Concrete pavement subdrainage shall be constructed adjacent to the low edge of the roadway pavement and under travel lanes, auxiliary pavement and shoulders, as called for in the plans. When the low edge shifts between outside and inside edges of pavement the concrete pavement subdrainage shall extend 50' beyond and begin 50' before the flat point (100' overlap).

Concrete pavement subdrainage shall be placed on the low side of ramps of crossroad terminals.

3. Concrete pavement subdrainage shall be constructed on a grade parallel with the edge of pavement profile, except on profiles flatter than one-tenth percent (0.10%) the concrete pavement subdrainage shall be constructed on a grade of one-tenth percent (0.10%).

4. Immediately prior to placing the filter fabric the entire vertical face of the concrete pavement shall be cleaned to remove adhering base materials and soil.

5. The Contractor shall devise a procedure for holding the filter fabric in position on the vertical face of the trench. The procedure must be approved by the Engineer prior to placement of the draincrete.

6. The upper end of each separate run of the concrete pavement subdrainage pipe shall be capped.

7. Outlet pipes shall be constructed at a maximum of 500' intervals. Elbows or 90° bends shall be used to connect the outlet pipe to the concrete pavement subdrainage pipe. The elbows or bends shall be of the same material as the outlet pipe but compatible with the pipe.

When directed by the Engineer, outlet pipes shall be stubbed into existing inlets or into existing ditch pavements at an elevation 6" above the inlet flowline or ditch bottom. Concrete apron and bordering sod are not required for stubbed outlets, but replacement sodding will be required at trenches for pipes stubbed into paved ditches.

In sag vertical curves separate outlet pipes for concrete pavement subdrains from opposite directions shall use a single apron unless otherwise shown in the plans or otherwise directed by the Engineer.

Backfill around outlet pipes shall be of cohesive soils, draincrete will not be permitted.

8. Existing paved shoulder that is removed for the construction of concrete pavement subdrains from opposite directions shall use a single apron unless otherwise shown in the plans or otherwise directed by the Engineer.

Backfill around outlet pipes shall be of cohesive soils, draincrete will not be permitted.

9. The contract unit price for Edgedrain Outlet Pipe (4") LF shall be full compensation for removal of existing shoulder pavement, trench excavation, pipe and fitting, concrete apron, hardware cloth, sod, stubbing into existing inlets and paved ditches, restoration of ditch pavement, backfill in place, and disposal of excess materials.

NOTE: For Section AA see following Sheets.

Asphaltic Concrete

Concrete Pavement

Concrete

Pavement

Concrete Exist.

SUBDRAINAGE PIPE

ALIGNMENT OF OUTLET PIPE

NOTE: For Section AA see following Sheets.

PLAN - OUTLET PIPE APRON

SUBDRRAINAGE PIPE

EDGEDRAIN OUTLET

SECTION BB

4 SLOPE

4.5 Min. Cover

1.6 In.

1.6 Min.

2 Min.

6.5 Min.

5.5 SF For 1:6 Slope

4.7 SF For 1:4 Slope

5.5 SF For 1:6 Slope

4.7 SF For 1:4 Slope

(Nonperforated) Length Varies

6" Dia. Minimum Outlet Pipe

6" Dia. Minimum Outlet Pipe

(Nonperforated) Length Varies

6" Dia. Minimum Outlet Pipe

4" Dia. Minimum Outlet Pipe

4" Dia. Minimum Outlet Pipe

4" Dia. Minimum Outlet Pipe

1:2 Pipe Bevel For 1:4 Slope

1:2 Pipe Bevel For 1:6 Slope

Trough Slope Shall Match Outlet Pipe Slope

Trough Slope Shall Match Outlet Pipe Slope

Class NS Concrete (6" Thick)

Class NS Concrete (6" Thick)

6" Thick (0.10 CY-1:8 Phenolic)

6" Thick (0.25 CY-1:6 Phenolic)

2' Sod

2' Sod

4' Sod

4' Sod

Ditch Bottom

Ditch Bottom

0.19 CY-1:4 Slope

0.25 CY-1:6 Slope

2' Minimum

2' Minimum

1/8" Galvanized Hardware Cloth

1/8" Galvanized Hardware Cloth

1:18 Bevel

1:18 Bevel

1:2 Bevel For 1:4 Slope

1:2 Bevel For 1:6 Slope

Concrete Pavement Subdrainage shall be constructed on a grade parallel with the edge of pavement profile, except on profiles flatter than one-tenth percent (0.10%). The concrete pavement subdrainage shall be constructed on a grade of one-tenth percent (0.10%).
Sealed Longitudinal Joint
Concrete Pavement (Depth Varies)

At The Contractor's Option This Area May Be Constructed Of Optional Base Material Or Special Stabilized Subbase. To Be Paid For Under Contract Unit Price For Special Stabilized Subbase.

Asphalt Pavement
Optional Base

Sealed Longitudinal Joint
Concrete Pavement (Depth Varies)

Overlap Filter Fabric 6'

6" Special Stabilized Subbase
Special Select Soil

Draincrete
Filter Fabric Type D-3
(See Specifications Section 985)

4" Dia Special Perforated Pipe (Non corrugated Or Smooth Lined Corrugated Only)
(See Sheet 1)

1'-6" 10" Min.

ASPHALT SHOULDERS

NEW CONSTRUCTION

Cut To A Neat Line Before Removal Of Shoulder Pavement

Exist Concrete Pavement

Tack

Top Of Filter Fabric: 2" Below Bottom Of Pavement For Cement Stabilized, Soil Cement And Econcrete Subbases; 2" Above Bottom Of Pavement For Other Subbases

Shoulder Joint Seal
Index No. 305

Type SP Asphaltic Concrete

12"

Shoulder Joint Seal

EXIST CONCRETE

CONCRETE TRAVEL LANES, SHOULDERS, AND AUXILIARY PAVEMENT

NEW CONSTRUCTION

Filter Fabric Type D-3
(See Specifications Section 985)

4" Dia Special Perforated Pipe (Non corrugated Or Smooth Lined Corrugated Only)
(See Sheet 1)

1'-6" 10" Min.

REHABILITATION

DRAINCRETE SUBDRAINAGE

NOTES FOR DRAINCRETE PAVEMENT SUBDRAINAGE

1. The edgdrain sections for DRAINCRETE SUBDRAINAGE are applicable to pavement construction identified as RIGID PAVEMENT on Index No. 505, Sheet 2 and 4.

2. The contractor shall confine the construction of draincrete edgdrain to an area in which the entire operation can be carried out in five (5) work days, unless another construction period is called for in the plans, with sufficient time allowed for the draincrete to set before placement of pavement.

METHOD OF PAYMENT

NEW CONSTRUCTION:

1. The contract unit price for Edgdrain (Draincrete) LF shall be full compensation for trench excavation, disposal of excess material, filter fabric, draincrete edgdrain pipe and fittings and draincrete.

Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

FOR REHABILITATION:

1. The contract unit price for Edgdrain (Draincrete) LF shall be full compensation for removal of existing shoulder pavement, trench excavation, disposal of excess materials, filter fabric, draincrete edgdrain pipe and fittings, and draincrete, necessary for edgdrain construction.

Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

Shoulder pavement shall be paid for under the contract unit price for Type SP, Asphaltic Concrete.

Shoulder joint seal shall be paid for under the contract unit price for Pavement Joint, LF.
NOTES FOR DRAINCRETE PAVEMENT SUBDRAINAGE

1. The edgdrain sections for DRAINCRETE SUBDRAINAGE are applicable to pavement construction identified as RIGID PAVEMENT on Index No. 505, Sheet 2 and 3.

2. The contractor shall confine the construction of draincrete edgdrain to an area in which the entire operation can be carried out in five (5) work days, unless another construction period is called for in the plans, with sufficient time allowed for the draincrete to set before placement of pavement.

METHOD OF PAYMENT

1. The contract unit price for Edgdrain (Draincrete) LF shall be full compensation for trench excavation, disposal of excess materials, filter fabric, draincrete edgdrain pipe and fittings and draincrete.

Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

2. Type B-12.5 shall be paid for under the contract unit price for Optional Base.

3. Shoulder pavement shall be paid for under the contract unit price for Type SP, Asphaltic Concrete.
GENERAL NOTES FOR TREATED PERMEABLE BASE EDGEDRAIN

NEW CONSTRUCTION

1. The contractor shall confine the construction of edgedrain to an area in which the entire operation can be carried out in (5) work days, unless another construction period is called for in the plans.

METHOD OF PAYMENT

NEW CONSTRUCTION

1. Payment shall be full compensation for trench excavation, disposal of excess materials, filter fabric, pipe and fittings, necessary for concrete pavement subdrainage construction. Payment shall be included in the cost for Asphalt Treated Permeable Base, CP or Cement Treated Permeable Base, CT.

Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

2. Shoulder pavement and separation layer shall be paid for under the contract unit price for Type SP, Asphaltic Concrete.

CONCRETE TRAVEL LANE, SHOULDERS, AND AUXILIARY PAVEMENT

ASPHALT SHOULDERS

TREATED PERMEABLE BASE SUBDRAINAGE
24" STEEL WELL GRATE

Heavy duty "bee hive" grate
Openings: 1-½" maximum
Total Opening: 1.7 sq ft minimum

For 24" well, outer diameter = 29
Steel well grate to be installed over 24" deep well.
Steel grate to be hot dipped galvanized after fabrication, see Specification Section 962.

STRUCTURE WITH NO OUTFLOW

SECTION A-A

SPECIAL MANHOLE STRUCTURE

DETAIL WITH OUTFALL

Design Notes

1. Depth of Casing Varies, 60' min.
2. Depth of Open Hole, 19'-20.
3. Actual Size Of The Inflow And Outflow Chambers Will Be Determined By The Size Of The Pipes (Refer To Table 3 Of Index 200.) The Width Of The Box Shall Be Constant Based On The Largest Pipe. The Length Is To Be Adjusted Based On Size and Orientation Of The Pipes.
**TABLE 1 NOTE:** Splice lengths are based on an AASHTO Class B tension lap splice for the Specification Section 346 concrete class shown.

**SPLICE (CLASS B)**

**NOTE:** For Culvert Skew see Contract Plans.

**HEADWALL & WINGWALL ALIGNMENT**

**GENERAL NOTES:**

**LIVE LOAD:** HL-93.

**CONSTRUCTION LOADING:** It is the construction Contractor's responsibility to provide for supporting construction loads that exceed AASHTO HL-93, and any construction load applied prior to 2 feet of compacted fill placed above the top slab.

**SURFACE FINISH:** All concrete surfaces shall receive a general surface finish.

**SKewed CONSTRUCTION JOINTS:** Construction joints in barrels of culverts with skewed wingwalls may be placed parallel to the headwalls and the reinforcing steel, and the slabs may be cut provided that the cut reinforcing steel extends beyond the construction joint enough for splices to be made in accordance with Table 1 on this sheet. The cost of construction joints and additional reinforcing shall be at the expense of the Contractor.

**CULVERT EXTENSIONS:** For cut backs and ties into existing concrete box culverts see Sheet 6 of 7.

**REINFORCING STEEL:** See the "Box Culvert Data Tables" in the Contract Plans for grade and bar spacing. See the Reinforcing Bar List in the Contract Plans for bar sizes and bar bending details.

**SCHEMATIC "A" - PLAN VIEW**

**HEAdWALL & WINGWALL ALIGNMENT**

**NOTE:** All headwall and culvert skew angles are measured in degrees from a line perpendicular to the centerline of culvert (counter-clockwise positive), see Schematic "B".

**SKEWED CONSTRUCTION JOINTS:** Construction joints in barrels of culverts with skewed wingwalls may be placed parallel to the headwalls and the reinforcing steel, and the slabs may be cut provided that the cut reinforcing steel extends beyond the construction joint enough for splices to be made in accordance with Table 1 on this sheet. The cost of construction joints and additional reinforcing shall be at the expense of the Contractor.

**CULVERT EXTENSIONS:** For cut backs and ties into existing concrete box culverts see Sheet 6 of 7.

**REINFORCING STEEL:** See the "Box Culvert Data Tables" in the Contract Plans for grade and bar spacing. See the Reinforcing Bar List in the Contract Plans for bar sizes and bar bending details.

**SCHEMATIC "B" - PLAN VIEW**

**CULVERT ALIGNMENT**

**GENERAL NOTES:**

**LIVE LOAD:** HL-93.

**CONSTRUCTION LOADING:** It is the construction Contractor's responsibility to provide for supporting construction loads that exceed AASHTO HL-93, and any construction load applied prior to 2 feet of compacted fill placed above the top slab.

**SURFACE FINISH:** All concrete surfaces shall receive a general surface finish.

**SKewed CONSTRUCTION JOINTS:** Construction joints in barrels of culverts with skewed wingwalls may be placed parallel to the headwalls and the reinforcing steel, and the slabs may be cut provided that the cut reinforcing steel extends beyond the construction joint enough for splices to be made in accordance with Table 1 on this sheet. The cost of construction joints and additional reinforcing shall be at the expense of the Contractor.

**CULVERT EXTENSIONS:** For cut backs and ties into existing concrete box culverts see Sheet 6 of 7.

**REINFORCING STEEL:** See the "Box Culvert Data Tables" in the Contract Plans for grade and bar spacing. See the Reinforcing Bar List in the Contract Plans for bar sizes and bar bending details.

**TABLE 1 - MINIMUM BAR SPLICE LENGTHS FOR LONGITUDINAL REINFORCING**

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>SPLICE (CLASS B)</th>
<th>BAR SIZE</th>
<th>SPLICE (CLASS B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot;</td>
<td>1&quot;</td>
<td>5/8&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>1/4&quot;</td>
<td>7/8&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>5/8&quot;</td>
<td>1&quot;</td>
<td>10/24&quot;</td>
</tr>
<tr>
<td>5/8&quot;</td>
<td>5/8&quot;</td>
<td>7/8&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>1&quot;</td>
<td>9/16&quot;</td>
<td>9/16&quot;</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>7/8&quot;</td>
<td>1&quot;</td>
<td>10/24&quot;</td>
</tr>
</tbody>
</table>

**TABLE 1 NOTE:** Splice lengths are based on an AASHTO Class B tension lap splice for the Specification Section 346 concrete class shown.
**CULVERT BARREL NOTES:**

1. Space Bars 110 and 111 with a bar in each corner, and at the ¼ of interior walls (for multiple barrel culverts only), and the remaining bars placed at equal spacing shown in the Contract Plans. Adjust last bar spacing when required.
2. Place Bars 113 and 114 at spacing shown in the Contract Plans evenly between Bars 109 and 111.
3. Locate the first transverse bar from the ends of the culvert at one half the bar spacing, but provide the minimum reinforcement cover and not greater than 4” clear.

**TYPICAL SECTION THRU SINGLE BARREL CULVERT**

**WINGWALL ELEVATION - Variable Height**

(Left End shown - other corners similar)

**WINGWALL NOTES:**

1. Align construction joint perpendicular to wingwall.
2. In the vicinity of the construction joint, field bend reinforcement as necessary to maintain minimum reinforcement cover.
3. For constant height wingwalls, variable length Bars 403, 405 & 408 are not required, and as such the limits of Bars 401 & 407 extend the full length of the wingwall, and the limits of Bars 402 & 404 extend to the full height of the wingwall.

**WINGWALL SECTION A-A**
NOTES:
2. WP = Working Point, used for wingwall layout and location of construction joint. See Detail C (Sheet 5).
2" x 2"
Chamfer
(Typ.)
Blhw
Bars 801
(Bars 804)
Optional
Construction
Joint (Typ.)
Bars 803
(Bars 806)
H lh w
6" x 6"
Chamfer
(Typ.)
Bars 802
(Bars 805)
(Typ.)
End of Barrel &
Face of Headwall
Edge of
Chamfer
1'-6"
Bars 807
(Bars 810)
(Hlcw
(Typ.)
Blcw
1/3 Ti
6"
Interior Wall
6" Side
Chamfer
6" Top
Chamfer
3/4" V-Groove at 6"
Construction Joint
in Vertical Face of
Wingwall Only
See Note 1
DETAIL "D"

DETAIL "E"

CROSS REFERENCE:
See Sheet 3 for locations of Details "D", "E", "F" & "K".
See Sheet 4 for locations of Detail "C".

DETAIL "F"

DETAIL "G"

SECTION H-H
LEFT CUTOFF WALL SECTION
(Right Cutoff Wall Similar)

DETAIL "I"
TRAFFIC RAILING ATTACHMENT TO HEADWALL

Provide supplemental top bars
(Min. 5'-0" long) (See Note 6)

DETAIL "J"
LEFT HEADWALL SECTION
(Right Headwall similar)

NOTES:
1. For small angles, the Contractor may elect to fill the area between the box and the wingwall footing with unreinforced concrete. For wingwall skew angles less then 90 degrees, field bend wingwall reinforcement as necessary while maintaining cover. No additional payment will be made for this work.
2. Location of Construction joint determined by WP at theoretical intersection of:
   - Soil side face of Headwall and outside face of Box Exterior Wall, for SW<90°;
   - Outside face of Wingwall and outside face of Box Exterior Wall, for SW>90°.
3. Provide 6" chamfer when angle 'A' is greater than 45°. Maintain minimum wall thickness. Field adjust reinforcing to maintain cover.
4. Wingwall Skew Angles (SW) are measured from the adjacent box exterior wall to the wingwall.
5. Turn or extend Wingwall Cutoff Wall as necessary to meet Box Cutoff Wall.
6. Provide additional reinforcement in the top of the top slab below traffic railings to ensure a minimum area of 0.80 sq. in./ft. transverse reinforcing.

DETAIL "K"
LEFT CUTOFF WALL SECTION
(Right Cutoff Wall similar)

CROSS REFERENCE:
See Traffic Railing Index for reinforcing details

Provide additional 3" Ø Weep Holes @ 10'-0" spacing when base of Wingwall is exposed

Provide additional 3" Ø Weep Holes @ 16'-0" spacing when base of Wingwall is exposed

Underdrain Pipe
(See Index 286)
Type D-3 Filter Fabric
Coarse Aggregate

Underdrain Detail
(Similar to Type II ~ Index 286)
TYPE I CONNECTION DETAILS FOR CONCRETE BOX CULVERT EXTENSIONS
(CUT BACK EXISTING CONCRETE)

NOTES:
1. The Box Culvert Data Tables and Reinforcing Bar List do not include the additional quantities needed for dowel connections or transitions from double walls of existing concrete box culverts; the cost for additional reinforcement and the thickened concrete wall in the transitional area shall be included in the costs for concrete and steel in the culvert extension.
2. Cost for removal and disposal of material from existing headwalls, wingwalls and box, and cost of cleaning, straightening and extending or doweling longitudinal reinforcing steel shall be included in the cost for concrete and steel of the culvert extension.
3. Remove existing concrete while avoiding damage to existing reinforcement. Clean and straighten existing reinforcement, lap and tie onto extension reinforcement.
4. Dowel in #4 Bars @ 1'-6" max. spacing into wall/slab when there is a single mat of existing reinforcing steel, otherwise splice 1'-6" as shown for inside reinforcement. Use an Adhesive Bonding Material System in accordance with Specifications Section 416 & 937.
5. Provide additional transverse bars for top and bottom slab, parallel and full width of any skewed joint connection when shown in the Plans.
6. See Box Culvert Data Table notes in Plans for Connection Types allowed.

DETAIL "L" - TRANSITION FOR EXTERIOR WALL/SLAB EXTENSION
(Interior Single Walls Similar)

DETAIL "M" - TRANSITION FOR INTERIOR DOUBLE WALLS OF BOX CULVERTS
Concrete Box Culvert

Filter Fabric (both sides)
2'-0'
1'-0'
Coarse Aggregate
Bottom of Base
Use Extra Base When This Dimension is Less Than 12'
10'-0'
The cost of furnishing and installing extra friable base material shall be included in the cost of the Box Culvert.

Friable Base Material
Bottom of Base
Concrete Box Culvert
FRIABLE BASE

Use Extra Base When This Dimension is Less Than 12'
10'-0'
2'-0'
The cost of furnishing and installing extra friable base material shall be included in the cost of the Box Culvert.

INLET TYPE A GRATE

NOTES:
1. Cost of Steel Grating to be included in cost of Box Culvert.
2. All reinforcing shall be 2" clear for Slightly and Moderately Aggressive Environments, and 3" clear for Extremely Aggressive Environments.

INLET IN TOP OF BOX CULVERT

Location of Number
2' or more
(Bridge Culverts)
The number is to be placed in the center of the top surface of all bridge culvert headwalls. For Bridge Number see Plan/Profile sheets.

SECTION THRU RECESSED V-GROOVE TO FORM INSCRIBED FIGURES
Black Plastic Figures 3" in height as approved by the Engineer may be used in lieu of numbers formed by 3/8" V-Grooves. V-Grooves shall be formed by preformed figures.

BRIDGE CULVERT NUMBER LOCATION

INLET TYPE B GRATE

Paint Recessed Surfaces Black

SEE INDEX NO. 230 FOR GRATE DETAIL

SECTION A-A

SECTION B-B

EXTRA BASE FOR BOX CULVERTS CROSSING UNDER FLEXIBLE PAVEMENT

NOTE: Extra base is required when cross box culverts are located on facilities subject to high speed traffic (>45 mph) or high traffic volumes (>1600 ADT) and the cover is within the range specified in the notation above.

ASPHALTIC CONCRETE BASE

NOTE: Extra base is required when cross box culverts are located on facilities subject to high speed traffic (>45 mph) or high traffic volumes (>1600 ADT) and the cover is within the range specified in the notation above.

EXTRA BASE FOR BOX CULVERTS CROSSING UNDER FLEXIBLE PAVEMENT

NOTE: Extra base is required when cross box culverts are located on facilities subject to high speed traffic (>45 mph) or high traffic volumes (>1600 ADT) and the cover is within the range specified in the notation above.
### GENERAL NOTES:

1. Specifications:
   - General: FDOT Standard Specifications for Road and Bridge Construction, Section 410 (current edition, and supplements thereto).
   - Concrete (Precast):
     - Class III or Class II Modified (5,000 psi) for slightly aggressive environments.
     - Class IV (5,500 psi) for moderately to extremely aggressive environments.
   - Concrete (Cast-In-Place):
     - Class II (3,400 psi) for slightly aggressive environments.
     - Class IV (5,500 psi) for moderately to extremely aggressive environments.
   - Rebar:
     - Maintain minimum clearances of 2" for slightly and moderately aggressive environments, unless otherwise shown. Equal area substitution of welded wire (WWR) reinforcement is permitted.

2. Work this Index with the Cast-In-Place Concrete Box Culvert Details and Data Tables shown in the plans, Index No. 292 and the Precast Concrete Box Culverts shown in the shop drawings when approved.

3. All joints between precast sections must be tongue & groove with joint sealant. Joints between cast-in-place & precast sections shall have longitudinal reinforcing extending from top, bottom & both side slabs of the precast box tied to the cast-in-place reinforcement. Single barrel culverts may have precast headwalls cast integrally with the end segment when approved by the Engineer.

4. Extension of existing multiple barrel box culverts with multiple single cell precast box culverts is not permitted unless approved by the District Structures Engineer. Full transition details must be shown in the shop drawings when approved.

5. Culverts larger than the specified size may be substituted with no additional payment to the Contractor. Substitution must be approved by the Engineer, minimum earth cover and invert elevations shown in the Contract Documents must be maintained.

### PERMITTED PRECAST ALTERNATE BOX SECTIONS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>SINGLE BARREL</th>
<th>MULTIPLE BARRELS</th>
<th>DESIGN NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Single Cell Mosaicitic (Four Sided)</td>
<td><img src="image" alt="Single Cell Mosaicitic (Four Sided)" /></td>
<td><img src="image" alt="Multiple Cells" /></td>
<td>Index No. 292</td>
</tr>
<tr>
<td>B</td>
<td>Single Cell Two-Piece (Four Sided)</td>
<td><img src="image" alt="Single Cell Two-Piece (Four Sided)" /></td>
<td><img src="image" alt="Multiple Cells" /></td>
<td>Contractor Design</td>
</tr>
<tr>
<td>C</td>
<td>Multi-Cell Monolithic</td>
<td><img src="image" alt="Multi-Cell Monolithic" /></td>
<td><img src="image" alt="Multiple Cells" /></td>
<td>Contractor Design</td>
</tr>
</tbody>
</table>

### SUPPLEMENTAL DETAILS FOR PRECAST CONCRETE BOX CULVERTS

**INDEX NO. 291**

**DESIGN STANDARDS**

**FY 2017-18**

**SHEET NO. 1 of 5**
Bottom Slab Joints in Type B Boxes may be single tongue & groove joints as shown in Section A-A when the Top Slab Joints are oriented as shown in Schematic "A".

* At the Contractor's option when the box culvert reinforcing utilizes WWR, extend wall and slab reinforcing into the joint and bend to maintain cover in lieu of 4\(\times\)4\(\times\)W4.0\(\times\)W4.0 WWR at joint. Transverse wire in tongue may be cut at corners of box to allow bending of the WWR.

ALTERNATE BOTTOM SLAB TRANSVERSE JOINT TYPICAL SECTION (DOUBLE-SIDED TONGUE & GROOVE JOINT) (All reinforcing not shown for clarity)

PRECAST SEGMENT TO SEGMENT TONGUE & GROOVE TRANSVERSE JOINTS

TWO-PIECE PRECAST SEGMENT ADDITIONAL JOINT DETAILS (TYPE B BOX)

SUPPLEMENTAL DETAILS FOR PRECAST CONCRETE BOX CULVERTS

DESCRIPTION:

REV.

INDEX

SD. 2017-18

CONTRACTOR:

FDO/TC

10/26/16

07/01/15

SUPPLEMENTAL DETAILS FOR PRECAST CONCRETE BOX CULVERTS

INDEX NO. 291

2 of 5
**SECTION D-D**

**C-I-P TOE SLAB & CUTOFF WALL DETAILS AND CONNECTION TO PRECAST BOX**

- Provide additional 6" depth of cutoff wall at no additional cost.

**SECTION E-E**

**EXTERIOR WALL/SLAB TRANSITION DETAIL FOR PRECAST EXTENSION**

- Type I Connection shown, Type II Connection similar.

---

**TYPE B BOX LONGITUDINAL JOINTS**

**SECTION B-B**

**TOP SLAB TO WALL JOINT (KEYED JOINT)**

- Provide adequate width to satisfy shear strength requirements at joint.

---

**SECTION B-B**

**TOP SLAB TO WALL JOINT (HAUNCHED JOINT)**

---

**SUPPLEMENTAL DETAILS FOR PRECAST CONCRETE BOX CULVERTS**

- 01/01/12
PIPE BLOCKOUT NOTES:
1. Cut box culvert reinforcement as required to maintain 2" cover.
2. For Precast Sections construct opening a minimum of 1'-6" away from any box to box joint, except opening may be a minimum of 1'-0" away from joint when at least 2'-0" of clearance to the box to box joint is provided on the opposite side of the pipe opening.
3. Pipe blockout diameter to be 6" greater than pipe outside diameter.
4. See Drainage Plans for size, placement, and invert elevation.

C-1-P END CAP DETAILS AND CONNECTION TO PRECAST BOX

VIEW G-G

(By Cutoff Wall Reinforcing not shown for clarity)

SECTION H-H

(SHOWING ADDITIONAL BLOCKOUT REINFORCING ONLY)

Provide 50% of vertical reinforcing cut by blockout on each side of pipe at each face (Typ.)

SECTION I-I

(Showing additional blockout reinforcing only)
**Differential Settlement Countermeasures for Precast Box Culverts**

**Link Slab Notes:**
1. Provide a Cast-In-Place Link Slab to ensure uniform joint opening of precast box culverts when the differential settlement shown in the plans exceeds the following limits, except that a Link Slab is not required for differential settlements less than 1/8".

\[ \Delta Y = \frac{\Delta V}{250 \times R \times W} \]

Where:
- \( \Delta V \) = Maximum Long-Term Differential Settlement (ft.)
- \( R \) = Exterior height of Box Culvert (ft.)
- \( W \) = Length of Box Culvert Segments (ft.)
- \( L \) = Effective length for single curvature deflection (ft.)

2. Extend Link Slab to back face of headwalls and to limits of existing box culverts for extensions.

**Estimated Link Slab Quantities**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II or IV Concrete (Culvert)</td>
<td>CY/SF</td>
<td>0.0216</td>
</tr>
<tr>
<td>Reinforcing Steel (Roadway)</td>
<td>Lb./SF</td>
<td>1.52</td>
</tr>
</tbody>
</table>

**NOTE:** Estimated quantities are based on the plan area of precast box slabs, and are provided for information only. No additional payment will be made for Link Slabs where these are required for the precast box culverts.

**Design Note:**
1. Link Slab required when joint openings from differential settlement exceed 1/8" as determined in Link Slab Note 1.
STANDARD PRECAST BOX CULVERT WITH 2" CONCRETE COVER

DESIGN STANDARDS FY 2017-18

NOTES:
1. Work this Index with Index No. 291.
2. See sheets 2 thru 5 for dimensions and areas of reinforcement.

SECTION A-A

SECTION B-B

TYPICAL SECTION THRU JOINT

TYPICAL BOX SECTION (TYPE 1)
DESIGN EARTH COVER LESS THAN 2'
(Option 1 Reinforcing Configuration Shown)

TYPICAL BOX SECTION (TYPE 2)
DESIGN EARTH COVER 2' OR GREATER
(Option 1 Reinforcing Configuration Shown)

DETAIL "A" (OPTION 1)

DETAIL "A" (OPTION 2)

DETAIL "A" (OPTION 3)

DETAIL "B" (OPTION 1)

DETAIL "B" (OPTION 2)

DETAIL "B" (OPTION 3)

STANDARD PRECAST CONCRETE BOX CULVERTS

INDEX NO. 292

1 of 14 SHEET
GENERAL NOTES:
1. These precast designs may be substituted for cast-in-place box culverts designed to AASHTO LRFD Bridge Design Specifications, 4th Edition. Designs are based on the design criteria shown in FDOT Structures Design Guidelines.
2. Loading: HL-93 & any fill heights between the minimum & maximum shown.
3. Only one design of precast box culvert is to be used for any installation.
4. Reinforcing steel must consist of smooth or deformed welded wire reinforcement (WWR) meeting the requirements of Specification Section 931. Longitudinal reinforcement may consist of reinforcing bars meeting the requirements of Specification Section 931. Minimum cover must be 2" for slightly or moderately aggressive environments or 3" for extremely aggressive environments, unless otherwise shown. The spacing of circumferential wires must not be less than 2", nor more than 8". The spacing of longitudinal wires or bars must not be more than 8".
5. As9 longitudinal wires must have a minimum cross-sectional area of 40% of the circumferential wires, but not less than a #2.5 or #4 for WWR, or #3 bars for deformed bars.
6. Welding of reinforcement must be limited to the locations shown in ASTM C1577 and in accordance with ANSI/AWS D1.4 "Structural Welding Code - Reinforcing Steel".
7. For alternate reinforcing configuration options 2 and 3 shown in Detail "W" and "B" (Sheet 1), As3 may be extended to the middle of either slab and lap spliced with As7 and As8. As4 may be lap spliced at any location or connected to As2 or As3 at corners by welding.
8. Haunch dimensions may vary between the minimum and maximum dimensions shown in the Design Tables but only one haunch dimension must be used within the full length of the box culvert installation.

### Table 1A - Standard Precast Concrete Box Culvert Designs (2" Cover) - 3' & 4' Spans

<table>
<thead>
<tr>
<th>SPAN x RISE (S) (R)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN</th>
<th>EARTH COVER</th>
<th>REINFORCEMENT AREAS (sq. in./ft.)</th>
<th>AS4 EXT LENGTH (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 x 3</td>
<td>7 x 7</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.33 - &lt;2</td>
<td>0.17 0.29 0.31 0.17 0.17 0.17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3</td>
<td>0.13 0.26 0.21 0.09</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 x 4</td>
<td>0.09 0.17 0.09 0.09</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5' - 10</td>
<td>0.09 0.17 0.09 0.09</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td>0.17 0.17 0.17 0.17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 x 3</td>
<td>0.19 0.38 0.26 0.17 0.17 0.17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3</td>
<td>0.19 0.38 0.26 0.17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 x 4</td>
<td>0.19 0.38 0.26 0.17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5' - 10</td>
<td>0.19 0.38 0.26 0.17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td>0.19 0.38 0.26 0.17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See General Notes 5.

### Table 1B - Standard Precast Concrete Box Culvert Designs (2" Cover) - 3' & 4' Spans

<table>
<thead>
<tr>
<th>SPAN x RISE (S) (R)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN</th>
<th>EARTH COVER</th>
<th>REINFORCEMENT AREAS (sq. in./ft.)</th>
<th>AS4 EXT LENGTH (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 x 3</td>
<td>8 x 8</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.33 - &lt;2</td>
<td>0.20 0.26 0.32 0.20 0.20 0.20</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3</td>
<td>0.16 0.25 0.31 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 x 4</td>
<td>0.12 0.20 0.20 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5' - 10</td>
<td>0.10 0.20 0.20 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td>0.17 0.20 0.20 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 x 3</td>
<td>0.33 - &lt;2</td>
<td>0.20 0.31 0.22 0.20 0.20 0.20</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3</td>
<td>0.12 0.22 0.22 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 x 4</td>
<td>0.12 0.22 0.22 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5' - 10</td>
<td>0.10 0.20 0.20 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td>0.19 0.24 0.24 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 x 4</td>
<td>0.33 - &lt;2</td>
<td>0.20 0.33 0.24 0.20 0.20 0.20</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3</td>
<td>0.13 0.24 0.24 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 x 4</td>
<td>0.12 0.20 0.20 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5' - 10</td>
<td>0.10 0.20 0.20 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8'</td>
<td>0.19 0.24 0.24 0.10</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For Design Earth Cover greater than 10 feet, the Contractor may interpolate the required areas of reinforcement and slab or wall thickness. Interpolated areas shown in Tables are provided.

- Nominal Cover is 2" for slightly or moderately aggressive environments or 3" for extremely aggressive environments, unless otherwise shown.
- Cover greater than 10 feet, the Contractor may interpolate the required areas of reinforcement and slab or wall thickness. Interpolated areas shown in Tables are provided.
- 8. Haunch dimensions may vary between the minimum and maximum dimensions shown in the Design Tables but only one haunch dimension must be used within the full length of the box culvert installation.

### Notes:
1. See Sheet 1 for reinforcing details and dimension locations.
2. See Sheet 14 for WWR bending diagram.
3. See General Notes 5.
4. See General Notes 5.
5. See General Notes 5.
6. See General Notes 5.
7. See General Notes 5.
8. See General Notes 5.
9. See General Notes 5.
10. See General Notes 5.
11. See General Notes 5.
12. See General Notes 5.

**Schematic of Lap Splice Locations**

**Index No. 292**
### TABLE 2A - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 5' & 6' SPANS

<table>
<thead>
<tr>
<th>SPAN (Ft)</th>
<th>TOP SLAB</th>
<th>BTG (In.)</th>
<th>S l (In.)</th>
<th>MAUNCH (In.)</th>
<th>DESIGN (As2)</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5' x 3</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>0.33 - &lt;7</td>
<td>0.31 - 0.48</td>
</tr>
<tr>
<td>6' x 3</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>0.33</td>
<td>0.31 - 0.48</td>
</tr>
<tr>
<td>5' x 4</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>0.33</td>
<td>0.31 - 0.48</td>
</tr>
<tr>
<td>6' x 4</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>0.33</td>
<td>0.31 - 0.48</td>
</tr>
<tr>
<td>5' x 5</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>0.33</td>
<td>0.31 - 0.48</td>
</tr>
<tr>
<td>6' x 5</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>0.33</td>
<td>0.31 - 0.48</td>
</tr>
<tr>
<td>5' x 6</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>0.33</td>
<td>0.31 - 0.48</td>
</tr>
<tr>
<td>6' x 6</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>0.33</td>
<td>0.31 - 0.48</td>
</tr>
</tbody>
</table>

### TABLE 2B - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 5' & 6' SPANS

<table>
<thead>
<tr>
<th>SPAN (Ft)</th>
<th>TOP SLAB</th>
<th>BTG (In.)</th>
<th>S l (In.)</th>
<th>MAUNCH (In.)</th>
<th>DESIGN (As2)</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5' x 3</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33 - &lt;7</td>
<td>0.26 - 0.48</td>
</tr>
<tr>
<td>6' x 3</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33</td>
<td>0.26 - 0.48</td>
</tr>
<tr>
<td>5' x 4</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33</td>
<td>0.26 - 0.48</td>
</tr>
<tr>
<td>6' x 4</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33</td>
<td>0.26 - 0.48</td>
</tr>
<tr>
<td>5' x 5</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33</td>
<td>0.26 - 0.48</td>
</tr>
<tr>
<td>6' x 5</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33</td>
<td>0.26 - 0.48</td>
</tr>
<tr>
<td>5' x 6</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33</td>
<td>0.26 - 0.48</td>
</tr>
<tr>
<td>6' x 6</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>0.33</td>
<td>0.26 - 0.48</td>
</tr>
</tbody>
</table>

**Note:** The table includes spans, top slabs, BTG, slabs, and other relevant dimensions and design values for various configurations of standard precast box culverts. These values are critical for design and engineering processes in civil and structural engineering.
### TABLE 3 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 7' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER (sq. in./Ft.)</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT. LENGTH (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Sft)</td>
<td>(in.)</td>
<td>TOP SLAB</td>
<td>MAUNCH (in.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(in.)</td>
<td>BGT (in.)</td>
<td>SID (in.)</td>
<td></td>
</tr>
<tr>
<td>7' x 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8</td>
<td>8 8 8</td>
<td>4</td>
<td>0.33 x 82</td>
<td>0.79 x 0.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.37 x 0.58</td>
<td>0.30 x 0.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.49 x 0.37</td>
<td>0.37 x 0.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/128</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 4 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 8' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER (sq. in./Ft.)</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT. LENGTH (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Sft)</td>
<td>(in.)</td>
<td>TOP SLAB</td>
<td>MAUNCH (in.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(in.)</td>
<td>BGT (in.)</td>
<td>SID (in.)</td>
<td></td>
</tr>
<tr>
<td>8' x 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/128</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/256</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/512</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/1024</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8' x 8 1/2048</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. See Sheet 1 for Reinforcing Details and dimension locations.
2. See Sheet 2 for General Notes.
### TABLE 5 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 9' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S)</th>
<th>TOP SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT. LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ft.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 x 5</td>
<td>9 9 9 9</td>
<td>4</td>
<td>0.33 &lt; 2</td>
<td>2 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.41 0.62 0.53 0.22 0.23 0.34 0.38</td>
<td>10 10 12</td>
</tr>
<tr>
<td>9 x 6</td>
<td>9 9 9 9</td>
<td>10</td>
<td>0.37 0.57 0.59 0.11</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.43 0.67 0.57 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 7</td>
<td>9 9 9 9</td>
<td>10</td>
<td>0.37 0.57 0.56 0.11</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.43 0.66 0.66 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 8</td>
<td>9 9 9 9</td>
<td>4</td>
<td>0.33 &lt; 2</td>
<td>2 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.41 0.71 0.62 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 9</td>
<td>9 9 9 9</td>
<td>10</td>
<td>0.37 0.57 0.59 0.11</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.43 0.73 0.73 0.15</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 6</td>
<td>9 9 9 9</td>
<td>8 to</td>
<td>25 0.77 0.90 0.90 0.11</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.68 0.88 0.87 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 5</td>
<td>9 9 9 9</td>
<td>10</td>
<td>9.5 9.5 10.5 8 to</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25 0.81 1.03 1.02 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 6</td>
<td>9 9 9 9</td>
<td>12</td>
<td>9.5 9.5 10.5 8 to</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 0.80 1.04 1.04 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 7</td>
<td>9 9 9 9</td>
<td>12</td>
<td>9.5 9.5 10.5 8 to</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 0.80 1.04 1.04 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>9 x 8</td>
<td>9 9 9 9</td>
<td>12</td>
<td>9.5 9.5 10.5 8 to</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 0.80 1.04 1.04 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
</tbody>
</table>

### TABLE 6 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 10' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S)</th>
<th>TOP SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT. LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ft.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 x 5</td>
<td>10 10 10</td>
<td>4</td>
<td>0.33 &lt; 2</td>
<td>0.46 0.62 0.57 0.24 0.24 0.41 0.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.54 0.72 0.64 0.17</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>10 x 6</td>
<td>10 10 10</td>
<td>10</td>
<td>0.37 0.57 0.59 0.11</td>
<td>0.37 0.57 0.59 0.11 0.67 0.87 0.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.44 0.64 0.64 0.17</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>10 x 7</td>
<td>10 10 10</td>
<td>10</td>
<td>0.37 0.57 0.56 0.11</td>
<td>0.37 0.57 0.59 0.11 0.67 0.87 0.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.44 0.64 0.64 0.17</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>10 x 8</td>
<td>10 10 10</td>
<td>10</td>
<td>0.37 0.57 0.59 0.11</td>
<td>0.37 0.57 0.59 0.11 0.67 0.87 0.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.44 0.64 0.64 0.17</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>10 x 9</td>
<td>10 10 10</td>
<td>8 to</td>
<td>10.5 10.5 10.5 8 to</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25 0.81 0.97 0.93 0.12</td>
<td>0.67 0.87 0.80</td>
</tr>
<tr>
<td>10 x 10</td>
<td>10 10 10</td>
<td>12</td>
<td>10.5 10.5 10.5 8 to</td>
<td>0.33 &lt; 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 0.80 1.04 1.04 0.11</td>
<td>0.67 0.87 0.80</td>
</tr>
</tbody>
</table>

**NOTES:**
1. See Sheet 1 for Reinforcing Details and dimension locations.
2. See Sheet 2 for General Notes.
3. See Sheet 14 for WWR Bending Diagram.
### TABLE 7 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 11' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT. LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11' x 4</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>11' x 6</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>11' x 8</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>12' x 4</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>12' x 6</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>12' x 8</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
</tbody>
</table>

### TABLE 8 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 12' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT. LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11' x 4</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>11' x 6</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>11' x 8</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>12' x 4</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>12' x 6</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
<tr>
<td>12' x 8</td>
<td></td>
<td>4</td>
<td>0.37 to 7</td>
<td>0.57 to 7</td>
</tr>
</tbody>
</table>

**NOTES:**
1. See Sheet 1 for Reinforcing Details and dimension locations.
2. See Sheet 2 for General Notes.
### TABLE 9A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 3' & 4' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./ft.)</th>
<th>AS1 EXT LENGTH (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3' x 3</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>3' x 4</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>4' x 3</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>4' x 4</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

### TABLE 9B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 3' & 4' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./ft.)</th>
<th>AS1 EXT LENGTH (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3' x 3</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>3' x 4</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4' x 3</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4' x 4</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

**NOTES:**
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
### TABLE 10A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 5' & 6' SPANS

<table>
<thead>
<tr>
<th>SPAN (ft)</th>
<th>TOP RAISER (in.)</th>
<th>SLAB / WALL THICKNESS (in.)</th>
<th>DESIGN EARTH COVER (sq. ft./ft.)</th>
<th>REINFORCEMENT AREAS (sq. ft./ft.)</th>
<th>AS1 EST. LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5' x 3</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>5' x 4</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>5' x 5</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>6' x 3</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>6' x 4</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>6' x 5</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>

### TABLE 10B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 5' & 6' SPANS

<table>
<thead>
<tr>
<th>SPAN (ft)</th>
<th>TOP RAISER (in.)</th>
<th>SLAB / WALL THICKNESS (in.)</th>
<th>DESIGN EARTH COVER (sq. ft./ft.)</th>
<th>REINFORCEMENT AREAS (sq. ft./ft.)</th>
<th>AS1 EST. LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5' x 3</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>5' x 4</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>5' x 5</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>6' x 3</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>6' x 4</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>6' x 5</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>
### TABLE IIA - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 7' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S) (Ft)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>A11 EXT. LENGTH (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
</tr>
<tr>
<td>7' x 4</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.42</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>0.35 - &lt;3</td>
<td>0.24</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.35 - &lt;3</td>
<td>0.24</td>
<td>0.39</td>
</tr>
<tr>
<td>7' x 5</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.41</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0.35 - &lt;5</td>
<td>0.37</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.35 - &lt;5</td>
<td>0.37</td>
<td>0.48</td>
</tr>
<tr>
<td>7' x 6</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.43</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.35 - &lt;5</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.35 - &lt;5</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>7' x 7</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.44</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.35 - &lt;5</td>
<td>0.39</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.35 - &lt;5</td>
<td>0.39</td>
<td>0.51</td>
</tr>
</tbody>
</table>

### TABLE IIB - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 7' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE (S) (Ft)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>A11 EXT. LENGTH (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
</tr>
<tr>
<td>7' x 4</td>
<td>4</td>
<td>0.37 - &lt;2</td>
<td>0.31</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.37 - &lt;2</td>
<td>0.31</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.37 - &lt;2</td>
<td>0.31</td>
<td>0.49</td>
</tr>
<tr>
<td>7' x 5</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.25</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.33 - &lt;2</td>
<td>0.25</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.33 - &lt;2</td>
<td>0.25</td>
<td>0.35</td>
</tr>
<tr>
<td>7' x 6</td>
<td>4</td>
<td>0.32 - &lt;2</td>
<td>0.29</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.32 - &lt;2</td>
<td>0.29</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.32 - &lt;2</td>
<td>0.29</td>
<td>0.41</td>
</tr>
<tr>
<td>7' x 7</td>
<td>4</td>
<td>0.32 - &lt;2</td>
<td>0.26</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.32 - &lt;2</td>
<td>0.26</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.32 - &lt;2</td>
<td>0.26</td>
<td>0.42</td>
</tr>
</tbody>
</table>

**NOTES:**
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
<table>
<thead>
<tr>
<th>TOP SLAB / WALL THICKNESS</th>
<th>9</th>
<th>9</th>
<th>9</th>
<th>9</th>
<th>9</th>
<th>9</th>
<th>9</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH</td>
<td>8' x 6'</td>
<td>8' x 5'</td>
<td>8' x 8'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENFORCED SPAN (Ft.)</td>
<td>30'</td>
<td>20'</td>
<td>15'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOP SLAB DESIGN</td>
<td>3' - &lt;5'</td>
<td>2' - &lt;3'</td>
<td>5' - 10'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DESIGN STANDARDS</td>
<td>0.41</td>
<td>0.52</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See General Note 5
### TABLE 13A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 9' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE</th>
<th>TOP SLAB</th>
<th>BOAT (T)</th>
<th>SIDE WALL THICKNESS</th>
<th>DESIGN F/C FOOT</th>
<th>EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT LENGTH (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 x 5</td>
<td>9 9 9</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.62</td>
<td>0.78</td>
<td>0.65</td>
<td>0.26 0.52 0.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 3</td>
<td>0.33 - &lt;2</td>
<td>0.62</td>
<td>0.78</td>
<td>0.65</td>
<td>0.26 0.52 0.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 12</td>
<td>0.33 - &lt;2</td>
<td>0.62</td>
<td>0.78</td>
<td>0.65</td>
<td>0.26 0.52 0.61</td>
</tr>
<tr>
<td></td>
<td>5' 10'</td>
<td>10</td>
<td>1.26 1.28 1.28</td>
<td>0.8</td>
<td>1.26 1.28 1.28</td>
<td>0.8</td>
<td>1.26 1.28 1.28</td>
</tr>
<tr>
<td>9 x 6</td>
<td>9 9 9</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 3</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 12</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td>5' 10'</td>
<td>10</td>
<td>1.26 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
</tr>
<tr>
<td>9 x 7</td>
<td>9 9 9</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 3</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 12</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td>5' 10'</td>
<td>10</td>
<td>1.26 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
</tr>
<tr>
<td>9 x 8</td>
<td>9 9 9</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 3</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 12</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td>5' 10'</td>
<td>10</td>
<td>1.26 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
</tr>
</tbody>
</table>

### TABLE 13B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 9' SPANS

<table>
<thead>
<tr>
<th>SPAN x RISE</th>
<th>TOP SLAB</th>
<th>BOAT (T)</th>
<th>SIDE WALL THICKNESS</th>
<th>DESIGN F/C FOOT</th>
<th>EARTH COVER ABOVE TOP SLAB</th>
<th>REINFORCEMENT AREAS (sq. in./Ft.)</th>
<th>AS1 EXT LENGTH (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 x 5</td>
<td>10 10 10</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 3</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to 12</td>
<td>0.33 - &lt;2</td>
<td>0.66</td>
<td>0.81</td>
<td>0.69</td>
<td>0.27 0.51 0.60</td>
</tr>
<tr>
<td></td>
<td>5' 10'</td>
<td>10</td>
<td>1.26 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
<td>1.26</td>
<td>1.28 1.28 1.28</td>
</tr>
</tbody>
</table>

NOTES:
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
3. See Sheet 14 for WWR Bending Diagnons.
### TABLE 14 - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 10' SPANS

<table>
<thead>
<tr>
<th>SPAN X RISE (S)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER (in.)</th>
<th>REINFORCEMENT AREAS (sq. in./ft.)</th>
<th>AS1 EXT. LENGTH (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10' x 5</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A51, A52</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10' x 6</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A53, A54</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10' x 7</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A56, A57</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10' x 8</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A58, A59</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10' x 9</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A60, A61</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10' x 10</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A62, A63</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 15 - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 11' SPANS

<table>
<thead>
<tr>
<th>SPAN X RISE (S)</th>
<th>SLAB / WALL THICKNESS</th>
<th>DESIGN EARTH COVER (in.)</th>
<th>REINFORCEMENT AREAS (sq. in./ft.)</th>
<th>AS1 EXT. LENGTH (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11' x 4</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A64, A65</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11' x 5</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A66, A67</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11' x 6</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A68, A69</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11' x 7</td>
<td>4</td>
<td>0.33 - &lt;2</td>
<td>A70, A71</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
### TABLE 16 - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 12' SPANS

<table>
<thead>
<tr>
<th>SPAN (ft)</th>
<th>M (in.)</th>
<th>R (in.)</th>
<th>S (in.)</th>
<th>Tb (in.)</th>
<th>Tt (in.)</th>
<th>Tw (in.)</th>
<th>M, R, S, Tb, Tt, Tw (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12'</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12 x 12</td>
</tr>
<tr>
<td>12.5</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12 x 12</td>
</tr>
<tr>
<td>13'</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12 x 12</td>
</tr>
<tr>
<td>13.5</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5 x 12.5</td>
</tr>
<tr>
<td>14'</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14 x 14</td>
</tr>
<tr>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5 x 14.5</td>
</tr>
</tbody>
</table>

**REINFORCEMENT AREAS**

- See General Note 5

**See Tables 1 thru 16 for dimensions M, R, S, Tb, Tt and Tw.**
SAFETY MODIFICATION FOR INLETS IN BOX CULVERTS

LONGITUDINAL SECTION

PLAN

SECTION AA

SECTION BB
SAFETY MODIFICATIONS FOR ENDWALLS

DIMENSIONS AND QUANTITIES PER GRADE

<table>
<thead>
<tr>
<th>Slope</th>
<th>Pipe</th>
<th>Channels @ 3.4 Lbs./LF</th>
<th>Bars @ 3.4 Lbs./LF</th>
<th>Angles @ 3.2 Lbs./LF</th>
<th>(2)Total Weight-Lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:6</td>
<td>15°</td>
<td>10 - 2-10' 139 11'-6&quot; 3'-6&quot; 9'-6&quot; 9'-6&quot; 60 209</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18°</td>
<td>12</td>
<td>13 - 2-10' 183 11'-6&quot; 3'-6&quot; 134 11'-6&quot; 73 370</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24°</td>
<td>15</td>
<td>16 - 2-10' 269 16'-6&quot; 6'-6&quot; 186 16'-6&quot; 52 499</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30°</td>
<td>18</td>
<td>19 - 2-10' 372 16'-6&quot; 6'-6&quot; 162 16'-6&quot; 311 645</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DIMENSIONS AND QUANTITIES PER U-ENDWALL

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>G</th>
<th>M</th>
<th>D</th>
<th>R</th>
<th>Class I Concrete-CY</th>
<th>Reinforcing Steel-Lbs.</th>
<th>Sod</th>
</tr>
</thead>
<tbody>
<tr>
<td>15'</td>
<td>7'-9&quot;</td>
<td>3'-11&quot;</td>
<td>2'-2&quot;</td>
<td>8'-6&quot;</td>
<td>2-9' 13'-3&quot;</td>
<td>187 23</td>
<td></td>
</tr>
<tr>
<td>18'</td>
<td>7'-9&quot;</td>
<td>3'-11&quot;</td>
<td>2'-2&quot;</td>
<td>8'-6&quot;</td>
<td>2-9' 13'-3&quot;</td>
<td>187 23</td>
<td></td>
</tr>
<tr>
<td>24'</td>
<td>7'-9&quot;</td>
<td>4'-6&quot;</td>
<td>2'-11&quot;</td>
<td>10'-0&quot;</td>
<td>3-14 16'-3&quot;</td>
<td>238 29</td>
<td></td>
</tr>
<tr>
<td>30'</td>
<td>7'-9&quot;</td>
<td>4'-6&quot;</td>
<td>2'-11&quot;</td>
<td>10'-0&quot;</td>
<td>3-14 16'-3&quot;</td>
<td>238 29</td>
<td></td>
</tr>
</tbody>
</table>

1. For use criteria see "Steel Grating Use Criteria" Index No. 261.
2. Grates shall be ASTM A242, A572 or A588. Grade 50 steel, and galvanized in accordance with Section 975 and 423-3.2 of the Standard Specifications.
3. Channel section C3 x 6.0 may be substituted for the C4 x 5.4 channel.
4. All steel reinforcing bars are #4 with 2" cover except as noted. Spacings shown are center to center. Lapps to be 1'-5" minimum. Welded wire fabric (two cages max.) with an equivalent cross section area (0.20 sq. in.) may be substituted for bar reinforcement.
5. Drill 1½" holes 8" deep with a rotary drill in existing endwall for dowel bars. Holes shall be thoroughly cleaned prior to installing Adhesive-Bonded Dowels.
6. Endwall to be paid for under the contract unit price for Class I Concrete (Endwall), CY and Reinforcing Steel (Roadway), LB. Cost of Adhesive-Bonded Dowels to be included in the contract unit price for reinforcing steel. Cost of grates to be paid for under the contract unit price for Endwall Grate, LB. quantity. Cost of galvanized bolts and nuts to be included in the contract unit price for the grate.
7. Sod slopes 5' each side and above endwall. Sodding to be paid for under the contract unit price for Performance Turf, SY.