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.

TYPICAL SECTION

REINFORCING STEEL BENDING DIAGRAMS

Total Length

1'-0" Lap Splice (Typ.)

BARS GI

BARS J & K

NOTE:
All bar dimensions are out-to-out.
Wall Joint Spacing

**Wall Joint Spacing**

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

**Ground Line**

See Plans for actual wall joint and expansion joint location.

**Wall Joint Spacing**

45° (Typ.)

**Front Face of Wall**

See 'Detail A'

**Vertical Line**

H

**Stem Offset (in.) = H(Ft.)/16**

For H < 20 Ft.)

**Front Face of Wall**

See Roadway Plans for drainage requirement

**Chars D @ 1'-0" (Max. spacing)**

**V-GROOVE DETAIL**

(see 'V-Groove Detail')

**Top of Footing**

**Optional Shear Key**

**Bars A (field bend)**

**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)**

**FRONT ELEVATION**

**TRAFFIC RAILING/JUNCTION SLAB DETAIL**

(36" Single-Slope shown, other Traffic Railings similar)

3" Ø PVC Drain Pipe. Slope down ½ from back to front of wall and extend ½ beyond both front face and back face of wall.

**Top of Coping - Top of CIP Wall**

**Height Variance**

**V-Groove (Typ.) (see 'V-Groove Detail')**

**V-Groove (Typ.)**

**SECTION A-A**

**WALL JOINT DETAIL**

**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 with an adhesive approved by the Engineer.**

**Traffic Railing (Index 521-610, 36" Single-Slope shown, see Plans for Traffic Railing Type)**

**Junction Slab**

**Traffic Railing (Index 521-610, 36" Single-Slope shown, other Traffic Railings similar)**

**TYPICAL CORNER JOINT DETAIL**

**SECTION A-A**

**EXPANSION JOINT DETAIL**

**Permitted Const. Joint**

**Bars R**

(paired with Bars G1)

**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)**

**3" Ø PVC Drain Pipe. Slope down ½ from back to front of wall and extend ½ beyond both front face and back face of wall.**

**Final Groundline**

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

**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')**

**Top of Footing**

required at footing step

**V-Groove (Typ.)**

**SECTION A-A**

**EXPANSION JOINT DETAIL**

**Permitted Const. Joint**

**Bars R**

(paired with Bars G1)

**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)**

**3" Ø PVC Drain Pipe. Slope down ½ from back to front of wall and extend ½ beyond both front face and back face of wall.**

**Final Groundline**

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

**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')**

**Top of Footing**

required at footing step

**V-Groove (Typ.)**

**SECTION A-A**

**EXPANSION JOINT DETAIL**

**Permitted Const. Joint**

**Bars R**

(paired with Bars G1)
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

<table>
<thead>
<tr>
<th>HEIGHT (FT.)</th>
<th>SCHEME 1</th>
<th>SCHEME 2</th>
<th>SCHEME 3</th>
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<tr>
<td>5'</td>
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REIN. STEEL & DRAIN NODES

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<th>WEAP HOLES &amp; DRAIN NODES</th>
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<tbody>
<tr>
<td>Scheme 1</td>
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<tr>
<td>Scheme 2</td>
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<tr>
<td>Scheme 3</td>
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GENERAL NOTES

1. C-I-P Gravity Walls constructed as extensions of reinforced concrete retaining walls, except walls of proprietary designs, shall have the same face texture and finish as the reinforced concrete retaining walls.

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 346, 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 basis. Do not increase bar/wire spacing for Grade 60 reinforcing steel or WWF.

4. When required, for adjacent guidewalls, see Index 515-075 or 315-080 as appropriate. For adjacent Type B fence use 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 1” clean gravel or crushed rock drain for wall heights > 2’ ft. and higher. Wrap drainage layer as shown, with Type D-3 geotextile fabric in accordance with Specification Section 985. Provide 3/8” galvanized mesh with 3/4” openings, at the inside end of the PVC Drain Pipe. Provide 2” Ø PVC Drain Pipe (Sch. 40) at 10 ft max. spacing when Drainage Layer is required. Locate or grade edges of Drain Pipe a minimum of 2’-0” from wall joints.

7. Cost of reinforcing steel, face texture, finish, joint seal, drain pipes, drainage layer, galvanized mesh and geotextile fabric to be included in the Contract Unit Price for Concrete Class NS, Gravity Wall. Cost of concrete for Junction Slab in Scheme 3, to be included in the Contract Unit Price for Concrete Traffic Railing Barrier With Junction Slab. Adjunct railings or fences to be paid for separately.

BILL OF REINFORCING STEEL

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<th>MARK</th>
<th>SIZE</th>
<th>LENGTH</th>
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<td>As Req.</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>As Req.</td>
</tr>
</tbody>
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BAR BENDING DIAGRAM

NOTES:
1. All bar dimensions are cut to out.
2. Lap splices for Bars A must be a minimum of 1’-0”.

REV: 04/08/20
DES: 400-011
1 of 1

STANDARD PLANS

FY 2020-21

GRAVITY WALL
STAIR TREAD AND RISER DETAILS

- The greatest riser height within the flight of steps shall not exceed the smallest by more than 3/16.
- The greatest tread depth within the flight of steps shall not exceed the smallest by more than 1/8.

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

**NOTES:**
1. Do not use this Index for suspended (structural) steps or stairways.
2. Construct steps in accordance with Specification 522.
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.

**HANDRAIL (Typ.)**
- Handrail: 3" Min. with 3" Min. cover
- Cheekwall: 2" Min. Cover
- Pedestrian Railing: (Typ.)
- Cheekwall Extension

**ELEVATION**
- 6'-3" Width (See Plans)
- 6'-0" Max. between landings
- Max Landing Slope = 2%
- Max Landing Cross-Slope = 2%

**SECTION A-A**
- 6'-0" Max. between landings
- 6'-0" Max. between landings
- Max Landing Slope = 2%
- Max Landing Cross-Slope = 2%

**SECTION B-B**
- 6'-0" Max. between landings
- 6'-0" Max. between landings
- Max Landing Slope = 2%
- Max Landing Cross-Slope = 2%

**SECTION C-C**
- 6'-0" Max. between landings
- 6'-0" Max. between landings
- Max Landing Slope = 2%
- Max Landing Cross-Slope = 2%
**SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS**

**DESCRIPTION:**

1. The standard cover is to be used for all frames Type I, II, III, and the 2-piece cover, and it is the replacement cover for all previous frames with 18" deep seats (traffic type). The 185 lb. cover (nontraffic type), 1984 Roadway and Traffic Design Standards Index 201, is the replacement cover for existing frames with 15" deep seats. Installation of frame with 15" deep seats is not permitted.

2. Use the 3'-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 5' and manual entry may be required for cleaning. Clearly note the requirement for a 2-piece cover on the Drainage Structure sheets in the plans.

**WEIGHT OF CASTINGS (LB):**

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<th>Frame Type</th>
<th>2' Opening</th>
<th>3' Opening</th>
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<td>2-Piece Cover</td>
<td>Inside</td>
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<td>190</td>
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<td>II</td>
<td>145</td>
<td>190</td>
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<tr>
<td>III</td>
<td>90</td>
<td>190</td>
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</tbody>
</table>

*Includes Type I Adjustable*
**FILTER FABRIC WRAP ON GRAOUTED PIPE TO STRUCTURE JOINT**

**SECTION**

**NOTES:**
1. Manhole Type 7 slabs shall be of Class II concrete. Concrete as specified in ASTM C478 may be used for precast units; see General Notes 3.

2. Manhole Type 7 slabs may be of cast-in-place or precast construction. The optional key is for precast units and in lieu of dowels. Frame and slab openings are to be omitted when top is used over a junction box.

3. Manhole Type 8 may be of cast-in-place or precast concrete construction or brick construction. For concrete construction, the concrete and steel reinforcement shall be the same as the supporting wall unit. An eccentric cone may be used.

4. Manholes shall be secured to structures by optional construction joints as shown on Sheet 3.

5. Frames can be adjusted a maximum 12" height with brick or precast ASTM C478 grade rings. The minimum concrete thickness (h) above pipe opening cannot be maintained with a substitution of Manhole top Type 7 for Type 8.

6. Substitution of Manhole top Type 7 for manhole top Type 8 is allowed if the provided minimum dimensions shown above are not reduced.

7. Substitution of Manhole top Type 7 for Type 8 is allowed if the minimum thickness (h) above pipe opening cannot be maintained with manhole top Type 8.

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

**EYEBOLT AND CHAIN REQUIREMENTS**

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<th>Index Number</th>
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<th>Eye-Bolts</th>
<th>Chain Length</th>
<th>Handling &amp; Remarks</th>
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<tr>
<td>425-033</td>
<td>2</td>
<td>1</td>
<td>4'-0&quot;</td>
<td>Slide &amp; Spin</td>
</tr>
<tr>
<td>425-034</td>
<td>3</td>
<td>2</td>
<td>2'-4&quot;</td>
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<td>2'-4&quot;</td>
<td>Slide &amp; Spin</td>
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<td>425-036</td>
<td>5</td>
<td>2</td>
<td>2'-4&quot;</td>
<td>Slide &amp; Spin</td>
</tr>
</tbody>
</table>

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

- Bevel Cut Upper Stub To Match Forming For Apron Face Caping Or Plugging Of Upper Stub Not Required (Flexible Base Material & Stub Opening Shall Be Removed To Permit Covering Of Opening With Structural Course Material).
- Prior To Placing Base Material Remove Riprap, Cement PVC Cap On Lower Stub And Place Compacted Fill In Entrance.
- Riprap Entrance Top Of Subgrade
- 4" PVC Pipe, 45° Lateral And Subs
- Grout Seal Or Integral Cast

**SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS**

**FY 2020-21 STANDARD PLANS**

**INDEX 425-001**
**SEPARATE RISER SEGMENTS WITH CONSTRUCTION JOINTS OTHER THAN DOWEL OPTION**

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

**MINIMUM DIMENSIONS FOR BOX AND RISER SEGMENTS**

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

**COMPARATIVE SIDE VIEWS**

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

**OPTIONAL CONSTRUCTION JOINTS**

1. Dowel joints may be used in a single structure, except for wall units where continuous joint is not required.
2. All grouted joints are to have a maximum thickness of 1".
3. Keyways are to be a minimum of 1/2" deep.
4. Joint dowels are to be #4 bars, 12" long with a minimum of 6 bars per joint spaced approximately evenly spaced for circular structures or at maximum 12" spacing for rectangular structures. Bars may be either Adhesive Bonded Dowels in accordance with Specification Section 416, or placed approximately 6" into fresh concrete leaving the remainder to extend into the secondary cast. Welded wire reinforcement may be substituted for the dowel bar in accordance with the equivalent steel area table on Sheet 4.
5. Minimum cover on dowel reinforcing bars is 2" to outside face of structure.
6. Joints between wall segments and between wall segments and top or bottom slabs may be sealed either by preformed plastic gasket material using the procedures given in Section 430 of the Specifications or by non-shrink grout, in accordance with Section 934 of the Specifications.
7. Insert products approved by the Engineer may be used in lieu of dowel embedment.

**WALL REINFORCING SPLICE DETAILS**

1. Dowel construction joint or monolithically cast only
2. Cold cast joint
3. Dowel construction joint
4. Top slab to walls
5. Bottom slab to walls
6. Min. (Typ.)

**NOTE:** NOT APPLICABLE AROUND MANHOLE AND RISER OPENINGS

**WALL JOINTS**

**BOTTOM SLABS TO WALLS**

**TOP SLABS TO WALLS**

**H (min.) ≤ h ≤ 2H**

**h ≥ zero and h ≥ 2H**

**h ≥ 0.75H (min.)**

**6" ≤ h < 0.75H (min.)**

**h ≥ H (min.)**

**H (min.) ≤ h ≥ 0.4H**

**MINIMUM COVER ON DOWEL REINFORCING BARS**

**OPTIONAL CONSTRUCTION JOINTS**

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

**WALL REINFORCING SPLICE DETAILS**

**MINIMUM COVER ON DOWEL REINFORCING BARS**

**NOTE:** NOT APPLICABLE AROUND MANHOLE AND RISER OPENINGS
### General Notes
1. For square or rectangular precast drainage structures, using either deformed or smooth WWR meeting the requirements of Specification Section 931, WWR shall be continuous around the box and lap in accordance with Option 1 or 2 as shown in the Wall Reinforcing Splice Details.
2. Horizontal steel in the walls of rectangular structures shall be lap spliced in accordance with Option 1 or 2 as shown in the Wall Reinforcing Splice Details.
3. Welding of splices and laps is permitted. The requirements and restrictions placed on welding in AASHTO M 259 shall apply.
4. Rebar straight and 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 C 478 (4000 psi) may be used in lieu of Class II concrete in precast items manufactured in plants which meet the requirements in accordance with Specification Section 449.
6. Precast opening for pipe shall be the pipe OD plus 6" (a 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" shall be computed using:
   - A: the elevation of the top of the manhole lid,
   - B: the grate elevation or the theoretical gutter grade elevation of an inlet, or
   - C: the outside top elevation of a junction box less the flow line elevation of the lowest pipe or to top of sump floor.

### Notes for Precast Options and Equivalent Reinforcement Substitution
1. Details for optional precast inlet construction up to depths of 15' are shown on the inlet indexes.
2. When precast units are used in conjunction with All "B" Structure Bottoms, Index 425-010, the interior dimensions of an All "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 welded wire reinforcement will be recognized as having a design strength of 70 ksi. The area of reinforcement required may be determined in accordance with the Equivalent Steel Area Table provided. For bars and spacings not given, the steel area required can be determined by the following equations:
5. Fiber-reinforced concrete may be substituted for conventional steel reinforcement in accordance with the Structures Design Guidelines. Shop drawings corresponding to an approved Fiber-reinforced concrete mix design must be submitted for approval to the State Drainage Engineer.

### Table 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 WIRE REINFORCEMENT</th>
<th>EQUIVALENT 70 KSI DEFORMED WIRE REINFORCEMENT</th>
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</thead>
<tbody>
<tr>
<td>Bar Size &amp; Spacing</td>
<td>Steel Area (in²/ft2)</td>
<td>Bar Size &amp; Spacing</td>
<td>Steel Area (in²/ft2)</td>
<td>Min. Steel Area (in²/ft2)</td>
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### Notes
1. Details for optional precast inlet construction up to depths of 15' are shown on the inlet indexes.
2. When precast units are used in conjunction with All "B" Structure Bottoms, Index 425-010, the interior dimensions of an All "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 welded wire reinforcement will be recognized as having a design strength of 70 ksi. The area of reinforcement required may be determined in accordance with the Equivalent Steel Area Table provided. For bars and spacings not given, the steel area required can be determined by the following equations:
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.
**REVISION DESCRIPTION:**

**REVISION LAST of STANDARD PLANS FY 2020-21 SHEET INDEX**

---

**MANHOLES AND INLETS**

**SUPPLEMENTARY DETAILS FOR 6" (See Note 3 Below)**

- **Top Corner Bar (Continuous Around Corner Evenly Spaced). Tie To The Outside Of Vertical Wall Rein.**
- **Dowel Construction Joint Or Monolithically Wall & Slabs**

**DEFORMATION BAR Details**

- **h _min_ ≥ 1'-0" (See Notes 2 and 3 Below)**

**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 _min_ 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 _min_ < 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**

**DETAILS FOR SKEWED PIPES IN RECTANGULAR STRUCTURES**

(Pipes Not Shown For Clarity)
**TOP SLAB REINFORCING STEEL DIAGRAM (ALTERNATE A)**

- **Structure Bottom**
- **Top Slab**
- **Perpendicular Bars A**
- **Bars B**
- **Bars A Short Way**
- **#5 Peripheral Reinforcement**

**SECTION A-A (ALTERNATE A)**

- **Note:** Not applicable for Type B, C, D, & E ditch bottom slabs or Type 4 & 5 gutter inlets. See Indexes 425-040, 425-050, 425-051, and 425-052.

**SQUARE OPENING WITH CORNER FILLETS**

- **Top Slab Reinforcing**
- **Bottom Slab Reinforcing**
- **#4 @ 12" O.C.**
- **3" Cl.** (Minimum #4 Bars)

**SECTION B-B (ALTERNATE B)**

- **Top Slab Reinforcing**
- **Bottom Slab Reinforcing**
- **#4 Hoop Bar**
- **#4 @ 12" O.C.**

**ROUND RISER OPENING**

- **Top Slab Reinforcing**
- **Bottom Slab Reinforcing**
- **#4 @ 12" O.C.**
- **2 Additional Bars B @ 5" O.C.**

**SPECIAL TOP SLAB**

- **#5 Peripheral Reinforcement**
- **Wall Reinforcing**
- **#4 Ties @ 12" O.C.**
- **1'-6" Max.**

**INDEX**

- **425-010**

**TYPICAL SLAB TO WALL DETAILS**

**FOR PRECAST STRUCTURES**

- **Bar Sizes**
- **Rebar Embedment Beyond Inside Face**
- **Shear Key**

**DESCRIPTION:**

FY 2020-21 STANDARD PLANS

**INDEX:** 425-010

**SHEET:** 1 of 5

**LAST REVISION:** 01/10/19

**REVISED:**

- Structure Bottoms Type J and P
### Table 1: Cast-in-Place Items

<table>
<thead>
<tr>
<th>Type</th>
<th>Structure/Riser Diameter (ft)</th>
<th>Class III Concrete</th>
<th>ASTM C478</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Front Areas</td>
<td>Rear Areas</td>
<td>Front Areas</td>
</tr>
<tr>
<td></td>
<td>Class II Concrete</td>
<td>Front Areas</td>
<td>Rear Areas</td>
</tr>
<tr>
<td></td>
<td>t_r</td>
<td>t_b</td>
<td>A_r</td>
</tr>
<tr>
<td>P</td>
<td>3'-6&quot;</td>
<td>0.20</td>
<td>6</td>
</tr>
<tr>
<td>P</td>
<td>4'-0&quot;</td>
<td>0.20</td>
<td>6</td>
</tr>
<tr>
<td>J</td>
<td>5'-0&quot;</td>
<td>0.20</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>6'-0&quot;</td>
<td>0.20</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>7'-0&quot;</td>
<td>0.20</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>8'-0&quot;</td>
<td>0.20</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>10'-0&quot;</td>
<td>0.40##</td>
<td>10</td>
</tr>
<tr>
<td>J</td>
<td>12'-0&quot;</td>
<td>0.40##</td>
<td>12</td>
</tr>
</tbody>
</table>

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

<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></td>
<td>CIP</td>
<td>Precast</td>
<td>B Bottom</td>
</tr>
<tr>
<td>P</td>
<td>3'-6&quot;</td>
<td>46</td>
<td>6</td>
</tr>
<tr>
<td>J</td>
<td>4'-0&quot;</td>
<td>46</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>5'-0&quot;</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>J</td>
<td>6'-0&quot;</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td>J</td>
<td>5'-9&quot; to 9'-6&quot;</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>10'-0&quot;</td>
<td>26</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>10'-9&quot; to 12'-0&quot;</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>J</td>
<td>12'-0&quot;</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td>J</td>
<td>18'-0&quot;</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>J</td>
<td>20'-0&quot;</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>J</td>
<td>20'-0&quot;</td>
<td>30</td>
<td>10</td>
</tr>
</tbody>
</table>

### Table 2 Notes:
See Table B 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>Diameter (D)</td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>2 to 4 Pipes</td>
</tr>
<tr>
<td></td>
<td>Single Pipe</td>
<td>or 5 to 10 Pipes</td>
</tr>
<tr>
<td>18&quot;</td>
<td>2'-10&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-6&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>4'-0&quot;</td>
<td>12'-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>5'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>5'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>6'-0&quot;</td>
<td>16'-0&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>7'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>7'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>8'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>9'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>9'-0&quot;</td>
<td>18'-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 FDOT 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 4'-0".

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

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>PIPE SPACING (S)</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>8'-0&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-6&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>4'-0&quot;</td>
<td>12'-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>5'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>5'-0&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>6'-0&quot;</td>
<td>16'-0&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>7'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>7'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>8'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>9'-0&quot;</td>
<td>18'-0&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>9'-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.

**STRUCTURE SIZES FOR PIPE CONNECTIONS**

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

<table>
<thead>
<tr>
<th>WALL THICKNESS</th>
<th>PIPE SIZE</th>
<th>MAXIMUM SKEW ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18&quot;</td>
<td>18°</td>
</tr>
<tr>
<td></td>
<td>16&quot;</td>
<td>19°</td>
</tr>
<tr>
<td></td>
<td>14&quot;</td>
<td>20°</td>
</tr>
<tr>
<td></td>
<td>12&quot;</td>
<td>21°</td>
</tr>
<tr>
<td></td>
<td>10&quot;</td>
<td>22°</td>
</tr>
<tr>
<td></td>
<td>8&quot;</td>
<td>23°</td>
</tr>
<tr>
<td></td>
<td>6&quot;</td>
<td>24°</td>
</tr>
<tr>
<td></td>
<td>4&quot;</td>
<td>24°</td>
</tr>
<tr>
<td></td>
<td>2&quot;</td>
<td>24°</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.

**MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS PLAN VIEW**

**MULTIPLE PARALLEL PIPE CONNECTIONS DETAIL PLAN VIEW**

**PRECAST ROUND STRUCTURES WITH MULTIPLE PIPE CONNECTIONS**
### SLAB DESIGNS - SQUARE AND RECTANGULAR STRUCTURES (TABLE 6)

<table>
<thead>
<tr>
<th>Size: 4' x 4' x UNLIMITED</th>
<th>Size: 6' x 6' x 8'</th>
<th>Size: 8' x 8' x 8'</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥0.5' &lt; 3'</td>
<td>≥0.5' &lt; 6'</td>
<td>≥0.5' &lt; 9'</td>
</tr>
<tr>
<td>B5.5</td>
<td>C6.5</td>
<td>D7</td>
</tr>
<tr>
<td>10' &lt; 16'</td>
<td>10' &lt; 18'</td>
<td>10' &lt; 20'</td>
</tr>
<tr>
<td>14' &lt; 24'</td>
<td>17' &lt; 25'</td>
<td>20' &lt; 28'</td>
</tr>
<tr>
<td>22' &lt; 30'</td>
<td>29' &lt; 38'</td>
<td>32' &lt; 40'</td>
</tr>
<tr>
<td>Size: 6' x 9'</td>
<td>Size: 8' x 9'</td>
<td>Size: 10' x 9'</td>
</tr>
<tr>
<td>≥0.5' &lt; 4'</td>
<td>≥0.5' &lt; 7'</td>
<td>≥0.5' &lt; 6'</td>
</tr>
<tr>
<td>B5.5</td>
<td>C6.5</td>
<td>D7</td>
</tr>
<tr>
<td>10' &lt; 16'</td>
<td>10' &lt; 18'</td>
<td>10' &lt; 19'</td>
</tr>
<tr>
<td>14' &lt; 21'</td>
<td>22' &lt; 29'</td>
<td>28' &lt; 36'</td>
</tr>
<tr>
<td>Size: 12' x 12'</td>
<td>Size: 15' x 12'</td>
<td>Size: 18' x 12'</td>
</tr>
<tr>
<td>≥0.5' &lt; 10'</td>
<td>≥0.5' &lt; 7'</td>
<td>≥0.5' &lt; 8'</td>
</tr>
<tr>
<td>B10</td>
<td>C6.5</td>
<td>D7</td>
</tr>
<tr>
<td>15' &lt; 20'</td>
<td>11' &lt; 19'</td>
<td>14' &lt; 21'</td>
</tr>
<tr>
<td>18' &lt; 24'</td>
<td>22' &lt; 30'</td>
<td>28' &lt; 38'</td>
</tr>
<tr>
<td>Size: 18' x 18'</td>
<td>Size: 21' x 18'</td>
<td>Size: 24' x 18'</td>
</tr>
<tr>
<td>≥0.5' &lt; 8'</td>
<td>≥0.5' &lt; 5'</td>
<td>≥0.5' &lt; 6'</td>
</tr>
<tr>
<td>B5.5</td>
<td>C3.5</td>
<td>D5</td>
</tr>
<tr>
<td>10' &lt; 17'</td>
<td>10' &lt; 17'</td>
<td>10' &lt; 19'</td>
</tr>
<tr>
<td>14' &lt; 22'</td>
<td>17' &lt; 25'</td>
<td>20' &lt; 28'</td>
</tr>
<tr>
<td>Size: 24' x 24'</td>
<td>Size: 30' x 24'</td>
<td>Size: 36' x 24'</td>
</tr>
<tr>
<td>≥0.5' &lt; 5'</td>
<td>≥0.5' &lt; 3'</td>
<td>≥0.5' &lt; 4'</td>
</tr>
<tr>
<td>B5.5</td>
<td>C3.5</td>
<td>D5</td>
</tr>
<tr>
<td>10' &lt; 16'</td>
<td>10' &lt; 17'</td>
<td>10' &lt; 19'</td>
</tr>
<tr>
<td>14' &lt; 21'</td>
<td>16' &lt; 23'</td>
<td>18' &lt; 26'</td>
</tr>
<tr>
<td>Size: 24' x 12'</td>
<td>Size: 30' x 12'</td>
<td>Size: 36' x 12'</td>
</tr>
<tr>
<td>≥0.5' &lt; 6'</td>
<td>≥0.5' &lt; 4'</td>
<td>≥0.5' &lt; 5'</td>
</tr>
<tr>
<td>B5.5</td>
<td>C3.5</td>
<td>D5</td>
</tr>
<tr>
<td>10' &lt; 16'</td>
<td>10' &lt; 17'</td>
<td>10' &lt; 19'</td>
</tr>
<tr>
<td>14' &lt; 21'</td>
<td>16' &lt; 23'</td>
<td>18' &lt; 26'</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Size: 4'-0&quot; DIAMETER</th>
<th>Size: 5'-0&quot; DIAMETER</th>
<th>Size: 6'-0&quot; DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥0.5' &lt; 2'</td>
<td>≥0.5' &lt; 2'</td>
<td>≥0.5' &lt; 2'</td>
</tr>
<tr>
<td>A6</td>
<td>B5</td>
<td>C6.5</td>
</tr>
<tr>
<td>10' &lt; 16'</td>
<td>10' &lt; 18'</td>
<td>10' &lt; 20'</td>
</tr>
<tr>
<td>14' &lt; 24'</td>
<td>17' &lt; 25'</td>
<td>20' &lt; 28'</td>
</tr>
<tr>
<td>22' &lt; 30'</td>
<td>29' &lt; 38'</td>
<td>32' &lt; 40'</td>
</tr>
<tr>
<td>Size: 6'-0&quot; DIAMETER</td>
<td>Size: 7'-0&quot; DIAMETER</td>
<td>Size: 8'-0&quot; DIAMETER</td>
</tr>
<tr>
<td>≥0.5' &lt; 2'</td>
<td>≥0.5' &lt; 2'</td>
<td>≥0.5' &lt; 2'</td>
</tr>
<tr>
<td>A6</td>
<td>B5</td>
<td>C6.5</td>
</tr>
<tr>
<td>10' &lt; 16'</td>
<td>10' &lt; 18'</td>
<td>10' &lt; 20'</td>
</tr>
<tr>
<td>14' &lt; 24'</td>
<td>17' &lt; 25'</td>
<td>20' &lt; 28'</td>
</tr>
<tr>
<td>22' &lt; 30'</td>
<td>29' &lt; 38'</td>
<td>32' &lt; 40'</td>
</tr>
</tbody>
</table>

### SLAB WALL DESIGN TABLE NOTES

1. Size is the inside dimensions of a structure.
2. Slab reinforcement is appropriate for top, intermediate, and bottom slabs.
3. Bottom Slabs for prestressed 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 bottom slabs.
6. Slab reinforcement is appropriate for top, intermediate, and bottom slabs.
7. Wall heights 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 heights exceeding the dimensions or depths shown in Table 8 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)

## WALL DEPTH SCHEDULE

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL SCHEDULE</th>
<th>WALL DEPTH SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot; x 12&quot;</td>
<td>A12</td>
<td>8&quot; x 12&quot;</td>
</tr>
<tr>
<td>10&quot; x 16&quot;</td>
<td>A12</td>
<td>10&quot; x 16&quot;</td>
</tr>
<tr>
<td>12&quot; x 20&quot;</td>
<td>A12</td>
<td>12&quot; x 20&quot;</td>
</tr>
</tbody>
</table>

## WALL THICKNESS

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL SCHEDULE</th>
<th>WALL DEPTH SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot;</td>
<td>A12</td>
<td>8&quot;</td>
</tr>
<tr>
<td>10&quot;</td>
<td>A12</td>
<td>10&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>A12</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

## WALL REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>WALL SCHEDULE</th>
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## REINFORCING SCHEDULE

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## WALL REINFORCING SPICE DETAILS (ALTERNATE B)

- **Single Layer Wall Reinforcing**
- **Double Layer Wall Reinforcing**
- **Lap Splice**
- **Lap Splice (8 For #4s, 10 For #5s, 12 For #6s)**
- **Lap Splice: With Standard 90° Hooks (8 For #4s, 10 For #5s, 12 For #6s)**
- **Lap Splice: Corner Spliced Bar (10 Bar Diameters, But Not Less Than Two Vertical Wire Spaces Plus 2 For WWR)**

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</table>
PLAN (INLET TYPE 2 SYMMETRICAL ABOUT A)

SECTION BB (INLET TYPE 2 SYMMETRICAL ABOUT A)

INLETS TYPES 1 AND 2

DIMENSIONAL SECTION

REINFORCING SECTION

3'-6" DIA. STRUCTURE BOTTOM (SECTION AA)

SECTION BB (INLET TYPE 4 SYMMETRICAL ABOUT A)

INLETS TYPES 3 AND 4

DIMENSIONAL SECTION

REINFORCING SECTION

4'-0" DIA. STRUCTURE BOTTOM (SECTION AA)

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

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

3. All steel in inlet top shall have 1/2" minimum cover unless otherwise shown. Inlet tops shall be either cast-in-place or precast concrete.

4. For precast units the rear wall and apron may be precast as a separate piece from the top slab. Provide a minimum of 7 ~ #4 dowels in accordance with Index 425-001 "OPTIONAL CONSTRUCTION JOINTS".

5. For supplemental details see Index 425-001.

6. Only round concrete support post will be acceptable.

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

8. For structure bottoms see Index 425-010.

9. Inlets to be paid for under the contract unit price for inlets (Curb) (Type_). Each.

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425-020

CURB INLET TOPS TYPES 1, 2, 3 AND 4

LATEST REVISION

07/17

DESCRIPTION:

FY 2020-21

STANDARD PLANS

INDEX

425-020

SHEET

1 of 1
**GENERAL NOTES**

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

2. For inlets constructed on a curve, refer to the plan 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 5 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 C496 (4,000 psi) may be used in lieu of Class 11 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 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 plans either the cast iron grate and galvanized steel frame or the galvanized steel grate and frame must be used. Grates are to be installed in accordance with the grating detail shown on Sheet 9, in lieu of tack welding.

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

**INLET TYPE 5** (Curb Inlet Type 6 Symmetrical With Left Half)

**SKETCH SHOWING FRAME SEAT AND THROAT RECESS**
**CROSS REFERENCES:**
For General Notes See Sheet 1.
For Location Of Sections DD Thru HH See Sheet 1.

**PRECAST DETAILS**

**SECTION DD**
(End View Of Inlet)

**SECTION EE**

**SECTION FF**

**SECTION GG**

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

SECTION HH (Type 5 Inlet Only)

CROSS REFERENCES:
For General Notes See Sheet 1.
For Location Of Sections CC Thru HH See Sheet 1.
GENERAL NOTES

1. This inlet is used in Traffic Separators Types 1 and 2, or, in separators constructed with Curbs Types A, B and E, 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.

### SCHEDULE (TABLE 1)

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<td>0.24</td>
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**Note:** To Be Paid For As Inlet (No Deduction For Separator)
GENERAL NOTES

1. This inlet is to be used only in Traffic Separators Types IV and V, or in separators constructed with Curbs Types D and F and sidewalk paving, which cannot accommodate Inlets Types 1, 2, 3, 4, 5 or 6. Use of this inlet on the through traffic side of the separator should be avoided in medians constructed with Curbs Type D (Curbs 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. Additional details and notes see Index 425-001.

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

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

Inlet to be paid for as Separator (No Deduction for Inlet).

Inlet to be paid for as Inlet.

4' Separator

6' Separator

180° Hook (Typ.)

90° Hook (Typ.)

#6 Bars ACI Std. Hooks Required

Each End Of Bent Bars And Right End Of Bent Bars. 180° Hooks, Canted 45°(s). On Odd Bars, 90° Hooks, Down. On Even Bars Numbered From Throat Side.

Top Slip Rebar Grids Required

#4 Bars @ 12" Ctrs.

#3 Bars

#5 Bars

A6

0.20

0.20

3" Cl. (Typ.)

MAX. SPACING

WWR

BARS

AREA

SCHEDULE

DEPTH

STANDARD PLANS

FY 2020-21

CURB INLET TYPE 8

INDEX

425-023

1 of 1
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. 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 1/2" minimum cover unless otherwise shown. Tops shall be either cast-in-place or precast concrete.
5. For Alternate B applications, top slab openings shall be placed such that 2 edges of inlet frame will be located directly above bottom wall or riser wall.
6. When used on a structure with dimensions larger than those detailed above and risers are not applied, the top slab shall be constructed using Index 425-010 with the slab opening adjusted to 24" x 36". 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, right or left.
**GENERAL NOTES**

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"x24”. 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.
**MEDIAN BARRIER INLETS TYPES 1 AND 2**

**GENERAL NOTES:**
1. Where called for in the Plans, use this inlet in conjunction with Median Barrier per Index 527-001.

Inlet Descriptions:
Type 1: Inlet on one side of Median Barrier
Type 2: Inlet on both sides of Median Barrier

2. For grade details, see Index 425-080. The parallel bar grate shall be used unless the trapezoidal grate is called for in the Plans. The trapezoidal grate shall be specified where bicycle traffic is anticipated. Used in 2" to 3" of occasional pedestrian traffic. Not suitable for use in pedestrian traffic or bicycle way.

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

4. For standard Median Barrier dimensions and requirements, see Index 521-001.

5. Inlet wall reinforcing is Grade 60 #4 bars. The horizontal wall reinforcing must be positioned 3' from the inside face unless otherwise shown. Per Index 425-001, the equivalent area of welded wire fabric is permitted.

6. Barrier reinforcing is Grade 60 #4 bars or #5 bars, as required to match the stirrup and longitudinal steel of the adjacent Concrete Barrier per Index 521-001. Barrier reinforcing steel cover may be either 2" or 2 1/2" as needed to match the adjacent barrier reinforcing cover, unless otherwise shown. Match the stirrup spacing of the adjacent barrier. Run longitudinal steel bars over the full length of the Concrete Barrier Transition and run continuously with the longitudinal steel of the adjacent barriers; use lap splices as required.

7. For supplemental details see Index 425-003.

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

9. Inlets to be paid for under the contract unit price for Inlets (Median Barrier Type), EA. Concrete Barrier to be paid for under the contract unit price for Concrete Barrier, LF.

10. Bond Breaker: One layer of ASTM 06380 Class S, Type III organic felt between inlet and barrier, including footings.
MEDIAN BARRIER INLETS TYPES 1 AND 2

PRECAST COLLAR REINFORCING DETAILS (TYPE 1)
(C-I-P COLLAR REINFORCING DETAILS SIMILAR)

PRECAST COLLAR REINFORCING DETAILS (TYPE 2)
(C-I-P COLLAR REINFORCING DETAILS SIMILAR)

DESCRIPTION:

REV IS IO N

11/01/17

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SHEET

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GENERAL NOTES:

1. Where called for in the Plans, use this inlet in conjunction with median or shoulder barrier per Index 521-001 or a barrier with junction slab and wall coping per Index 521-610. The inlet is suitable for bicycle and occasional pedestrian traffic, with roller bar installation (see INSET B), but should not be placed in a designated pedestrian travel way.

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

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

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

5. When Alternate B grate is specified in the Plans, the grate is to be hot-dip galvanized after fabrication. 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 are 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.

Inlet with Structure Bottom

Inlet with Structure Bottom Only. See Index 425-010

Inlet with Structure Bottom

Note: All B Structure Bottom Only. See Index 425-010
DESCRIPTION:
BEGIN CROSS-SLOPE TRANSITION
(ALIGN WITH CURB AND GUTTER BARRIER, SEE INDEX 521-001)

SECTION A-A
TRANSITION BARRIER
BEGIN CROSS-SLOPE TRANSITION
(ALIGN WITH CURB AND GUTTER BARRIER, SEE INDEX 521-001)

SECTION B-B
TRANSITION BARRIER
END CROSS-SLOPE TRANSITION
(ALIGN WITH INLET STRUCTURE)

SECTION C-C
BARRIER OVER INLET STRUCTURE
(THROAT FULLY TRANSITIONED)

GENERAL NOTES:
1. Where called for in the Plans, use this joint in conjunction with Curb and Gutter Barrier per Index 521-001. Construct Barrier segments shown herein in accordance with requirements of Index 521-001, including connections to adjacent barrier segments using the Doweled joint.
2. Reinforcing shown is grade 60 steel. For the equivalent area of welded wire reinforcement for the joint, see Index 425-001. Reinforcing shall have 2" minimum cover unless otherwise shown. Trim or bend bars to provide 1/2" clearance around pipe openings. The cost for additional reinforcing in the barrier is included in the cost of the concrete barrier.
3. All barriers are Class II or IV concrete per Index 521-001.
4. Apply a 3/16" chamfer or 3" radius to all exposed concrete edges.
5. For pipe connections to inlet structure bottoms, the recommended maximum pipe sizes are 18" longitudinal and 30" transverse. For larger pipe, use Alternate B bottoms, Index 425-030.
6. Grates may be fabricated with reticuline bars or with either 100% welded or 100% electroforged cross bars and bearing bars as detailed on Sheet 2.
7. When Alternate A grate is specified in the plans, the grate is to be hot-dip galvanized after fabrication in accordance with Specification 962-9.
8. For Pay Item purposes, the depth of the barrier inlets shall be computed using the center of box grate elevation, minus either the flow line elevation of the lowest pipe flow line or the top of the sump floor elevation.
9. All dimensions are for both precast and cast-in-place (C-I-P) inlets unless otherwise indicated.
10. For pipe placed in areas of bicycle traffic, provide the extended crossbar or reticuline grate as specified herein in accordance with requirements of Index 521-001, including connections to adjacent barrier segments using the Doweled joint.

BARRIER SECTIONS
1. For Bar Bending Diagrams of Bars 5V2 & 5U4. See Index 521-001. Bars 5V2M, 5U4M, & 5S 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 ~ 3½ PVC Schedule 40 pipes longitudinally spaced at 8", with the center pipe as near to the inlet centerline as practical without conflicting with the steel reinforcing.

**TABLE 1: HORIZONTAL WALL REINFORCING SCHEDULE**

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<td>9 ~ 10</td>
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<tr>
<td>10 ~ 13</td>
<td>6 ~ 15</td>
<td>6½&quot;</td>
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**NOTES:**

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

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

**SECTIONS D-D**

INLET STRUCTURE

(18" Dia. Pipe Opening Shown)

**SECTIONS E-E**

(Pipe Opening Not Shown)

(Barreled Reinforcing Steel Not Shown, See Sheet 1, Section C-C)

**NOTES:**

1. 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 ~ 3½ PVC Schedule 40 pipes longitudinally spaced at 8", with the center pipe as near to the inlet centerline as practical without conflicting with the steel reinforcing.
CROSS BAR OPTIONS

OPTIONAL STEEL GRATES

PICTORIAL VIEW OF INLET TOP

PRECAST INLET TOP REINFORCING DETAILS

DESCRIPTION:

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

**GUTTER INLET TYPE S**

**SECTION BB**

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

- **#4 Bars @ 12" Ctrs.**
- **Or 4" C-I-P**
- **Lip Of Gutter**
- **(See Table 1)**

**SECTION CC**

- **Shoulder Gutter Transition**
- **To Be Paid For As Shoulder Gutter**
- **Back Of Inlet**
- **Lip Of Gutter**

**SECTION DD**

- **Gutter Transition**
- **To Be Paid For As Inlet**
- **Center Of Box Sta/offset Location**
- **Bar Stub (See Detail)**

**SECTION FF**

- **Steel Grating**
- **4"x4" Welded WF**
- **1/3 Extra #4 Bar Below Grate Seat**
- **#4 Bars @ 12" Ctrs.**

**INLET WITH STRUCTURE BOTTOM**

**FY 2020-21**

**INDEX**

**425-040**

**1 of 3**
Apron To be Constructed At The Most Downstream Inlet In A Run Of Shoulder Gutter

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

TOP SLAB OPENINGS

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

Top Slab With Centered Opening

Round Structure Bottom - See Index 425-020 For Structure Bottom Details and Hole Reinforcement.

9'/0 For 5'-0" To 8'-0" Structure Bottoms
11'/0 For 8'-0" Structure Bottoms

SECTION AA

TOP SLAB REINFORCING DIAGRAM

SECTION BB

#5 Hoop Bar (Peripheral Reinforcement)

2 Way Reinforcement - See Tables

#6 Bars Each Corner

(2'-0" Min. Length)

Centered Opening - See Table For Dimensions

#8 Bars @ 5" Spacing

Centered Inlet

Structure Bottom

GUTTER INLET TYPE S

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REVISION 01/01/17

DESCRIPTION:

FY 2020-21

STANDARD PLANS

GUTTER INLET TYPE S

TOP SLAB REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>OR HS 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>0.27</td>
</tr>
<tr>
<td>D</td>
<td>0.51</td>
</tr>
<tr>
<td>E</td>
<td>0.73</td>
</tr>
<tr>
<td>F</td>
<td>1.35</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>6'-0&quot;</td>
<td>9.5&quot;</td>
<td>C</td>
</tr>
<tr>
<td>9'-0&quot;</td>
<td>9.5&quot;</td>
<td>D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIZE: 5'-0&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>w=0.5&quot;&lt;8&quot;</td>
</tr>
<tr>
<td>8&quot;&lt;15&quot;</td>
</tr>
<tr>
<td>15&quot;&lt;23&quot;</td>
</tr>
<tr>
<td>23&quot;&lt;30&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIZE: 6'-0&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>w=0.5&quot;&lt;8&quot;</td>
</tr>
<tr>
<td>8&quot;&lt;15&quot;</td>
</tr>
<tr>
<td>15&quot;&lt;23&quot;</td>
</tr>
<tr>
<td>23&quot;&lt;30&quot;</td>
</tr>
<tr>
<td>30&quot;&lt;40&quot;</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>6&quot;</td>
</tr>
<tr>
<td>4'-0&quot; Or 3'-10&quot;</td>
<td>8&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.

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 1/2".

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

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

6. For supplementary details see Index 425-001.

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

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 - 5'</td>
<td>0.20</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5 - 9'</td>
<td>0.24</td>
<td>5&quot;</td>
</tr>
<tr>
<td>9 - 15'</td>
<td>0.24</td>
<td>5&quot;</td>
</tr>
</tbody>
</table>

INDEX

425-041
ALT. A STRUCTURE BOTTOM FOR INLET TYPE V

**TOP SLAB OPENINGS**

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>OPENING SIZE</th>
<th>MIN.</th>
<th>MAX.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9'-0&quot; To 8'-0&quot;</td>
<td>2'-11&quot; x 4'-0&quot;</td>
<td>2'-3&quot; x 3'-10&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**TOP SLAB REINFORCING DIAGRAM**

- **Centered Opening**
  - Structure Bottom 
  - Round Structure Bottom
  - See Index 425-010 For Structure Bottom Details and Hole Reinforcement.
  - #4 Bar Each Corner (2'-0" Min. Length)
  - #5 Hoop Bar (Peripheral Reinforcement)
  - 2 Way Reinforcement

**TOP SLAB REINFORCEMENT SCHEDULE**

<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>#5 0.5&quot; &lt; 20'</td>
<td>95° C</td>
</tr>
<tr>
<td>30' &lt; 60'</td>
<td>95° G</td>
<td></td>
</tr>
<tr>
<td>SIZE: 6'-0&quot;</td>
<td>0.5&quot; &lt; #</td>
<td>95° B</td>
</tr>
<tr>
<td># &lt; 16&quot;</td>
<td>95° C</td>
<td></td>
</tr>
<tr>
<td>16&quot; &lt; 30&quot;</td>
<td>90° C</td>
<td></td>
</tr>
<tr>
<td>30&quot; &lt; 37&quot;</td>
<td>90° B</td>
<td></td>
</tr>
<tr>
<td>37&quot; &lt; 40&quot;</td>
<td>90° G</td>
<td></td>
</tr>
<tr>
<td>SIZE: 8'-0&quot;</td>
<td>0.5&quot; &lt; #</td>
<td>115° C</td>
</tr>
<tr>
<td>9&quot; &lt; 15&quot;</td>
<td>115° C</td>
<td></td>
</tr>
<tr>
<td>15&quot; &lt; 23&quot;</td>
<td>115° G</td>
<td></td>
</tr>
<tr>
<td>23&quot; &lt; 33&quot;</td>
<td>115° E</td>
<td></td>
</tr>
<tr>
<td>33&quot; &lt; 40&quot;</td>
<td>115° G</td>
<td></td>
</tr>
</tbody>
</table>

**TOP SLAB WITH CENTERED OPENING**

- Centered Inlet Structure Bottom
  - #8 Bars (2'-0" Min. Length)
  - #4 Bar Each Corner
  - See Tables

**SECTION AA**

- Top Slab With Centered Opening
- Round Structure Bottom
- See Index 425-010 For Structure Bottom Details and Hole Reinforcement.
- #4 Bars Each Corner
- #8 Bars @ 5" Spacing

**SECTION BB**

- 9" For 3'-0" For Structure Bottoms
- 11" For 4'-0" Structure Bottoms

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**GUTTER INLET TYPE V**

**FY 2020-21 STANDARD PLANS**

**REV. 2/11/17**

**DESCRIPTION:**

- REVISED

**LAST REVISION 02/11/17**

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**SHEET 2 of 2**
RECOMMENDED MAXIMUM PIPE SIZES

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>2'</th>
<th>3'-1&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-0&quot;</td>
<td>18&quot;</td>
<td>24&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 right and Index 425-010.

SECTION DD

Ditch Bottom Inlet Type A

NOTE: All B Structure Bottom Only. See Index 425-010 for Structure Bottom Details and Hole Reinforcement.

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 1/2". See Index 425-001 for equivalent area of welded wire fabric.

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

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

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

6. For supplemental details see Index 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 (Ditch Type A), EA.

HORIZONTAL WALL REINFORCING SCHEDULE (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 - 10</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 8&quot;</td>
</tr>
<tr>
<td>10 - 15</td>
<td>A12</td>
<td>0.20</td>
<td>6&quot; 5&quot;</td>
</tr>
</tbody>
</table>

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ALT. A STRUCTURE BOTTOM FOR INLET TYPE A
**CONCRETE INLET PAVEMENT AND SODDING**

**SECTION CC**

**SECTION DD**

**RECOMMENDED MAXIMUM PIPE SIZES**

<table>
<thead>
<tr>
<th>INLET INSIDE WIDTH</th>
<th>PIPE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-6&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>4'-3&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.

**SECTION AA**

**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 EE**

DITCH BOTTOM INLET TYPE B

**SECTION BB**

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

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX SPACING</th>
<th>BARS</th>
<th>WWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>A12</td>
<td>0.18</td>
<td>12</td>
<td>6&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>3 - 6</td>
<td>B6</td>
<td>0.20</td>
<td>12</td>
<td>6&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>6 - 9</td>
<td>B5</td>
<td>0.24</td>
<td>12</td>
<td>8&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>9 - 12</td>
<td>B5</td>
<td>0.29</td>
<td>12</td>
<td>8&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>12 - 15</td>
<td>B5</td>
<td>0.38</td>
<td>12</td>
<td>8&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>15 - 18</td>
<td>B5</td>
<td>0.38</td>
<td>12</td>
<td>8&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

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

**PLAN**

**SECTION DD**

**STEEL GRATE**
**GENERAL NOTES**

1. 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 with light traffic. 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 for min. 1½" clearance around pipe.

3. All exposed edges and corners shall be ½" chamfer or tooled to ¼" 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 and disposal 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 work 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.

**DESIGN NOTES**

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

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

**MAINTENANCE NOTES**

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

---

**TRAVERSABLE TOPS FOR INLETS TYPE B AND FOR CONVERSIONS OF EXISTING INLETS TYPE B AND TYPE X**
Top Slab Reinforcing Diagram

Top Slab Openings

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Opening Size</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-0&quot; to 8'-0&quot;</td>
<td>3'-8&quot; x 4'-2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3'-10&quot; x 4'-2&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Top Slab with Centered Opening

Round Structure Bottom

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

Top Slab Reinforcing Schedule

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Grade 40 (Bar)</th>
<th>65 KSI &amp; 70 KSI (Wire Fabric)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.20</td>
<td>0.24</td>
</tr>
<tr>
<td>B</td>
<td>0.37</td>
<td>0.33</td>
</tr>
<tr>
<td>C</td>
<td>0.53</td>
<td>0.33</td>
</tr>
<tr>
<td>D</td>
<td>0.73</td>
<td>0.33</td>
</tr>
<tr>
<td>E</td>
<td>1.06</td>
<td>0.33</td>
</tr>
<tr>
<td>F</td>
<td>1.45</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Top Slab with Centered Opening

Table 2 Way Reinforcement

<table>
<thead>
<tr>
<th>Slab Depth</th>
<th>Slab Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5'-0&quot;</td>
<td>0.24</td>
</tr>
<tr>
<td>1'-0&quot;</td>
<td>0.20</td>
</tr>
<tr>
<td>1'-10&quot;</td>
<td>0.20</td>
</tr>
<tr>
<td>3'-0&quot;</td>
<td>0.20</td>
</tr>
<tr>
<td>3'-10&quot;</td>
<td>0.20</td>
</tr>
<tr>
<td>6'-0&quot; Min. To 12'-0&quot; Max</td>
<td>0.20</td>
</tr>
</tbody>
</table>

#5 Hoop Bar (Peripheral Reinforcement)

#4 Bars @ 5" Spacing

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

#8 Bars

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

2 Way Reinforcement

See Tables

Centered Opening

See Table For Dimensions

Top Slab with Reinforcing Schedule

Standard Plans

Ditch Bottom Inlet Type B

Alt. A Structure Bottom For Inlet Type B

FY 2020-21

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3 of 3
DITCH BOTTOM INLET TYPES C, D, E AND H

### 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'-15'</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'-0&quot;</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot; 8&quot;</td>
</tr>
<tr>
<td>0'-19'</td>
<td>46</td>
<td>0.20</td>
<td>6&quot; 5&quot;</td>
</tr>
<tr>
<td>10'-19'</td>
<td>46</td>
<td>0.20</td>
<td>4&quot; 3&quot;</td>
</tr>
<tr>
<td>10'-15'</td>
<td>65.5</td>
<td>0.24</td>
<td>300 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&quot;</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'-10'</td>
<td>65.5</td>
<td>0.24</td>
<td>300 5&quot;</td>
</tr>
<tr>
<td>10'-15'</td>
<td>65.5</td>
<td>0.37</td>
<td>600 8&quot;</td>
</tr>
</tbody>
</table>

**TYPE E**

Recommended Maximum Pipe Size:

3'-0" Wall - 24" Pipe
4'-0" Wall - 30" Pipe

*Refer to Index 425-001 for additional details.*
**SCHEDULES (TABLE 4)**

**HORIZONTAL WALL REINFORCING**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft.)</th>
<th>MAX. SPACING BARS</th>
<th>WWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-5'</td>
<td>C3.5</td>
<td>0.37</td>
<td>600'</td>
<td>6'</td>
</tr>
<tr>
<td>5'-10'</td>
<td>D4.5</td>
<td>0.53</td>
<td>400'</td>
<td>4'</td>
</tr>
</tbody>
</table>

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

Recommended Maximum Pipe Size:
- 3'-0" Wall - 24" Pipe
- 6'-7" Wall - 1-1/8" Pipe
- Or 2-24" Pipe (5'-3'5"

**SCHEDULES (TABLE 5)**

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft.)</th>
<th>MAX. SPACING BARS</th>
<th>WWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-5'</td>
<td>C3.5</td>
<td>0.37</td>
<td>300'</td>
<td>3'</td>
</tr>
<tr>
<td>5'-10'</td>
<td>D4.5</td>
<td>0.53</td>
<td>400'</td>
<td>4'</td>
</tr>
</tbody>
</table>

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

Recommended Maximum Pipe Size:
- 3'-0" Wall - 24" Pipe
- 6'-7" Wall - 1-1/8" 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 frequent 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 end 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 6 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 1/4" 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 inlets partial. For conversion work and method of payment see TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS.

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

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.

STEEL GRATES

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

GENERAL NOTES

FY 2020-21
STANDARD PLANS

DITCH BOTTOM INLET TYPES C, D, E AND H

INDEX
425-052
3 of 7
For traversable 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>SY</td>
<td>SY</td>
<td>SY</td>
</tr>
<tr>
<td>C</td>
<td>4.87</td>
<td>0.71</td>
</tr>
<tr>
<td>D</td>
<td>5.99</td>
<td>0.91</td>
</tr>
<tr>
<td>E</td>
<td>5.88</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Concrete Inlet Pavement (Hand Shape to Neat Lines)
DITCH BLOCK FOR INLETS WITH OR WITHOUT SLOTS

PAVT. AND SOD

SOD ONLY

PLAN

SECTION AA

SECTION BB

NON-TRAVERSABLE 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></td>
<td>SY</td>
<td>CF</td>
</tr>
<tr>
<td>C</td>
<td>6.07</td>
<td>0.83</td>
</tr>
<tr>
<td>D</td>
<td>5.99</td>
<td>1.01</td>
</tr>
<tr>
<td>E</td>
<td>5.96</td>
<td>0.99</td>
</tr>
</tbody>
</table>

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

TRAVERSABLE SLOTS FOR EXISTING INLETS

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

For plan view and additional details see Sheet 4 of 7.
**DESIGN NOTES FOR TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS**

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

2. The corrective procedure depends on the approach ditch grade and hydraulic requirements of the site. The selection of the appropriate case depends on the relationship between inlet top and ditch elevation, and, on the vertical clearance between the top of the uppermost pipe(s) and the grate. The purpose for the Case 1 conversion is to add the traversable slot to an existing inlet where top removal, change in grade 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. A designer shall stipulate in the plans which case is to be constructed at each individual inlet location.

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

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

The designer shall determine whether right soil or other conditions as each individual Inlet indicates the need for underdrain in Case 3 conversions and shall call for Underdrain, Type I in the plans.

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

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

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

3. Concrete inlet pavement and sodding shall be paid 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 (FY Bid/FY _ ) (Partial), each. Sodding 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.

**SINGLE SLOT SHOWN (DOUBLE SLOTS SYMMETRICAL ABOUT CENTERLINE)**

**SECTION CC (CASE 2)**

**SECTION CC (CASE 3)**
ALT. A STRUCTURE BOTTOM FOR INLETS TYPE C, D & E

TOP SLAB OPENINGS

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>MIN.</th>
<th>MAX.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'-0&quot;</td>
<td>2'-0&quot;</td>
<td>3'-1&quot;</td>
</tr>
<tr>
<td>5'-0&quot;</td>
<td>2'-0&quot;</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>2'-0&quot;</td>
<td>4'-0&quot;</td>
</tr>
</tbody>
</table>

TOP SLAB REINFORCING SCHEDULE

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>GRADE 60 (BAR)</th>
<th>70 KSI (WIRE FABRIC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.20</td>
<td>0.24</td>
</tr>
<tr>
<td>B</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>C</td>
<td>0.54</td>
<td>0.54</td>
</tr>
<tr>
<td>D</td>
<td>0.73</td>
<td>0.73</td>
</tr>
<tr>
<td>E</td>
<td>1.06</td>
<td>1.06</td>
</tr>
<tr>
<td>F</td>
<td>1.29</td>
<td>1.29</td>
</tr>
</tbody>
</table>

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

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

PIPE OPENING SCHEMATIC

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

CENTRED OPENING

ROUND STRUCTURE BOTTOM

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

TOP SLAB WITH CENTERED OPENING

- Slab Depth: 4'-0"
- Slab Thickness: 95" C
- Reinforcing (2 Ways) Schedule:
  - Size: 8'-0"
  - 0.5' < 9" C
  - 9' < 13" D
  - 13' < 17" E
  - 17' < 22" F
  - 22' < 30" G

- Size: 6'-0"
  - 0.5' < 9" C
  - 9' < 13" D
  - 13' < 17" E
  - 17' < 22" F
  - 22' < 30" G

- Size: 4'-0"
  - 0.5' < 9" C
  - 9' < 13" D
  - 13' < 17" E
  - 17' < 22" F
  - 22' < 30" G

- Size: 3'-0"
  - ≥0.5' < 30" D
  - ≥0.5' < 9" C

- Size: 2'-0"
  - 0.5' < 8' A
  - 8' < 18" C
  - 18' < 30" D
  - 30' < 37" E
  - 37' < 40" F
  - ≥0.5' < 40" G
GENERAL NOTES

1. These inlets are designed for use in ditches, medians, pavement areas, or other areas subject to heavy wheel loads, minimal debris, and bicycle traffic. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet. When inlet is placed in areas subject to bicycle traffic, install filler bar when clearance or gap is greater than 1/4" 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 use Alternate B structure bottoms, Index 425-030. The inlet and bottom combinations are to be paid for under the contract unit price for inlets (DT Bot) (Type F or G) (Bot, Depth), Ea.

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

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

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

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

PAVEMENT AND SODDING

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

STEEL GRATE
Steel Grating, Straight Bars 4 x 4/5 Retineline Bars 2 x 2 x 4/5

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 830 Lbs. Main Bars 5" x 1/4"
Intermediate Bars 1 1/4" x 1/4", Reticuline Bars 1 1/4" x 1/4"

TYPE G INLET (TABLE 2)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING</th>
<th>WWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>A12</td>
<td>0.20</td>
<td>12'</td>
<td>8&quot;</td>
</tr>
<tr>
<td>3' - 7</td>
<td>A13</td>
<td>0.20</td>
<td>8'</td>
<td>5&quot;</td>
</tr>
<tr>
<td>7' - 10</td>
<td>B5.5</td>
<td>0.24</td>
<td>30'</td>
<td>5&quot;</td>
</tr>
<tr>
<td>10' - 15</td>
<td>C6.5</td>
<td>0.37</td>
<td>60'</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

Note: Horiz. Wall Rein. (See Table 2)
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 1½".

3. All exposed edges and corners shall be 1/2" chamfered or tooled to 1/2" radius.

4. When alternate C 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.

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

<table>
<thead>
<tr>
<th>WALL DEPTH</th>
<th>SCHEDULE</th>
<th>AREA (in²/ft)</th>
<th>MAX. SPACING</th>
<th>BARS</th>
<th>WWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-4&quot;</td>
<td>A12</td>
<td>0.20</td>
<td>12&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>4'-9&quot;</td>
<td>A6</td>
<td>0.20</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>9'-12&quot;</td>
<td>A4</td>
<td>0.20</td>
<td>8&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>9'-15&quot;</td>
<td>0.24</td>
<td>50&quot;</td>
<td>3&quot;</td>
<td></td>
<td></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: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fill in accordance with Index 425-001. For larger pipe, see Structure Bottom detail above and Index 425-010.
SECTION CC

Ditch Bottom

SIDE SLOPE

SECTION DD

Ditch Block (low side of inlet on continuous ditches)

Ditch Bottom

SIDE SLOPE

PAVEMENT & SODDING

STEEL GRATING

DETAIL

Note: Two Required Per Inlet
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 2020-21
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.

- **Pipe Size (in)**, **Concrete Class I (CY)**, **Sand-Cement Riprap (CY)**

<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>4-9</td>
<td>2.3</td>
</tr>
<tr>
<td>18</td>
<td>5-3</td>
<td>2.5</td>
</tr>
<tr>
<td>24</td>
<td>6-3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

- See Plans For Handrail Requirements
- Special Concrete Endwall
- Back of Sidewalk Drainage
- Pipe Size 24" max.
- 1/2" Preformed Joint Filler
- Sidewalk
- Back Of Sidewalk
- Grader Slopes 1:1
- Riprap Slopes Steeper Than 1:1 (Max. 1:1)
- See Plans For Handrail Requirements
- And Ditch Bottom (Symmetrical About ζ)
YARD DRAIN ITEM INCLUDES:

1. 15" x 15" x 12" Concrete or PVC Tee 4' long.
2. Grade diameter = 14-½"
   Thickness = 2-½"
   Flow area = 45 sq in min.
   Light Duty Cast Iron, see Specification Section 962.
3. 12" pipe as necessary.
4. 0.04 Cubic yards concrete for slab.

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 Mitered End to be paid for under the contract unit price for either Cast Iron Soil Pipe (Standard) (4"), 1/2 or PVC Pipe For Back Of Sidewalk Drainage (4"), 1/2.
4. 0.04 Cubic yards concrete for slab.
**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 1/8".

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

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

SINGLE BARREL FLUME DEPICTED

**ENDWALL**

- #4 Steel Tie Bar
- #4 Steel Tie Bar

**SECTION AA**

- Sta/Offset Location
- Varies
- 2'-0" (Min)
- C & G
- Varies
- 2" Typ
- E Thick Concrete Slab
- Varies
- Varies
- 3'-0" (Min)

**SECTION BB**

- The Cost Of The 4" Thick Slab And The 6"x6" W2.5x42.5 Min. Welded Wire Reinforcement In The Width Of Sod To Be Included In The Cost Of The Inlet.

- Existing Ground
- 6'-0"
- 3'-0" (Min)
- Varies
- 6'-0"

**PLAN**

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

- *Bricks to Dissipate Energy:
  - When Called For In Plans:
  - Bricks To Be Included In The Cost Of The Inlet.

- Sod (Same As Right)
- Ditch Bottom
- Swale or Ditch

**INDEX**

11/01/17

**CLOSLED FLUME INLET**

**DESCRIPTION:**

FAA

**REV ISIO N:**

10 /29 /2019

**LAST REVISION:**

01/01/17

**STANDARD PLANS**

**FY 2020-21**

**INDEX:**

425-061

**SHEET:**

2 of 3
**DESCRIPTION:**

REVISION OF STANDARD PLANS

FY 2020-21

STANDARD PLANS

CLOSED FLUME INLET

INDEX 425-061 SHEET 3 of 3
GENERAL NOTES

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

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

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

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

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

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

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

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

DESIGN NOTES

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

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

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

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

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

6. The designer must show the configuration of the weir slots in the outlet control structure detail.
**SKIMMER FOR OUTLET CONTROL STRUCTURES**

**DIMENSIONS**

<table>
<thead>
<tr>
<th>Height (as Specified in the Plans)</th>
<th>Bolt Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H</strong></td>
<td><strong>D</strong></td>
</tr>
<tr>
<td>Inches</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3 3/4</td>
</tr>
<tr>
<td>14</td>
<td>4 3/8</td>
</tr>
<tr>
<td>16</td>
<td>5 3/8</td>
</tr>
<tr>
<td>18</td>
<td>6 3/8</td>
</tr>
<tr>
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<td>7 1/8</td>
</tr>
<tr>
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</tr>
<tr>
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<td>30</td>
<td>12 1/8</td>
</tr>
<tr>
<td>32</td>
<td>5 3/4</td>
</tr>
<tr>
<td>34</td>
<td>6 3/8</td>
</tr>
<tr>
<td>36</td>
<td>6 3/8</td>
</tr>
<tr>
<td>38</td>
<td>6 3/8</td>
</tr>
<tr>
<td>40</td>
<td>6 3/8</td>
</tr>
</tbody>
</table>

**SIDE PANEL**

- 3/8" x 1 3/4" (3 Slots)
- Steel Sheet 0.1345" Thick (10 Gages)
- 3/16" Dia. (6 Holes)

**TOP VIEW**

- Top Flange (Cut Away)
- Bottom Flange
- 43°

**END VIEW (FRONT)**

- Front Flange (Cut Away)
- 3/16" Dia. (6 Holes)

**SIDE VIEW**

- E Holes For Expansion Anchors

**IDENTIFICATION**

- FY 2020-21 STANDARD PLANS
- SKIMMER FOR OUTLET CONTROL STRUCTURES
- 425-070

---

**REV** 03/27/17
**REV** 03/27/17
**REV** 03/27/17

**LAST** 03/01/17 **REVISION** 03/01/17 **INDEX** 425-070

**DESCRIPTION:**

- 10/29/2019

**REVISION:**

- 11/01/17
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 C476. 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 "Organizer" 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.

UTILITY CONFLICT CONDITION I
(Nonpressure Or Nonfluid Carrier Installations)

UTILITY CONFLICT CONDITION II
(Pressure Or Fluid Carrier Installations)

SECTION A-A

SECTION B-B

UTILITY CONFLICT PIPES THRU STORM DRAIN STRUCTURES
SAFETY MODIFICATION FOR INLETS IN BOX CULVERTS
**NOTES:**

1. Fill or excavate variable slopes during normal grading operations.

2. Minimum distance as required to comply with safety criteria.

3. Use larger Value Of Either:
   - L=10xH (No Maximum)
   - L=10xDitch Offset (Maximum L=100')

4. Slope to normal slope if possible. Slope not to be steeper than 1:2. See side elevation (extended) below if 1:2 slope must go beyond toe of normal slope.

5. 1:2 slope if necessary to go beyond normal toe of slope and maintain ditch width by moving out back slope.

---

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<th>Description</th>
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<td>Limits of Variable Front Slopes at Drainage Structures</td>
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<tr>
<td>2</td>
<td>Round and Elliptical Concrete Pipe Joints</td>
</tr>
<tr>
<td>3</td>
<td>Filter Fabric Jacket, Concrete Jacket, and Pipe Plug</td>
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<td>Concrete Collars</td>
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<td>Pipe End Guard</td>
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<td>6</td>
<td>Retaining Wall Concrete Gutter and Drains</td>
</tr>
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</table>

---

**LIMITS OF VARIABLE FRONT SLOPES AT DRAINAGE STRUCTURES**
SCHEDULE OF BELL REINFORCEMENT
Classes II, III, IV, V: Wall A, B, C

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter</th>
<th>Design Bell Reinforcement</th>
<th>Maximum Bell Reinforcement Under Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in² per foot</td>
<td>in² per foot</td>
</tr>
<tr>
<td>15&quot;</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>18&quot;</td>
<td>0.07</td>
<td>0.10</td>
</tr>
<tr>
<td>24&quot;</td>
<td>0.14</td>
<td>0.15</td>
</tr>
<tr>
<td>30&quot;</td>
<td>0.18</td>
<td>0.20</td>
</tr>
<tr>
<td>48&quot;</td>
<td>0.23</td>
<td>0.24</td>
</tr>
<tr>
<td>60&quot;</td>
<td>0.28</td>
<td>0.29</td>
</tr>
<tr>
<td>72&quot;</td>
<td>0.33</td>
<td>0.34</td>
</tr>
<tr>
<td>84&quot;</td>
<td>0.38</td>
<td>0.39</td>
</tr>
<tr>
<td>96&quot;</td>
<td>0.42</td>
<td>0.43</td>
</tr>
</tbody>
</table>

NOTES:
1. Allowable Tolerance for the last full wrap of reinforcing when using single elliptical cage.
2. Extend the last full wrap of reinforcing to the shoulder point and meet ASTM C-76 requirements.
3. All circumferential steel located above this line and within the 1.75 L is defined as bell reinforcement.

ROUND CONCRETE PIPE JOINT DETAIL

ELLIPtical CONCRETE PIPE JOINT DETAIL

MISCELLANEOUS DRAINAGE DETAILS
DESCRIPTION:

REVISION OF STANDARD PLANS FY 2020-21

SECTION VIEW

ISOMETRIC VIEW

FILTER FABRIC JACKET
(For All Pipe Types - Concrete Elliptical Pipe Shown)

CONCRETE JACKET

FILTER FABRIC JACKET, CONCRETE JACKET, AND PIPE PLUG

NOTES:

1. Alternate connection must be approved by the Engineer.

2. Install securing device in accordance with Specification 985.

3. Any wire mesh arrangement which provides 0.126 square inches of steel area per linear foot may be used, provided the wires are spaced a minimum of 2" and a maximum of 6" on centers.

4. Do not use a concrete jacket to join dissimilar metal pipes.

5. 12" for pipes 15" through 24"; 24" for pipes 30" and larger.

6. 12" for pipes 14" x 23" through 19" x 30"; 24" for pipes 24" x 38" and larger.

(See Note 2)
DESCRIPTION:

REVISION

LAST

REVISED

STANDARD PLANS

MISCELLANEOUS DRAINAGE DETAILS

430-001

CONCRETE COLLARS

NOTES:

1. The collar may be formed by any method approved by the Engineer.

2. Install [3"x16"] dowels in adhesive bond material.

3. Stub Pipes maximum diameter:
   \( \frac{d}{2} \) of a round main line pipe diameter, or \( \frac{1}{2} \) the height of elliptical main line pipes.

4. Opening by Pipe Manufacturer.

5. Install riser reinforcement using #5 Bars @ 18" centers vertically and 6" centers horizontally. Bend pipe steel to riser.

6. Reinforced concrete top required when inlet: manhole or junction box riser is less than 4 feet in diameter, or when 3-4", 6", 8" inlet, manhole or junction box riser is used; or when rectangular inlet is used.

7. See Index 425-001 for optional construction joints.
DESCRIPTION:

REVISION

LAST
OF
STANDARD PLANS

FY 2020-21

SHEET

INDEX

8" and Pipe Endwall

" PVC Pipe Sleeve

Clip Angle and Washers (See Note 2)

Ø Anchor Bolt with Nut

Guard Bars 8" On Center

See DETAIL "A"

Top Steel Bracket

Bottom Steel Plate

GUARD TABLE

Pipe Dia. Top Steel Bracket Bottom Steel Plate Number of Vert. Bars Number of Horiz. Bars Bars Size Weight lbs.

18" 2'-6" 3'-6" 4 1 ½ 48

24" 3'-0" 4'-0" 5 2 ½ 58

30" 3'-0" 4'-8" 6 2 ¾ 74

36" 3'-6" 5'-6" 7 3 ½ 90

42" 4'-4" 6'-0" 9 5 ⅞ 111

NOTES:

1. Construct guards only at locations specifically called for in Plans.

GENERAL NOTES:

1. Use Class I concrete.

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

3. Endwall may be cast in place or precast concrete. Construct precast units to dimensions shown, or as shown in approved shop drawings. Use Index 425-001 for opening and grouting details.

4. Quantities shown are for estimating purposes only.

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<td>2</td>
<td>Dimensional and Reinforcing Details</td>
</tr>
<tr>
<td>3</td>
<td>Type 1 and Type 2 Grate Details</td>
</tr>
</tbody>
</table>

U-TYPE CONCRETE ENDWALLS 15" TO 30" PIPES WITH GRATES

(24" Pipe Shown)

GENERAL NOTES:

1. Use Class I concrete.

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

3. Endwall may be cast in place or precast concrete. Construct precast units to dimensions shown, or as shown in approved shop drawings. Use Index 425-001 for opening and grouting details.

4. Quantities shown are for estimating purposes only.

TABLE 1

<table>
<thead>
<tr>
<th>Slope</th>
<th>Pipe Dia.</th>
<th>Offset (FT)</th>
<th>L (FT)</th>
</tr>
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<tbody>
<tr>
<td>1.4</td>
<td>15&quot;</td>
<td>4.8</td>
<td>6.7</td>
</tr>
<tr>
<td>1.6</td>
<td>18&quot;</td>
<td>4.8</td>
<td>6.7</td>
</tr>
<tr>
<td>1.8</td>
<td>24&quot;</td>
<td>6.9</td>
<td>7.6</td>
</tr>
<tr>
<td>2.4</td>
<td>30&quot;</td>
<td>6.9</td>
<td>7.6</td>
</tr>
</tbody>
</table>

FRONT SLOPE TRANSITION AT ENDWALL
**LEGEND:**

- **D** = Dowels or Diagonal Bars
- **B** = Bent Bars
- **V** = Vertical Bars
- **H** = Horizontal Bars

**TABLE 2**

<table>
<thead>
<tr>
<th>Slope (LA)</th>
<th>Pipe Dia. (ft)</th>
<th>A (ft)</th>
<th>B (ft)</th>
<th>Class I Conc. (CY)</th>
<th>Rein. Steel (lbs)</th>
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<tr>
<td>15</td>
<td>2.38</td>
<td>0.85</td>
<td>95</td>
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<td>16</td>
<td>2.67</td>
<td>1.00</td>
<td>87</td>
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<td></td>
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<tr>
<td>17</td>
<td>1.86</td>
<td>1.45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>1.80</td>
<td>2.13</td>
<td>129</td>
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**DIMENSIONAL AND REINFORCING DETAILS**

**U-TYPE CONCRETE ENDWALLS**

15' TO 30' PIPES WITH GRATES

**INDEX**

430-010
NOTES:
1. Install grate bars evenly spaced across dimension D.
2. All bars and grate bars are ¾" x 2".

<table>
<thead>
<tr>
<th>Pipe Dia</th>
<th>Grate Bars Req'd</th>
<th>Grate Wt. (lbs)</th>
<th>Grate Bars Req'd</th>
<th>Grate Wt. (lbs)</th>
<th>Total Grate Wt. (lbs)</th>
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<tr>
<td>15&quot;</td>
<td>0</td>
<td>42.33</td>
<td>0</td>
<td>2</td>
<td>23.56</td>
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<td>18&quot;</td>
<td>5</td>
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<td>5</td>
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<td>297.75</td>
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<td>24&quot;</td>
<td>0</td>
<td>61.69</td>
<td>0</td>
<td>7</td>
<td>111.98</td>
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<tr>
<td>30&quot;</td>
<td>5</td>
<td>69.85</td>
<td>5</td>
<td>5</td>
<td>267.75</td>
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</table>

**TABLE 3**

**NUMBER OF GRATE BARS AND GRATES REQUIRED**

**U-TYPE CONCRETE ENDWALLS**

**15" TO 30" PIPES WITH GRATES**

**TYPE 1 AND TYPE 2 GRATE DETAILS**

**DETIAL "A"**

**SIDE VIEW**

**TOP VIEW**

**END VIEW**

**PLAN**

**ELEVATION**

**SECTION A-A**

**PLAN**

**ELEVATION**

**SIDE VIEW**

**TOP VIEW**

**END VIEW**

**SIDE VIEW**

**TOP VIEW**

**END VIEW**

**SECTION A-A**

**PLAN**

**ELEVATION**

**SIDE VIEW**

**TOP VIEW**

**END VIEW**

**SECTION A-A**
GENERAL NOTES:
1. Use Class I concrete

2. Construct Baffles only when called for in Plans

3. See Sheet 5 when steel grating is required on endwall

4. All reinforcing #4 bars with 2" clearance except as noted

5. Channel section C 3x6 may be substituted for C 4x5.8 channel

6. Endwall may be cast in place or precast concrete. Construct precast units to dimensions shown, or as shown in approved shop drawings. Submit requests for shop drawing approvals to the Engineer. Use Index 425-001 for opening and grouting details.

7. Quantities shown are for estimating purposes only.

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<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>
ENDWALLS FOR 1:2 SLOPES WITH BAFFLES

DIMENSIONAL DETAILS

DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL

<table>
<thead>
<tr>
<th>Pipe Dia.</th>
<th>Area</th>
<th>L</th>
<th>H</th>
<th>W</th>
<th>S</th>
<th>B</th>
<th>Dia.</th>
<th>X Baffle</th>
<th>Y Baffle</th>
<th>Class I</th>
<th>Reinf.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dia.</td>
<td>Sq. Ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15&quot;</td>
<td>1.23</td>
<td>5&quot;-W</td>
<td>2'-3(\frac{3}{4})&quot;</td>
<td>3'-7&quot;</td>
<td>2'-3&quot;</td>
<td>1'-9&quot;</td>
<td>7'-9&quot;</td>
<td>2#4</td>
<td>2#4</td>
<td>1#4</td>
<td>1.61</td>
<td>72</td>
</tr>
<tr>
<td>18&quot;</td>
<td>1.77</td>
<td>6'-6&quot;</td>
<td>2'-5(\frac{3}{4})&quot;</td>
<td>3'-10&quot;</td>
<td>2'-6&quot;</td>
<td>1'-10&quot;</td>
<td>9'-6&quot;</td>
<td>2#4</td>
<td>2#4</td>
<td>1#4</td>
<td>1.89</td>
<td>86</td>
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<td>24&quot;</td>
<td>3.14</td>
<td>8'-8&quot;</td>
<td>2'-8&quot;</td>
<td>4'-4&quot;</td>
<td>3'-6&quot;</td>
<td>2'-9&quot;</td>
<td>7'-6&quot;</td>
<td>3#4</td>
<td>3#4</td>
<td>2#4</td>
<td>2.52</td>
<td>108</td>
</tr>
<tr>
<td>30&quot;</td>
<td>4.91</td>
<td>10'-6&quot;</td>
<td>2'-11(\frac{3}{4})&quot;</td>
<td>6'-10&quot;</td>
<td>3'-8&quot;</td>
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<td>7'-6&quot;</td>
<td>4#4</td>
<td>4#4</td>
<td>3#4</td>
<td>3.21</td>
<td>131</td>
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</tbody>
</table>

REINFORCING DETAILS

NOTE:
See Sheet 3 for Bar Bending Diagram.

LEGEND:
H = Horizontal Bars
V = Vertical Bars
B = Bent Bars
D = Dowels or Diagonal Bars
**Description:**

**Revision:**

**Last Revision Date:**

**Project:**

**Index:**

**Sheet:**
### TABLE OF DIMENSIONS AND QUANTITIES FOR ONE GRATE

<table>
<thead>
<tr>
<th>Rate of Slope</th>
<th>Size Dia.</th>
<th>G</th>
<th>2 Each Bars @ 34 lb/ft</th>
<th>(X) Channels @ 5.4 lb/ft</th>
<th>2 Angles @ 3.6 lb/ft</th>
<th>Total Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:3</td>
<td>15&quot;</td>
<td>2</td>
<td>4'-3&quot; 3'-3&quot; 2'-7&quot; 1'-0&quot;</td>
<td>3 4'-3&quot; 3'-3&quot; 2'-7&quot; 1'-0&quot;</td>
<td>3 3'-3&quot; 2'-7&quot; 1'-0&quot;</td>
<td>17 110</td>
</tr>
<tr>
<td></td>
<td>20&quot;</td>
<td>3</td>
<td>3'-5&quot; 2'-4&quot; 1'-0&quot;</td>
<td>3 3'-5&quot; 2'-4&quot; 1'-0&quot;</td>
<td>3 3'-5&quot; 2'-4&quot; 1'-0&quot;</td>
<td>23 145</td>
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<tr>
<td></td>
<td>25&quot;</td>
<td>5</td>
<td>2'-8&quot; 1'-0&quot;</td>
<td>3 2'-8&quot; 1'-0&quot;</td>
<td>3 2'-8&quot; 1'-0&quot;</td>
<td>31 191</td>
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</tbody>
</table>

### ELEVATION

**Grate Seat (See DETAIL "B")**

**Anchor Bolt Detail**

**CHANNEL TO ANGLE WELD**

**ANCHOR BOLT DETAIL**

### SECTION A-A

**2" x 1/2" Bar**

**C4 x 5.4**

**SECTION B-B**

**2" x 1/2" Bar**

**C4 x 5.4**

### STEEL GRATE DETAILS

**STEEL GRATE MOUNTING**

**ANGLE TO CHANNEL WELD**

**CHANNEL TO ANGLE WELD**

**ANCHOR BOLT DETAIL**

**DETAIL "B"**

### STEEL GRATE OPTION

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

**INDEX 430-011**

**SHEET 5 of 5**

**LAST REV. 01/01/19**

**DESCRIPTION: FY 2020-21 STANDARD PLANS**
GENERAL NOTES:
1. Use Class I concrete.
2. Chamfer all exposed edges 1/8".
3. See Index 550-002 for details of Type B fencing.
4. Quantities shown are for estimating purposes only.

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<tr>
<td>2</td>
<td>Dimensional Details</td>
</tr>
<tr>
<td>3</td>
<td>Reinforcing Details and Bending Diagram</td>
</tr>
</tbody>
</table>

ENERGY DISSIPATOR 30" TO 72" PIPE

U-TYPE CONCRETE ENDWALLS

Fence Type B (When called for in the Plans)

Slope 1:1½ (Typ.)

Sand-Cement Riprap

Pipe
DIMENSION TABLE

<table>
<thead>
<tr>
<th>Dia (in)</th>
<th>Area (SF)</th>
<th>W</th>
<th>H</th>
<th>L</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>M</th>
<th>N</th>
<th>P</th>
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<th>R</th>
<th>S</th>
<th>T</th>
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<td>4.91</td>
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<td>1.2</td>
<td>2.6</td>
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<td>7.3</td>
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<td>1.2</td>
<td>1.3</td>
<td>2.0</td>
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<td>7.25</td>
<td>8.6</td>
<td>3</td>
<td>10.34</td>
<td>1,072</td>
<td></td>
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<td>42&quot;</td>
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Concrete (CF) | 10.6 |
Rein Steel (%) | 13.6 |
Sand-Cement Riprap (Nom.) (SF) | 17.5 |

U-TYPE CONCRETE ENDWALL
ENERGY DISSIPATOR 30° TO 72° PIPE
GENERAL NOTES:

1. Provide flared end sections meeting the requirements of ASTM C76 with the exception that dimensions and reinforcement meet the criteria in the table on sheet 2. Circumferential reinforcement may consist of either one cage or two cages of steel. Use concrete compressive strength of 4000 psi.

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

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

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

   c. Reinforced concrete jackets, as detailed on sheet 2. When non-coated corrugated metal pipe is called for in the Plans, use bituminous coated pipe in the jacketed area as specified on Index 430-001. Construct concrete jacket as specified in Index 430-001.

3. Toe walls are to be cast-in-place using Class I Concrete.

4. On skewed pipe culverts place the flared end sections in line with the pipe culvert. Warp the side slopes as required to fit the flared end sections.

5. Quantities shown are for estimating purposes only.

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FLARED END SECTION
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. When bituminous coated metal pipe is specified for cross drain pipe, construct the mitered end sections with 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), steel reinforced polyethylene pipe (SRPE), and polypropylene pipe (PP). When used in conjunction with corrugated mitered end sections, make connection using either a formed metal band specifically designated to join HDPE, PVC, SRPE, or PP pipe with metal pipe. When used in conjunction with a concrete mitered end sections, construct concrete jacket in accordance with index 430-001.

3. Class NS concrete cast-in-place reinforced slabs are required for all sizes of cross drain pipes. Construct slabs at 5½” thick, unless P’ thickness is called for in the Plans.

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

5. Repair corrugated metal pipe galingizing that is damaged during beveling and perforating.

6. 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 single pipe or collectively as multiple pipe end sections as directed by the Engineer.

7. Saddle Slope:
   1.4 Miter - Slope to Ø of pipe for round pipes less than or equal to 18” diameter and 1:1 for round pipes greater than or equal to 24” diameter. Slope to the major axis for elliptical pipes 24”x38” or smaller and 1:2 for pipes 29”x45” or larger. Slope to the span line for pipe arch 28”x20” or smaller and 1:2 for pipe arch 33”x24” or larger.
   1.2 Miter - Slope to Ø of pipe for round pipes less than or equal to 18” diameter and 1:2 for round pipes greater than or equal to 24” diameter. Slope to the major axis for elliptical pipes 29”x45” or smaller and 1:1 for pipes 34”x53” or larger. Slope 1.1 for all pipe arch sizes.

8. Quantities shown are for estimating purposes only.

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<table>
<thead>
<tr>
<th>Sheet</th>
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<tbody>
<tr>
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<td>General Notes and Contents</td>
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<tr>
<td>2</td>
<td>Single and Multiple Concrete Pipe</td>
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<td>Concrete Pipe Dimensions and Quantities</td>
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<td>Single and Multiple Corrugated Metal Pipe</td>
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<td>5</td>
<td>Corrugated Metal Pipe Dimensions and Quantities</td>
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<td>Concrete Pipe Connections and Corrugated Metal Pipe (CMP) Anchor Detail</td>
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Note: See Table 1 on Sheet 3 for Dimensions and Quantities.
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**TABLE 1**

**SINGLE AND MULTIPLE CONCRETE PIPE DIMENSIONS AND QUANTITIES**

**CONCRETE PIPE DIMENSIONS AND QUANTITIES**

**LAST REVISION**

01/19

**MATERIALS LIST**

**DESCRIPTION:**

FY 2020-21

**CROSS DRAIN MITERED END SECTION**

**INDEX SHEET**

3 of 6

**STANDARD PLANS**

**430-021**

**6.42** Dimensions permitted to allow use of 6" standard pipe lengths.

**10.49** Dimensions permitted to allow use of 12" standard pipe lengths.
PLAN - SINGLE PIPE

Concrete Slab Reinforced With WRR 6x6-W1.4xW1.4 (See General Note 3)

PLAN - MULTIPLE PIPE

Concrete Slab Reinforced With WRR 6x6-W1.4xW1.4 (See General Note 3)

SECTION B-B
(Pipe/Slab Fillet)

Concrete Slab

DETAIL "B"

SADDLE SLOPE (See General Note 3)

NOTE:
See Table 2 on Sheet 5 for Dimensions and Quantities.

6x6-W1.4xW1.4 (See General Note 3)

Concrete Slab Reinforced With WRR

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NOTES:
1. Anchors required for CMP only.
2. Use galvanized steel for all anchors, nuts, and washers.
3. Bend anchor where required to center in concrete slab.
4. Repair damaged surfaces after bending.
5. Place flat washers on inside wall of pipe.
6. Drill or punch holes in the mitered end pipe; burning not permitted.
7. A 6" x 1/2" bolt substitution is permitted.

TONGUE AND GROOVE CONNECTOR DETAIL

BELL AND SPIGOT CONNECTOR DETAIL

STEEL BAR

CONCRETE PIPE CONNECTION DETAIL

CORRUGATED METAL PIPE (CMP) ANCHOR DETAIL

CONCRETE PIPE CONNECTION AND CORRUGATED PIPE ANCHOR DETAILS
GENERAL NOTES:

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

2. Use either corrugated metal or concrete mitered end sections for corrugated polyethylene pipe (HDPE), polyvinyl chloride pipe (PVC), steel reinforced polyethylene pipe (SRPE), and polypropylene pipe (PP). When used in conjunction with corrugated mitered end sections, make connection using either a formed metal band specifically designated to join HDPE, PVC, SRPE, or PVC pipe. When used in conjunction with a concrete mitered end sections, construct concrete jacket in accordance with Index 430-001.

3. Use class NS concrete cast-in-place reinforced slabs for all cross drain pipes.

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. 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. Saddle Slope:
   1.4 Miter - Slope to $\frac{1}{4}$ of pipe for round pipes less than or equal to 18" diameter and 1:1 for round pipes greater than or equal to 24" diameter.
   Slope to the major axis for elliptical pipes 24"x38" or smaller and 1:2 for pipes 29"x45" or larger.
   Slope to the span line for pipe arch 28"x20" or smaller and 1:2 for pipe arch 35"x24" or larger.

   1.2 Miter - Slope to $\frac{1}{4}$ of pipe for round pipes less than or equal to 18" diameter and 1:2 for round pipes greater than or equal to 24" diameter.
   Slope to the major axis for elliptical pipes 29"x45" or smaller and 1:1 for pipes 34"x53" or larger.
   Slope 1:1 for all pipe arch sizes.

8. Quantities shown are for estimating purposes only.

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<table>
<thead>
<tr>
<th>Sheet</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>General Notes and Contents</td>
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<tr>
<td>2</td>
<td>Single and Multiple Concrete Pipe</td>
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<td>Concrete Pipe Dimensions and Quantities and Permissible Pavement Modifications</td>
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<td>Single and Multiple Corrugated Metal Pipe</td>
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<td>6</td>
<td>Concrete Pipe Connection and Corrugated Metal Pipe Anchor Details</td>
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<td>Fastener Unit and Grate Details</td>
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**LAST REVISION:**
- **DATE:** 11/01/18
- **REVISION:** 2

**FY 2020-21 STANDARD PLANS**

**SIDE DRAIN MITERED END SECTION**

**INDEX:** 430-022

**SHEET:** 2 of 7

---

1. **PLAN - SINGLE PIPE**
   - Connector
   - Side Ditch Grade
   - Concrete Slab, 3" Thick Reinforced (See Sheet 7)
   - Grates and Fasteners

2. **PLAN - MULTIPLE PIPE**
   - Concrete Slab, 3" Thick Reinforced (With WWR 6x6-WI.4xWI.4)
   - Concrete Slab, 3" Thick Reinforced (See Sheet 7)
   - Construction Joint Permitted

3. **ELEVATION**
   - Round Concrete Pipe (Elliptical Pipe Similar)
   - Saddle Slope (See General Note 7)
   - 2'-0" Min. Sod
   - No Pipe Joint Unless Approved By Engineer

4. **SECTION A-A**
   - Concrete Slab
   - Saddle Slope (See General Note 7)
   - Pipe/Slab Fillet: Deepen Concrete Slab to Form Bridge Across Crown of Pipe
   - Grates and Fasteners

5. **DETAIL "A"**
   - Concrete Slab
   - Grates Spaced 14" c to c
   - Side Ditch Grade
   - Construction Joint Permitted

---

**GENERAL NOTES:**

1. **SIDE DRAIN MITERED END SECTION**
   - Plan - Single Pipe
   - Plan - Multiple Pipe
   - Elevation
   - Section A-A
   - Detail "A"

**REVISION:**
- **DATE:** 10/29/19
- **TIME:** 8:16:29 AM

**DESCRIPTION:**

**LAST REVISION:**
- **DATE:** 11/01/18
- **REVISION:** 2

**FY 2020-21 STANDARD PLANS**

**SIDE DRAIN MITERED END SECTION**

**INDEX:** 430-022

**SHEET:** 2 of 7

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   - Side Ditch Grade
   - Construction Joint Permitted

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**GENERAL NOTES:**

1. **SIDE DRAIN MITERED END SECTION**
   - Plan - Single Pipe
   - Plan - Multiple Pipe
   - Elevation
   - Section A-A
   - Detail "A"

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**FY 2020-21 STANDARD PLANS**

**SIDE DRAIN MITERED END SECTION**

**INDEX:** 430-022

**SHEET:** 2 of 7

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   - Grates and Fasteners

5. **DETAIL "A"**
   - Concrete Slab
   - Grates Spaced 14" c to c
   - Side Ditch Grade
   - Construction Joint Permitted
### Single and Multiple Concrete Pipe Dimensions and Quantities

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**PERMISSIBLE PAVEMENT MODIFICATION**

- Dimensions permitted to allow use of 12" standard pipe lengths.
- Dimensions permitted to allow use of 10" standard pipe lengths.

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**SIDE DRAIN MITERED END SECTION**

- FY 2020-21
- STANDARD PLANS
SINGLE AND MULTIPLE CORRUGATED METAL PIPE

SIDE DRAIN MITERED END SECTION

PLAN - SINGLE PIPE

PLAN - MULTIPLE PIPE

ROUND CORRUGATED PIPE
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**SINGLE AND MULTIPLE CORRUGATED METAL PIPE DIMENSIONS AND QUANTITIES**

**INDEX**

**SIDE DRAIN MITERED END SECTION**

**FY 2020-21 STANDARD PLANS**

**430-022 5 of 7**
NOTES:
1. Anchors required for CMP only.
2. Use galvanized steel for all anchors, nuts, and washers.
3. Bend anchor where required to center in concrete slab.
4. Repair damaged surfaces after bending.
5. Space anchors a distance equal to four (4) corrugations.
6. Place the anchors in the outside crest of corrugation.
7. Place flat washers on inside wall of pipe.
8. Drill or punch holes in the mitered end pipe; burning not permitted.
9. A 6" x 1/2" bolt substitution is permitted.
NOTES:
1. 3/4" x 3" bolts are standard for all grate fasteners, except when the contractor elects to use the slotted upper holes for the intermediate fasteners on multiple drain pipes, which will require bolt lengths in the Special Bolt Length Table.
2. 3/4" galvanized bolt hex head bolt shown, either hex head or square head bolt may be used. Use only hex nuts.
3. Make the specified weld 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.
4. Omit on trailing downstream ends on divided roadways.
5. Use grates only when called for in the plans on round pipes 24" or less in diameter, arch pipes 28" x 20" or smaller, and elliptical pipes 14" x 23" or smaller.

### CONCRETE PIPE

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### CORRUGATED METAL PIPE

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**NOTE:**
1. Install intermediate slot and fastener for multiple drain pipes only.

**Options for top opening:**
- 4" of 3/4" mill head cut, 1" deep
- 2" diameter drilled hole
- 3/4" x 2" slot

**Bottom opening:** 1/2" x 2" slot.

---

**MULTIPLE FASTENER UNIT DETAIL**

(FOR SINGLE AND MULTIPLE PIPES)

**NOTE:**
1. Install intermediate slot and fastener for multiple drain pipes only.

---

**SIDE DRAIN MITERED END SECTION**

---

**FASTENER UNIT AND GRATE DETAILS**
GENERAL NOTES:
1. Use Class I concrete.

2. Reinforcing steel is either Grade 40 or 60.

3. Endwalls may be cast in place or precast concrete. (Additional reinforcement necessary for handling precast units will be determined by the Contractor or the supplier).

4. Chamfer all exposed edges and corners to 1/2".

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

6. On outfall ditches with side slopes flatter than 1:1.5 provide 20' transitions from the endwall to the flatter side slopes, right of way permitting.

7. Construct front slope and ditch transitions in accordance with Index 430-001.

8. Quantities shown are for estimating purposes only.

<table>
<thead>
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<tr>
<td>Sheet</td>
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<td>Concrete and Metal Pipe Tables</td>
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<tr>
<td>4</td>
<td>Spacing for Multiple Pipes</td>
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STRAIGHT CONCRETE ENDWALL
### ROUND CONCRETE AND CORRUGATED METAL PIPE

#### Dimensions

<table>
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<tr>
<th>Diagram</th>
<th>Opening Area (SF)</th>
<th>Dimensions</th>
<th>Number of Pipe</th>
<th>Number of Pipe and Angle of Pipe (°)</th>
<th>Double Pipe</th>
<th>Inside Diameter</th>
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<tbody>
<tr>
<td>30°</td>
<td>3.32</td>
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<tr>
<td>60°</td>
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<td>1.37</td>
<td>1.55</td>
<td>1.55</td>
<td>1.60</td>
<td>1.99</td>
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#### Notes:
1. Dimension X is calculated as: X = 2*SEC a.
2. Select tabular quantities using skew values as follows:

### ELLIPTICAL CONCRETE AND CORRUGATED METAL PIPE ARCH

#### Dimensions

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<th>Number Of Pipe</th>
<th>Number Of Pipe And Angle Of Pipe (°)</th>
<th>Double Pipe</th>
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#### Notes:
1. Dimension X is calculated as: X = 2*SEC a.
2. Select tabular quantities using skew values as follows:

### CONCRETE AND METAL PIPE TABLES

#### FY 2020-21 STANDARD PLANS

#### STRAIGHT CONCRETE ENDWALLS SINGLE AND MULTIPLE PIPE

#### INDEX

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#### Last Revision

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<td>10/01/19</td>
<td>FY 2020-21 STANDARD PLANS</td>
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**LEGEND:**

- $\alpha$ = Pipe Skew Angle
- $S$ = Center to Center between pipes
- $X$ = Center to Center along front of Headwall

**SPACING FOR MULTIPLE PIPES**

(Multiple Pipe Shown, Single Pipe Similar)

**PLAN**

- Normal Pipe (Typ)
- Skewed Pipe (Typ)
- Sta./Offset Location
- $\alpha$ = Pipe Skew Angle
- $X$ = Center to Center along front of Headwall

**FRONT ELEVATION**

- Normal Pipe
- Skewed Pipe (Typ)
- Sta./Offset Location
- $\alpha$ = Pipe Skew Angle
- $X$ = Center to Center along front of Headwall

**STRAIGHT CONCRETE ENDWALLS**

- SINGLE AND MULTIPLE PIPE

**INDEX**

430-030

**SHEET**

4 of 4
GENERAL NOTES:

1. Use Class 31 concrete.

2. Reinforcing steel is either Grade 40 or 60.

3. Endwalls may be cast in place or precast concrete. The Contractor or the Supplier will determine the additional reinforcement necessary for handling precast units.

4. Chamfer all exposed edges and corners $\frac{3}{4}$" unless otherwise shown.

5. Quantities shown are for estimating purposes only.

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<td>3</td>
<td>Double 60&quot; Pipe Endwall Details</td>
</tr>
</tbody>
</table>
NOTES:
1. 3" clearance on all reinforcement, unless otherwise shown.
2. Cut and bend B1 and B2 Bars as shown.
3. All bar dimensions are out to out.

LEGEND:
H = Horizontal Bars  B = Bent Bars
V = Vertical Bars  D = Dowels or Diagonal Bars

BILL OF REINFORCING STEEL

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SINGLE 60" PIPE ENDWALL DETAILS

SECTION A-A
(Rebar Not Shown)

SECTION B-B
(Typical Section)

SECTION C-C

BENDING DIAGRAM

Varies (5" for 3" Corrugation)
NOTES:
1. 2" clearance on all reinforcement, unless otherwise shown.
2. Cut and bend B Bars as shown.
3. All bar dimensions are out to out.

LEGEND:
H = Horizontal Bars
V = Vertical Bars
B = Bent Bars
D = Dowels or Diagonal Bars

BILL OF REINFORCING STEEL

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HALF ELEVATION
(Showing Bars in Front Face of Wall)

HALF ELEVATION
(Showing Bars in Back Face of Wall)

SYMMETRICAL ABOUT ξ
GENERAL NOTES:

1. Use Class 31 concrete.

2. Reinforcing steel is either Grade 40 or 60.

3. Endwalls may be cast in place or precast concrete. The Contractor or the Supplier will determine the additional reinforcement necessary for handling precast units.

4. Chamfer all exposed edges and corners %2 unless otherwise shown.

5. Quantities shown are for estimating purposes only.

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<tr>
<td>3</td>
<td>Double 66&quot; Pipe Endwall Details</td>
</tr>
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</table>
DESCRIPTION:
LAST REVIEWED OF STANDARD PLANS FY 2020-21 SHEET INDEX

NOTES:
1. 2" clearance on all reinforcement, unless otherwise shown.
2. Cut and bend B2 Bars as shown.
3. All bar dimensions are cut to cut.

LEGEND:
H = Horizontal Bars
V = Vertical Bars
B = Bent Bars
D = Dowels or Diagonal Bars

INTENDED COORDINATES:

---

DOUBLE 66° PIPE ENDWALL DETAILS

---

BILL OF REINFORCING STEEL

---

ESTIMATED QUANTITIES

---

NOTES:
3. All bar dimensions are cut to cut.
2. Cut and bend B2 Bars as shown.
1. 2" clearance on all reinforcement, unless otherwise shown.

---

LEGEND:
D = Dowels or Diagonal Bars
B = Bent Bars
V = Vertical Bars
H = Horizontal Bars

---

PLAN
(Showing Bars in Footing)

---

HALF ELEVATION
(Showing Bars in Front Face of Wall)

---

HALF ELEVATION
(Showing Bars in Back Face of Wall)

---

43°-0'
21'-6'
17°-0'
4'-0'
4'-0'
17°-0'
7°-0'
21'-6'
17°-0'

---

SYMMETRICAL ABOUT H

---

FIELD BEND (Typ.) (See Note 2)

---

H @ 66" Ctrs. (Typ.) - 12'

---

H @ 66" Ctrs. (Typ.) - 12'

---

H @ 10" Ctrs. (Typ.)

---

H @ 10" Ctrs. (Typ.)

---

B @ 10"

---

V @ 1'-6" Ctrs. (Typ.)

---

B @ 10" Ctrs. (Typ.)

---

V @ 1'-6" Ctrs. (Typ.)

---

CORRUGATED METAL PIPE (Typ.)

---

CONCRETE PIPE (Typ.)

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66" DIAM.

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66" DIAM.
GENERAL NOTES:

1. Use Class II concrete.

2. Reinforcing steel is either Grade 40 or 60.

3. Endwalls may be cast in place or precast concrete. The Contractor or the Supplier will determine the additional reinforcement necessary for handling precast units.

4. Chamfer all exposed edges and corners 1/2" unless otherwise shown.

5. Quantities shown are for estimating purposes only.

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STRAIGHT CONCRETE ENDWALLS 72" PIPE
NOTES:
1. 2" clearance on all reinforcement, unless otherwise shown.
2. Cut and bend B B Bars as shown.
3. All bar dimensions are out to out.

LEGEND:
H = Horizontal Bars
B = Bent Bars
V = Vertical Bars
D = Dowels or Diagonal Bars

BILL OF REINFORCING STEEL

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DETAIL "A"
(Concrete Pipe Optional Entrance)

SECTION A-A
(Rebar Not Shown)

SECTION B-B
(Typical Section)

SECTION C-C

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DETAIL "A"
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SECTION A-A
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SECTION B-B
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SECTION C-C

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SECTION A-A
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SECTION B-B
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SECTION C-C

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DETAIL "A"
(Concrete Pipe Optional Entrance)

SECTION A-A
(Rebar Not Shown)

SECTION B-B
(Typical Section)

SECTION C-C

BILL OF REINFORCING STEEL

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SECTION B-B
(Typical Section)

SECTION C-C

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</table>
NOTES:
1. 2" clearance on all reinforcement, unless otherwise shown.
2. Cut and bend B, Bars as shown.
3. All bar dimensions are out to out.

LEGEND:
H = Horizontal Bars
V = Vertical Bars
B = Bent Bars
D = Dowels or Diagonal Bars

---

DOUBLE 72" PIPE ENDWALL

---

DOUBLE 72" PIPE ENDWALL DETAILS

---

SYMMETRICAL ABOUT H
GENERAL NOTES:

1. Use Class 31 concrete.

2. Reinforcing steel is either Grade 40 or 60.

3. Endwalls may be cast in place or precast concrete. The Contractor or the Supplier will determine the additional reinforcement necessary for handling precast units.

4. Chamfer all exposed edges and corners ¼" unless otherwise shown.

5. Quantities shown are for estimating purposes only.

TABLE OF CONTENTS:

<table>
<thead>
<tr>
<th>Sheet</th>
<th>Description</th>
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<tbody>
<tr>
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<td>2</td>
<td>Single 84&quot; Pipe Endwall Details</td>
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</table>

STRAIGHT CONCRETE ENDWALLS
SINGLE 84" PIPE
NOTES:
1. 2" clearance on all reinforcement, unless otherwise shown.
2. Cut and/or bend B2 Bars as shown.
3. All bar dimensions are out to out.
4. Install a ¾" V-Groove at the top, front and back.

**SINGLE 84" PIPE ENDWALL**

**BILL OF REINFORCING STEEL**

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**SECTION A-A**

- (Typical Section)
- Concrete Pipe
- Corrugated Metal Pipe

**SECTION B-B**

- (Typical Section)
- Concrete Pipe
- Corrugated Metal Pipe

**SECTION C-C**

- (Typical Section)
- Concrete Pipe
- Corrugated Metal Pipe

**DETAIL "A"**

- (Concrete Pipe Optional Entrance)
- Concrete Pipe
- Corrugated Metal Pipe

**ENDWALL DETAILS**

- SINGLE 84" PIPE
- STRAIGHT CONCRETE ENDWALLS
- STANDARD PLANS
- FY 2020-21

**INDEX**

- 430-034
GENERAL NOTES:
1. Use Class I concrete.
2. Chamfer all exposed edges and corners ½" unless otherwise shown.
3. Quantities shown are for estimating purposes only.

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<td>U-Type and 45° Endwalls</td>
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WINGED CONCRETE ENDWALLS

U-TYPE

45° WING

Pipe
**Revision:**

**Description:**

**Standard Plans FY 2020-21**

**Sheet:**

**Page 2 of 2**

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**Dimensions and Estimated Quantities Pipe Culvert Endwalls with U-Type Wings**

<table>
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<tr>
<th>Dia. D (in)</th>
<th>Area (ft²)</th>
<th>Wall</th>
<th>Foating</th>
<th>Concrete, Class I, Total (CY)</th>
<th>Steel Tie Bars</th>
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**Dimensions and Estimated Quantities Pipe Culvert Endwalls with 45° Wings**

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<th>Wall</th>
<th>Foating</th>
<th>Concrete, Class I</th>
<th>Steel Tie Bars</th>
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<td>60</td>
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**U-Type and 45° Endwalls**

**Concrete Endwalls**

Here are the endwall details for both U-Type and 45° wings.

---

**Notes:**

- Dimensions are provided for each section, including wall, footing, and concrete class.
- Steel tie bars are listed for each section.
- Area calculations and total concrete amounts are calculated.

---

**Acknowledgments:**

- This section details the endwall specifications for both U-Type and 45° wings, providing comprehensive data for designers and engineers.

---

**Contact Information:**

For further inquiries, please contact the lead designer at (555) 123-4567.
GENERAL NOTES:
1. Use Class I Concrete.
2. Channel section C3 x 6.0 may be substituted for the C4 x 5.4 channel.
3. All steel reinforcing bars are #4 with 2" cover except as noted. Spacing shown are center to center. Lap bars 1'-5" minimum. Welded wire fabric (two cages max.) with an equivalent cross section area (0.20 sq. in.) may be substituted for bar reinforcement.
4. Drill 1½" holes 8" deep with a rotary drill in existing endwall for dowel bars. Thoroughly clean holes prior to installing Adhesive-Bonded Dowels.
5. Quantities shown are for estimating purposes only.
6. For supplemental details, see Index 425-001.

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SAFETY MODIFICATIONS FOR ENDWALLS
**Description:**

**Revision:**

**Last Revision:**

**Reinforcing Details:**

**Table 1: U-Endwall Dimensions and Quantities**

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<th>R</th>
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<td>313</td>
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**Endwalls for 1:4 and 1:6 Slopes**

**Legend:**

- N = Horizontal Bars
- B = Bent Bars

**Safety Modifications for Endwalls**

**Standard Plans FY 2020-21**

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TABLE 2

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<th>Slope</th>
<th>Pipe Dia. (In.)</th>
<th>Channels @ 5.4 lbs/LF</th>
<th>Bars @ 2.8 lbs/LF (2 ea.)</th>
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<td>12'-3&quot;</td>
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</table>

SAFETY MODIFICATIONS FOR ENDWALLS

STEEL GRATE MOUNTING

SECTION A-A

SECTION B-B

STEEL GRATE DETAILS

STEEL GRATE
GENERAL NOTES:
1. Install outlet pipes and preformed channel inverts with a slope of 0.6% or steeper toward the outlet regardless of the surface slope, unless shown different in the Plans.

2. Stub trench drain directly into drainage structures or install outlet pipes to connect trench drain to drainage structures.

3. Provide a cleanout port compatible with the manufactured system for Type I drains at the upstream end and at intervals of 50 feet maximum. Provide a cleanout port with an opening of 6" to 10" wide (transverse to the trench drain length) and 18" to 24" long. Form curbs or separators around the cleanout when cleanouts are placed adjacent to raised curb or separator. Install the cleanout with a removable load resistant cover or grate.

4. Excavate trench to allow for a minimum of 6' of concrete to be placed under and alongside the trench drain channel system. Install concrete backfill in accordance with Specification 347. Install concrete backfill extending a minimum of 6" past the end of the drain opening at the end of all Type I or II units.

5. Install transverse bars spaced 4" to 6" on center for Type I Trench Drain.

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|---|---|
| Sheet | Description |
| 1 | General Notes and Contents |
| 2 | Type I - Nonremovable Grate |
| 3 | Type II - Removable Grate |
NOTES:
1. Opening for fixed height grates. Opening at the pipe can be 3".
2. The Round Pipe Channel is 15" in diameter, unless otherwise shown in the Plans.
3. Provide a minimum 6" concrete on this side of the drain.
4. Install grates on preformed polyethylene channel at driveways.

TYPICAL LOCATIONS
(Round Channel Shown, Preformed Polyethylene Similar)

WITHIN TYPE E CURB
WITHIN TYPE F CURB
WITHIN DROP CURB
ADJACENT TO TRAFFIC SEPARATOR

TYPE I - NONREMOVABLE GRATE
DESCRIPTION:

REVISION

LAST

STANDARD PLANS

FY 2020-21

TRENCH DRAIN

REV IS IO N

INDEX

Sheet

REV 02/19

REV 02/19

REV 02/19

REV 02/19

REV 02/19

NOTE:

1. Provide minimum 6" of concrete on this side of the drain.
2. 4" Minimum unless otherwise shown in Plans.
GENERAL NOTES:

1. Install underdrain pipe that is 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 is quartz sand meeting the requirements of Specifications 902-4.

3. Coarse aggregate is gravel or stone meeting the requirements of Specifications 902-2 or 902-3. The gradation is in accordance with Specifications 901, Grades 4, 467, 5, 56 or 57 stone unless otherwise shown in the Plans.

4. Install Underdrain Type I, II, III and V in accordance with Specification 440.

5. Install filter fabric Type D-3 in accordance with Specifications 985. The internal filter fabric of Type V underdrain has a permittivity of 0.7 sec and an AOS of 

6. When Type 1 is used, use a filter fabric sock in accordance with Specification 948.

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. Install filter fabric joints with a lap overlap a minimum of 1'. Install the internal filter fabric of Type V underdrain with an overlap into the coarse aggregate or the fine aggregate a minimum of 1'.

9. Use nonperforated pipes for underdrain outlet and make all bends using 1/4 (90 deg.) elbows. Construct 90 deg. bends with two 90 deg. elbows separated by at least 3' of straight pipe. Outlet pipes stubbed into inlets or other drainage structures must be a minimum 6" above the structure flow line. Install concrete aprons, hardware cloth, and sod for outlet pipes discharging to grassed areas as shown in Index 666-001 for Edgedrain Outlets.

3. Coarse aggregate is gravel or stone meeting the requirements of Specification 901-2 or 901-3. The gradation is in accordance with Specifications 901, Grades 4, 467, 5, 56 or 57 stone unless otherwise shown restricted in the Plans.

4. when Type I is used, use a filter fabric sock in accordance with Specification 948.

5. Install filter fabric Type D-3 in accordance with Specifications 985. The internal filter fabric of Type V underdrain has a permittivity of 0.7 sec and an AOS of 

6. When Type 1 is used, use a filter fabric sock in accordance with Specification 948.

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. Install filter fabric joints with a lap overlap a minimum of 1'. Install the internal filter fabric of Type V underdrain with an overlap into the coarse aggregate or the fine aggregate a minimum of 1'.

9. Use nonperforated pipes for underdrain outlet and make all bends using 1/4 (90 deg.) elbows. Construct 90 deg. bends with two 90 deg. elbows separated by at least 3' of straight pipe. Outlet pipes stubbed into inlets or other drainage structures must be a minimum 6" above the structure flow line. Install concrete aprons, hardware cloth, and sod for outlet pipes discharging to grassed areas as shown in Index 666-001 for Edgedrain Outlets.

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UNDERDRAIN TYPE I, II, AND III ASSEMBLY
(Type II Shown, Others Similar)

UNDERDRAIN TYPE Va AND Vb ASSEMBLY
**DESCRIPTION:**

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<tr>
<th>UNDERDRAIN TYPE</th>
<th>Ditch or Basin Bottom</th>
<th>Fine Aggregate</th>
<th>Underdrain Pipe</th>
<th>Coarse Aggregate</th>
<th>Filter Fabric Envelope</th>
<th>Envelope Fabric</th>
<th>Envelope Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TYPE I</strong></td>
<td>24&quot; (Typ.)</td>
<td>3&quot; (Typ.)</td>
<td>(Min.)</td>
<td>(Min.)</td>
<td>24&quot; (Typ.)</td>
<td>3&quot; (Typ.)</td>
<td>(Min.)</td>
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<tr>
<td><strong>TYPE II</strong></td>
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<td>3&quot; (Typ.)</td>
<td>(Min.)</td>
<td>(Min.)</td>
<td>24&quot; (Typ.)</td>
<td>3&quot; (Typ.)</td>
<td>(Min.)</td>
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<tr>
<td><strong>TYPE III</strong></td>
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<td>30&quot; (Typ.)</td>
<td>18&quot; (Typ.)</td>
<td>18&quot; (Typ.)</td>
<td>30&quot; (Typ.)</td>
<td>30&quot; (Typ.)</td>
<td>18&quot; (Typ.)</td>
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</tbody>
</table>
LOWER LIMITS

TYPE Va

Varies (4'-0" Typ.)
3" (Typ.)
Coarse Aggregate
No Filter Fabric
Ditch or Basin Bottom

Optional Trench Side
Alt. Overlap (See Gen. Note 8)

Design Water Table

TYPE Vb

Varies (4'-0" Typ.)
3" (Typ.)
Coarse Aggregate
No Filter Fabric
Ditch or Basin Bottom

Optional Trench Side
Alt. Overlap (See Gen. Note 8)

Design Water Table

TYPE V CLEANOUT

UPPER LIMITS

Design Water Table

TYPE Va, Vb, AND CLEANOUT

UNERDRAIN
GENERAL NOTES:

1. Install light duty cast iron cover and frame in accordance with Specifications 963.
2. Use Class I concrete. Use No. 3 bars (Grade 60) on 8" centers both ways, sides and bottom.
3. Furnish covers with pick holes. Do not use fitted lifts or handles.
4. Manhole Type P Alternate A. Index 425-010, Type I Frame and Cover, Index 425-001, may be used in lieu of the box detailed in this Index.

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<td>Typical Inspection Box Installations</td>
</tr>
<tr>
<td>3</td>
<td>Typical Urban, Slope, and Top Adjustment Installations</td>
</tr>
</tbody>
</table>

UNDERDRAIN INSPECTION BOX ASSEMBLY
NOTES:
1. Cast or field cut 2 - 4" wide slots for hinges. Grout around hinge covers.
2. One or more sides may have an opening, see Plans for required openings. Grout around opening to seal between underdrain pipe and inspection box.

1. Cast or field cut 2 ~ 4" wide slots for hinges. Grout around hinge covers.
2. One or more sides may have an opening, see Plans for required openings. Grout around opening to seal between underdrain pipe and inspection box.

1. Cast or field cut 2 ~ 4" wide slots for hinges. Grout around hinge covers.
2. One or more sides may have an opening, see Plans for required openings. Grout around opening to seal between underdrain pipe and inspection box.
DESCRIPTION:

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TERMINAL INSTALLATION ON SLOPE

10/29/2019

NOTES:

1. See Index 120-002 for Underdrain placement.
2. Curve the Underdrain to connect to the Inspection Box.
3. A maximum of 2 adjustment courses of brick is permitted.

CONCRETE APRON

TYPICAL URBAN INSTALLATION

TOP ADJUSTMENT

TYPICAL URBAN, SLOPE, AND TOP ADJUSTMENT INSTALLATIONS

INDEX 440-002 SHEET 3 of 3

UNIVERSAL INSPECTION BOX
GENERAL NOTES:

1. Install light duty cast iron cover and frame in accordance with Specifications 963.
2. Use Class J concrete. Use No. 3 bars (Grade 60) on 8'' centers both ways, sides and bottom.
3. Furnish covers with pick holes. Do not use fitted lifts or handles.
4. Manhole Type P Alternate A. Index 425-010, Type I Frame and Cover, Index 425-001, may be used in lieu of the box detailed in this Index.

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</tr>
</tbody>
</table>

FRENCH DRAIN ASSEMBLY

- Perforated Pipe
- Aggregate
- Metal or Plastic Pipe
- Coupling Band
- Nonperforated Pipe
- Sump
- Weep Hole
- Aggregate
- Aggregate
- Filter Fabric
- Concrete Pipe
- Nonperforated Pipe
- Slotted or Perforated Pipe
- Manhole or Inlet (Manhole Shown)

1. Install light duty cast iron cover and frame in accordance with Specifications 963.
2. Use Class J concrete. Use No. 3 bars (Grade 60) on 8'' centers both ways, sides and bottom.
3. Furnish covers with pick holes. Do not use fitted lifts or handles.
4. Manhole Type P Alternate A. Index 425-010, Type I Frame and Cover, Index 425-001, may be used in lieu of the box detailed in this Index.
NOTES:
2. For additional sump bottom information see Index 425-001.
3. Construct weep holes only where called for in the Plans.
4. Only cast and ductile iron sanitary sewer, or cast iron, ductile and steel water mains will be allowed to pass directly through French drain (without sleeves).
5. Use only steel, cast or ductile iron sleeves.
6. No slots or perforations.
## Concrete Slotted Pipe Options

### Option A - Round Pipe

- **Slots (Typ.)**
  - **Concrete Pipe**
  - **Pipe**

### Option B - Round or Elliptical Pipe

- **Slots (Typ.)**
  - **Concrete Pipe**
  - **Pipe**

### Notes:
1. 2'-0" for 8'-0" joints of pipe.
2. A curved cut is acceptable provided the control dimension is maintained.

### Elliptical Pipe

<table>
<thead>
<tr>
<th>Pipe Size (C)</th>
<th>Slot Cut Min.</th>
<th>Slot Cut Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot; to 24&quot;</td>
<td>12&quot;</td>
<td>14&quot;</td>
</tr>
<tr>
<td>24&quot; to 36&quot;</td>
<td>16&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>36&quot; to 48&quot;</td>
<td>20&quot;</td>
<td>22&quot;</td>
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<tr>
<td>48&quot; to 60&quot;</td>
<td>24&quot;</td>
<td>26&quot;</td>
</tr>
<tr>
<td>60&quot; to 72&quot;</td>
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### Round Pipe

<table>
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<th>Opening (C) Min.</th>
<th>Opening (C) Max.</th>
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<td>±4&quot;</td>
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<td>±6&quot;</td>
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<td>48&quot; to 60&quot;</td>
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<tr>
<td>60&quot; to 72&quot;</td>
<td>±10&quot;</td>
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- **SECTION A-A**
  - **SIDE VIEW**
  - **Concrete Pipe**
  - **Pipe**
  - **Slots (Typ.)**

- **SECTION B-B**
  - **ISOMETRIC VIEW**
  - **Concrete Pipe**
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  - **Slots (Typ.)**

- **SECTION C-C**
  - **SIDE VIEW**
  - **Concrete Pipe**
  - **Pipe**
  - **Slots (Typ.)**

- **SECTION D-D**
  - **SIDE VIEW**
  - **Concrete Pipe**
  - **Pipe**
  - **Slots (Typ.)**
GENERAL NOTES:

1. The French Drain Skimmer is a hooded cover, mounted over an outlet in a catchbasin, that prevents oil and floating debris from exiting the basin.

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

3. Provide skimmer baffle, cleanout pipe and angles constructed of either galvanized steel, aluminum, polyvinyl chloride, polyethylene, fiberglass or acrylonitrile butadiene styrene. Provide hot-dip galvanized steel components, unless stainless.

4. Use Mounting hardware, hinges and latches made of stainless steel. Loss prevention device can use either stainless steel chain or riveted nylon strap.

5. Provide skimmer bodies (baffles) and cleanout pipe meeting Specification 943 for steel, 945 for aluminum or 948 for plastics.

6. Work this Index in accordance with Specification 425.

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</table>

SKIMMER FOR FRENCH DRAIN OUTLETS ASSEMBLY
NOTES:
1. Conform the backs of skimmers to the shape of the basin walls on which they are mounted.
2. "R" is the radii required for curved back skimmers. Applies to both skimmer types. See Plans.
3. Weld Angles at all points of contact with skimmer.

<table>
<thead>
<tr>
<th>OUTLET PIPE</th>
<th>A</th>
<th>B</th>
<th>C</th>
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</thead>
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<tr>
<td>36&quot;</td>
<td>30&quot;</td>
<td>48&quot;</td>
<td>60&quot;</td>
</tr>
</tbody>
</table>

ANGLE DETAIL

NOTE:
- Limits of skimmer on Circular Basin Wall
- Circular Basin Wall
- Flat Basin Wall

PLAN

DIAMETER TABLE

- No. of Bolt, Hex Nut and Washer (4 Typ.)
- Lid Hinge
- Latch Pin

SIDE ELEVATION

SIDE ELEVATION

FRONT ELEVATION

SCHEMATIC VIEW

TYPE 1 DETAILS

TYPE 1 SKIMMERS

INDEX

SKIMMERS FOR FRENCH DRAIN OUTLETS

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SKIMMERS FOR FRENCH DRAIN OUTLETS
Outlet Pipe 2'-0" (Min.)
Basin Wall

Neoprene Gasket

Flange

10" Port Cleanout

NOTE:
1. Install a gasket for the cleanout with either a threaded screw-in lid or a lid secured by four stainless steel quick-release latches.

Loss Prevention Device
2" Dia. Hole (Typ.)
1'-0" Center to Center

3" Flange (Min.)

10" Dia. Cleanout Port
With Neoprene Gasket

With Neoprene Gasket 5" Dia. Studs With Nuts

NOTE:

SIDES ELEVATION

FRONT ELEVATION

TYPE II DETAILS

TYPE II SKIMMERS

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STANDARD PLANS
SKIMMERS FOR FRENCH DRAIN OUTLETS

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**24" STEEL WELL GRATE**

Heavy duty "bee hive" grate

Openings: 1.5' 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 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.
GENERAL NOTES:

1. Do not leave trench greater than 2' in depth overnight. Barricade trenches at all times.

2. Construct concrete pavement subdrainage adjacent to the low edge of the roadway pavement and under travel lanes, auxiliary pavement and shoulders, as called for in the plans. Extend the concrete pavement subdrainage 50' beyond and begin 50' before the flat point (100' overlap) when the low edge shifts between outside and inside edges of pavement. Place concrete pavement subdrainage on the low side of ramps for crossroad terminals.

3. Install concrete pavement subdrainage on a grade parallel with the edge of pavement profile, except on profiles flatter than one-tenth percent (0.10%) install the concrete pavement subdrainage on a minimum grade of one-tenth percent (0.10%).

4. Remove adhering base material and soil from the vertical face of the concrete immediately prior to placing the filter fabric.

5. Submit a procedure for holding the filter fabric in position on the vertical face of the trench for approval by the Engineer prior to placing draincrete.

6. Cap the upper end of each separate run of the concrete pavement subdrainage pipe.

7. Install outlet pipes at 500' maximum intervals. Use elbows or 1/8 bends to connect the outlet pipe to the concrete pavement subdrain pipe. Use elbows or bends of the same material as the outlet pipe.

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

Install a single outlet apron for separate outlet pipes of concrete pavement subdrainage from opposite directions in sag vertical curves.

Install backfill consisting of cohesive soils around outlet pipes.

8. Replace existing paved shoulder removed for the construction of outlet pipes with Type SP asphaltic concrete at the rate of 500 LB per SY.

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<tr>
<td>2</td>
<td>Edgedrain and Outlet</td>
</tr>
<tr>
<td>3</td>
<td>New Construction</td>
</tr>
<tr>
<td>4</td>
<td>Rehabilitation</td>
</tr>
</tbody>
</table>
NOTES:
1. Install 4" thick Class NS concrete, 0.19 cubic yard for 1:4 slopes and 0.25 cubic yard for 1:6 slopes.
2. Install perimeter sod, 4.7 square feet for 1:4 slopes and 5.5 square feet for 1:6 slopes.
3. 1.75' std. for grassed ditches; 0.5' feet for 1:6 slopes.
0.19 cubic yard for 1:4 slopes and 0.19 cubic yard for 1:4 slopes.
1. Install 6" thick Class NS concrete, 0.19 cubic yard for 1:4 slopes and 0.19 cubic yard for 1:4 slopes.
2. Install perimeter sod, 4.7 square feet for 1:4 slopes and 5.5 square feet for 1:6 slopes.
3. 1.75' std. for grassed ditches; 0.5' feet for 1:6 slopes.
0.19 cubic yard for 1:4 slopes and 0.19 cubic yard for 1:4 slopes.
1. Install 6" thick Class NS concrete, 0.19 cubic yard for 1:4 slopes and 0.19 cubic yard for 1:4 slopes.
2. Install perimeter sod, 4.7 square feet for 1:4 slopes and 5.5 square feet for 1:6 slopes.
3. 1.75' std. for grassed ditches; 0.5' feet for 1:6 slopes.
0.19 cubic yard for 1:4 slopes and 0.19 cubic yard for 1:4 slopes.
1. Install 6" thick Class NS concrete, 0.19 cubic yard for 1:4 slopes and 0.19 cubic yard for 1:4 slopes.
2. Install perimeter sod, 4.7 square feet for 1:4 slopes and 5.5 square feet for 1:6 slopes.
3. 1.75' std. for grassed ditches; 0.5' feet for 1:6 slopes.
NOTES:
1. The edgdrain sections for DRAINCRETE SUBDRAINAGE are applicable to pavement construction identified as RIGID PAVEMENT on Index 120-001.
2. Confin the construction of draincrete edgdrain to an area in which the entire operation can be carried out in five (5) work days, unless another construction period is called for in the plans, with sufficient time allowed for the draincrete to set before placement of pavement.
3. Install the filter fabric in accordance with Specification 514.
4. Install only noncorrugated or smooth lined corrugated pipe.
5. At the Contractor's option this area may be constructed of Optional Base material (Specification 285) or special stabilized subbase.
EXISTING SHOULders

NOTES:

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

2. Confin 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.


4. Install only noncorrograted or smooth lined corrugated pipe.

5. Install Filter Fabric 2' below bottom of pavement for cement stabilized, soil cement and econcrete subbases and 2' above bottom of pavement for other subbases.

Concrete Pavement

Shoulder Joint Seal
(See Index 350-001)

Tack

Existing Pavement

Top of Filter Fabric
(See Note 5)

Concrete or Asphalt Shoulder or Auxiliary Pavement

2' (Min.) Type SP Asphaltic Concrete

Filter Fabric - Type D-3
(See Note 5)

Draincrete

4' Dia. Special Perforated Pipe (See Note 4)

1'-0"
DESCRIPTION:
This Index 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 270 (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'ci ≥ 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 1/8" to allow for Sheet Pile fit-up in its final position. Minimum Sheet Pile width is 2'-5 1/8". 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.

NOTE: Detail "A" shows a Part-Plan View of an assumed bulkhead.
(Section Taken Above Dimension X)

DETAIL "A"
(Section Taken Below Dimension X)

PILE STORAGE AND TRANSPORTATION SUPPORT DETAILS

NOTES AND DETAILS

PRECAST CONCRETE SHEET PILE WALL
(CONVENTIONAL)
**TYPICAL PILE**

**SPACING**

- Bars A: Spaced at 1'-0" Maximum
- Bars S: Spaced at 1'-0" Maximum

**BAR SIZING**

- Bars A: #5
- Bars S: #4

**NOTES**

1. Intermediate Prestress Strands not shown in Elevations and Sections.
2. All bar dimensions are out-to-out.
3. Bars A are #5 and Bars S are #4.
4. At the Contractor's option Bars S may be fabricated as a two piece bar as shown in the Bar Bending Diagram.
5. The Contractor may use Deformed Welded Wire Reinforcement meeting the requirements of Specification Section 931 in lieu of Bars A and Bars S if the wire size and spacing provide the same area of reinforcing steel per foot as the Bars shown.
6. For Dimensions L and A see Sheet Pile Data Table in Structures Plans.

**SPACING**

- 2 sp. @ 4" (Typ.)
- 6 sp. @ 4" (Typ.)

**WALL THICKNESS**

<table>
<thead>
<tr>
<th>WALL THICKNESS IN</th>
<th>STRAND DIA.</th>
<th>MAXIMUM L IN.</th>
<th>n</th>
<th>COVER D IN.</th>
<th>TOTAL # OF STRANDS</th>
<th>INITIAL (JACKING) FORCE (KIP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T=10 in.</td>
<td>0.5</td>
<td>28-0&quot;</td>
<td>6</td>
<td>3/8&quot;</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>27-0&quot;</td>
<td>4</td>
<td>5/8&quot;</td>
<td>10</td>
<td>44</td>
</tr>
<tr>
<td>T=12 in.</td>
<td>0.5</td>
<td>31-0&quot;</td>
<td>7</td>
<td>2/8&quot;</td>
<td>16</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>30-0&quot;</td>
<td>5</td>
<td>3/8&quot;</td>
<td>12</td>
<td>44</td>
</tr>
</tbody>
</table>

**SECTION A-A**

- See Detail "D" (Typical Tongue)

**SECTION B-B**

- See Detail "E" (Typical Groove)

**SECTION C-C**

- See Detail "D" (Typical Tongue)

- See Detail "E" (Typical Groove)

**TYPE "A" STANDARD SECTION**

**DIMENSION A**

<table>
<thead>
<tr>
<th>STRAND DIA.</th>
<th>MAXIMUM L IN.</th>
<th>n</th>
<th>COVER D IN.</th>
<th>TOTAL # OF STRANDS</th>
<th>INITIAL (JACKING) FORCE (KIP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>1'-11/2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S7</td>
<td>1'-9/2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>1'-8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>1'-10/2&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S6</td>
<td>1'-12&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIMENSION B**

- T=10 in. 4'
- T=12 in. 6'
Bar Marking 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>S1</td>
<td>11 1/2</td>
<td>4'</td>
<td>1'-0&quot;</td>
<td>1'-6&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>3 1/2</td>
<td>8&quot;</td>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>11 1/2</td>
<td>4'</td>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>1 1/2</td>
<td>8&quot;</td>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</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>S1</td>
<td>11 1/2</td>
<td>4'</td>
<td>1'-0&quot;</td>
<td>1'-6&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>3 1/2</td>
<td>8&quot;</td>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>11 1/2</td>
<td>4'</td>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>1 1/2</td>
<td>8&quot;</td>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
<td>2'</td>
<td>2'</td>
<td>4'</td>
<td>4'</td>
</tr>
</tbody>
</table>

Notations:
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 #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 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 Structures Plans.

Bar Marking Diagrams

1 - PIECE
BARS S1 & S2

2 - PIECE
BARS S3 & S4

SECTION A-A

SECTION B-B

DETAIL "D"

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

Bar Bending Diagrams

NOTE: 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.

All bar dimensions are out-to-out.

Bars A are #8 and Bars S are #4.

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

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.

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.

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.

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

Type "B1" and "B2" - Variable Angle Corner Pile

Bar Bending Diagrams

NOTE: All bar dimensions are out-to-out.

Bars A are #8 and Bars S are #4.

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

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.

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.

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.

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

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

* 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".
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: 145 pcf
Modulus of Elasticity: Based on the use of Florida limestone 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: Minimum compressive strength f’c ≥ 4000 psi required for two-point pick-up; f’c ≥ 6000 psi for single-point pick-up.

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 1⁄2" 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.

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

CROSS REFERENCES:
For Dimensions L and X see Sheet Pile Wall Data Table in Structures Plans.

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.

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

NOTE: Type "C2" shown. Type "C1" opposite hand.
**NOTES:**
1. Intermediate Prestress Strands not shown in Elevations and Sections.
2. All bar dimensions are out-to-out.
3. Bars A are GFRP #5
4. Bars S are GFRP #4 and may be a single closed bar (hoop) with equivalent area and tensile strength.
5. For 10" thick Sheet Piles, Bars S may be tilted to achieve contact with strands or provide supplemental GFRP Bars to offset Bars S from strands and maintain 2" Nominal cover.
6. For Dimensions L and X see Sheet Pile Data Table in Structures Plans.

---

**TYPE "A" STANDARD SECTION**

**STANDARD PLANS**

**REVISION 08/01/19**

**REVISION 08/29/19**

**DESCRIPTION:**

**PRECAST CONCRETE SHEET PILE WALL**

(CFRP/GFRP & HSSS/GFRP)

**INDEX 455-440**

**SHEET 2 of 4**

**FY 2020-21**

---

**STARTER PILE**

**TYPICAL PILE**

**SECTIONS A-A, B-B, C-C**

**BAR BENDING DIAGRAMS**

**DETAIL "D" (Typical Tongue)**

**DETAIL "E" (Typical Groove)**

**DIMENSIONS A**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>T=11(\frac{1}{4})&quot;</td>
</tr>
<tr>
<td>S7</td>
<td>T=9.5&quot;</td>
</tr>
<tr>
<td>S3</td>
<td>T=7&quot;</td>
</tr>
<tr>
<td>S4</td>
<td>T=5.5&quot;</td>
</tr>
<tr>
<td>S5</td>
<td>T=9.5&quot;</td>
</tr>
<tr>
<td>S6</td>
<td>T=7&quot;</td>
</tr>
</tbody>
</table>

**DIMENSIONS B**

T=10 in. 6"
T=12 in. 6"

---

**SHEET PILE DIMENSIONS**

<table>
<thead>
<tr>
<th>Strand Material</th>
<th>Wall Thickness</th>
<th>Strand Dia. (in.)</th>
<th>Maximum L (in.)</th>
<th>Initial (Jacking) Force (Kip)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFRP Strand</td>
<td>T=10 in.</td>
<td>0.49 (12.5mm)</td>
<td>26'-0&quot;</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>T=12 in.</td>
<td>0.5 (12.7mm)</td>
<td>27'-0&quot;</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.6 (15.2mm)</td>
<td>27'-0&quot;</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.49 (12.5mm)</td>
<td>31'-0&quot;</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 (12.7mm)</td>
<td>31'-0&quot;</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.6 (15.2mm)</td>
<td>31'-0&quot;</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>T=10 in.</td>
<td>0.5 (12.7mm)</td>
<td>27'-0&quot;</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>T=12 in.</td>
<td>0.5 (12.7mm)</td>
<td>32'-0&quot;</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.6 (15.2mm)</td>
<td>32'-0&quot;</td>
<td>4</td>
</tr>
</tbody>
</table>

**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"

* Based on lifting using single point pick-up.

---

**STRAND DIA. Material**

<table>
<thead>
<tr>
<th>Material</th>
<th>CFRP Strand</th>
<th>HSSS Strand</th>
</tr>
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<tbody>
<tr>
<td>Diameter</td>
<td>0.5 (12.7mm)</td>
<td>0.6 (15.2mm)</td>
</tr>
</tbody>
</table>

---

**FORCE (Kip)**

<table>
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<tr>
<th></th>
<th>Initial (Jacking)</th>
</tr>
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<tbody>
<tr>
<td>25.7</td>
<td>36.5</td>
</tr>
<tr>
<td>28.7</td>
<td>36.5</td>
</tr>
<tr>
<td>41.7</td>
<td>36.5</td>
</tr>
</tbody>
</table>

---

**BAR A**

**BAR S (2-PIECE)**

(See Note 4)

---

**Varies**

---

**BAR S (2-PIECE)**

(See Note 4)
BAR BENDING DIAGRAMS

STIRRUP DIMENSIONS (T = 10")

<table>
<thead>
<tr>
<th>Ø</th>
<th>BAR MARK</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
<th>#5</th>
<th>#6</th>
<th>#7</th>
<th>#8</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>S1</td>
<td>3/16&quot;</td>
<td>1/4&quot;</td>
<td>1/8&quot;</td>
<td>3/32&quot;</td>
<td>1/16&quot;</td>
<td>5/32&quot;</td>
<td>3/32&quot;</td>
<td>1/8&quot;</td>
</tr>
<tr>
<td>45°</td>
<td>S1</td>
<td>3/16&quot;</td>
<td>1/4&quot;</td>
<td>1/8&quot;</td>
<td>3/32&quot;</td>
<td>1/16&quot;</td>
<td>5/32&quot;</td>
<td>3/32&quot;</td>
<td>1/8&quot;</td>
</tr>
<tr>
<td>60°</td>
<td>S1</td>
<td>3/16&quot;</td>
<td>1/4&quot;</td>
<td>1/8&quot;</td>
<td>3/32&quot;</td>
<td>1/16&quot;</td>
<td>5/32&quot;</td>
<td>3/32&quot;</td>
<td>1/8&quot;</td>
</tr>
</tbody>
</table>

STIRRUP DIMENSIONS (T = 12")

<table>
<thead>
<tr>
<th>Ø</th>
<th>BAR MARK</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
<th>#5</th>
<th>#6</th>
<th>#7</th>
<th>#8</th>
</tr>
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<tbody>
<tr>
<td>30°</td>
<td>S1</td>
<td>3/16&quot;</td>
<td>1/4&quot;</td>
<td>1/8&quot;</td>
<td>3/32&quot;</td>
<td>1/16&quot;</td>
<td>5/32&quot;</td>
<td>3/32&quot;</td>
<td>1/8&quot;</td>
</tr>
<tr>
<td>45°</td>
<td>S1</td>
<td>3/16&quot;</td>
<td>1/4&quot;</td>
<td>1/8&quot;</td>
<td>3/32&quot;</td>
<td>1/16&quot;</td>
<td>5/32&quot;</td>
<td>3/32&quot;</td>
<td>1/8&quot;</td>
</tr>
<tr>
<td>60°</td>
<td>S1</td>
<td>3/16&quot;</td>
<td>1/4&quot;</td>
<td>1/8&quot;</td>
<td>3/32&quot;</td>
<td>1/16&quot;</td>
<td>5/32&quot;</td>
<td>3/32&quot;</td>
<td>1/8&quot;</td>
</tr>
</tbody>
</table>

NOTES:
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-of-out.
4. Bars A are GFRP #8 and Bars S 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 8", 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 torque on both sides of pile from Dim X down. Show dimensions for Bars S2, S3, S5 & S4 in shop drawings.
8. If torque 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.

TYPE "B1" AND "B2" - VARIABLE ANGLE CORNER PILE

SHEET PILE DIMENSIONS

<table>
<thead>
<tr>
<th>T (in)</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y (in)</td>
<td>3&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

PRECAST CONCRETE SHEET PILE WALL
(CFRP/GFRP & HSS/GFRP)
**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".

- All bar dimensions are out-to-out.
- Bars A are GFRP #8 and Bars S are GFRP #4.
- 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.
- 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.
- 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.
- If tongue must be on opposite side (Groove Side) from that shown, all dimensions and reinforcement shall follow the corresponding Tongue or Groove side.
- For Dimensions L and X see Sheet Pile Data Table in Structures Plans.

** STIRRUPS S **

<table>
<thead>
<tr>
<th>T (in.)</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
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</tr>
<tr>
<td>15</td>
<td>9</td>
<td>7</td>
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** STIRRUPS S (2 - Piece)**

<table>
<thead>
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<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
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** STIRRUPS S (3 - Piece)**

<table>
<thead>
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<th>T (in.)</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
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</thead>
<tbody>
<tr>
<td>10</td>
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<td>2</td>
<td>6</td>
<td>1</td>
<td>4</td>
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<tr>
<td>12</td>
<td>6</td>
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<td>1</td>
<td>4</td>
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** SHEET PILE DIMENSIONS **

<table>
<thead>
<tr>
<th>T (in.)</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y (in.)</td>
<td>3%</td>
<td>4%</td>
</tr>
</tbody>
</table>

** BARS A **

** TYPE "C1" AND "C2" - RIGHT ANGLE CORNER PILE **