NOTE: WHERE CONDITIONS REQUIRE, USE ALTERNATE LENGTHS IN INCREMENTS OF 6" (150)

OPTIONAL FOR HANDLING DURING GALVANIZING

NOTE: ALL HOLES SHALL BE 5/16" (20) 0.5" BOLT HOLE PATTERN IS SYMMETRICAL WITH RESPECT TO THE VERTICAL AXIS OF THE POST.
**W-THREE BEAM TRANSITION SECTION**

- **POST BOLT SLOTS**: $\frac{3}{4}" \times 1\frac{1}{4}" (30 x 32)
- **SPlice BOLT SLOTS**: $\frac{1}{2}" \times 1\frac{1}{4}" (13 x 32)

**Dimensions**:
- Depth: 3'-4" (973.8)
- Length: 7'-3" (2225)
- Height: 3'-6" (914.4)

**Notes**:
- Scale: N.T.S.
ANCHOR PLATE TO W-BEAM CONNECTION DETAIL

NOTES:
1. TO ENSURE THAT THE TIMBER BEARING PLATE REMAINS IN POSITION, WELD END PLATE TO ANCHOR PLATE ON THREE SIDES.
2. ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.
3. TO TIGHTEN ASSEMBLY UNTIL CABLE IS TIGHT, SWAGE CONNECTION SLEEVE AND NUTS.
4. 2 - 10d GALVANIZED STEEL NAILS SHALL BE DRIVEN IN THE SHORT TIMBER BREAKAWAY POST, AND BENT OVER BEARING PLATE.
5. SWAGED CABLE ASSEMBLAGE AND RELATED HARDWARE ASSEMBLY

1. TO ENSURE THAT THE TIMBER BEARING PLATE REMAINS IN POSITION, WELD END PLATE TO ANCHOR PLATE ON THREE SIDES.

2. ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.

3. TO TIGHTEN ASSEMBLY UNTIL CABLE IS TIGHT, SWAGE CONNECTION SLEEVE AND NUTS.

4. 2 - 10d GALVANIZED STEEL NAILS SHALL BE DRIVEN IN THE SHORT TIMBER BREAKAWAY POST, AND BENT OVER BEARING PLATE.

5. SWAGED CABLE ASSEMBLAGE AND RELATED HARDWARE ASSEMBLY

DELWARE DEPARTMENT OF TRANSPORTATION

HARDWARE

APPROVED

STANDARD NO. B-13 (2004) SHT. 8 OF 13 RECOMMENDED

09/29/2004
GUARDRAIL REFLECTOR

BEARING PLATE DETAIL

DRILL 1/8" (25) HOLE (TYPE)

3/4" (19) PLATE

HARDWARE

B-13 (2004)

SHT. 9 OF 13

DEPARTMENT OF TRANSPORTATION

DELWARE

STANDARD NO.

APPROVED

RECOMMENDED
Recessed nut (for 5/8" (16) guardrail bolt)

Steel washer (for 5/8" (16) guardrail bolt)

Notes:
- Dimension for washer thickness is approximate based on metal thickness.

Guardrail bolt

Notes:
- All fillets shall have a minimum radius of 1/2 (12).
- If the bolt extends more than 3/32 beyond the nut, the bolt shall be trimmed back as per the Department's specifications.

ardware

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 (35)</td>
<td>FULL THREAD LENGTH</td>
</tr>
<tr>
<td>5/32 (100)</td>
<td>FULL THREAD LENGTH</td>
</tr>
<tr>
<td>3/32 (100)</td>
<td>FULL THREAD LENGTH</td>
</tr>
<tr>
<td>1/8 (250)</td>
<td>4&quot; X 400 THREAD LENGTH</td>
</tr>
<tr>
<td>5/32 (200)</td>
<td>4&quot; X 400 THREAD LENGTH</td>
</tr>
</tbody>
</table>

Notes:
- All fillets shall have a minimum radius of 1/2 (12).
- If the bolt extends more than 3/32 beyond the nut, the bolt shall be trimmed back as per the Department's specifications.
Note: Dimension for washer thickness is approximate base metal thickness.
STEEL WASHER

NOTES:
1. FOR USE WITH SWAGED CABLE ASSEMBLAGE.
2. DIMENSION FOR WASHER THICKNESS IS APPROXIMATE BASE METAL THICKNESS.

1/2" (12.7) 

5/16" (7.9) 

1/2" (12.7) 

1/4" (6.35) 

5/16" (7.9) CARRIAGE BOLT

5/16" (7.9) HEX NUT

NOTE: FOR USE WITH SWAGED CABLE ASSEMBLAGE.
NOTES:
1. RAIL SHALL BE MOUNTED ON GUARDRAIL ADJACENT TO A BIKEWAY OR SIDEWALK.
2. ALL COMPONENTS OF THE RAIL SHALL BE SHOP FABRICATED. ALL CUTTING AND DRILLING SHALL BE DONE IN THE SHOP.
3. ALL EXPOSED THREADED HARDWARE SHALL BE BURIED.
4. GUARDRAIL POSTS UPON WHICH RAIL IS TO BE INSTALLED SHALL BE SHOP DRILLED FOR THE RAIL, BRACKETS DURING FABRICATION.
5. ALL RAIL SPLICES WILL BE AT RAIL SUPPORT BRACKETS, THE SAME BOLT USED TO ATTACH THE RAIL TO THE BRACKET WILL BE USED TO SECURE THE SPlice TUBE.
6. RAILS SHALL BE INSTALLED ONLY ON STANDARD "W" BEAM SECTIONS AND AT LEAST ONE POST AWAY FROM THE PAYMENT LIMITS OF THE END TREATMENT.
TYPICAL CAST-IN-PLACE OR SLIP-FORM CONSTRUCTION

BAR OFFSETS

<table>
<thead>
<tr>
<th>KIND OF BARRIER SECTION</th>
<th>X</th>
<th>NO. REQS. FOR EACH BARRELL SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-6&quot; (6000)</td>
<td>3&quot;-0&quot; (750)</td>
<td>4</td>
</tr>
<tr>
<td>4'-0&quot; (1200)</td>
<td>3&quot;-0&quot; (750)</td>
<td>4</td>
</tr>
<tr>
<td>4'-6&quot; (1350)</td>
<td>3&quot;-0&quot; (750)</td>
<td>4</td>
</tr>
<tr>
<td>6'-0&quot; (1800)</td>
<td>3&quot;-0&quot; (750)</td>
<td>4</td>
</tr>
<tr>
<td>6'-6&quot; (1950)</td>
<td>2&quot;-6&quot; (750)</td>
<td>4</td>
</tr>
</tbody>
</table>

BAR LIST

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>NUMBER IN EACH SECTION</th>
<th>LENGTH</th>
<th>TYPE</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>4&quot;</td>
<td>2</td>
<td>0'-0&quot; (0)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482</td>
<td>4&quot;</td>
<td>4</td>
<td>0'-0&quot; (0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* THE LENGTH OF BAR 482 SHALL BE 6" (150) SHORTER IN LENGTH THAN THE NOMINAL SIZE OF THE BARRIER IN WHICH IT IS USED.

** SEE "BAR OFFSETS" CHART ON THIS SHEET FOR MORE INFORMATION.

NOTES:

1. CONCRETE CLEAR COVER FOR REINFORCING BARS SHALL BE 1/2" (1250) MIN. (2L BARS SHALL BE CLG AT EVERY JOINT IF MADE USING CONTINUOUS SLIP-FORM CONSTRUCTION.)
**Steel Connector Plate**

ASTM A490, grade 50W (450M)

**Slot Dimensions**

Concrete Safety Barrier, Precast Construction

**Section A-A**

**Section B-B**

DELWARE DEPARTMENT OF TRANSPORTATION

SLOTTED PLATE CONNECTION DETAILS

STANDARD NO. B-14 (2009)  SHT. 4 OF 4  RECOMMENDED

APPROVED SIGNATURE ON FILE  01/10/2010  01/14/2010

03/18/2009
DETECTABLE WARNING TRUNCATED DOME DETAILS

NOTES:
1. THE AREA OF DETECTABLE WARNING TRUNCATED DOMES SHALL BE 24"X1600" LONG AND THE FULL WIDTH OF THE RAMP OR DEPRESSED CURB.
2. SEE SPECIFICATION FOR ADDITIONAL INFORMATION.

SECTION B-B

MAXIMUM DIFFERENCE IN GRADE
FOR EXAMPLE, IF THE CURB RAMP AND DEPRESSED CURB SLOPE IS 1% AND THE PAVEMENT SLOPE IS 0.5%, THEN TO DETERMINE THE DIFFERENCE IN GRADE, ADD X + Y TO GET 1.5%, WHICH IS GREATER THAN THE 1% PRESCRIBED BUT LESS THAN THE 1.5% MAXIMUM.

CURB RAMP, TYPE 1

CURB RAMP, TYPE 1 AND SECTIONS

DELWARE
DEPARTMENT OF TRANSPORTATION

STANDARD NO. C-2 (2006)
SHT. 1 OF 4

APPROVED

D/8/2008

D/8/2008
PLAN
- JOINT
- EXPANSION MATERIAL

ELEVATION

SECTION A-A
ENTRANCE WITH SIDEWALK

NOTE: IF WIDTH OF DRIVEWAY IS 16' (4.88M) OR GREATER, THE Y-FLARE CAN BE OMITTED.

DELaware
DEPARTMENT OF TRANSPORTATION

ENTRANCES
STANDARD NO. C-3 (2006) SHT. 1 OF 1
APPROVED
RECOMMENDED

09/10/2008

SCALE 1/20 , 5000
Tipo D
Integral P.G.P. Curb and Gutter, Type 1

Tipo E
Integral P.G.P. Curb and Gutter, Type 2
PLAN VIEW
SHOWN WITHOUT GRATE

NOTE: 61 SAFETY END STRUCTURE TO BE PRECAST

SECTION A-A

FRONT VIEW
PLAN VIEW
Shown without grate

NOTE: All safety end structure to be precast.

SECTION A-A
* Required only for pipe size of 24" (625) or 28" (700)

DELAWARE
DEPARTMENT OF TRANSPORTATION

STANDARD NO. D-2 (2001) SHT. 1 OF 2

APPROVED

RECOMMENDED

04/17/2001
### Dimensions

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; (1575)</td>
<td>15&quot;</td>
<td>4&quot;</td>
<td>1720</td>
</tr>
<tr>
<td>8&quot; (1450)</td>
<td>9&quot;</td>
<td>6&quot;</td>
<td>1690</td>
</tr>
<tr>
<td>8&quot; (1450)</td>
<td>9&quot;</td>
<td>6&quot;</td>
<td>1690</td>
</tr>
<tr>
<td>2&quot; (525)</td>
<td>24&quot;</td>
<td>3&quot;</td>
<td>1530</td>
</tr>
</tbody>
</table>

### Bending Diagram

**Pipe Size**

- 6" (1575) to 6" (1450) to 8" (1450) to 8" (1450) to 2" (525) to 24" (1600)

**Bending Points**

- 2" (525) or 24" (1600) to 23" (1725)

### Approximate Quantities

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Concrete FT3 (m3)</th>
<th>Reinforcing Steel LBS. (kg)</th>
<th>No. of Grates</th>
<th>Length to be Cut from 1 Grate</th>
<th>Weight of Full Size Grate LBS. (kg)</th>
<th>Weight of Cut Grate LBS. (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; (1575)</td>
<td>46.35</td>
<td>4.78</td>
<td>4</td>
<td>2&quot; (1630)</td>
<td>215.92</td>
<td>422.89</td>
</tr>
<tr>
<td>8&quot; (1450)</td>
<td>50.81</td>
<td>4.435</td>
<td>5</td>
<td>2&quot; (1630)</td>
<td>215.92</td>
<td>422.89</td>
</tr>
<tr>
<td>2&quot; (525)</td>
<td>65.13</td>
<td>10.968</td>
<td>6</td>
<td>2&quot; (1630)</td>
<td>215.92</td>
<td>422.89</td>
</tr>
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</table>

### Schedule of Reinforcing Steel

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>A-Bars</th>
<th>B-Bars</th>
<th>C-Bars</th>
<th>D-Bars</th>
<th>G-Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; (1575)</td>
<td>4 (M3)</td>
<td>1</td>
<td>-</td>
<td>4 (M3)</td>
<td>5</td>
</tr>
<tr>
<td>8&quot; (1450)</td>
<td>4 (M3)</td>
<td>1</td>
<td>-</td>
<td>4 (M3)</td>
<td>5</td>
</tr>
<tr>
<td>2&quot; (525)</td>
<td>4 (M3)</td>
<td>2</td>
<td>-</td>
<td>4 (M3)</td>
<td>5</td>
</tr>
</tbody>
</table>

**Note:**

- A-Bars, B-Bars, C-Bars, D-Bars, G-Bars refer to different sections of the reinforcing steel schedule.

---

**Delaware Department of Transportation**

**161 Safety End Structure**


Approved [Signature]

Recommended [Signature]

Date: 04/17/2001
GRATE DETAIL

FRAME & GRATE ASSEMBLY DETAIL
1. Personnel Safety Grates (PSG) shall only be installed on the inlets of storm water pipes 2' (300) or larger in diameter that are not straight from the inlet to the open outlet, regardless of the length.

2. The grate shall be made to fit the outside perimeter of the Flared End Section (FES) ± 1/8" (13).

3. All bolt holes are to be drilled in the field.

4. A stiffener is to be installed where two or more bars are used.

5. Bottom bar shall be 6" (150) above invert of FES.

6. All hardware attached to concrete shall be attached using approved tamper proof anchors.
DRAINAGE INLET FRAME AND GRATES

NOTES:
1. THE TYPE 2 DRAINAGE INLET GRATE SHALL NOT BE INSTALLED WHERE BICYCLE TRAFFIC MAY BE PRESENT.
2. THE TOP OF ALL DRAINAGE INLET GRATES SHALL BE LABELLED "ONLY RAIN DOWN THE STORM DRAIN".
3. DRAINAGE INLET GRATES TYPE 1 AND TYPE 4 SHALL BE LABELLED WITH "WATER FLOW" AND AN ARROW INDICATING FLOW DIRECTION AS SHOWN IN THE EXAMPLE DETAIL.
4. THE TYPE 5 & 6 FRAME AND GRATE COMBINATIONS ARE TO BE USED IN CONJUNCTION WITH LAWN INLET BOXES ONLY. SEE SCHEDULE ON DETAIL D-4 SHEET OF 1 FOR WHICH BOX SIZES ARE CONSIDERED LAWN INLET BOXES.
5. THE TYPE 6 FRAME AND GRATE COMBINATION SHOWN IS THE MELANAH FOUNDARY FRAME AND GRATE COMBINATION MODEL M-1018-ASS. AN ACCEPTABLE ALTERNATIVE IS THE EAST JORDAN IRON WORKS FRAME AND GRATE COMBINATION MODEL V-3622.

DELTADE OF TRANSPORTATION

DRAINAGE INLET FRAME AND GRATES

STANDARD NO. D-6 (2009) SHT. 2 OF 8

APPROVED

SIGNATURE ON FILE 01/11/2010

RECOMMENDED

SIGNATURE ON FILE 01/14/2010
**INLET TOP UNIT APPLICATIONS**

<table>
<thead>
<tr>
<th>CURB</th>
<th>TOP UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>TYPE A</td>
</tr>
<tr>
<td>B</td>
<td>TYPE B</td>
</tr>
<tr>
<td>C</td>
<td>TYPE C</td>
</tr>
<tr>
<td>D</td>
<td>TYPE D</td>
</tr>
<tr>
<td>E</td>
<td>TYPE E</td>
</tr>
</tbody>
</table>

**TOP UNIT**
- **A**: USE IN DRAINAGE SWALE
- **B**: INTEGRAL PCC CURB & GUTTER, TYPE I & 3, PCC CURB TYPE 1
- **C**: INTEGRAL PCC CURB & GUTTER, TYPE 4, PCC CURB TYPE 3
- **D**: INTEGRAL PCC CURB & GUTTER, TYPE 2
- **E**: PCC CURB TYPE 2

**S501 BENDING DIAGRAM**

S501 IS NOT REQUIRED TO BE ONE CONTINUOUS BAR. IF MORE THAN ONE BAR IS USED, THERE MUST BE A 12" (300 MM) OVERLAP BETWEEN BARS.

**ISOMETRIC VIEW**

**TYPE E UNIT SHOWN**

- 2" (50 MM) x 4" (100 MM) TEMPORARY DRAINAGE OPENING

---

**DELaware DEPARTMENT OF TRANSPORTATION**

**DRAINAGE INLET TOP UNITS**

**STANDARD NO.**: D-5 (2009)  **SHT.**: 3  **OF**: 8  **APPROVED**

**RCOMMENDED**

**SIGNATURE ON FILE**: 01/19/2010  **SIGNED**

**SIGNATURE ON FILE**: 01/14/2020  **SIGNED**
72" (830) x 72" (830) INLET

72" (830) x 48" (1220) INLET

72" (830) x 24" (610) INLET

SECTION B-B
FOR TYPE B TOP UNITS

SECTION B-B
FOR TYPES A, C, D, & E TOP UNITS

NOTES:
1. RETRACT ENCROACHING REINFORCING BARS WHEN USING TYPE B TOP UNIT.
2. COVER SLABS ARE TO BE PRECAST AND MUST BE SIZED TO FIT INLET BOX DIMENSIONS.
3. ALL BARS ARE TO BE 5" SPACED @ 6" (150) UNLESS NOTED OTHERWISE. TOP REINFORCEMENT SHALL BE 8" (200) MIN. HORIZONTAL REINFORCEMENT PER FOOT IN BOTH DIRECTIONS.
4. MINIMUM BAR COVER - 1/2" (130).

DELWARE
DEPARTMENT OF TRANSPORTATION

DOUBLE INLET COVER SLAB DETAILS

STANDARD NO. D-6 (2009) SHT. 5 OF 8

APPROVED SIGNATURE ON FILE 01/14/2010

RECOMMENDED SIGNATURE ON FILE 01/09/2010

S502 BENDING DIAGRAM
S502 IS NOT REQUIRED TO BE ONE CONTINUOUS BAR, IF MORE THAN ONE BAR IS USED, THERE MUST BE A 12" (300) OVERLAP BETWEEN BARS.