NOTES

TRAFFIC RAILINGS OR PARAPETS:
If there is a Traffic Railing or Parapet on the wall, align Wall Joints with V-Grooves, and Wall Expansion Joints with Barrier Open Joints.

FOUNDATION: Prepare the soil below the footing in accordance with the requirements for spread footings in Specification Section 455.

* Shear Key is required only when specified in the Plans.

NOTE: See Plans for Retaining Wall Data

REINFORCING STEEL BENDING DIAGRAMS
**Wall joint spacing** 25 ft. maximum and 5 ft. minimum. At minimum, every fourth wall joint to be an expansion joint. See Plans for actual wall joint spacing and expansion joint location.

TRAFFIC RAILING/JUNCTION SLAB DETAIL
(36° Single-Slope shown, other Traffic Railings similar)

3" Ø PVC Drain Pipe at 10 ft. max. spacing (Typ.) See Typical Backfill Detail—
Traffic Railing (Index 521-610, 36° Single-Slope shown, see Plans for Traffic Railing Type)

**STEM OFFSET VALUES**
(for H < 20 ft.)

\[
\text{Stem Offset (in.)} = \frac{H \text{ (Ft.)}}{16}
\]

**V-GROOVE DETAIL**

- ½ V-Groove across top and down front face of wall at joint (Typ.). Extend V-Groove down back of wall to 6" min. below ground. (see V-Groove Detail)
- At Contractor's option, surface treatments may terminate 6" below ground line
- See 'Detail A'

**SECTION A-A WALL JOINT DETAIL**

**EXPANSION JOINT DETAIL**

**TYPICAL CORNER JOINT DETAIL**

**TYPICAL BACKFILL DETAIL**

Inside ends of weep holes shall be covered with 1.0 square foot of galvanized mesh with ½" openings

Final Groundline shall be covered with 1.0 square foot of galvanized mesh with ½" openings

Limits of Excavation

Drain shall be continuous 1.5' x 1.5' clean, broken stone or gravel, graded and placed to allow free drainage. Place Type D-3 (see Specification Section 985) geotextile fabric, 1'-0" wide and full height of fill, to the back of wall and around the perimeter to prevent fill from washing out.

Slope backfill layers transversely and longitudinally as necessary to drain and prevent ponding during backfilling.

* Key to stop at top of footing and 6" from top of wall. Joint across footing and top of wall to be a straight line.
** Stay-In-Place Plastic Preformed Bond Beakers are permitted to form joints.

**Final Groundline**

Attach Type D-5 (see Specification Section 985) Geotextile fabric, 1'-0" wide and full height of fill, to the back of wall with an adhesive approved by the Engineer.

**STANDARD PLANS**

FY 2018-19

CANTILEVER RETAINING WALL (C-I-P)
KEYWAY & WALL JOINT DETAIL

(TOP VIEW)

TYPICAL SECTION

C-I-P CONCRETE GRAVITY WALL

ESTIMATED QUANTITIES FOR C-I-P WALL

PER LINEAR FOOT OF WALL

HEIGHT (FT.)

CLASS NS CONCRETE (C3)  REINF.
WEEP
HOLES & DRAIN NOD.

SCOPE 1  SCOPE 2  SCOPE 3  **

1'  0.08  0.11  (0.20)*  0.09  3 (4)**  No
2'  0.14  0.20  (0.32)*  0.09  4 (5)**  No
3'  0.22  0.32  (0.47)*  0.29  5 (6)***  Yes
4'  0.32  (0.63)*  0.47  (0.85)*  0.43  6 (7)**  Yes
5'  0.43  (0.80)*  0.65  (1.30)*  0.60  7 (9)**  Yes

ESTIMATED QUANTITIES NOTES:

For Scheme 3 Junction Slab and Traffic Railing see the referenced Index for estimated quantities.
* Quantity for 2'-0" Toe Depth.
** Quantity for Scheme 3 assumes 1'-3" thick coping above Gravity Wall.

GENERAL NOTES

1. C-I-P Gravity Walls constructed as extensions of reinforced concrete retaining walls, except walls of proprietary design, shall have the same face texture and finish as the reinforced concrete retaining wall.
2. Concrete for Gravity Wall shall be Class NS per Section 347. Concrete for Scheme 3 Junction Slab and Traffic Railing shall be Class II per Section 348, unless otherwise specified in the plans.
3. Reinforcing steel shall meet the requirements of Specification Section 931 (Grade 40 or 60). Smooth or Deformed Welded Wire Reinforcement (WWR) may be substituted on an equal area basis. Do not increase bar/wire spacing for Grade 60 reinforcing steel or WWR.
4. When required, for adjacent guardrail, see Index 315-070 or 315-080 as appropriate. For adjacent Type B fence see Index 550-002.
5. Joint Seal: Organic Felt bond breaker in accordance with Specification Section 400 or Type D-3 geotextile fabric in accordance with Specification Section 985. Map all contact surfaces of concrete and Organic Felt or geotextile fabric with cut-back asphalt. Stop Organic Felt or geotextile fabric 6" below top of wall.
6. Provide a continuous 1½" clean gravel or crushed rock drain for wall heights 3 ft. and higher. Wrap drainage layer as shown, with Type D-3 geotextile fabric in accordance with Specification Section 985. Provide 5" galvanized mesh with ½" openings, at the inside end of the PVC Drain Pipe. Provide 2 " PVC Drain Pipe (SCH 40) at 10 ft. max. spacing (when Drainage Layer is required). Locate or grout edge of Drain Pipe a minimum of 2'-0" from wall joints.
7. Joint Seal: Organic Felt bond breaker in accordance with Specification Section 400 or Type D-3 geotextile fabric in accordance with Specification Section 985. Map all contact surfaces of concrete and Organic Felt or geotextile fabric with cut-back asphalt. Stop Organic Felt or geotextile fabric 6" below top of wall.
8. Provide a continuous 1½" clean gravel or crushed rock drain for wall heights 3 ft. and higher. Wrap drainage layer as shown, with Type D-3 geotextile fabric in accordance with Specification Section 985. Provide 5" galvanized mesh with ½" openings, at the inside end of the PVC Drain Pipe. Provide 2 " PVC Drain Pipe (SCH 40) at 10 ft. max. spacing (when Drainage Layer is required). Locate or grout edge of Drain Pipe a minimum of 2'-0" from wall joints.
9. Cost of reinforcing steel, face texture, finish, joint seal, drain pipes, drainage layer, galvanized mesh and geotextile fabric to be included in the Unit Price for Concrete Class NS, Gravity Wall. Cost of concrete for Junction Slab in Scheme 3, to be included in Contract Unit Price for Concrete Traffic Railing Barrier. Adjunct Traffic Railing or Fencing to be paid for separately.

BILL OF REINFORCING STEEL

MARK  SIZE  LENGTH

0  4  As Reqd.
4  4  As Reqd.

BAR BENDING DIAGRAM

BAR A

BAR B

INDEX 400-011

F Y  2 0 1 8 - 1 9
STANDARD PLANS

GRAVITY WALL
**REVISION DESCRIPTION: STANDARD PLANS**

**FY 2018-19 SHEET INDEX 11/01/17**

**CONCRETE STEPS**

1. **NOTES:**
   1. Do not use this Index for suspended (structural) steps or stairways.
   2. Construct steps in accordance with Section 522 of the FDOT Standard Specifications.
   3. Concrete: Class NS, Specification 347.
   4. Tread Finish: Broom finish parallel to steps unless otherwise shown in Plans.
   6. Cost of concrete steps, landings and cheekwalls shall be paid for under the contract unit price for Class NS Concrete (Concrete Steps). Cost of reinforcing steel shall be paid for under the contract unit price for Reinforcing Steel (Miscellaneous), LB.

**STAIR TREAD AND RISER DETAILS**

- The greatest riser height within the flight of steps shall not exceed the smallest by more than 1/2".
- The greatest tread depth within the flight of steps shall not exceed the smallest by more than 3/16".

**ELEVATION**

- **Length of Intermediate Landing:** 1'-0" (2" Min. Cover)
- **Length of Landing:** 5'-0" Min.
- **Max. Landing Slope:** 2%
- **Max. Landing Cross-Slope:** 2%

**SECTION A-A**

- **Cheekwall Extension:**
- **Handrail (Typ.)**
- **3/4" Expansion Joint (Precast Unit Filler)**
- **Cheekwall**
- **Pedestrian Railing (Typ.)**

**SECTION B-B**

- **Cheekwall**
- **3/4" Cheekwall**
- **Handrail (Typ.)**
- **4 Bars (2" Min. Cover)**
- **#4 Bars (2" Min. Cover)**
- **#3 Bars (2" Min. Cover)**
- **#3 Bars (2" Min. Cover)**
- **#3 Bars (2" Min. Cover)**

**SECTION C-C**

- **Cheekwall**
- **Handrail (Typ.)**
- **3/4" Cheekwall**
- **4 Bars (2" Min. Cover)**
- **#3 Bars (2" Min. Cover)**
- **#3 Bars (2" Min. Cover)**
- **#3 Bars (2" Min. Cover)**

**PLAN AT JUNCTION OF STEPS & LANDING**

(Bottom Landing shown, Top Landing similar)

**NOTE:** Provide a maximum of 12 risers between landings.

- **Max. Landing Slope:** 2%
- **Max. Landing Cross-Slope:** 2%

**STAIR TREAD AND RISER DETAILS**

- **Tread Finish:** Broom finish parallel to steps unless otherwise shown in Plans.
- **Concrete:** Class NS, Specification 347.
- **Construct steps in accordance with Section 522 of the FDOT Standard Specifications.**
- **Do not use this Index for suspended (structural) steps or stairways.**
- **Pedestrian Railing:** See Indexes 515-052, 515-062, 515-070, 515-080 or Project Specific Design.
- **Cost of concrete steps, landings and cheekwalls shall be paid for under the contract unit price for Class NS Concrete (Concrete Steps). Cost of reinforcing steel shall be paid for under the contract unit price for Reinforcing Steel (Miscellaneous), LB.**

---

**INDEX 400-021**

1 of 1
**SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS**

**WEIGHT OF CASTINGS (lb)**

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>2&quot; OPENING</th>
<th>3&quot; OPENING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frame</td>
<td>Cover (Std.)</td>
</tr>
<tr>
<td>III</td>
<td>155</td>
<td>190</td>
</tr>
<tr>
<td>III</td>
<td>145</td>
<td>190</td>
</tr>
<tr>
<td>II</td>
<td>90</td>
<td>190</td>
</tr>
</tbody>
</table>

* Includes Type I Adjustable

**NOTES (FRAMES, AND COVER)**

1. The standard cover is to be used for all frames Types I, III, and the 2-piece cover, and is the replacement cover for all previous frames with 12" deep seats (traffic type). The 198 lb cover (nontraffic type), 1984 Roadway and Traffic Design Standards Index 201, is the replacement cover for existing frames with 12" deep seats. Installation of frame with 12" 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 use the 2-piece cover when the sump depth exceeds 2', unless otherwise noted.

**DESIGNER NOTE:**
Consider using the 2-piece cover where depths exceed 0' 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.

**COVER FOR ALL FRAMES**

<table>
<thead>
<tr>
<th>FRAME</th>
<th>STANDARD COVER</th>
<th>2'-0&quot; Cover</th>
<th>2'-11 3/4&quot; Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS**

**WEIGHT OF CASTINGS (lb)**

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>2&quot; OPENING</th>
<th>3&quot; OPENING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frame</td>
<td>Cover (Std.)</td>
</tr>
<tr>
<td>III</td>
<td>155</td>
<td>190</td>
</tr>
<tr>
<td>III</td>
<td>145</td>
<td>190</td>
</tr>
<tr>
<td>II</td>
<td>90</td>
<td>190</td>
</tr>
</tbody>
</table>

* Includes Type I Adjustable

**NOTES (FRAMES, AND COVER)**

1. The standard cover is to be used for all frames Types I, III, and the 2-piece cover, and is the replacement cover for all previous frames with 12" deep seats (traffic type). The 198 lb cover (nontraffic type), 1984 Roadway and Traffic Design Standards Index 201, is the replacement cover for existing frames with 12" deep seats. Installation of frame with 12" 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 use the 2-piece cover when the sump depth exceeds 2', unless otherwise noted.

**DESIGNER NOTE:**
Consider using the 2-piece cover where depths exceed 0' 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.

**COVER FOR ALL FRAMES**

<table>
<thead>
<tr>
<th>FRAME</th>
<th>STANDARD COVER</th>
<th>2'-0&quot; Cover</th>
<th>2'-11 3/4&quot; Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION

MANHOLE TOPS

NOTES (TOPS)

1. Manhole top Type 7 slabs shall be of Class II concrete. Concrete as specified in ASTM C478 may be used for precast units; see General Notes No. 3.

2. Manhole top Type 7 slabs may be of cast-in-place or precast construction. The optional key is for precut tops and is installed over a junction box. When Alternate "G" grate is specified, the chain, bolt, nuts, washer and cold shuts shall be galvanized in accordance with Section 425 of the Standard Specifications.

3. Manhole top Type 8 may be of cast-in-place or precast construction. Concrete 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 details as shown on Sheet 3.

5. Frames can be adjusted a maximum 12" height with brick or precast construction or brick construction. Frame and slab openings are to be omitted when top is used over a junction box.

6. 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 manhole top Type 8 is allowed if the minimum thickness is added above pipe opening cannot be maintained with manhole top Type 7.

DESIGN NOTES

1. Manhole top Type 8 should be specified in the plans when depths shown above can be maintained.

FILTER FABRIC WRAP ON GROUTED PIPE TO STRUCTURE JOINT

NOTE: See Slab Designs Index 425-010.

PIPE TO STRUCTURE JOINT

Bevel Cut Upper Stub To Match Forging For Apron Face

CAUTION: Slab Surfacing Treatment for Gasketed Slabs on Precast Frames;

Note: Cost of pipe, fittings and sandbagging to be included in the contract unit price for inlets.

EYEBOLT AND CHAIN REQUIREMENTS

<table>
<thead>
<tr>
<th>Index</th>
<th>Inlet Type</th>
<th>Eyebolt</th>
<th>Chain Length</th>
<th>Handling &amp; Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>425-010</td>
<td>2 @ 2'-6&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-011</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-012</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-013</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-014</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-015</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-016</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-017</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-018</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-019</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-020</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-021</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-022</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-023</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-024</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-025</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-026</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-027</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-028</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-029</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-030</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-031</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-032</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-033</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>425-034</td>
<td>2 @ 4'-0&quot;</td>
<td>Slide &amp; Spin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FINISH FABRIC WRAP ON GRouted PIPE TO STRUCTURE JOINT

**PIPE TO STRUCTURE JOINT**

Prior To Placing Base Material

Bevel Cut Upper Stub To Match Forging For Apron Face

**EYEBOLT AND CHAIN REQUIREMENTS**

1. Chain Connection To Grate

2. 4" Min. Embedment For Adhesive Bonded Grates

3. Jam Nut, Nut And Washer On Straight Bolt

4. Type HV Adhesive) Or Precaster QCP Approved Connector

5. Half To Two-Thirds Wall Thickness

6. Provide Adequate Loop For Chaining Two Grates Together

7. Washer On Straight Bolt

8. Bevel Cut Upper Stub To Match Forming For Apron Face

9. Cold Shut & 3/4 Cold Shuts

10. See Table For Lengths When Chaining Two Grates Together

11. Provide Adequate Loop For Easy Handling

12. Chain Connection To Grate

13. 4" Min. Embedment For Adhesive Bonded Grates

14. Jam Nut, Nut And Washer On Straight Bolt

15. Type HV Adhesive) Or Precaster QCP Approved Connector

16. Half To Two-Thirds Wall Thickness

17. Provide Adequate Loop For Chaining Two Grates Together

18. Washer On Straight Bolt

19. Bevel Cut Upper Stub To Match Forming For Apron Face

20. Cold Shut & 3/4 Cold Shuts

21. See Table For Lengths When Chaining Two Grates Together

22. Provide Adequate Loop For Easy Handling
Separate Riser Segments with Construction Joints Other Than Dowel Option

Segments for Slab to Wall Dowel Construction Joints or Monolithically Cast Segments

Comparative Side Views

Minimum Dimensions for Box and Riser Segments

Rebar Straight End Embedment for Top and Bottom Slabs

Optional Construction Joints

Note: Not applicable around Manhole and Riser Openings

Wall Reinforcing Splice Details
### Mortar Construction

- Mortar construction is used to seal openings less than 2 inches wide.
- Dry-pack mortar may be used in lieu of brick and mortar jointing.

### Splice Details

- 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.
- Horizontal steel in the walls of rectangular structures shall be lap spliced in accordance with Option 1, 2 or 3 as shown in the Wall Reinforcing Splice Details.

### GENERAL NOTES

1. For square or rectangular precast drainage structures, use 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 laid spliced in accordance with Option 1 or 3 as shown in the Wall Reinforcing Splice Details.

3. Welding of splices and laps is permitted. The requirements and restrictions placed on welding in AASHO 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 C478, (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 openings 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 items purposes, the height used to determine if a drainage structure is greater than 10 feet shall be computed using:

   - 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. The elevation of the top of the manhole lid.

### 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 in conjunction with Alt. "B" Structure Bottoms, Index 425-010, the interdimensional details of an Alt. "B" Bottom can be adjusted to reflect these inlet interior dimensions.

3. Concrete which meets the requirements of ASTM C478 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 deformed 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. For bars and spacings not given, the area of reinforcement required can be determined by the following equations:

   - Max. Smooth Welded Wire Reinforcement Steel Area = A 65 = 65 x A 60

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.

### 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>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Size &amp; Spacing</td>
<td>Steel Area (in²/ft)</td>
<td>Bar Size &amp; Spacing</td>
<td>Steel Area (in²/ft)</td>
<td>Style Designation</td>
</tr>
<tr>
<td>A</td>
<td>#3 @ 65° Cirs.</td>
<td>0.20</td>
<td>#2 @ 45° Cirs.</td>
<td>0.30</td>
</tr>
<tr>
<td>B</td>
<td>#3 @ 55° Cirs.</td>
<td>0.24</td>
<td>#2 @ 35° Cirs.</td>
<td>0.06</td>
</tr>
</tbody>
</table>

### SPECIAL 1

- #3 @ 35° Cirs.
- #4 @ 25° Cirs.
- #5 @ 15° Cirs.

| C | #3 @ 35° Cirs. | 0.267 | #4 @ 25° Cirs. | 0.40 | 3" x 525.6 x 4.2 | 0.2465 | 3" x 543.0 x 4.7 | 0.2289 |

### SPECIAL 2

- #3 @ 35° Cirs.
- #4 @ 25° Cirs.
- #5 @ 15° Cirs.

| D | #3 @ 35° Cirs. | 0.37 | #4 @ 25° Cirs. | 0.355 | 3" x 525.6 x 5.5 | 0.3415 | 3" x 543.0 x 6.0 | 0.3171 |

### E

- #3 @ 35° Cirs.
- #4 @ 25° Cirs.
- #5 @ 15° Cirs.

| F | #5 @ 35° Cirs. | 1.06 | #6 @ 35° Cirs. | 1.59 | 3" x 525.6 x 2.6 | 0.9783 | 3" x 543.0 x 3.1 | 0.9086 |

### SPECIAL 2

- #3 @ 35° Cirs.
- #4 @ 25° Cirs.
- #5 @ 15° Cirs.

| G | #6 @ 35° Cirs. | 1.24 | #7 @ 35° Cirs. | 1.86 | 3" x 525.6 x 1.6 | 1.1446 | 3" x 543.0 x 1.9 | 1.0929 |

### EQUIVALENT REINFORCEMENT SUBSTITUTION

1. When an increased area of reinforcement is provided, then the maximum bar spacing may be increased by the square ratio of increased steel area, but not to exceed 12".

2. When precast units are in conjunction with Alt. "B" Structure Bottoms, Index 425-010, the interdimensional details of an Alt. "B" Bottom can be adjusted to reflect these inlet interior dimensions.

3. Concrete which meets the requirements of ASTM C478 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 deformed 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. For bars and spacings not given, the area of reinforcement required can be determined by the following equations:

   - Max. Smooth Welded Wire Reinforcement Steel Area = A 65 = 65 x A 60

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.
DESIGNER NOTE: Use only when round structures are not practical, engineer of record approval required.

PICTORIAL VIEW

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

2.  $h_1$ 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" ≤ $h_1 < 2'-0$.

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)

DETAILS FOR SKEWED PIPES IN RECTANGULAR STRUCTURES
### Round Structure Bottoms (Alternate A) & Round Risers - Table 1

<table>
<thead>
<tr>
<th>Type</th>
<th>Structure/Riser Diameter (ft)</th>
<th>Cast-in-Place Items</th>
<th>Precast Items</th>
<th>Class II Concrete</th>
<th>ASTM C478</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>3'-6&quot;</td>
<td>6</td>
<td>0.20</td>
<td>6</td>
<td>0.20</td>
</tr>
<tr>
<td>J</td>
<td>6'-0&quot;</td>
<td>-</td>
<td>0.20</td>
<td>-</td>
<td>0.20</td>
</tr>
<tr>
<td>J</td>
<td>9'-0&quot;</td>
<td>-</td>
<td>0.20</td>
<td>-</td>
<td>0.20</td>
</tr>
<tr>
<td>J</td>
<td>12'-0&quot;</td>
<td>-</td>
<td>0.20</td>
<td>-</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Table 1 Notes:

- **A**: 0.60 sq. in. for riser section height equal or less than 2'-0" (3 hoop min.)
- **A**: 0.40 sq. in. for riser section height more than 2'-0" up to 4'-0" (3 hoop min.)
- Areas of reinforcing for precast items are based on Grade 60 reinforcing.
- No reduction in the area of reinforcement is allowed for welded wire fabric in Table 1.
- Area of vertical reinforcing may be reduced in accordance with ASTM C478.

### Square & Rectangular Structures (Alternate B) - Table 2

<table>
<thead>
<tr>
<th>Type</th>
<th>Wall Length (ft)</th>
<th>Max. Depth (ft)</th>
<th>Wall Thickness (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>4</td>
<td>6</td>
<td>6 Riser Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>4</td>
<td>6</td>
<td>6 Riser Bottom 6</td>
</tr>
<tr>
<td>J</td>
<td>4</td>
<td>8</td>
<td>8 Riser Bottom 8</td>
</tr>
<tr>
<td>J</td>
<td>9</td>
<td>15</td>
<td>15 Riser Bottom 15</td>
</tr>
<tr>
<td>J</td>
<td>10</td>
<td>13</td>
<td>13 Riser Bottom 13</td>
</tr>
<tr>
<td>J</td>
<td>15</td>
<td>19</td>
<td>19 Riser Bottom 19</td>
</tr>
</tbody>
</table>

Table 2 Notes:

See Table 8 for Reinforcing Schedule.
TABLE 3-MINIMUM STRUCTURE SIZES FOR SINGLE PIPE CONNECTION PER SIDE

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>RECTANGULAR</th>
<th>ROUND</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Pipe</td>
<td>Note</td>
</tr>
<tr>
<td></td>
<td>Side Dimension (L)</td>
<td>Diameter (D)</td>
</tr>
<tr>
<td>18&quot;</td>
<td>3'-6&quot;</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>5'-0&quot;</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>6'-6&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>7'-0&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>8'-0&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>9'-0&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>10'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>11'-0&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>12'-0&quot;</td>
<td>16'-0&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>13'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>14'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>15'-0&quot;</td>
<td>20'-0&quot;</td>
</tr>
</tbody>
</table>

TABLE 3 NOTES:
1. For Round Structures sizes with variable angles between sides and variable pipe sizes, refer to the FOOT 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 3'-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 3'-0".
4. For 7'-0" Precast Square Structure Bottoms, 66" Pipes with similar invert elevations are not 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 6'-0".

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

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>PIPE SPACING</th>
<th>MINIMUM WALL LENGTH (L) FOR NUMBER OF PARALLEL PIPES</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot;</td>
<td>2'-10&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-0&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-0&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>4'-0&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>4'-0&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>4'-0&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>5'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>5'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>6'-0&quot;</td>
<td>16'-0&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>6'-0&quot;</td>
<td>16'-0&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>7'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>7'-0&quot;</td>
<td>18'-0&quot;</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.

TABLE 5-MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS

<table>
<thead>
<tr>
<th>WALL THICKNESS</th>
<th>MAXIMUM PIPE SKEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot;</td>
<td>17° - 19°</td>
</tr>
<tr>
<td>10&quot;</td>
<td>17° - 20°</td>
</tr>
<tr>
<td>12&quot;</td>
<td>17° - 20°</td>
</tr>
<tr>
<td>14&quot;</td>
<td>17° - 20°</td>
</tr>
<tr>
<td>16&quot;</td>
<td>17° - 20°</td>
</tr>
<tr>
<td>18&quot;</td>
<td>17° - 20°</td>
</tr>
<tr>
<td>20&quot;</td>
<td>17° - 20°</td>
</tr>
<tr>
<td>22&quot;</td>
<td>17° - 20°</td>
</tr>
</tbody>
</table>

TABLE 5 NOTES:
These values 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

MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS PLAN VIEW

STRUCTURE SIZES FOR PIPE CONNECTIONS

STANDARD PLANS

FY 2018-19

STRUCTURE BOTTOMS TYPE J AND P

INDEX

425-010

3 of 5
## SLAB DESIGNS - SQUARE AND RECTANGULAR STRUCTURES (TABLE 6)

### SLAB DEPTH

<table>
<thead>
<tr>
<th>SHORT-WAY</th>
<th>LONG-WAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE: 4' x 8'</td>
<td>SIZE: 5' x 10'</td>
</tr>
<tr>
<td>4.5' &lt; 5'</td>
<td>5.0' &lt; 6'</td>
</tr>
<tr>
<td>6.0' &lt; 8.4'</td>
<td>7.0' &lt; 9.4'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SHORT-WAY</th>
<th>LONG-WAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE: 5' x 10'</td>
<td>SIZE: 6' x 12'</td>
</tr>
<tr>
<td>5.5' &lt; 6.4'</td>
<td>6.5' &lt; 7.4'</td>
</tr>
<tr>
<td>7.5' &lt; 9.4'</td>
<td>8.5' &lt; 10.4'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SHORT-WAY</th>
<th>LONG-WAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE: 6' x 12'</td>
<td>SIZE: 7' x 14'</td>
</tr>
<tr>
<td>6.5' &lt; 7.4'</td>
<td>7.5' &lt; 8.4'</td>
</tr>
<tr>
<td>8.5' &lt; 9.4'</td>
<td>9.5' &lt; 10.4'</td>
</tr>
</tbody>
</table>

### SLAB STRENGTH

<table>
<thead>
<tr>
<th>SHORT-WAY</th>
<th>LONG-WAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE: 7' x 14'</td>
<td>SIZE: 8' x 16'</td>
</tr>
<tr>
<td>7.5' &lt; 8.4'</td>
<td>8.5' &lt; 9.4'</td>
</tr>
<tr>
<td>9.5' &lt; 10.4'</td>
<td>10.5' &lt; 11.4'</td>
</tr>
</tbody>
</table>

### SLAB WALL DESIGN TABLE NOTES

1. Size is the inside dimension(s) of a structure.
2. Slab reinforcement is appropriate for top, intermediate, and bottom slabs.
3. Bottom Slabs for precast 3'-6" x 3'-6" 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 3', or 10' for wall lengths exceeding 12.

7. Wall lengths exceeding 6'-0" require two layers of reinforcing (See Table 6) 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 66. See Index 425-001 for allowable bar spacing adjustments when larger areas of reinforcing are substituted.
### WALL DESIGNS - RECTANGULAR STRUCTURES (TABLE 8)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1.17'</td>
<td>Inside/Outside</td>
<td>Inside/Outside</td>
<td>Inside/Outside</td>
</tr>
<tr>
<td>10'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>9&quot;</td>
</tr>
<tr>
<td>≥1.17'</td>
<td>Inside/Outside</td>
<td>Inside/Outside</td>
<td>Inside/Outside</td>
</tr>
<tr>
<td>9.5'-0&quot;</td>
<td>25'-40&quot; D7 D7</td>
<td>25'-40&quot; F5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>9'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>7'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>5'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>3'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>2'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>1'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
<tr>
<td>0'-0&quot;</td>
<td>20'-40&quot; D7 D7</td>
<td>20'-40&quot; D5 F5 F5</td>
<td>10&quot;</td>
</tr>
</tbody>
</table>

### WALL REINFORCING SPICE DETAILS (ALTERNATE B)

<table>
<thead>
<tr>
<th>Option 1) Lap Splice:</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Quarter Point (8&quot; Bar Diameters Or Vertical Wire Spacing Plus 2&quot; For WWR)</td>
</tr>
<tr>
<td>Half Plan</td>
</tr>
<tr>
<td>Structure Wall</td>
</tr>
<tr>
<td>Option 2) Lap Splice:</td>
</tr>
</tbody>
</table>
| With Standard 90° Hooks At Corners (8" For #4's, 10" For #5's, 12" #6"
| Option 3) Lap Splice: |
| Corner Spliced Bar (10 Bar Diameters, But Not Less Than Two Vertical Wire Spacing Plus 2" For WWR) |

### WALL SCHEDULE

<table>
<thead>
<tr>
<th>GRADE 60 AREA</th>
<th>MAXIMUM SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 KSI (l.t.)</td>
<td>70 KSI (l.t.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AW</th>
<th>AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A12</td>
<td>0.20</td>
</tr>
<tr>
<td>A6</td>
<td>0.20</td>
</tr>
<tr>
<td>B10</td>
<td>2.04</td>
</tr>
<tr>
<td>B5.5</td>
<td>0.73</td>
</tr>
<tr>
<td>C6.5</td>
<td>0.37</td>
</tr>
<tr>
<td>C3.5</td>
<td>0.37</td>
</tr>
<tr>
<td>D7</td>
<td>0.37</td>
</tr>
<tr>
<td>D4.5</td>
<td>0.37</td>
</tr>
<tr>
<td>E5</td>
<td>0.37</td>
</tr>
<tr>
<td>E3</td>
<td>0.37</td>
</tr>
<tr>
<td>F5</td>
<td>0.37</td>
</tr>
<tr>
<td>F3.5</td>
<td>0.37</td>
</tr>
<tr>
<td>G5</td>
<td>0.37</td>
</tr>
<tr>
<td>H3</td>
<td>0.37</td>
</tr>
</tbody>
</table>

*Equivalent Area Welded Wire Reinforcing may be substituted in accordance with Index 425-001*
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 accordingly. Bend steel when necessary.

3. All reinforcing steel to be Grade 60 bars with 1½’ minimum cover unless otherwise shown, see Sheet 4 for equivalent area Welded Wire Reinforcement details.

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 C476 (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 425-010. 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).


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 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.

CURB INLET TOPS TYPES 5 AND 6

INDEX 425-021
**SECTION DD**  
(End View Of Inlet)

**SECTION EE**

**SECTION FF**

**SECTION GG**

**SECTION HH**  
(Type 5 Inlet Only)

**PRECAST DETAILS**
CURB INLET TOPS TYPES 5 AND 6

SECTION CC
(Gutter Transition
Type F Shown, Type E Similar)

SECTION DD (OPTION A)
(End View Of Inlet)

SECTION DD (OPTION B)
(End View Of Inlet)

SECTION EE (OPTION A)

SECTION EE (OPTION B)

SECTION FF

SECTION HH (Type 5 Inlet Only)

CAST-IN-PLACE DETAILS
GENERAL NOTES

1. This inlet is used in Traffic Separators Types I and II, or, in separators constructed with Curbs Types A, B and F and sidewalk paving which cannot accommodate inlets
   Types 1, 2, 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 425-001 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary. Bars to clear pipe by 1½".

3. Recommended maximum pipe sizes are 24" longitudinal and 30" transverse. For larger pipe, inlets with Alt. B bottoms, Index 425-010 are recommended.

4. For supplementary details see Index 425-001.

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.

Inlet to be paid for as separator (no deduction for inlet).

To be paid for as separator.


Top Slab of Inlets

Reinforcing Steel Diagram

Horizontal Wall Reinforcing Schedule (Table 1)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (IN²/)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0' - 6'</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 8&quot;</td>
</tr>
<tr>
<td>6' - 10'</td>
<td>A6</td>
<td>0.20</td>
<td>6&quot; 7&quot;</td>
</tr>
<tr>
<td>10' - 13'</td>
<td>A4</td>
<td>0.20</td>
<td>4&quot; 7&quot;</td>
</tr>
<tr>
<td>13' - 16'</td>
<td>85.5</td>
<td>0.24</td>
<td>5½&quot; 9½&quot;</td>
</tr>
</tbody>
</table>

For Bottom Slab Rebar Embedment Options See Optional Construction Joints, Index 425-001.
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 425-001 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary. Bars to clear pipe by 10".

3. Recommended maximum pipe sizes are 24" longitudinal and 30" transverse. For larger pipe, inlets with All. B bottoms, Index 425-010 are recommended.

4. For supplemental details and notes see Index 425-001.

5. Recommended maximum pipe sizes are 24" longitudinal and 30" transverse. For larger pipe, inlets with All. B bottoms, Index 425-010 are recommended.

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

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

For supplemental details and notes see Index 425-001.
GENERAL NOTES

1. This inlet is primarily intended for locations 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. For structure bottoms see Index 425-010. For supplemental details see Index 425-001.

3. Grates shall be oriented with vanes directed toward Predominant Flow.

4. All steel in slab tops shall have 1 3/4" 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 425-010 with the slab opening adjusted to 24"x36". The "Special Top Slab" on Index 425-010 is not permitted.

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

8. Vanned grates with approximately equal openings will be permitted that satisfy AASHTO HL-93 loading. Grates shall be reversible, right or left.
1. This inlet is primarily intended for locations with light flows where right of way does not permit the use of throated 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 425-010. For supplemental details see Index 425-001.

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 425-010 with the slab opening adjusted to 22" x 24". The "Special Top Slab" on Index 425-010 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.
INLET WITH STRUCTURE BOTTOM

PAVEMENT WARP FOR SHOULDERS IN SUPERELEVATION

GENERAL NOTES:

1. When called for in the Plans, use this inlet in conjunction with Shoulder Barrier as per Index 521-001 or a Wall Coping with Barrier and Junction Slab as per Index 521-610. Use of the inlet adjacent to other Concrete Barrier or Traffic Railing types requires approval of the Drainage Engineer. The grate 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.

2. Grates which require tolerance adjustment during fabrication and/or casting, or, matching grate to structure, shall be adjusted prior to galvanizing. Field installation of the filler bar called for in Inset B will not be permitted, thereby requiring tolerance adjustment during fabrication and/or casting, or, matching grate to structure prior to galvanizing.

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 1⁄4 chamfer or tooled to 1⁄4 radius.

5. When Alternate G grate is specified in the plans, the grate is to be hot-dip galvanized after fabrication. Field installation of the filler bar called for in Inset B will 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 425-001 for equivalent area of welded wire fabric.

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

8. For supplemental details see indexes 425-001 and 425-010.

9. Inlets to be paid for under the contract unit for Inlets (Concrete Barrier), Ea.

See Plan 425-610 for details of Shoulder Barrier Inlet.

Note: All B Structure Bottom Only. See Index 425-010

INLET WITH STRUCTURE BOTTOM

SCALE 1=1'-0"

SECTION A-A (WITHOUT GRATE)
(Pipe Opening Shown)

WALL REINFORCING SCHEDULE

TABLE 1: HORIZONTAL

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (sq./ft.)</th>
<th>MAX. SPACING</th>
<th>BASE</th>
<th>WF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-5</td>
<td>A12</td>
<td>0.20</td>
<td>10'</td>
<td>5&quot;</td>
<td>-</td>
</tr>
<tr>
<td>5'-10</td>
<td>A6</td>
<td>0.20</td>
<td>4'</td>
<td>3&quot;</td>
<td>-</td>
</tr>
<tr>
<td>10'-15</td>
<td>A4</td>
<td>0.24</td>
<td>4'</td>
<td>3&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>15'-20</td>
<td>85.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3'-3" or 3'-8"

3'-6" or 3'-8"

SECTION B-B
(Pipe Opening Not Shown)

3'-3" or 3'-8"

TOP VIEW (WITHOUT GRATE)

See Sheet 2 of 2

GRADE ELEVATION

SEE SHEET 2 OF 2

Wall Depth (Circa B17)

4'-3"
INSET A

- Install Grate With
- Extended CROSSBAR
- OPTIONS (Sheet 3)
- To Front Of Inlet

INSET B

- Install Grate With
- BAR STUB (Sheet 3)
- To Front Of Inlet

INSET B ALTERNATE

- (See General Note 10)

TABLE 1: HORIZONTAL WALL REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>6-9</td>
<td>A12</td>
<td>0.20</td>
</tr>
<tr>
<td>4-9</td>
<td>6-9</td>
<td>A6</td>
<td>0.20</td>
</tr>
<tr>
<td>9-15</td>
<td>6-10</td>
<td>B5.5</td>
<td>0.24</td>
</tr>
<tr>
<td>15-19</td>
<td>6-10</td>
<td>C6.5</td>
<td>0.37</td>
</tr>
</tbody>
</table>

NOTES:
1. For Bar Bending Diagrams of Bars 5V2 & 5U4. See Index 521-001. Bars 5V2, 5U4, & 55 may be field cut from Bars 5V2 & 5U4.

2. Install PVC drainage pipes at the inlet centerline when the inlet is located in a sag curve or when drainage pipes are called for in the plans. Install a quantity of 3 - 3/4" PVC pipes longitudinally spaced at 8", with the center line as near to the inlet centerline as practical without conflicting with the steel reinforcing.
OPTIONAL STEEL GRATES

CROSS BAR OPTIONS

PLAN VIEW

PLAN VIEW

CROSS BAR GRATE

RETICULINE GRATE

TOP VIEW OF INLET TOP WITHOUT GRATE

PRECAST INLET TOP REINFORCING DETAILS

PICTORIAL VIEW OF INLET TOP

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

REV: 01/01/17

CURB AND GUTTER BARRIER INLET

INDEX

FY 2018-19

STANDARD PLANS

425-032

3 of 3

PRECAST INLET TOP REINFORCING DETAILS

PICTORIAL VIEW OF INLET TOP
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

SECTION AA

- Centered Inlet
- Structure Bottom

SECTION BB

- Centered Opening
- See Table For Dimensions

TOP SLAB OPENINGS

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>OPENING SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'-0&quot; Min. 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 (Unless Otherwise Shown In The Plans)</td>
<td>3'-3&quot; x 3'-10&quot;</td>
</tr>
</tbody>
</table>

TOP SLAB REINFORCING DIAGRAM

- Top Slab With Centered Opening
- Round Structure Bottom
- See Index 425-020 For Structure Bottom Details and Hole Reinforcement.
- 9½" For 5'-0"/8'-0" Structure Bottoms
- 11½" For 8'-0" Structure Bottoms

TOP SLAB REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>SLAB DEPTH</th>
<th>SLAB THICKNESS</th>
<th>REINFORCING (2 WAYS) SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE: 5'-0&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥0.5'&lt;30'</td>
<td>9½&quot;</td>
<td>C</td>
</tr>
<tr>
<td>30'&lt;40'</td>
<td>9½&quot;</td>
<td>C</td>
</tr>
<tr>
<td>≥0.5'&lt;8'</td>
<td>9½&quot;</td>
<td>C</td>
</tr>
<tr>
<td>8'&lt;15'</td>
<td>9½&quot;</td>
<td>C</td>
</tr>
<tr>
<td>15'&lt;23'</td>
<td>9½&quot;</td>
<td>C</td>
</tr>
<tr>
<td>≥0.5'&lt;9'</td>
<td>11½&quot;</td>
<td>C</td>
</tr>
<tr>
<td>9'&lt;11'</td>
<td>11½&quot;</td>
<td>D</td>
</tr>
<tr>
<td>11'&lt;15'</td>
<td>11½&quot;</td>
<td>D</td>
</tr>
<tr>
<td>15'&lt;23'</td>
<td>11½&quot;</td>
<td>D</td>
</tr>
</tbody>
</table>

- #5 Hoop Bar (Peripheral Reinforcement)
- #4 Bar Each Corner
- #8 Bars @ 5" Spacing
- 2 Way Reinforcement
- See Tables
RECOMMENDED MAXIMUM PIPE SIZES

<table>
<thead>
<tr>
<th>Inlet Inside Width</th>
<th>Pipe Size</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-11&quot; Or 3'-3&quot;</td>
<td>2'-11&quot; C-I-P, 2&quot; C-l.</td>
<td>Ref to Index 425-001 for details and sections.</td>
</tr>
<tr>
<td>2'-11&quot; Or 3'-3&quot;</td>
<td>3'-10&quot; Or 6'-0&quot; C-I-P</td>
<td></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 425-001. For larger pipe see bottom detail above and Index 425-010.

GENERAL NOTES

1. This inlet is suitable for village swales, ditches, or other areas subject to heavy wheel loads, minimum debris. 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 "G" 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 425-001 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe to clear pipe inlet.

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

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

6. For supplementary details see Index 425-001.

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

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE I)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEULE AREA (IN²/FT)</th>
<th>MAX. SPACING BARS</th>
<th>WALL</th>
<th>WWF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-5'</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>9'-15'</td>
<td>A12</td>
<td>0.20</td>
<td>6&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>9'-15'</td>
<td>A16</td>
<td>0.20</td>
<td>6&quot;</td>
<td>3&quot;</td>
</tr>
</tbody>
</table>
Centred Inlet
Structure Bottom


gutter inlet type V

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

2 Way Reinforcement
See Tables

#5 Hoop Bar
(Peripheral Reinforcement)

Centered Opening
See Table For Dimensions

#8 Bars


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'-7&quot; x 3'-10&quot;</td>
</tr>
</tbody>
</table>


SECTION AA

ALT. A STRUCTURE BOTTOM FOR INLET TYPE V

GUTTER INLET TYPE V

INDEX

425-041

2 of 2

TOP SLAB REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>Schedule</th>
<th>GRADE 60 (BAR)</th>
<th>OR #5 KSI &amp; 70 KSI (WIRE FABRIC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.20</td>
<td>p/ft.</td>
</tr>
<tr>
<td>B</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>0.38</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>0.15</td>
<td></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>0.5'-30'</td>
<td>95°</td>
<td>C</td>
</tr>
<tr>
<td>30'-60'</td>
<td>95°</td>
<td>D</td>
</tr>
<tr>
<td>SIZE: 9'-6&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5'-9'</td>
<td>95°</td>
<td>B</td>
</tr>
<tr>
<td>9'-15'</td>
<td>95°</td>
<td>C</td>
</tr>
<tr>
<td>15'-23'</td>
<td>95°</td>
<td>D</td>
</tr>
<tr>
<td>23'-40'</td>
<td>95°</td>
<td>E</td>
</tr>
<tr>
<td>SIZE: 9'-8&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5'-9'</td>
<td>115°</td>
<td>C</td>
</tr>
<tr>
<td>9'-15'</td>
<td>115°</td>
<td>D</td>
</tr>
<tr>
<td>15'-23'</td>
<td>115°</td>
<td>E</td>
</tr>
<tr>
<td>23'-40'</td>
<td>115°</td>
<td>F</td>
</tr>
</tbody>
</table>


SECTION BB

Top Slab With Centered Opening

Round Structure Bottom
See Index 425-010 For Structure Bottom Details and Hole Reinforcement.

9½" For 3'-0" To 6'-0" Structure Bottoms
11½" For 8'-0" Structure Bottoms

2' Cl.

#8 Bars @ 5' Spacing

See Tables
**Ditch Bottom Inlet Type A**

**SECTION DD**

**SECTION CC**

**SECTION AA**

**SECTION BB**

**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'-1&quot;</td>
<td>18&quot; Where An 18&quot; pipe Enters A 2'-0&quot; Wall</td>
</tr>
</tbody>
</table>

**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 pipe by 1½". See Index 425-001 for equivalent area of welded wire fabric.

3. All exposed edges and corners shall be ½" chamfer or tooled to ½" 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, SY.

6. For supplemental details see Index 425-001.

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 (Dt Bot Type A), EA.

**HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in.²/ft.)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 8&quot;</td>
</tr>
<tr>
<td>10 - 15</td>
<td>A6</td>
<td>0.20</td>
<td>6&quot; 5&quot;</td>
</tr>
</tbody>
</table>

**INDEX 425-050**

1 of 2
**TOP SLAB REINFORCING SCHEDULE**

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GRADE 60 (BAR) OR 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>0.33</td>
</tr>
<tr>
<td>D</td>
<td>0.35</td>
</tr>
<tr>
<td>E</td>
<td>0.45</td>
</tr>
</tbody>
</table>

**TOP SLAB REINFORCING DIAGRAM**

*ALT. A STRUCTURE BOTTOM FOR INLET TYPE A*
DITCH BOTTOM INLET TYPE B

**ESTIMATED QUANTITIES**

For Informational Purposes Only

<table>
<thead>
<tr>
<th>SLOT TYPE</th>
<th>PAVEMENT</th>
<th>SOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Slot</td>
<td>6.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Double Slot</td>
<td>8.1</td>
<td>1.1</td>
</tr>
</tbody>
</table>

**CONCRETE INLET PAVEMENT AND SODDING**

**SECTION DD**

**RECOMMENDED MAXIMUM PIPE SIZES**

<table>
<thead>
<tr>
<th>INLET INSIDE WIDTH</th>
<th>PIPE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-8&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>4'-2&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 425-001. For larger pipe see bottom detail above and Index 425-010.
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 horizontal slot designs for replacing the vertical slot tops on existing Inlets Type B and Type X that are in locations subject to occasional pedestrian traffic.

2. All reinforcing is Grade 60 bars with 2” min. cover unless otherwise noted. See Index 425-001 for equivalent area of welded wire fabric. Bars to be cut or bent to min 1½ clearance around pipe.

3. All exposed edges and corners shall be ½” chamfer or tooled to 1” radius.

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

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 to 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 425-001.

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 at other elevations, 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.
TOP SLAB REINFORCING DIAGRAM

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>3'-8&quot; x 4'-2&quot;</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>3'-10&quot; x 4'-2&quot;</td>
</tr>
</tbody>
</table>

SECTION AA

SECTION BB

TOP SLAB REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GRADE 60 (BAR) ON 65 KSI &amp; 70 KSI (WIRE FABRIC) (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>0.37</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) SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-0&quot;</td>
<td>0.5 ≤ V ≤ 6&quot;</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>6&quot; ≤ V ≤ 18&quot;</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>18&quot; ≤ V ≤ 30&quot;</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>30&quot; ≤ V ≤ 37&quot;</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>37&quot; ≤ V ≤ 40&quot;</td>
<td>G</td>
</tr>
</tbody>
</table>

ALT. A STRUCTURE BOTTOM FOR INLET TYPE B

DITCH BOTTOM INLET TYPE B

INDEX 425-051

Sheet 3 of 3
HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 1)

<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'-6'</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 8&quot;</td>
</tr>
</tbody>
</table>

**TYPE C**

Recommended Maximum Pipe Size:

2'-0" Wall - 18" Pipe
3'-1" Wall - 24" Pipe (18" where an 18" pipe enters a 2'-0" wall)

HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 2)

<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'-6'</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 8&quot;</td>
</tr>
<tr>
<td>0'-10'</td>
<td>46</td>
<td>0.20</td>
<td>6&quot; 5&quot;</td>
</tr>
<tr>
<td>10'-15'</td>
<td>44</td>
<td>0.20</td>
<td>4&quot; 3&quot;</td>
</tr>
<tr>
<td>10'-15'</td>
<td>85.5</td>
<td>0.24</td>
<td>50&quot; 5&quot;</td>
</tr>
</tbody>
</table>

**TYPE D**

Recommended Maximum Pipe Size:

3'-1" Wall - 24" Pipe
4'-1" Wall - 30" Pipe

HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 3)

<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>0'-7.5'</td>
<td>46</td>
<td>0.20</td>
<td>6&quot; 5&quot;</td>
</tr>
<tr>
<td>7.5'-15'</td>
<td>85.5</td>
<td>0.24</td>
<td>50&quot; 5&quot;</td>
</tr>
<tr>
<td>10'-15'</td>
<td>65.5</td>
<td>0.37</td>
<td>60&quot; 8&quot;</td>
</tr>
</tbody>
</table>

**TYPE E**

Recommended Maximum Pipe Size:

3'-0" Wall - 24" Pipe
4'-6" Wall - 30" Pipe
### Horizontal Wall Reinforcing Schedules (Table 4)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING BARS</th>
<th>WWF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-0&quot;</td>
<td>83.5</td>
<td>0.24</td>
<td>5/8&quot; 0&quot;</td>
<td></td>
</tr>
<tr>
<td>0'-5&quot;</td>
<td>63.5</td>
<td>0.37</td>
<td>6/0&quot; 6&quot;</td>
<td></td>
</tr>
<tr>
<td>5'-10&quot;</td>
<td>44.5</td>
<td>0.53</td>
<td>4/0&quot; 8&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Type H (2 & 3-Grate Inlet)**

Recommended Maximum Pipe Size:
- 3'-0" Wall - 24" Pipe
- 6'-7" Wall - 1-80" Pipe
- Or 3-30" Pipe (5-3-5')

### Horizontal Wall Reinforcing Schedules (Table 5)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING BARS</th>
<th>WWF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-0&quot;</td>
<td>C3.5</td>
<td>0.37</td>
<td>3/8&quot; 3&quot;</td>
<td></td>
</tr>
<tr>
<td>3'-0&quot;</td>
<td>D4.5</td>
<td>0.53</td>
<td>4/0&quot; 4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Type H (4-Grate Inlet)**

Recommended Maximum Pipe Size:
- 3'-0" Wall - 24" Pipe
- 6'-6" Wall - 1-78" Pipe
- Or 3-30" Pipe (5-4-3')

---

**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. Steel grates are to be used on all inlets with traversable slots. Either cast iron or steel grates may be used on inlets without slots where bicycle traffic is not anticipated. Either cast iron or steel grates may be used on all inlets with non-traversable slots. Subject to the selection described above, when alternate grate is specified in the plans, either the steel grate, hot dip galvanized after fabrication, or the cast iron grate may be used, unless the plans stipulate the particular type.

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 tooled to 1/4" 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 inlet 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, $3.67.

9. For supplementary details see Index 425-001.

10. 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.
DITCH BLOCK FOR INLETS WITH OR WITHOUT SLOTS

PAVEMENT AND 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>C</td>
<td>SY 0.83</td>
<td>CY 6.16</td>
</tr>
<tr>
<td>D</td>
<td>SY 1.11</td>
<td>CY 7.70</td>
</tr>
<tr>
<td>E</td>
<td>SY 0.99</td>
<td>CY 7.37</td>
</tr>
</tbody>
</table>

DITCH BLOCK FOR INLETS WITH OR WITHOUT SLOTS

SINGLE SLOT SHOWN (DOUBLE SLOTS SYMMETRICAL ABOUT CENTERLINE)

SECTION AA

SECTION BB

NOTE: See General Notes Nos. 6 and 7, Sheet 3 of 7.

NOTE: For plan view and additional details see Sheet 4 of 7.

FOR TRAVERSABLE SLOTS FOR EXISTING INLETS

 noted for both traversable and non-traversable slots.

For payment see General Notes Nos. 6 and 7, Sheet 3 of 7.

For plan view and additional details see Sheet 4 of 7.

NOTE: For payment see General Notes Nos. 6 and 7, Sheet 3 of 7.

DITCH BOTTOM INLET TYPES C, D, E AND H

INDEX 425-052

SHEET 5 of 7

LAST REVISION 11/01/17

DESCRIPTION:

FY 2018-19

STANDARD PLANS

REVISED 10/23/17

10:27:21 AM

10/23/17

11/01/17

REV ISIO N

INDEX

SHEET
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 toe 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 flatter 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.

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 backfilling are not included as part of the 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 Plan 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 __) (Partial), each.

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

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

SECTION AA

TOP SLAB OPENINGS

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>OPENING SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN.</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>2'-0&quot;</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>2'-0&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOP SLAB REINFORCING DIAGRAM

Top Slab With Centered Opening

9/16" For 4'-0"/5'-0"/6'-0" Structure Bottoms
11/16" For 8'-0" Structure Bottoms

SECTION BB

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

See Index 425-010 for structure bottom details and hole reinforcement.

TOP SLAB REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GRADE 60 (BAR) OR 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>0.51</td>
</tr>
<tr>
<td>E</td>
<td>1.06</td>
</tr>
<tr>
<td>F</td>
<td>1.45</td>
</tr>
</tbody>
</table>

TOP SLAB WITH CENTERED OPENING

Type C 4'-0"
Type D 4'-1"
Type E 4'-6"

Pipe Opening Schematic
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 \( \frac{1}{8} \)" as shown in Index 425-031.

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 425-010. The inlet and bottom combinations are to be paid for under the contract unit price for inlets (DT Bot) (Type F or G) (J Bot, Depth), Ea.

4. All exposed edges and corners shall be \( \frac{3}{4} \)" chamfer or tooled to \( \frac{1}{8} \)" radius.

5. For supplemental details, see Index 425-001.

6. All reinforcing is Grade 60 bars with \( \frac{3}{4} \)" min. cover unless otherwise noted. Bars to be cut or bent for \( \frac{3}{4} \)" clearance around pipe opening. Provide one extra #4 bar above and at each side of pipe opening.

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

### General Notes

#### Recommended Maximum Pipe Sizes

<table>
<thead>
<tr>
<th>Inlet Inside Width</th>
<th>Pipe Size</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 425-001. For larger pipe sizes see Note 3.
STEEL GRATE
5" Steel Decking, Weight 630 Lbs. Main Bars 5" x 1/2" Intermediate Bars 1/2" x 1/4" Reticuline Bars 1/2" x 1/4"

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING BARS</th>
<th>WRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>3 - 7</td>
<td>A6</td>
<td>0.20</td>
<td>8'</td>
<td>5</td>
</tr>
<tr>
<td>7 - 10</td>
<td>B5.5</td>
<td>0.24</td>
<td>10'</td>
<td>5</td>
</tr>
<tr>
<td>10' - 15'</td>
<td>C6.5</td>
<td>0.37</td>
<td>15'</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>
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 425-001 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary; bars to clear pipe by 1/2".

3. All exposed edges and corners shall be 1/4" 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. For supplemental details, see Index 425-001.

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.

**GENERAL NOTES**

**HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-0&quot;</td>
<td>20</td>
<td>12'</td>
</tr>
<tr>
<td>4'-0&quot;</td>
<td>20</td>
<td>8'</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>20</td>
<td>6'</td>
</tr>
</tbody>
</table>

**RECOMMENDED MAXIMUM PIPE SIZES**

<table>
<thead>
<tr>
<th>INLET INSIDE 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>3'-10&quot; or 4'-0&quot;</td>
<td>30&quot;</td>
</tr>
</tbody>
</table>

**NOTE:** All B Structure Bottom Only. See Index 425-010 for structure bottom details and hole reinforcement.

**DITCH BOTTOM INLET TYPE J**

**INLET WITH STRUCTURE BOTTOM**

**PIPING**

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

**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 425-001 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary; bars to clear pipe by 1/2".

3. All exposed edges and corners shall be 1/4" 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. For supplemental details, see Index 425-001.

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.
DESCRIPTION:

REVISION

LAST OF STANDARD PLANS

SHEET

REVIEW

11/01/17

DITCH BOTTOM INLET TYPE J

425-054

2 of 2

REV 1

FY 2018-19

STANDARD PLANS

DITCH BOTTOM INLET TYPE J

INDEX

10 /23 /2017

10 :27 :27 A M

Section CC

Section DD

Tow Wall Required (Paved or Unpaved Ditches)

Ditch Block (low Side of Inlet On Continuous Ditches)

1'-6" Equally Spaced 9 Main Bars

Main Bars 9" x ½" (Notched For Cross Bars)
Cross Bars 1½" x ½" (Continuously Welded At Main Bar Notches) Main Bars And Cross Bars Flush On Top.

Note: Two Required Per Inlet

STEEL GRATING

PAVEMENT & SODDING

2' Sod All Around (Total 9 SY)

1'-6"

Main Bar Notches) Main Bars And Cross Bars Flush On Top.

Note: Two Required Per Inlet

STEEL GRATING

4-3" Out To Out

L 5x3V1/2 Each End

Weld Main Bars To L

(See Detail Below)

4' 4" Preformed Joint Filler

7" Conc. Ditch Pavt.

3" Conc. Ditch Pavt.

2' Sod All Around (Total 9 SY)

2' Sod All Around (Total 9 SY)
GENERAL NOTES

1. This inlet is to be used at locations having high flow rates, usually where an embankment 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 425-010 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 50 with 2” min. cover unless otherwise noted. See Index 425-001 for equivalent area of embedded wire fabric (EWF).

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 A588/A588M, Grade 50 steel, and galvanized in accordance with Specification Section 975.

9. Fence enclosure shall be Fence Type B (Index 550-002). 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, 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). Each.

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 A190 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)
NOTES:

1. For additional details see Index 425-052.

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.

INLET TYPE C (MODIFIED)

FY 2018-19
STANDARD PLANS
BACK OF SIDEWALK DRAINAGE

INDEX
425-060
1 of 3
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 I (Endwalls), CY. Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

<table>
<thead>
<tr>
<th>Pipe Size (in)</th>
<th>Concrete Class I (CY)</th>
<th>Sand-Cement Riprap (CY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>4'-0&quot;</td>
<td>2.3</td>
</tr>
<tr>
<td>18</td>
<td>5'-3&quot;</td>
<td>2.5</td>
</tr>
<tr>
<td>24</td>
<td>6'-3&quot;</td>
<td>3.3</td>
</tr>
</tbody>
</table>

See Plans for Handrail Requirements and Ditch Bottom (Symmetrical About $\xi$)
YARD DRAIN ITEM INCLUDES:

1. 15” x 15” x 12” Concrete or PVC Tee 4’ long.

2. Grate diameter = 14.5g
   Thickness = 2.5g
   Flow area = 0.5 sq ft
   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 430-001.
4. Yard drains to be paid for under the contract unit price for Yard Drains, 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 Mitred End to be paid for under the contract unit price for either Cast Iron Soil Pipe (Standard) (4”), 12’ or PVC Pipe For Back Of Sidewalk Drainage (4”), 12’.
4. 1562.

Flow Lines Of Pipes To Match Gutter Elevations
Curb And Gutter

Double 4” Pipe

Curb And Gutter

Mitered End
Class I Concrete

Ditch Bottom

Miter to slope
**DESIGN NOTES**

1. These inlets are designed for use with Type F curb and gutter only. Locate inlet outside of curb ramp area. The Single Barrel Flume is intended for locations with light to moderate flows. Multiple Barrel Flumes must be selected to meet design heavy flows.

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 45°.

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/SIDEWALK INLET (CLOSED FLUME) TYPE I**

SINGLE BARREL FLUME DEPICTED

**SECTION AA**

Top Wall

- #4 Bars @ 6" cc
- #5 Bars @ 6" Continuous Around Structure (See Section BB)

**SECTION BB**

- 19" Top & Nosing
- Laps 1'-9" Min.
- Construction Joint Permitted

**SECTION CC**

- Limits of Inlet Construction
- To Be Paid For
- As curb & gutter
- F.L. of gutter

**SECTION DD**

- Single Barrel Flume Type "D" dimension, number of barrels and guiderail requirements in plans.

**SECTION EE**

- Flume W/Sidewalk Inlet (Closed Flume) Type I

**SECTION FF**

- Sidewalk
- Curb & Gutter
- Util. Strip D (See Design Notes)

**INDEX**

1 of 3
**FLUME W/O SIDEWALK INLET (CLOSED FLUME) TYPE II**

**SINGLE BARREL FLUME DEPICTED**

---

**DESCRIPTION:**

- #4 Steel Tie Bar
- #4 Steel Tie Bar
- Curb & Gutter Type "F"
- Swale or Ditch Bottom
- Curb & Gutters Type "F"
- Sod (Same as Right)
- Endwall

**PLAN:**

- Existing Ground
- 6'-0" (Min.)

**SECTION AA:**

- Sta./Offset Location
- 4" Thick Concrete Slab
- 2" Typ E.P.
- 0'-0" (Min.)

**SECTION BB:**

- 6'-0"
- 6'-0" (Min.)

---

*Bricks to Dissipate Energy When Called for In Plans. Bricks To Be Included In The Cost Of The Inlet.*
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 are 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>3/8</td>
<td>3</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>3/8</td>
<td>3</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>3/8</td>
<td>3</td>
<td>28</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>3/8</td>
<td>3</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>20</td>
<td>3/8</td>
<td>4</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>22</td>
<td>3/8</td>
<td>4</td>
<td>31</td>
<td>7</td>
</tr>
<tr>
<td>24</td>
<td>3/8</td>
<td>4</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>26</td>
<td>3/8</td>
<td>4</td>
<td>31</td>
<td>9</td>
</tr>
<tr>
<td>28</td>
<td>3/8</td>
<td>4</td>
<td>31</td>
<td>10</td>
</tr>
<tr>
<td>30</td>
<td>3/8</td>
<td>5</td>
<td>31</td>
<td>10</td>
</tr>
<tr>
<td>32</td>
<td>3/8</td>
<td>5</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>34</td>
<td>3/8</td>
<td>5</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>36</td>
<td>3/8</td>
<td>6</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>38</td>
<td>3/8</td>
<td>6</td>
<td>31</td>
<td>13</td>
</tr>
<tr>
<td>40</td>
<td>3/8</td>
<td>6</td>
<td>31</td>
<td>14</td>
</tr>
</tbody>
</table>

**SIDE PANEL**

- Steel Sheet 0.1345" Thick (10 Gage)
- 3/8" Dia (6 Holes)

**END VIEW (FRONT)**

- 3/8" x 1/2" (3 Slots)

**TOP VIEW**

- E Holes for Expansion Anchors

**SIDE VIEW**

- Steel Sheet 0.1345" Thick (10 Gage)
- 3/8" Dia (6 Holes)

**END VIEW (FRONT)**

- Front Panel Width Varies, See General Notes

**TOP VIEW**

- Top Flange (Cut Away)
- Bottom Flange

**FRONT VIEW**

- Steel Sheet 0.1345" Thick (10 Gage)
- 3/8" Dia (6 Holes)

**FRONT PANEL**

- 3/8" x 1/2" Wide

- FLAT BAR

**SKIMMER FOR OUTLET CONTROL STRUCTURES**

**DESCRIPTION:**

**REV: 30/01/17**
NOTES:
1. These details are for construction field expedience to resolve utility conflicts that cannot be remedied by relocation. For conflicts determined during design, use the construction shop drawings for structure details.

2. Concrete used in conflict structures shall be as specified in ASTM C497. 4000 psi may be used in lieu of Class I concrete.

3. Maximum opening for pipe shall be the pipe OD plus 6". Mortar used to seal the pipe into the opening will be of such mix that shrinkage will not cause leakage into or out of the structure.

4. If the conflict structure is round or there are multiple inlet or outlet pipes, then the wall section should be reviewed for strength.

5. If during construction or the plans design process it is determined that a potable water supply line must pass through a storm drain structure, it must be in compliance with Chapter 62-555.314 (3) F.A.C., and shown on the design or construction plans and submitted to the Florida Department of Environmental Protection (FDEP) Administrator For Drinking Water in the respective FDEP District for review and comment. This index and rule citation provide accepted methods for addressing conflicts when and where they cannot be reasonably avoided. To be submitted along with the plans shall be a justification describing inordinate cost and the impracticality of avoidance. If identified, properly justified, and accomplished in accordance with this index, approval is granted. Upon request, the Utility Agency Owner (UAO) must provide support data on the cost of relocation or adjustment to the FDOT for submittal to the FDEP. See the following web site for District FDEP Drinking Water Contacts: www.dep.state.fl.us/water/drinkingwater/index.htm and click on "Organizational" on the menu to the right.

DESIGNER'S NOTES:
"Sumped" conflict manholes shall not be used unless the system is hydraulically designed to account for the headloss generated if the sump is completely blocked.
SAFETY MODIFICATION FOR INLETS IN BOX CULVERTS

LONGITUDINAL SECTION

SECTION AA

SECTION BB

SLOPE VARIES NOT LESS THAN 1/2:1

3" CONCRETE DITCH PAVEMENT

6'

TOP OF BOX

EXIST. SLOT IN BOX (DEPTH VARIES)

3" CONCRETE DITCH PAVEMENT

2'

3" CONCRETE DITCH PAVEMENT

6'

2'

SLOPE VARIES NOT LESS THAN 1/2:1
CONCRETE GUTTER AND DRAINS AT RETAINING WALLS

MISCELLANEOUS DRAINAGE DETAILS

FRONT SLOPES AT DRAINAGE STRUCTURES

METHOD FOR SETTING LIMITS OF VARIABLE SLOPES

EDGES OF PAVEMENT

SIDE VIEW

NOTE: Filling or excavation of variable slopes to be done during normal grading operations.

GUARD AT PIPE ENDS

Note: Guards to be constructed only at locations specifically called for in plans.
<table>
<thead>
<tr>
<th>RAILROAD COMPANY</th>
<th>CLEARANCE BELOW BOTTOM OF RAIL (Ft.)</th>
<th>STRENGTH</th>
<th>ASTM (C76) CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama &amp; Gulf Coast Railway (Rail America)</td>
<td>5.5</td>
<td>IV</td>
<td>V</td>
</tr>
<tr>
<td>All Railway &amp; Bay Line Railroad (Genesee &amp;</td>
<td>5.5 / 4.5**</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Wyoming)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSX Transportation</td>
<td>5.5</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>First Coast Railroad (Genesee &amp; Wyoming)</td>
<td>5.5 / 4.5**</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Florida Midland, Central, and Northern</td>
<td>5.5</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Railroads (Pinsly Railroad)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Florida East Coast Railway Company</td>
<td>5.5</td>
<td>IV</td>
<td>V</td>
</tr>
<tr>
<td>Florida West Coast Railroad Company</td>
<td>5.5</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Georgia &amp; Florida Railway, Inc.</td>
<td>5.5</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Norfolk Southern (NS) Railway Corporation</td>
<td>5.5 / 4.5**</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Port of Palm Beach District Railroad</td>
<td>5.5</td>
<td>IV</td>
<td>V</td>
</tr>
<tr>
<td>Seminole Gulf Railway (1P)</td>
<td>6.0</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>South Central Florida Express</td>
<td>6.0</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Talleyrand Terminal Railroad (Genesee &amp;</td>
<td>5.5 / 4.3**</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Wyoming)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Florida Regional Transportation Authority</td>
<td>5.5</td>
<td>V</td>
<td>V</td>
</tr>
</tbody>
</table>

(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.

METHOD FOR DETERMINING THE LENGTH OF SPECIAL PIPE REQUIRED UNDER RAILROADS

INLETS, MANHOLES OR JUNCTION BOXES
ON INTEGRAL PRECAST CONCRETE RISER FOR CONCRETE PIPE
**U-TYPE CONCRETE ENDWALLS WITH GRATES 15" TO 30" PIPE**

**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 #6. Spacings shown are center to center. Laps to be 1 1/2" 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 reinforcement.

3. Grates shall be ASTM A325/A325M, 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, SY.

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 425-001 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 449 of the Specifications.

**TABLE OF DIMENSIONS AND QUANTITIES**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>A</th>
<th>B</th>
<th>Grade</th>
<th>Number Of Grates Reqd.</th>
<th>Total Grate Wt. (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SIDE VIEW**

- Top view
- Grate type no. 1
- Grate type no. 2
- Grate, seat, weld & chain detail

**SECTION AA**

- Stage E
- Seat of adjacent grates
- Use two chains if needed for security purpose
- 1" or 1/2" chain (approx. 16 links) & 1 cold shut

**SECTION BB**

- Top view
- See grate details

**END VIEW**

- Stage E
- Bars C (Top)
- Bars V (Side & Bottom)

**INDEX 430-010**

**STD PLAN**

**GRADES OF REINFORCING STEEL**

- ASTM A325/A325M
- ASTM A572/A572M
- ASTM A588/A588M

**PIPE SIZE**

- 15" to 30" pipe

**BARS REQUIRED**

- 2 to 4 bars

**GRATE BARS**

- Type no. 1
- Type no. 2

**WEIGHT**

- 33.69 lb
- 43.63 lb
- 53.55 lb

**SLOPE TRANSITION AT ENDWALL**

- Slope transition

**LAST REV. 09/01/17**

**DESCRIPTION:**

- U-type concrete endwalls

**FY 2018-19 STANDARD PLANS**

**INDEX 430-010**

**SHEET 1 of 1**
Quantities shown are for estimating purposes only.

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 or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index 425-001 for opening and grouting details.
7. Concrete shall be Class I, except ASTM C476 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 499 of the Specifications.
8. Sodding shall be in accordance with Index 524-001, 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, baffles and accessories. Quantities shown are for estimating purposes only.

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 or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index 425-001 for opening and grouting details.
7. Concrete shall be Class I, except ASTM C476 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 499 of the Specifications.
8. Sodding shall be in accordance with Index 524-001, 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, baffles and accessories. Quantities shown are for estimating purposes only.

ENDWALLS FOR 1:2 SLOPES

WITH BARRIERS

END VIEW

SECTION AA

PLAN

DIMENSIONAL DETAILS

DIMENSIONAL DETAILS

PLAN

END VIEW

SECTION BB

WITH BARRIERS

END VIEW

SECTION AA

PLAN

DIMENSIONAL DETAILS

DIMENSIONAL DETAILS

PLAN

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 or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index 425-001 for opening and grouting details.
7. Concrete shall be Class I, except ASTM C476 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 499 of the Specifications.
8. Sodding shall be in accordance with Index 524-001, 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, baffles and accessories. Quantities shown are for estimating purposes only.

ENDWALLS FOR 1:2 SLOPES

WITH BARRIERS

END VIEW

SECTION AA

PLAN

DIMENSIONAL DETAILS

DIMENSIONAL DETAILS

PLAN

END VIEW

SECTION BB

WITH BARRIERS

END VIEW

SECTION AA

PLAN

DIMENSIONAL DETAILS

DIMENSIONAL DETAILS

PLAN

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 or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index 425-001 for opening and grouting details.
7. Concrete shall be Class I, except ASTM C476 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 499 of the Specifications.
8. Sodding shall be in accordance with Index 524-001, 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, baffles and accessories. Quantities shown are for estimating purposes only.

ENDWALLS FOR 1:2 SLOPES

WITH BARRIERS

END VIEW

SECTION AA

PLAN

DIMENSIONAL DETAILS

DIMENSIONAL DETAILS

PLAN

END VIEW

SECTION BB

WITH BARRIERS

END VIEW

SECTION AA

PLAN

DIMENSIONAL DETAILS

DIMENSIONAL DETAILS

PLAN
DESCRIPTION:

REVISION
LAST
of
STANDARD PLANS
FY 2018-19
SHEET
INDEX
11/01/17
& GRATE OPTIONAL 15" TO 30" PIPE

U-TYPE CONCRETE ENDWALLS BAFFLES
& GRATE OPTIONAL 15" TO 30" PIPE

DIMENSIONAL DETAILS

DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL

ENDWALLS WITH AND WITHOUT BAFFLES FOR 1:3, 1:4 AND 1:6 SLOPES
STEEL GRATING USE CRITERIA

1. Provide positive debris control at all upgradient openings. Do not install grates unless one 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 and/or drift is negligible.

   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.
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 Reinforcing Steel (Roadway), LB. 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 550-002 for details of Type B fencing.
ENERGY DISSIPATOR 30" TO 72" PIPE

U-TYPE CONCRETE ENDWALL

FY 2018-19
STANDARD PLANS

INDEX 430-012 2 of 2

Note: Bars C, G, C, (N.S. & F.S.) equivalent in size to C.
(cut and bend as required)

Bars A, A, A, A, B, B, B, B, B are straight bars.

BENDING DIAGRAM

PLAN

SECTION AA

SECTION CC

SECTION DD

BENT BARS TABLE

<table>
<thead>
<tr>
<th>Pipe</th>
<th>Size (No.)</th>
<th>Size (No.)</th>
<th>Size (No.)</th>
<th>Size (No.)</th>
<th>Size (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (No.)</td>
<td>Spacing (Ft.-In.)</td>
<td>Spacing (Ft.-In.)</td>
<td>Spacing (Ft.-In.)</td>
<td>Spacing (Ft.-In.)</td>
<td>Spacing (Ft.-In.)</td>
</tr>
<tr>
<td>3&quot;</td>
<td>2</td>
<td>0-95</td>
<td>4</td>
<td>1-0</td>
<td>5</td>
</tr>
<tr>
<td>3&quot;</td>
<td>5</td>
<td>1-0</td>
<td>4</td>
<td>1-4</td>
<td>5</td>
</tr>
<tr>
<td>4&quot;</td>
<td>5</td>
<td>0-11</td>
<td>4</td>
<td>1-6</td>
<td>6</td>
</tr>
<tr>
<td>4&quot;</td>
<td>5</td>
<td>0-95</td>
<td>4</td>
<td>1-0</td>
<td>6</td>
</tr>
<tr>
<td>5&quot;</td>
<td>5</td>
<td>0-85</td>
<td>4</td>
<td>0-10</td>
<td>7</td>
</tr>
<tr>
<td>6&quot;</td>
<td>6</td>
<td>0-10</td>
<td>5</td>
<td>1-1</td>
<td>7</td>
</tr>
<tr>
<td>6&quot;</td>
<td>6</td>
<td>0-85</td>
<td>5</td>
<td>0-11</td>
<td>7</td>
</tr>
<tr>
<td>7&quot;</td>
<td>6</td>
<td>0-75</td>
<td>5</td>
<td>0-10</td>
<td>7</td>
</tr>
</tbody>
</table>
### DESCRIPTION:

**Optional Shape**

Cylindrical For Flared End Section (Outlet Section Spigot On Inlet Outlet Section Pipe Shown)

**Section AA**

Sta./Offset Location

**Plan**

Toe Wall

**Straight Flare Section BB**

Sta./Offset Location

**Optional Shape Only**

### GENERAL NOTES

1. Flared end sections shall conform to the requirements of ASTM C76 with the exception that dimensions and reinforcement shall be as prescribed in the table above. Circumferential 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.

2. Shop drawings for flared end sections having fiber reinforcing or dimensions other than above must be submitted for approval to the State Drainage Engineer.

3. Reinforced concrete jackets, as detailed on this drawing. Cost of the reinforced concrete jacket to be included in accordance with Index 524-001, and paid for under the contract unit price for Performance Turf, SY.

4. 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 section.

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 flared end section. When non-coated corrugated metal pipe is called for in the plans, the pipe shall be bituminous coated in the jacketed area as specified on Index 430-001. Bituminous coating to be included in the contract unit price for the pipe culvert. Concrete jacket shall be specified on Index 430-001. Cost of concrete and reinforcement shall be included in the contract unit price for the pipe culvert.

3. Toe walls shall be constructed when shown on the plans or at locations designated by the Engineer. Toe walls are to be cast-in-place with Class I Concrete and paid for under the contract unit price for 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 524-001, and paid for under the contract unit price for Performance Turf, SY.

<table>
<thead>
<tr>
<th>DIA</th>
<th>T</th>
<th>REINF. (m²/ft)</th>
<th>BRILL. OR Shape</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>P</th>
<th>R1</th>
<th>R2</th>
<th>FLAT</th>
<th>WEIGHT (lb)</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>3&quot;</td>
<td>0.07</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>15&quot;</td>
<td>3&quot;</td>
<td>0.07</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>3&quot;</td>
<td>0.07</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>21&quot;</td>
<td>3&quot;</td>
<td>0.07</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3&quot;</td>
<td>0.07</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3&quot;</td>
<td>0.16</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>3&quot;</td>
<td>0.16</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>3&quot;</td>
<td>0.16</td>
<td>4</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>19/16&quot;</td>
<td>13/16&quot;</td>
<td>9/16&quot;</td>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
</tr>
</tbody>
</table>

### STANDARD PLANS

FY 2018-19

INDEX 430-020
DIMENSIONS AND QUANTITIES

**5' CONCRETE SLAB (CY)**

<table>
<thead>
<tr>
<th>Slope</th>
<th>Single</th>
<th>Double</th>
<th>Triple</th>
<th>Quad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2</td>
<td>1.02</td>
<td>2.14</td>
<td>4.28</td>
<td>8.56</td>
</tr>
<tr>
<td>1:4</td>
<td>1.02</td>
<td>2.14</td>
<td>4.28</td>
<td>8.56</td>
</tr>
</tbody>
</table>

**SOODING (BY)**

<table>
<thead>
<tr>
<th>Slope</th>
<th>Single</th>
<th>Double</th>
<th>Triple</th>
<th>Quad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2</td>
<td>1.02</td>
<td>2.14</td>
<td>4.28</td>
<td>8.56</td>
</tr>
<tr>
<td>1:4</td>
<td>1.02</td>
<td>2.14</td>
<td>4.28</td>
<td>8.56</td>
</tr>
</tbody>
</table>

**Concrete Slab, 3' or 5'2" Thick, Reinforced With WWF 6x6-W1.4xW1.4**

**CROSS DRAIN MITERED END SECTION**

**TOP-VIEW SINGLE PIPE**

**TOP-VIEW MULTIPLE PIPE**

**SINGLE AND MULTIPLE ROUND CONCRETE PIPE**

**INDEX**

CROSS STANDARD PLANS

<table>
<thead>
<tr>
<th>DESCRIPTION:</th>
<th>INDEX</th>
<th>SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2018-19 STANDARD PLANS</td>
<td>430-021</td>
<td>1 of 6</td>
</tr>
</tbody>
</table>
### DIMENSIONS AND QUANTITIES

<table>
<thead>
<tr>
<th>Section</th>
<th>Slope</th>
<th>D</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>
<th>S/J CONCRETE SLAB (CY)</th>
<th>SODDING (SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Single Pipe</td>
<td>Single Pipe</td>
</tr>
<tr>
<td>1.2</td>
<td>1:2</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Double Pipe</td>
<td>Double Pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Triple Pipe</td>
<td>Triple Pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Quad. Pipe</td>
<td>Quad. Pipe</td>
</tr>
<tr>
<td>1:4</td>
<td>1:4</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Single Pipe</td>
<td>Single Pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Double Pipe</td>
<td>Double Pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Triple Pipe</td>
<td>Triple Pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Quad. Pipe</td>
<td>Quad. Pipe</td>
</tr>
</tbody>
</table>

- **See General Note No. 5.**
- **Sod Sheet 5**
- **For pipe quantities and are for information only**

### DESCRIPTION:

- Concrete Slab, 3" Or 5" Thick, Beveled Or Round Corners
- Sodding (SY)

### INDEX

- Sheet 6
- FY 2018-19 Standard Plans
- Cross Drain Mitered End Section
- Single and Multiple Round Corrugated Metal Pipe

### NOTE:

- See Sheet 6 For Details And Notes.
### QUANTITIES FOR 3" THICK CONCRETE SLABS (CY)

#### ROUND-CONCRETE

<table>
<thead>
<tr>
<th>Slope</th>
<th>D</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2</td>
<td>15°</td>
<td>0.27</td>
<td>0.44</td>
<td>0.54</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>18°</td>
<td>0.31</td>
<td>0.45</td>
<td>0.60</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>24°</td>
<td>0.39</td>
<td>0.59</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>0.46</td>
<td>0.60</td>
<td>0.79</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>36°</td>
<td>0.55</td>
<td>0.64</td>
<td>0.81</td>
<td>1.41</td>
</tr>
<tr>
<td></td>
<td>48°</td>
<td>0.76</td>
<td>1.07</td>
<td>1.56</td>
<td>2.53</td>
</tr>
<tr>
<td></td>
<td>54°</td>
<td>0.87</td>
<td>1.26</td>
<td>1.96</td>
<td>2.81</td>
</tr>
<tr>
<td></td>
<td>66°</td>
<td>1.11</td>
<td>1.54</td>
<td>2.52</td>
<td>3.22</td>
</tr>
<tr>
<td></td>
<td>72°</td>
<td>1.24</td>
<td>1.96</td>
<td>2.90</td>
<td>3.68</td>
</tr>
</tbody>
</table>

#### ROUND-CMP

<table>
<thead>
<tr>
<th>Slope</th>
<th>D</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2</td>
<td>15°</td>
<td>0.24</td>
<td>0.37</td>
<td>0.51</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>18°</td>
<td>0.28</td>
<td>0.43</td>
<td>0.56</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>24°</td>
<td>0.32</td>
<td>0.52</td>
<td>0.72</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>0.38</td>
<td>0.64</td>
<td>0.91</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>36°</td>
<td>0.44</td>
<td>0.78</td>
<td>1.13</td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td>48°</td>
<td>0.57</td>
<td>0.99</td>
<td>1.41</td>
<td>1.87</td>
</tr>
<tr>
<td></td>
<td>54°</td>
<td>0.65</td>
<td>1.17</td>
<td>1.99</td>
<td>2.66</td>
</tr>
<tr>
<td></td>
<td>66°</td>
<td>0.71</td>
<td>1.40</td>
<td>2.28</td>
<td>3.07</td>
</tr>
<tr>
<td></td>
<td>72°</td>
<td>1.04</td>
<td>1.96</td>
<td>2.90</td>
<td>3.68</td>
</tr>
</tbody>
</table>

#### CMP-ARCH

<table>
<thead>
<tr>
<th>Slope</th>
<th>D</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2</td>
<td>15°</td>
<td>0.33</td>
<td>0.46</td>
<td>0.65</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>18°</td>
<td>0.37</td>
<td>0.56</td>
<td>0.76</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>24°</td>
<td>0.40</td>
<td>0.60</td>
<td>0.82</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>0.45</td>
<td>0.70</td>
<td>0.98</td>
<td>1.28</td>
</tr>
<tr>
<td></td>
<td>36°</td>
<td>0.51</td>
<td>0.81</td>
<td>1.15</td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td>48°</td>
<td>0.55</td>
<td>0.93</td>
<td>1.35</td>
<td>1.75</td>
</tr>
<tr>
<td></td>
<td>54°</td>
<td>0.62</td>
<td>1.12</td>
<td>1.67</td>
<td>2.25</td>
</tr>
<tr>
<td></td>
<td>66°</td>
<td>0.69</td>
<td>1.25</td>
<td>1.80</td>
<td>2.35</td>
</tr>
</tbody>
</table>

#### ELLIPTICAL-CONCRETE

<table>
<thead>
<tr>
<th>Slope</th>
<th>D</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2</td>
<td>15°</td>
<td>0.43</td>
<td>0.72</td>
<td>1.10</td>
<td>1.58</td>
</tr>
<tr>
<td></td>
<td>18°</td>
<td>0.46</td>
<td>0.78</td>
<td>1.18</td>
<td>1.65</td>
</tr>
<tr>
<td></td>
<td>24°</td>
<td>0.50</td>
<td>0.84</td>
<td>1.25</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>0.56</td>
<td>0.94</td>
<td>1.40</td>
<td>2.03</td>
</tr>
<tr>
<td></td>
<td>36°</td>
<td>0.62</td>
<td>1.05</td>
<td>1.60</td>
<td>2.40</td>
</tr>
<tr>
<td></td>
<td>48°</td>
<td>0.68</td>
<td>1.16</td>
<td>1.81</td>
<td>2.81</td>
</tr>
<tr>
<td></td>
<td>54°</td>
<td>0.75</td>
<td>1.27</td>
<td>2.00</td>
<td>3.27</td>
</tr>
<tr>
<td></td>
<td>66°</td>
<td>0.82</td>
<td>1.38</td>
<td>2.28</td>
<td>3.75</td>
</tr>
<tr>
<td></td>
<td>72°</td>
<td>1.04</td>
<td>1.62</td>
<td>2.60</td>
<td>3.95</td>
</tr>
</tbody>
</table>

### CROSS DRAIN MITERED END SECTION

#### INDEX

- FY 2018-19
- STANDARD PLANS
- CROSS DRAIN MITERED END SECTION
- 430-021

#### SHEET

- 5 of 6
GENERAL NOTES
1. Unless otherwise designated in the plans, concrete pipe mitered end sections may be used with any type of cross drain pipe; corrugated steel pipe mitered end sections may be used with any type of cross drain pipe except aluminum pipe; and, corrugated aluminum mitered end sections may be used with any type of cross drain pipe except steel pipe. When bituminous coated metal pipe is specified for cross drain pipe, construct the mitered end sections with like pipe or concrete pipe. When the mitered end section pipe is dissimilar to the cross drain pipe, construct a concrete jacket in accordance with Index 430-001.

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 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 430-001.

3. Class NS concrete cast-in-place reinforced slabs are required for all sizes of cross drain pipes. Unless 3" thickness called for in plans, construct slabs at 5 1/2" 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 beveling 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 cross 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 simple pipe or collectively as multiple pipe end sections as directed by the Engineer.

DESIGN 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.

CONCRETE PIPE CONNECTOR

ANCHOR DETAIL

SPECIAL DETAILS AND NOTES
SINGLE AND MULTIPLE ROUND CORRUGATED METAL PIPE

DIMENSIONS & QUANTITIES

<table>
<thead>
<tr>
<th>M</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>2.5'</td>
<td>3.75'</td>
<td>5.25'</td>
<td>7.75'</td>
</tr>
<tr>
<td>10&quot;</td>
<td>2.25'</td>
<td>3.50'</td>
<td>4.75'</td>
<td>7.25'</td>
</tr>
<tr>
<td>8&quot;</td>
<td>2.00'</td>
<td>3.25'</td>
<td>4.50'</td>
<td>6.75'</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1.75'</td>
<td>2.95'</td>
<td>4.25'</td>
<td>5.75'</td>
</tr>
<tr>
<td>4&quot;</td>
<td>1.50'</td>
<td>2.35'</td>
<td>3.65'</td>
<td>4.95'</td>
</tr>
<tr>
<td>3&quot;</td>
<td>1.25'</td>
<td>1.95'</td>
<td>3.25'</td>
<td>4.45'</td>
</tr>
<tr>
<td>2&quot;</td>
<td>1.00'</td>
<td>1.65'</td>
<td>2.95'</td>
<td>3.65'</td>
</tr>
<tr>
<td>1.5&quot;</td>
<td>0.75'</td>
<td>1.35'</td>
<td>2.65'</td>
<td>3.35'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>H</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot;</td>
<td>1.00'</td>
<td>1.50'</td>
<td>2.00'</td>
<td>2.50'</td>
</tr>
<tr>
<td>4&quot;</td>
<td>0.75'</td>
<td>1.25'</td>
<td>1.75'</td>
<td>2.25'</td>
</tr>
<tr>
<td>3&quot;</td>
<td>0.50'</td>
<td>0.80'</td>
<td>1.20'</td>
<td>1.60'</td>
</tr>
<tr>
<td>2&quot;</td>
<td>0.30'</td>
<td>0.50'</td>
<td>0.70'</td>
<td>1.00'</td>
</tr>
<tr>
<td>1.5&quot;</td>
<td>0.20'</td>
<td>0.30'</td>
<td>0.40'</td>
<td>0.50'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
<th>Standard Weight Pipe</th>
<th>Extra Strong Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>0.12</td>
<td>0.15</td>
</tr>
<tr>
<td>1.5&quot;</td>
<td>0.13</td>
<td>0.15</td>
</tr>
<tr>
<td>2&quot;</td>
<td>0.16</td>
<td>0.18</td>
</tr>
<tr>
<td>2.5&quot;</td>
<td>0.19</td>
<td>0.21</td>
</tr>
<tr>
<td>3&quot;</td>
<td>0.22</td>
<td>0.24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONCRETE (CY)</th>
<th>SODDING (FY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5' R</td>
<td>2.5' R</td>
</tr>
<tr>
<td>1' M</td>
<td>1' M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>These sizes are restricted to inlet and outlet treatment for water management systems or similar applications.</td>
</tr>
</tbody>
</table>

Values shown for estimating pipe quantities and are for information only.

INDEX

SIDE DRAIN MITERED END SECTION

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

SYMBOLS

- Pipe Culvert
- Pipe To Be Rerolled
- Mitered End Section
- Joint Permitted
- Fastener
- Beveled Or Round Corners
- Construction Joint Permitted
- Grate
- Grate Spaced 12" to 18"
- Reinforced Concrete Slab, 3" Thick
- Reinforced Concrete Slab, 1.5" Thick
- Reinforced Concrete Slab, 1" Thick

SECTIONS

- TOP VIEW-SINGLE PIPE
- TOP VIEW-MULTIPLE PIPE

INDEX

430-022

SHEET

2 of 7

DESCRIPTION:

FY 2018-19 STANDARD PLANS

REVISION:

01/11/17

DESCRIPTION:

SIDE DRAIN MITERED END SECTION

INDEX

430-022

SHEET

2 of 7
**DIMENSIONS & QUANTITIES**

<table>
<thead>
<tr>
<th>Rise</th>
<th>R</th>
<th>Span</th>
<th>X</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>F</th>
<th>G</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>12&quot;</td>
<td>18&quot;</td>
<td>2'-10&quot;</td>
<td>3.98</td>
<td>3.06</td>
<td>3.42</td>
<td>3.07</td>
<td>3.52</td>
<td>2.90</td>
<td>2.70</td>
<td>4.32</td>
<td>7.75</td>
<td>10.58</td>
<td>13.42</td>
</tr>
<tr>
<td>14&quot;</td>
<td>21&quot;</td>
<td>2'-4&quot;</td>
<td>4.44</td>
<td>3.75</td>
<td>6.19</td>
<td>5.10</td>
<td>5.90</td>
<td>5.30</td>
<td>5.50</td>
<td>5.58</td>
<td>8.17</td>
<td>13.50</td>
<td>14.72</td>
</tr>
<tr>
<td>19&quot;</td>
<td>30&quot;</td>
<td>4'-9&quot;</td>
<td>6.24</td>
<td>5.45</td>
<td>8.09</td>
<td>7.10</td>
<td>7.50</td>
<td>6.80</td>
<td>6.60</td>
<td>6.64</td>
<td>10.04</td>
<td>14.04</td>
<td>18.04</td>
</tr>
<tr>
<td>24&quot;</td>
<td>48&quot;</td>
<td>5'-8&quot;</td>
<td>7.18</td>
<td>8.97</td>
<td>8.10</td>
<td>7.00</td>
<td>5.90</td>
<td>5.40</td>
<td>5.30</td>
<td>5.70</td>
<td>11.09</td>
<td>16.70</td>
<td>19.30</td>
</tr>
<tr>
<td>29&quot;</td>
<td>62&quot;</td>
<td>5'-11&quot;</td>
<td>8.96</td>
<td>11.95</td>
<td>12.80</td>
<td>10.10</td>
<td>9.10</td>
<td>8.10</td>
<td>7.80</td>
<td>7.50</td>
<td>13.42</td>
<td>20.35</td>
<td>25.25</td>
</tr>
<tr>
<td>34&quot;</td>
<td>70&quot;</td>
<td>7'-2&quot;</td>
<td>9.62</td>
<td>10.84</td>
<td>13.84</td>
<td>10.10</td>
<td>9.30</td>
<td>8.30</td>
<td>8.00</td>
<td>7.80</td>
<td>15.25</td>
<td>22.25</td>
<td>29.25</td>
</tr>
<tr>
<td>38&quot;</td>
<td>70&quot;</td>
<td>7'-10&quot;</td>
<td>10.79</td>
<td>11.99</td>
<td>15.98</td>
<td>11.70</td>
<td>10.90</td>
<td>9.70</td>
<td>9.50</td>
<td>9.20</td>
<td>17.58</td>
<td>24.58</td>
<td>32.58</td>
</tr>
<tr>
<td>43&quot;</td>
<td>80&quot;</td>
<td>8'-7&quot;</td>
<td>12.77</td>
<td>13.77</td>
<td>17.77</td>
<td>13.30</td>
<td>12.50</td>
<td>11.50</td>
<td>11.20</td>
<td>10.90</td>
<td>27.50</td>
<td>37.50</td>
<td>46.50</td>
</tr>
<tr>
<td>48&quot;</td>
<td>80&quot;</td>
<td>9'-11&quot;</td>
<td>15.44</td>
<td>16.66</td>
<td>19.76</td>
<td>15.03</td>
<td>14.20</td>
<td>13.10</td>
<td>12.80</td>
<td>12.50</td>
<td>36.42</td>
<td>46.42</td>
<td>56.42</td>
</tr>
<tr>
<td>52&quot;</td>
<td>87&quot;</td>
<td>10'-8&quot;</td>
<td>18.87</td>
<td>20.26</td>
<td>23.06</td>
<td>20.30</td>
<td>19.60</td>
<td>18.50</td>
<td>18.20</td>
<td>17.90</td>
<td>46.83</td>
<td>56.83</td>
<td>66.83</td>
</tr>
</tbody>
</table>

**SODDING (SY)**

- Not Less Than R
- Beveled Or Round Corners

**CONCRETE (CY)**

<table>
<thead>
<tr>
<th>N</th>
<th>Standard Pipe</th>
<th>Extra Pipe</th>
<th>Single Pipe</th>
<th>Double Pipe</th>
<th>Triple Pipe</th>
<th>Quad. Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.88</td>
<td>1.04</td>
<td>1.41</td>
<td>2.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.76</td>
<td>0.91</td>
<td>1.28</td>
<td>1.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.69</td>
<td>0.85</td>
<td>1.12</td>
<td>1.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.62</td>
<td>0.76</td>
<td>1.03</td>
<td>1.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.57</td>
<td>0.72</td>
<td>0.99</td>
<td>1.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.52</td>
<td>0.66</td>
<td>0.93</td>
<td>1.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.48</td>
<td>0.62</td>
<td>0.88</td>
<td>1.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.44</td>
<td>0.57</td>
<td>0.83</td>
<td>1.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.40</td>
<td>0.52</td>
<td>0.77</td>
<td>1.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.37</td>
<td>0.48</td>
<td>0.72</td>
<td>1.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GRATE SIZES**

- Beveled Or Round Corners

**VALUES SHOWN FOR ESTIMATING PIPE QUANTITIES AND ARE FOR INFORMATION ONLY.**

**INDEX**

- Beveled Or Round Corners

**SIDE DRAIN MITERED END SECTION**

- Construction Joint Permitted

**NOTE:** See Sheets 6 and 7 for details and general notes.
### Side Drain Mitered End Section

**DESCRIPTION:**
- **REVISED:** 11/01/17
- **INDEX:** 430-022 5 of 7

**CONCRETE PIPE (ROUND)**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>n</th>
<th>l</th>
<th>t</th>
<th>1a</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>3</td>
<td>4</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
<tr>
<td>16&quot;</td>
<td>4</td>
<td>5</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
<tr>
<td>20&quot;</td>
<td>7</td>
<td>9</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>9</td>
<td>10</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
</tbody>
</table>

**LAST OF STANDARD PLANS FY 2018-19 SHEET INDEX 11/01/17**

- **SIDE DRAIN MITERED END SECTION:**
  - 430-022

**REVISION**

- **DESCRIPTION:**
  - **NOTE:** ½" 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:
    - **Grate Size (Std. & X-Stg.)**
      - Bolt Length
        - ½" x 3" ½" ½"
        - ¾" x 4" ¾" ¾"
        - 1" x 5" 1" 1"
    - **To be used only when grates are called for in the plans.**
    - **1974 AASHTO Pipe Arch Sizes:**
      - ***1974 AASHTO Pipe Arch Sizes.***

**DETAILS FOR CONCRETE & CORRUGATED METAL PIPE**

**CONCRETE PIPE (ROUND):**

- **TOP VIEW**
- **END VIEW**
- **SIDE VIEW**
- **BOTTOM VIEW**

- **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.**

- **NOTES:**
  - **Galvanized Bolt Hex Head Bolt Shown:** Either Hex Head or Square Head Bolt May Be Used. Only Hex Nut To Be Used.
  - **Note:** **Galvanized Nut & Washer, Install With Chamfered Face Down**
  - **Galvanized Bolt & Grate Spacing 1:2**
  - **Bolt & Grate Spacing 1:4**
  - **Bolt & Grate Spacing 1:6**

**ELLIPtical CONCRETE Pipe**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>1a</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;x18&quot;</td>
<td>2</td>
<td>3</td>
<td>2-10&quot;</td>
<td>2-1/2&quot;</td>
</tr>
<tr>
<td>14&quot;x23&quot;</td>
<td>3</td>
<td>4</td>
<td>4-0&quot;</td>
<td>4-1/2&quot;</td>
</tr>
<tr>
<td>16&quot;x28&quot;</td>
<td>5</td>
<td>6</td>
<td>6-4&quot;</td>
<td>6-8&quot;</td>
</tr>
</tbody>
</table>

**CORRUGATED METAL PIPE (ROUND):**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>n</th>
<th>l</th>
<th>t</th>
<th>1a</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot;</td>
<td>3</td>
<td>6</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
<tr>
<td>16&quot;</td>
<td>4</td>
<td>9</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
<tr>
<td>20&quot;</td>
<td>10</td>
<td>12</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>12</td>
<td>14</td>
<td>2-1/4&quot;</td>
<td>4-1/16&quot;</td>
</tr>
</tbody>
</table>

**CORRUGATED METAL PIPE (ARCH):**

<table>
<thead>
<tr>
<th>Drain Size</th>
<th>s</th>
<th>n</th>
<th>l</th>
<th>1a</th>
</tr>
</thead>
<tbody>
<tr>
<td>17&quot;x13&quot;</td>
<td>1</td>
<td>2</td>
<td>1-8&quot;</td>
<td>2-2/3&quot;</td>
</tr>
<tr>
<td>21&quot;x15&quot;</td>
<td>2</td>
<td>3</td>
<td>2-10&quot;</td>
<td>3-3/4&quot;</td>
</tr>
<tr>
<td>28&quot;x20&quot;</td>
<td>4</td>
<td>5</td>
<td>5-2&quot;</td>
<td>6-1/2&quot;</td>
</tr>
</tbody>
</table>

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

- **#3 Steel Bars**
- **Wire Mesh**
- **#3 Bars**
- **Saddle**
- **Pipe Grate**
- **Galvanized Bolt**
- **Spacer Bar**
- **Bolt & Grate Spacing 1:2**
- **Bolt & Grate Spacing 1:4**
- **Bolt & Grate Spacing 1:6**
- **To be omitted on trailing downstream ends on divided roadways.**

**Materials:**
- **10 /23 /2017**
- **10 :27 :45 A M**

**Last Revision:** 01/01/17

**FY 2018-19 STANDARD PLANS**

- **LAST REVISION:** 01/01/17
- **DESCRIPTION:**
- **INDEX:** 430-022 5 of 7

**FILE:** FDOT

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

**Details for Concrete & Corrugated Metal Pipe**
**DESCRIPTION:**

**REVISION**

**LAST REVIEW**

**INDEX**

**SHEET**

---

**SIDE DRAIN MITERED END SECTION**

---

**ANCHOR DETAIL**

- Flat Washer (1 Req.)
- Hex Nuts (2 Req.)
- 3/8" x 6" Bolt

**Notes:**

- Anchors required for CMP only.
- Anchor, washer and nuts 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.

---

**FOR SINGLE & MULTIPLE DRAIN PIPE**

---

**GRATE DETAIL**

See General Notes, Sheet 7.

---

**CONCRETE PIPE CONNECTOR DETAIL**

---

**DETAILS FOR CONCRETE & CORRUGATED METAL PIPE**

---

- Bolt holes in pipe shell are to be drilled.
- All bars, bolts, nuts and washers are to be galvanized steel.
- Bolt diameters shall be 1/8" for 15" to 36" pipe and 1/6" for 42" to 60" pipe.
- Two connectors required per joint, located 60° right and left of bottom center of pipe.
- Bolt holes in pipe shell are to be drilled.
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 line 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 430-001.

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 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 section, concrete jacket constructed in accordance with Index 430-001.

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 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.

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 toe points of the mitered end sections.

4. Provide ditch transitions on all grades in excess of 3%.
GENERAL NOTES

1. Endwall dimensions, locations and positions are for round and ellipsoidal concrete pipe and for round and pipe-arch corrugated metal pipe. Round concrete pipe shown.

2. Pipe length plan quantities shall be based on the pipe end measured to this point.

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. 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).

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 524-001.

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 3° | 0°
   3° to 6° | 15°
   6° to 10° | 30°
   10° to 30° | 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.
**DATA AND ESTIMATED QUANTITIES FOR ONE ENDWALL**

**ROUND CONCRETE AND CORRUGATED METAL PIPE**

<table>
<thead>
<tr>
<th>D</th>
<th>Opening Area (SF)</th>
<th>Dimensions</th>
<th>Class 1 Concrete (CY)</th>
<th>Number and Type Of Pipe and Saw Angle Of Pipe</th>
<th>Single</th>
<th>Double</th>
<th>Triple</th>
<th>Quadruple</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.144</td>
<td>1.48 x 1.11</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>15</td>
<td>0.216</td>
<td>2.16 x 1.68</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>20</td>
<td>0.314</td>
<td>2.88 x 2.14</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>25</td>
<td>0.430</td>
<td>3.56 x 2.66</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>30</td>
<td>0.566</td>
<td>4.24 x 3.16</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>35</td>
<td>0.720</td>
<td>5.00 x 3.66</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>40</td>
<td>0.896</td>
<td>5.84 x 4.14</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
</tbody>
</table>

**CORRUGATED METAL PIPE ARCH**

<table>
<thead>
<tr>
<th>D</th>
<th>Opening Area (SF)</th>
<th>Dimensions</th>
<th>Class 1 Concrete (CY)</th>
<th>Number of Pipe and Saw Angle of Pipe</th>
<th>Single</th>
<th>Double</th>
<th>Triple</th>
<th>Quadruple</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.144</td>
<td>1.48 x 1.11</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>15</td>
<td>0.216</td>
<td>2.16 x 1.68</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>20</td>
<td>0.314</td>
<td>2.88 x 2.14</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>25</td>
<td>0.430</td>
<td>3.56 x 2.66</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>30</td>
<td>0.566</td>
<td>4.24 x 3.16</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>35</td>
<td>0.720</td>
<td>5.00 x 3.66</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>40</td>
<td>0.896</td>
<td>5.84 x 4.14</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
</tbody>
</table>

**CONCRETE ELLIPTICAL PIPE**

<table>
<thead>
<tr>
<th>D</th>
<th>Opening Area (SF)</th>
<th>Dimensions</th>
<th>Class 1 Concrete (CY)</th>
<th>Number of Pipe and Saw Angle of Pipe</th>
<th>Single</th>
<th>Double</th>
<th>Triple</th>
<th>Quadruple</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.144</td>
<td>1.48 x 1.11</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>15</td>
<td>0.216</td>
<td>2.16 x 1.68</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>20</td>
<td>0.314</td>
<td>2.88 x 2.14</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>25</td>
<td>0.430</td>
<td>3.56 x 2.66</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>30</td>
<td>0.566</td>
<td>4.24 x 3.16</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>35</td>
<td>0.720</td>
<td>5.00 x 3.66</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
<tr>
<td>40</td>
<td>0.896</td>
<td>5.84 x 4.14</td>
<td>3°-10'</td>
<td>Concrete</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
<td>0°-3°</td>
</tr>
</tbody>
</table>
REVISION DESCRIPTION:

LAST REVIEW 01/01/17

REVISED

REVIEWED

10/23/2017

2:57:47 AM

10

R E V I S I O N

STANDARD PLANS

FY 2018-19

INDEX

SHEET

430-031

1 of 2

STRAIGHT CONCRETE ENDWALLS

SINGLE AND DOUBLE 60" PIPE

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 425-001 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 1/2" 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 524-001 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.

NOTE: All bar dimensions are out to out.
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 425-001 for opening and grouting details.

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

4. Concrete shall be Class II except ASTM C49 (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 4" 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 524-001 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), SY and Reinforcing Steel (Roadway), LB.
Straight concrete endwalls are intended for use outside the clear zone.

Concrete may be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast concrete.

Reinforcing steel shall be either Grade 40 or 60.

Performance Turf, SY.

Concrete and reinforcing steel shall be paid for under the contract unit price for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.

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.

NOTE: All bar dimensions are out to out.

NOTE: Cut and Field Bend Bars B As Shown.

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

NOTE: Bar D B @ 18" Centers.

NOTE: Field Bend Bars B @ 18" Centers.

Gentle Bending Diagrams

Plan (Showing Bars in Footing)

Half Elevation (Showing Bars in Front Face of Wall)

TYPICAL SECTION THRU ENDWALL

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. 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 425-001 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. The 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 524-001 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.
DESCRIPTION:

REVISION LAST of STANDARD PLANS FY 2018-19

SHEET INDEX

11/01/17

SINGLE AND DOUBLE 72" PIPE

STRAIGHT CONCRETE ENDWALLS

PLAN

(Showing Bars In Footing)

SECTION AA

HALF ELEVATION

(Showing Bars In Back 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>4</td>
<td>17</td>
<td>4'11&quot;</td>
<td>Footing</td>
<td>Straight</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>38</td>
<td>10'-9&quot;</td>
<td>Wall</td>
<td>Bond</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>23</td>
<td>6'-7&quot;</td>
<td>Wall</td>
<td>Straight</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>8</td>
<td>2'-4&quot;</td>
<td>Wall</td>
<td>Straight</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>8</td>
<td>1'-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>

BENDING DIAGRAM

NOTE: All bar dimensions are out to out

ITEM ESTIMATED QUANTITIES

Concrete Class II

<table>
<thead>
<tr>
<th>UNIT</th>
<th>RCP</th>
<th>CMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu. Yd.</td>
<td>1519</td>
<td>17.5</td>
</tr>
</tbody>
</table>

Reinforcing Steel

<table>
<thead>
<tr>
<th>UNIT</th>
<th>RCP</th>
<th>CMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lb.</td>
<td>1519</td>
<td>17.5</td>
</tr>
</tbody>
</table>

NOTE: See Sheet 1 of 2 for General Notes.
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 489 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 524-001 and paid for under the contract unit price for Performance Turf, SF.

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.
The image contains a technical drawing and text related to engineering specifications. The text includes dimensions, quantities, and construction details, with references to standards and guidelines. The drawing shows sections of a structure with labeled components and measurements. The text provides instructions and notes for construction practices, including the use of certain materials and the application of various techniques. The document appears to be a part of a larger set of engineering plans, possibly for a construction project involving concrete and metal components.

The text and diagrams are designed to be read by professionals in the field to ensure that construction projects are completed according to specified standards and codes. The use of specific materials, such as steel and concrete, is detailed, along with the correct measurement and placement of components. The drawing includes plans and sections, with annotations for different parts of the structure, such as walls, grates, and anchor bolts. The text is likely to be a part of a larger set of plans, with references to other sections and notes for various aspects of the project.

The document is likely to be used by engineers, contractors, and architects to guide the construction process, ensuring that all necessary components are correctly installed and that the project adheres to the specified standards and guidelines.
GENERAL NOTES

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 grate 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 inverts 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 10" 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 lid resistant to traffic.

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, designer shall detail in the plans the position of the drain relative to the barrier to avoid conflicts with the foundation. (See Index 521-001)

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 location of the outlet pipe if the Trench Drain is not stubbed directly into a drainage structure.

(d) The design flow (Q) for the Trench Drain must be shown on the plans.

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.
WITHIN TYPE E CURB

WITHIN TYPE F CURB

WITHIN DROP CURB

ADJACENT TO TRAFFIC SEPARATOR

ROUND PIPE ALTERNATE SHOWN, BUT PREFORMED POLYETHYLENE ALTERNATE ACCEPTABLE

TYPICAL LOCATIONS FOR TYPE I

WITHIN VALLEY GUTTER

WITHIN DROP CURB

TYPICAL LOCATIONS FOR TYPE II

* As Necessary To Provide 6" Of Concrete On This Side Of Drain
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 901-2 or 901-3. The gradation shall meet Section 901, Grades 4, 467, 5, 56 or 57 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 percentilithy of 0.7/1 csec. and an AOS of #40 sieve.

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

7. See Index 120-002 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. bends shall be constructed with two 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 466-001 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, aggregate, sock, hardware cloth, and bordering sod as shown in Index 466-001 for Edgedrain outlets.

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 filter fabric 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, and (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.
Underdrain Inspection Box

Concrete Apron (12" Max.)

Curb & Gutter

Concrete Apron

Grout

Grout

Curved Underdrain To Box

Curved Underdrain To Box

Varies

Varies

Varies

Varies

Center of Box Sta./Offset Location

Concrete Apron

28½" or 28¾"

23½" or 21½"

28½" or 28¾"

23½" or 21½"

Concrete Apron

A Maximum Of Two (2) Adjustment Courses Of Brick Will Be Permitted

Typical Opening, One Or More Sides, See Plans For Required Openings. Grout Fill To Be Included In Cost Of Box

Grout

Concrete Apron

Cast Or Field Cut 4" Wide Slots (2) For Hinge Covers Grout Around Hinge Covers

4" Chamfer

Optional Construction Joint Permitted

General Notes

1. Light duty cast iron cover and frame, see Specifications Section 962.
2. Concrete shall be Class I, except ASTM C479 (Grade 60) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications. Box shall be reinforced with No 3 bars (Grade 60) on 8" centers both ways, sides and bottom.
3. Concrete apron to be included in the contract unit price for Underdrain Inspection Box.
4. All covers shall be furnished with pick holes. Fitted lifts or handles are not permitted.
5. Manhole Type P Alternate A, Index 425-010, with Type I Frame and Cover, Index 425-001, 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.

Typical Top and Apron

Typical Urban Installation

Permissible Top Adjustment

Typical Installation On Slopes

TOP VIEW

 GefniaT VIE W

SECTION AA

SECTION BB

SECTION CC

Hinge Detail

Cover Removal

Back View

General Notes

1. Light duty cast iron cover and frame, see Specifications Section 962.
2. Concrete shall be Class I, except ASTM C479 (Grade 60) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications. Box shall be reinforced with No 3 bars (Grade 60) on 8" centers both ways, sides and bottom.
3. Concrete apron to be included in the contract unit price for Underdrain Inspection Box.
4. All covers shall be furnished with pick holes. Fitted lifts or handles are not permitted.
5. Manhole Type P Alternate A, Index 425-010, with Type I Frame and Cover, Index 425-001, 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.
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 430-001.

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**

**OPTION B - ROUND OR ELLIPTICAL PIPE**

**ROUND PIPE**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Slot Cut Opening c</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>14&quot; x 23&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>15&quot; x 30&quot;</td>
<td>14&quot;</td>
<td>14&quot;</td>
<td>17&quot;</td>
</tr>
<tr>
<td>24&quot; x 36&quot;</td>
<td>14&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>29&quot; x 45&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>23&quot;</td>
</tr>
<tr>
<td>34&quot; x 53&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>22&quot;</td>
</tr>
<tr>
<td>38&quot; x 60&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>22&quot;</td>
</tr>
</tbody>
</table>

**ELLIPSE PIPE**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Slot Cut Opening c</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>14&quot; x 23&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>15&quot; x 30&quot;</td>
<td>14&quot;</td>
<td>14&quot;</td>
<td>17&quot;</td>
</tr>
<tr>
<td>24&quot; x 36&quot;</td>
<td>14&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>29&quot; x 45&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>23&quot;</td>
</tr>
<tr>
<td>34&quot; x 53&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>22&quot;</td>
</tr>
<tr>
<td>38&quot; x 60&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>22&quot;</td>
</tr>
</tbody>
</table>

**SIDE VIEW**

**SECTION AA**

**SECTION BB**

**A curved cut is acceptable provided the control dimension is maintained (Typical for Elliptical & Round Pipe).**
Show, in the plans, the radii required for curved-back skimmers. Applies to both skimmer types.

The backs of skimmers must conform to the shape of the basin walls on which they are mounted. Show, in the plans, the radii required for curved-back skimmers. Applies to both skimmer types.

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

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 nearly to extend ½ 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. Retract 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.

**GENERAL NOTES**

**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".
**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 grate to be installed over 24" deep well.

Steel grate to be hot dipped galvanized after fabrication, see Specification Section 962.

**DESIGN NOTES:**

1. Depth of Casing Varies, 60' min.

2. Depth of Open Hole, 10'-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 425-010). 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.
NOTE: For Section AA see following Sheets.

ALIGNMENT OF OUTLET PIPE

EDGEDRAIN OUTLET PIPE

1. Edgedrain outlet pipe for counter drain in sag vertical curves.
2. Minimum outlet pipe length varies based on elevation.
3. Elbow or bend as required with the standard specifications.
4. Perimeter sod varies (to exist. shd. pavt.)

4" Dia. Minimum Outlet Pipe
(Nonperforated) Length Varies

4" Dia. Outlet Pipe
(Nonperforated) Length Varies

Concrete Pavement Subdrainage

GENERAL NOTES FOR CONCRETE PAVEMENT SUBDRAINAGE

1. No trench greater than 2' in depth will be allowed overnight. Trenches shall be barricaded 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).

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

4. Immediately prior to placing the filter fabric in position on the vertical face of the concrete pavement, the subdrainage shall be cleaned to remove adhering base material 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 bend 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. When stubbed into inlets or existing ditch pavements, the upper end of each separate run of the concrete pavement subdrainage shall be cleaned to remove adhering base material and soil.

8. 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, hardwaste, sodding into existing inlets and paved ditches, restoration of ditch pavement, backfilling in place, and disposal of excess materials.

9. A 1.75' standard for grassed ditches, 0.75' for paved ditches (less is acceptable to provide minimum 0.1% outlet pipe slope)
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

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 (Noncorrugated Or Smooth Lined Corrugated Only)
(See Sheet 1)

Rehabilitation

DRAINCRETE SUBDRAINAGE

NEW CONSTRUCTION

Concrete Travel Lanes, Shoulders, and Auxiliary Pavement

NOTES FOR DRAINCRETE PAVEMENT SUBDRAINAGE

1. The edgedrain sections for DRAINCRETE SUBDRAINAGE are applicable to pavement construction identified as RIGID PAVEMENT on Index 120-001.

2. The contractor shall confine the construction of draincrete edgedrain 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 Edgedrain (Draincrete) LF shall be full compensation for trench excavation, disposal of excess material, filter fabric, draincrete edgedrain 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 Edgedrain (Draincrete) LF shall be full compensation for removal of existing shoulder pavement, trench excavation, disposal of excess materials, filter fabric, draincrete edgedrain pipe and fittings, and draincrete, necessary for edgedrain construction.

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

Shoulder joint seal 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 edgedrain sections for DRAINCRETE SUBDRAINAGE are applicable to pavement construction identified as RIGID PAVEMENT on Index 120-001.

2. The contractor shall confine the construction of draincrete edgedrain 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 Edgedrain (Draincrete) LF shall be full compensation for trench excavation, disposal of excess materials, filter fabric, draincrete edgedrain 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.
CONCRETE TRAVEL LANE, SHOULDERS, AND AUXILIARY PAVEMENT

ASPHALT SHOULDERS

TREATED PERMEABLE BASE SUBDRAINAGE
DESCRIPTION:
This Design Standard includes details for five types of piles with two thicknesses. Types "B1", "B2", "C1" and "C2" piles (corner piles) are of reinforced concrete construction, and Type "A" is of prestressed concrete construction. The piles shall be manufactured, cured and installed in accordance with the requirements of the contract documents.

MATERIALS: (for materials not listed refer to the Specifications)
CONCRETE
Class:
V (Special) for slightly and moderately aggressive environments
V (Special) with silica fume, metakaolin or ultrafine fly ash for extremely aggressive environments
Unit weight: 150 pcf
Modulus of Elasticity: Based on the use of Florida limestone concrete

REINFORCING STEEL
ASTM A615 Grade 60

PRESTRESSING STEEL
ASTM A416 Grade 70 (Low-Relaxation Strand)

DESIGN PARAMETERS:
Type "A"
Concrete Compressive Strength at release of prestressing: 4000 psi minimum
Uniform compression after prestressing losses: 1000 psi minimum
Pick-up, Storage and Transportation: 0.0 psi tension with 1.5 times pile self weight
Types "B1", "B2", "C1" & "C2"
Pick-up, Storage and Transportation: Minimum compressive strength f'c' ≥ 4000 psi required.

ENVIRONMENT:
The pile designs are applicable to all Environments.

PLASTIC FILTER FABRIC:
The plastic filter fabric shall extend to the bottom of the "X" dimension.

PILE PICK-UP AND HANDLING:
Type "A"
Pick-up of pile may be either a single point pick-up or a two point pick-up as shown below.
Types "B1", "B2", "C1" & "C2"
Two point pick-up for lifting out of forms & two point support for storage & transportation.
Single point pick-up for installation only.

PILE FIT-UP:
The 2'-6" Sheet Pile dimension is nominal. This dimension may be shortened by the Manufacturer up to 1/2" to allow for Sheet Pile fit-up in its final position. Minimum Sheet Pile width is 2'-5 1/2". No changes shall be made to the tongues or grooves.

DETAIL "A"
(Cap and Anchoring System Not Shown)
(Section Taken Above Dimension X)

NOTE: Detail "A" shows a Part-Plan View of an assumed bulkhead. See Bulkhead plans for actual Plan View.
**TYPICAL PILE**

**STANDARD PLANS**

**DESCRIPTION:**

**REV**

**DATE**

**INDEX**

**PRECAST CONCRETE SHEET PILE WALL**

**CONVENTIONAL**

**FY 2018-19**

**STANDARD PLANS**

**INDEX**

**PRECAST CONCRETE SHEET PILE WALL**

**CONVENTIONAL**

**INDEX**

**PRECAST CONCRETE SHEET PILE WALL**

**CONVENTIONAL**

**INDEX**

**PRECAST CONCRETE SHEET PILE WALL**

**CONVENTIONAL**

**INDEX**

**PRECAST CONCRETE SHEET PILE WALL**

**CONVENTIONAL**

**INDEX**
1. This drawing includes details for precast concrete corner piles for 10" and 12" thick sheet pile systems. The details apply equally to both thicknesses.
2. The bar configurations shown in Sections A and B shall be used for Ø angles between 13° and 75°. For Ø angles not shown, the reinforcing bar dimensions may be interpolated or extrapolated from the stirrup dimensions shown.
3. All bar dimensions are out-to-out.
4. Bars A are #8 and Bars S are #4.
5. Values for Stirrup Dimensions are shown for Ø equal to 30°, 45° & 60° only.
6. At the Contractor's option Bars S may be fabricated as a 2 piece bar with a minimum lap length of 1-4", as shown in Bar Bending Diagrams.
7. If Type "B1" or "B2" pile is used as a Starter pile show tongue on both sides of pile from Dim. X down. Show dimensions for Bars S2, S3 & S4 in shop drawings.
8. If tongue must be on the opposite side from that shown all dimensions and Bars A, S2, S3 and S4 will be the same but opposite hand.
9. For Dimensions L, X and Angle Ø, see Sheet Pile Data Table in Structure Plans.

Sheet Pile Dimensions

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>10&quot;</td>
<td>10&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>12&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

ELEVATION (TYPE "B1" PILE SHOWN, TYPE "B2" PILE OPPOSITE HAND)

BAR BENDING DIAGRAMS

STIRRUP DIMENSIONS (T = 10")

<table>
<thead>
<tr>
<th>Ø</th>
<th>BAR MARK</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>R7</th>
<th>R8</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>1'-0</td>
<td>Ø</td>
<td>8&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>45°</td>
<td>1'-0</td>
<td>Ø</td>
<td>8&quot;</td>
<td>7'-4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>60°</td>
<td>1'-0</td>
<td>Ø</td>
<td>7'-4&quot;</td>
<td>5&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

STIRRUP DIMENSIONS (T = 12")

<table>
<thead>
<tr>
<th>Ø</th>
<th>BAR MARK</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>R7</th>
<th>R8</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>1'-0</td>
<td>Ø</td>
<td>8&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>45°</td>
<td>1'-0</td>
<td>Ø</td>
<td>8&quot;</td>
<td>7'-4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>60°</td>
<td>1'-0</td>
<td>Ø</td>
<td>7'-4&quot;</td>
<td>5&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

NOTES:

See Detail "D"
1. All bar dimensions are out-to-out.
2. Bars A are #8 and Bars S are #4.
3. This drawing includes information for precast Corner Piles for 10" and 12" thick Sheet Pile systems. The details apply to both thicknesses but the bar configurations change slightly according to the thickness values used.
4. If Type "C1" or "C2" pile is used as a Starter Pile show tongue on both sides of pile from Dim X down. Show dimensions for Bars S2, S3, S4 & S5 in shop drawings.
5. If tongue must be on opposite side (Groove Side) from that shown, all dimensions and reinforcement shall follow the corresponding Tongue or Groove side.
6. For Dimensions L and X see Sheet Pile Data Table in Structures Plans.
DESCRIPTION:
This Index includes details for six types of piles with two thicknesses.
Type "A" is prestressed concrete construction with CFRP or HSSS strands.
Types "B1", "B2", "C1" and "C2" piles (corner piles) are reinforced concrete construction.
Manufacture, cure and install Sheet Piles in accordance with the requirements of the contract documents.

MATERIALS: (for materials not listed refer to the Specifications)
CONCRETE
Class: V (Special)
Unit weight: 145pcf
Modulus of Elasticity: Based on the use of Florida limber aggregate concrete

REINFORCING BARS
Glass Fiber Reinforced Polymer (GFRP) bars meeting the requirements of Specification Section 932.

PRESTRESSING STRAND
Stainless Steel: Prestressing steel shall be seven-wire HSSS, UNS S32205 (Type 2205) or
UNS S31803 strand, meeting the requirements of Specification Section 933.
Carbon FRP: Prestressing strand shall be CFRP strand, meeting the requirements of
Specification Section 933.

DESIGN PARAMETERS:
Type "A"
Concrete Compressive Strength at release of prestressing: 4000 psi minimum
Uniform compression after prestressing losses: 700 psi minimum
Pick-up, Storage and Transportation: 450 psi tension with 1.5 times pile self weight
for single-point pick-up at f'c ≥ 6000 psi
Types "B1", "B2", "C1" & "C2"
Pick-up, Storage and Transportation: Minimum compressive strength f'ci ≥ 4000 psi required for two-point pick-up;
f'c ≥ 6000 psi for single-point pick-up.

PLASTIC FILTER FABRIC:
The plastic filter fabric shall extend to the bottom of the "X" dimension.

PILE PICK-UP AND HANDLING:
Two-point pick-up for lifting out of forms & two-point support for storage & transportation.
Single-point pick-up for installation only.

PILE FIT-UP:
The 2'-6" Sheet Pile dimension is nominal. This dimension may be shortened by the Manufacturer up to ½" to
allow for Sheet Pile fit-up in its final position. Minimum Sheet Pile width is 2'-5½". No changes shall be made
to the tongues or grooves.

DETAIL "A" (Cap and Anchoring System Not Shown)
See Bulkhead plans for actual Pile View.

PILE STORAGE AND TRANSPORTATION SUPPORT DETAILS

NOTES AND DETAILS

PRECAST CONCRETE SHEET PILE WALL
(CFRP/GFRP & HSSS/GFRP)
INDEX 455-440
FY 2018-19
STANDARD PLANS
1 of 4
NOTES:
1. Intermediate Prestress Strands not shown in Elevations and Sections.
2. All bar dimensions are out-to-out.
3. Bars A are CFRP #5
4. Bars S are GFRP #4 and may be a single closed bar (hoop) with equivalent area and tensile strength.
5. For Dimensions L and if See Sheet Pile Data Table in Structures Plans.

Alternate symmetrical strand patterns:
(1) 4 sp. @ 2" & 1 sp. @ 8"
(2) 2 sp. @ 4" & 1 sp. @ 8"
(3) 4 sp. @ 2" & 2 sp. @ 4"

* Unit Prestress after losses @ Section B-B.
** Based on lifting using single point pick-up.
1. This drawing includes details for precast concrete corner piles for 10" and 12" thick sheet pile systems. The details apply equally to both thicknesses.

2. The bar configurations shown in Sections A-A and B-B shall be used for Ø angles between 15° and 75°. For Ø angles not shown, the reinforcing bar dimensions may be interpolated or extrapolated from the stirrup dimensions shown.

3. All bar dimensions are out-to-out.

4. Bars A are GFRP #4 and Bars B are GFRP #4.

5. Values for Stirrup Dimensions are shown for Ø equal to 30°, 45° & 60° only.

6. Bars S are fabricated as a 2 piece stirrup with a minimum lap length of Ø", as shown in Bar Bending Diagrams, or a single closed bar (hoop) when approved by the Engineer.

7. If Type "B1" or "B2" pile is used as a Starter Pile show tongue on both sides of pile as shown in Bar Bending Diagrams, or a single closed bar (hoop) when approved by the Engineer.

8. If tongue must be on the opposite side from that shown all dimensions and Bars A, S2, S3 and S4 will be the same but opposite hand.

9. For Dimensions L, X and Angle Ø, see Sheet Pile Data Table in Structures Plans.

**Bar Bending Diagrams**

**STIRRUP DIMENSIONS (T = 10")**

<table>
<thead>
<tr>
<th>Ø</th>
<th>BAR MARK</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
<th>A7</th>
<th>A8</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>S1</td>
<td>11 1/2</td>
<td>6 1/2</td>
<td>7 1/2</td>
<td>6 1/2</td>
<td>5 1/2</td>
<td>4 1/2</td>
<td>3 1/2</td>
<td>2 1/2</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>6 1/2</td>
<td>5 1/2</td>
<td>4 1/2</td>
<td>3 1/2</td>
<td>2 1/2</td>
<td>1 1/2</td>
<td>1 1/2</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>7 1/2</td>
<td>6 1/2</td>
<td>5 1/2</td>
<td>4 1/2</td>
<td>3 1/2</td>
<td>2 1/2</td>
<td>1 1/2</td>
<td>1 1/2</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
</tr>
</tbody>
</table>

**STIRRUP DIMENSIONS (T = 12")**

<table>
<thead>
<tr>
<th>Ø</th>
<th>BAR MARK</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
<th>A7</th>
<th>A8</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>S1</td>
<td>11 1/2</td>
<td>10 1/2</td>
<td>9 1/2</td>
<td>8 1/2</td>
<td>7 1/2</td>
<td>6 1/2</td>
<td>5 1/2</td>
<td>4 1/2</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>10 1/2</td>
<td>9 1/2</td>
<td>8 1/2</td>
<td>7 1/2</td>
<td>6 1/2</td>
<td>5 1/2</td>
<td>4 1/2</td>
<td>3 1/2</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>9 1/2</td>
<td>8 1/2</td>
<td>7 1/2</td>
<td>6 1/2</td>
<td>5 1/2</td>
<td>4 1/2</td>
<td>3 1/2</td>
<td>2 1/2</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
<td>11 1/2</td>
</tr>
</tbody>
</table>

**Typical Details**

**Detail "D"**

(TYPE "B1" PILE SHOWN, TYPE "B2" PILE OPPOSITE HAND)

**Notes:**

1. If Type "B1" or "B2" pile is used as a Starter Pile show tongue on both sides of pile from Dim X down. Show dimensions for Bars S2, S3 & S4 in shop drawings.

2. If tongue must be on the opposite side from that shown all dimensions and Bars A, S2, S3 and S4 will be the same but opposite hand.
**This Bar A4 shall be 1'-2" shorter than other A4 bars for T = 12".**

**This Bar A4 (not shown in elevation) is included only if T = 12".**

1. All bar dimensions are out-to-out.
2. Bars A are GFRP #8 and Bars S are GFRP #4.
3. This drawing includes information for precast Corner Piles for 10" and 12" thick Sheet Pile systems. The details apply to both thicknesses but the bar configurations change slightly according to the thickness values used.
4. If Type "C1" or "C2" pile is used as a Starter Pile show tongue on both sides of pile from Dim. X down. Show dimensions for Bars S2, S3, S4 & S5 in shop drawings.
5. At the Contractor’s option Bars S may be fabricated as a 2 piece or 3 piece bar with a minimum lap length of 8", as shown in Bar Bending Diagrams, or as a single closed bar (hoop) when approved by the Engineer.
6. If tongue must be on opposite side (Groove Side) from that shown, all dimensions and reinforcement shall follow the corresponding Tongue or Groove side.
7. For Dimensions L and X see Sheet Pile Data Table in Structures Plans.