### Front Slopes at Drainage Structures

#### Section 1: Limits of Variable Front Slopes at Drainage Structures

- Minimum distance as required to comply with safety criteria.
- Fill or excavate variable slopes during normal grading operations.
- Use larger value of either:
  - L=10xH (No Maximum)
  - L=10xDitch Offset (Maximum L=100')

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

#### TABLE OF CONTENTS:

<table>
<thead>
<tr>
<th>Sheet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Limits of Variable Front Slopes at Drainage Structures</td>
</tr>
<tr>
<td>2</td>
<td>Round and Elliptical Concrete Pipe Joint</td>
</tr>
<tr>
<td>3</td>
<td>Filter Fabric Jacket, Concrete Jacket, and Pipe Plug</td>
</tr>
<tr>
<td>4</td>
<td>Concrete Collars</td>
</tr>
<tr>
<td>5</td>
<td>Pipe End Guard</td>
</tr>
<tr>
<td>6</td>
<td>Retaining Wall Concrete Gutters and Drains</td>
</tr>
</tbody>
</table>

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

#### Diagrams:

**Plan View**
- Edge of Pavement
- Edge of Shoulder
- Drainage Pipe
- Not Steeper Than 1:10
- Endwall
- Ditch Bottom

**Elevation View**
- Edge of Pavement
- Edge of Shoulder
- Drainage Pipe
- Not Steeper Than 1:10
- Endwall
- Ditch Bottom

**Notes:**
- Use larger value of either:
  - L=10xH (No Maximum)
  - L=10xDitch Offset (Maximum L=100')

- 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.
- 1:2 slope if necessary to go beyond normal toe of slope and maintain ditch width by moving out back slope.
### SCHEDULE OF BELL REINFORCEMENT

**Classes I, III, IV, V: Wall A, B, C**

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter</th>
<th>Design Bell Reinforcement</th>
<th>Maximum Reinforcement Under Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in² per foot</td>
<td>in² per foot</td>
</tr>
<tr>
<td>12&quot;</td>
<td>0.09</td>
<td>0.010</td>
</tr>
<tr>
<td>18&quot;</td>
<td>0.12</td>
<td>0.010</td>
</tr>
<tr>
<td>24&quot;</td>
<td>0.14</td>
<td>0.010</td>
</tr>
<tr>
<td>30&quot;</td>
<td>0.16</td>
<td>0.010</td>
</tr>
<tr>
<td>36&quot;</td>
<td>0.18</td>
<td>0.010</td>
</tr>
<tr>
<td>48&quot;</td>
<td>0.21</td>
<td>0.012</td>
</tr>
<tr>
<td>60&quot;</td>
<td>0.33</td>
<td>0.015</td>
</tr>
<tr>
<td>72&quot;</td>
<td>0.28</td>
<td>0.016</td>
</tr>
<tr>
<td>72&quot;</td>
<td>0.31</td>
<td>0.018</td>
</tr>
<tr>
<td>84&quot;</td>
<td>0.33</td>
<td>0.019</td>
</tr>
<tr>
<td>90&quot;</td>
<td>0.35</td>
<td>0.021</td>
</tr>
<tr>
<td>90&quot;</td>
<td>0.37</td>
<td>0.0225</td>
</tr>
<tr>
<td>102&quot;</td>
<td>0.40</td>
<td>0.024</td>
</tr>
<tr>
<td>108&quot;</td>
<td>0.42</td>
<td>0.025</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

**NOTES:**
1. Filter Fabric Jacket is required on both type of joints.
2. Details shown before pull-up.

---

### ELLIPTICAL CONCRETE PIPE JOINT DETAIL

**NOTES:**
1. Filter Fabric Jacket is required on both type of joints.
2. Details shown before pull-up.

---

**MISCELLANEOUS DRAINAGE DETAILS**

**INDEX:** 430-001

**SHEET:** 2 of 6

---

**ROUND AND ELLIPTICAL CONCRETE PIPE JOINT**

---

**DESCRIPTION:**

**FY 2020-21 STANDARD PLANS**

---

**LAST REVISE:** 1/3/19

---

**REV SYSTEM:** 1/3/19
FILTER FABRIC JACKET

(FOR ALL PIPE TYPES - CONCRETE ELLIPTICAL PIPE SHOWN)

Concrete Pipe

FILTER FABRIC JACKET

8"; Pipes to 60"; 12"; Pipes 66" to 108"; 16"; Pipes Above 108"

CONCRETE PLUG

SECTION VIEW

FILTER FABRIC JACKET

CONCRETE PLUG

CONCRETE JACKET

(ONLY WHEN CALLED FOR IN THE PLANS)

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 both ways 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.
1. The collar may be formed by any method approved by the Engineer.
2. Install 6x16” dowels in adhesive bond material.
3. Stub Pipe maximum diameter: \( \frac{1}{2} \) 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'-6", alt. b inlet, rectangular inlet is used.
7. See Index 425-001 for optional construction joints.
**DESCRIPTION:**

- **Revision:** FY 2020-21
- **Standard Plans:** MISCELLANEOUS DRAINAGE DETAILS

---

**GUARD TABLE**

<table>
<thead>
<tr>
<th>Pipe Dia.</th>
<th>Top Steel Bracket</th>
<th>Bottom Steel Plate</th>
<th>Number of Vert. Bars</th>
<th>Number of Horiz. Bars</th>
<th>Bars Size</th>
<th>Weight Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot;</td>
<td>2'-4&quot;</td>
<td>3'-6&quot;</td>
<td>4</td>
<td>1</td>
<td>1/2&quot;</td>
<td>48</td>
</tr>
<tr>
<td>24&quot;</td>
<td>3'-0&quot;</td>
<td>4'-0&quot;</td>
<td>5</td>
<td>2</td>
<td>1/2&quot;</td>
<td>58</td>
</tr>
<tr>
<td>30&quot;</td>
<td>3'-0&quot;</td>
<td>4'-0&quot;</td>
<td>5</td>
<td>2</td>
<td>1/2&quot;</td>
<td>74</td>
</tr>
<tr>
<td>36&quot;</td>
<td>3'-0&quot;</td>
<td>5'-0&quot;</td>
<td>6</td>
<td>4</td>
<td>3/8&quot;</td>
<td>90</td>
</tr>
<tr>
<td>42&quot;</td>
<td>4'-0&quot;</td>
<td>5'-6&quot;</td>
<td>5</td>
<td>5</td>
<td>5/8&quot;</td>
<td>111</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Construct guards only at locations specifically called for in Plans.
**GUTTER AND DRAINS**

**MISCELLANEOUS DRAINAGE DETAILS**

**PLAN**
- Expansion Material
- 6" Pipes
- Face of Curb
- Sidewalk
- Retaining Wall
- Gutter

**ELEVATION**
- 1/2" Slope
- Front Slope (1:2 Std.)
- Expansion Material
- 4" Pipes
- 90° Elbow or Quarter Bend

**SECTION A-A**
- Sidewalk
- 4" Pipe
- Face of Curb

**SECTION B-B**
- Front Slope
- 1 1/2" Slope
- 2'-0"