W-THREE BEAM TRANSITION SECTION

STANDARD W-BEAM SECTION

STANDARD THREE BEAM SECTION

HP 20 x 1 1/4 x 300 SPlice bolt slots

1 1/4 x 300 POST BOLT SLOTS

3'-5" (937.5)
2" (50.8)
2" (50.8)
2" (50.8)
3'-5" (937.5)

1/8" x 2" (52.0) MIN.
2" (50.8)
2" (50.8)
2" (50.8)
2" (50.8)
2" (50.8)
2" (50.8)

SHEET 6 OF 13

HARDWARE

B-13 (2000)

APPROVED

RECOMMENDED

STANDARD NO.

DELAWARE

DEPARTMENT OF TRANSPORTATION

DATE: N.T.S.

11/10/05

11/10/05

11/10/05

11/10/05

11/10/05

11/10/05

11/10/05

11/10/05

11/10/05

11/10/05
NOTES:
1. ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.
2. ALL WOOD SIZES ARE NOMINAL DIMENSIONS.
3. POSTS SHOULD BE PLACED SO THAT BREAKAWAY HOLES ARE NOT LOWER THAN GROUND LEVEL AND NO HIGHER THAN 4'-0" ABOVE GROUND LEVEL.

WOOD BLOCK

STEEL TUBE

SHORT WOOD BREAKAWAY POST

LONG WOOD BREAKAWAY POST

DELaware
DEPARTMENT OF TRANSPORTATION

HARDWARE

APPROVED


07/14/2008
ANCHOR PLATE TO W-BEAM CONNECTION DETAIL

SWAGED CABLE ASSEMBLAGE AND RELATED HARDWARE ASSEMBLY

1. To ensure that the timber bearing plate remains in position, drill 4 holes-
   \( \frac{3}{4}'' \times 240 \) DIA. (UPPER BOLT L)
   \( \frac{3}{4}'' \times 240 \) DIA. (LOWER BOLT L)
   \( \frac{3}{4}'' \times 240 \) DIA. (UPPER BOLT R)
   \( \frac{3}{4}'' \times 240 \) DIA. (LOWER BOLT R)

2. Tighten assembly until cable is taut.
3. All holes shall be drilled prior to galvanizing.

NOTES:
- End plate
- Weld end plate to anchor plate
- Three sides
- Drill 4 holes-
  \( \frac{3}{4}'' \times 240 \) DIA. - HEX BOLTS AND NUTS

END PLATE

SECTION A-A

ANCHOR PLATE

STEEL POST SLEEVE

POST SLEEVE

TIMBER BEARING PLATE

SWAGE CONNECTION SLEEVE

ANCHOR PLATE

STEEL POST SLEEVE

POST SLEEVE

TIMBER BEARING PLATE

SHORT TIMBER BREAKAWAY POST

TIMBER BEARING PLATE

\( \frac{1}{8}'' \times 120 \) DIA. STEEL WASHER

END PLATE

HARDWARE

DELAWARE DEPARTMENT OF TRANSPORTATION


APPROVED

RECOMMENDED

SCALE: N.T.S.

SWAGED CABLE ASSEMBLAGE AND RELATED HARDWARE ASSEMBLY

NOTES:
- This application for use in end anchorage only
- \( \frac{3}{4}'' \times 240 \) DIA. (UPPER BOLT L)
- \( \frac{3}{4}'' \times 240 \) DIA. (LOWER BOLT L)
- \( \frac{3}{4}'' \times 240 \) DIA. (UPPER BOLT R)
- \( \frac{3}{4}'' \times 240 \) DIA. (LOWER BOLT R)

END PLATE

ANCHOR PLATE

STEEL POST SLEEVE

POST SLEEVE

TIMBER BEARING PLATE

SHORT TIMBER BREAKAWAY POST

TIMBER BEARING PLATE

\( \frac{1}{8}'' \times 120 \) DIA. STEEL WASHER

NOTES:
- To ensure that the timber bearing plate remains in position, drill 4 holes-
  \( \frac{3}{4}'' \times 240 \) DIA. (UPPER BOLT L)
  \( \frac{3}{4}'' \times 240 \) DIA. (LOWER BOLT L)
  \( \frac{3}{4}'' \times 240 \) DIA. (UPPER BOLT R)
  \( \frac{3}{4}'' \times 240 \) DIA. (LOWER BOLT R)

2. Tighten assembly until cable is taut.
3. All holes shall be drilled prior to galvanizing.
GUARDRAIL REFLECTOR

MOUNTING POSITION

GUARDRAIL REFLECTOR

BEARING PLATE DETAIL

BOLT

POST

HARDWARE

B-13 (2004)

SHEET 9 OF 13

DELWARE DEPARTMENT OF TRANSPORTATION

HARDWARE

APPROVED

STANDARD NO.

RECOMMENDED

TIGHTNUT WHIT 11/10/05

1/4" (102)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"

1/4" (101)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"

1/4" (100)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"

1/4" (90)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"

1/4" (85)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"

1/4" (80)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"

1/4" (75)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"

1/4" (70)

þ 2.3"

þ 3.1"

þ 13"

þ 3.6"
RECOMMENDED
APPROVED
N.T.S.

STEEL WASHER (FOR 5/8" (16) GUARDRAIL BOLT)

NOTE: DIMENSION FOR WASHER THICKNESS IS APPROXIMATE BASED ON METAL THICKNESS.

GUARDRAIL BOLT

NOTES:

1. ALL FILLETS SHALL HAVE A MINIMUM RADIUS OF 1/4" R. (10).
2. IF THE BOLT EXTENDS MORE THAN 1/8" BEYOND THE NUT, THE BOLT SHALL BE TRIMMED BACK AS PER THE DEPARTMENT'S SPECIFICATIONS.
**HIGH-STRENGTH STRUCTURAL HEX BOLT**

\[
\frac{3}{8} \text{ in} \times (16)
\]

**HIGH-STRENGTH STRUCTURAL HEX NUT**

\[
\frac{3}{8} \text{ in} \times (20)
\]

**STEEL WASHER**

\[
\frac{3}{8} \text{ in} \times (5)
\]

**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.

1/4" (6.3)

1/8" (3.2)

5/8" (16) CARRIAGE BOLT

1/4" (6.3)

1/8" (3.2)

1/8" (3.2)

1/4" (6.3)

5/8" (16) HEX NUT

NOTE:
FOR USE WITH SWAGED CABLE ASSEMBLAGE.

HARDWARE

DELAWARE
DEPARTMENT OF TRANSPORTATION

STANDARD NO. B-13 (2004)  SHT. 12  OF 13  APPROVED  DATE

RECOMMENDED  DATE

SCALE: NO SCALE
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 X-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 SHALL BE CUT AT EVERY JOINT if WADE
CONTINUOUS FOR SLIP-FORM CONSTRUCTION
TYPICAL PRE-CAST CONSTRUCTION

F' SHAPE BARRIER SECTION

TYPICAL PRE-CAST REINFORCEMENT DETAILS

NOTE: B. CONCRETE CLEAR COVER FOR REINFORCING BARS SHALL BE 1 3/4 (40) MIL.
NOTES:

1. WHEN P.C.C. CURB OR INTEGRAL P.C.C. CURB AND GUTTER IS PLACED ADJACENT TO PORTLAND CEMENT CONCRETE PAVEMENT, CONSTRUCT THE JOINT AS PER THE LONGITUDINAL JOINT SEALANT DETAIL ON DETAIL P-2, SHEET 3 OF 5. USE APPROVED JOINT FILLER TO SEAL. WORK TO BE PAID UNDER RESPECTIVE CURB AND GUTTER ITEM.

2. DEPRESS CURB AT ENTRANCES AND CURB RAMPS AS DETAILED ON THIS SHEET.

3. DEPRESS CURB FLUSH WITH PAVEMENT AT CURB RAMPS. MAXIMUM SLOPE OF CURB AT CURB RAMPS IS 20% IN THE DIRECTION OF PEDESTRIAN TRAVEL. SEE DETAIL C-2, SHEET 1 OF 4.

4. DEPRESS CURB FLUSH WITH PAVEMENT OR ADJACENT AREA AT NOSE OF ISLANDS, TAPERING BACK TO FULL HEIGHT AT A SLOPE OF 20%.

DELAWARE
DEPARTMENT OF TRANSPORTATION

P.C.C. CURB, P.C.C. CURB & GUTTER, AND HOT-MIX CURB

STANDARD NO. C-1 (2009) SHT. 1 OF 1

APPROVED

RECOMMENDED

07/02/2008
NOTES:
0. WHERE A Maximum SLOPE RAMP WILL NOT MEET THE SIDEWALK GRADE WITHIN A LENGTH OF 6' HORIZONTAL DUE TO STEEP ADJACENT ROADSIDE, THE RAMP LENGTH MAY BE LIMITED TO 2' HORIZONTAL, AND THE RAMP SLOPE ALLOWED TO EXCEED €0.7.
1. TRANSITION TO EXISTING SIDEWALK WIDTH OVER THE LENGTH OF THE RAMP.
2. The RAMP AND SIDEWALK CROSS-SLOPE SHALL BE 0.5:12 VERTICAL MAXIMUM.
3. If GRADING WILL BE STEEPER THAN 6% ADJACENT TO THE CURB RAMP OR SIDEWALK, THEN A TYPE 1 CURB OR RETAINING WALL SHOULD BE USED TO ELIMINATE THE NEED FOR THE STEEP SLOPE.
4. FOR THE CURB RAMP, TYPE 3" THE WIDTH OF THE FULLY DEPRESSED CURB AT THE STREET IS MORE THAN 8' 0" DEEP, THE DETECTABLE WARNING TRUNCATED DOMES SHALL FOLLOW THE RADIUS OF THE CURB CONTINUOUSLY WITHOUT GAPS FOR THE ENTIRE LENGTH OF DEPRESSED CURB.
5. THE MAXIMUM DIFFERENCE IN GRADE BETWEEN THE SIDEWALK OR CURB AND THE PAVEMENT SHALL BE 1:12, HOWEVER IT IS PREFERRED. SEE STANDARD NO.C-2, SHEET 1 OF 4.
6. The manufacturing of the FULLY DEPRESSED CURB AT THE STREET IS 6' 0" DEEP OR LESS, THEN A RECTANGULAR PIECE OF DETECTABLE WARNING TRUNCATED DOMES MAY BE USED.

DELAWARE DEPARTMENT OF TRANSPORTATION
CURB RAMPS, TYPES 2, 3, & 4
STANDARD NO. C-2 (2008)
SHT. 2 OF 4
APPROVED
RECOMMENDED
PLAN

- Joint
- Expansion material

ELEVATION

SECTION A-A

ENTRANCE WITH SIDEWALK

NOTE: If width of driveway is 16' (4.87m) or greater, the U-flare can be omitted.

SECTION B-B

ENTRANCE WITHOUT SIDEWALK

DELWARE
DEPARTMENT OF TRANSPORTATION

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

APPROVED RECOMMENDED

09/10/2008
TYPE D
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 1

TYPE E
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 2

DELAWARE DEPARTMENT OF TRANSPORTATION

CURB OPENINGS

STANDARD NO. C-4 (2001) SHT. 2 OF 3

APPROVED

03/03/2001
TYPE F
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 3

TYPE G
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 4
PLAN VIEW
SHOWN WITHOUT GRATE

NOTE: 61 SAFETY END STRUCTURE TO BE PRECAST

SECTION A-A

DELaware
DEPARTMENT OF TRANSPORTATION

61 SAFETY END STRUCTURE

STANDARD NO. D-1 (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;*1375</td>
<td>9&quot;-6&quot; (299)</td>
<td>2&quot;-5&quot; (133)</td>
<td>8&quot;-4&quot; (254)</td>
</tr>
<tr>
<td>8&quot;*1450</td>
<td>8&quot;-8&quot; (229)</td>
<td>2&quot;-9&quot; (125)</td>
<td>10&quot;-3&quot; (257)</td>
</tr>
<tr>
<td>2*1520 OR 24&quot; (609)</td>
<td>14&quot;-4&quot; (356)</td>
<td>3&quot;-26&quot; (966)</td>
<td>12&quot;-8&quot; (320)</td>
</tr>
</tbody>
</table>

### Approximate Quantities

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Concrete Ft(^2) (Lbs)</th>
<th>Reinforced 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;*1375</td>
<td>25 (773) 25.43 (111) 2.42 (54.4)</td>
<td>2</td>
<td>--</td>
<td>270.92 (422.4)</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>8&quot;*1450</td>
<td>35.5 (962) 32.07 (3608) 56.7 (121)</td>
<td>3</td>
<td>2&quot;-11 (335)</td>
<td>270.92 (422.4)</td>
<td>(95.47 (210.45)</td>
<td></td>
</tr>
<tr>
<td>2*1520 OR 24&quot; (609)</td>
<td>45.75 (1441) 59.87 (1344) 89.4 (1660)</td>
<td>3</td>
<td>--</td>
<td>270.92 (422.4)</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

### Bending Diagram

- **A-Bars**
- **B-Bars**
- **C-Bars**
- **D-Bars**
- **G-Bars**
- **B-Bars**
- **G-Bars**
- **B-Bars**

### 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>C-Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size</td>
<td>No. SPA</td>
<td>Length</td>
<td>Size</td>
<td>No. SPA</td>
</tr>
<tr>
<td>6*1375</td>
<td>4 (M)</td>
<td>3</td>
<td>2</td>
<td>4 (M)</td>
<td>5</td>
</tr>
<tr>
<td>8*1450</td>
<td>4 (M)</td>
<td>3</td>
<td>2</td>
<td>4 (M)</td>
<td>5</td>
</tr>
<tr>
<td>2*1520 OR 24&quot; (609)</td>
<td>4 (M)</td>
<td>2</td>
<td>2</td>
<td>4 (M)</td>
<td>5</td>
</tr>
<tr>
<td>50 (2270) TO 100&quot; (2540)</td>
<td>Varies</td>
<td>4 (M)</td>
<td>5</td>
<td>2</td>
<td>4 (M)</td>
</tr>
<tr>
<td>40 (2030) TO 80&quot; (2032)</td>
<td>Varies</td>
<td>4 (M)</td>
<td>5</td>
<td>2</td>
<td>4 (M)</td>
</tr>
<tr>
<td>40 (2030) TO 80&quot; (2032)</td>
<td>Varies</td>
<td>4 (M)</td>
<td>5</td>
<td>2</td>
<td>4 (M)</td>
</tr>
</tbody>
</table>

**DELAWARE**
**DEPARTMENT OF TRANSPORTATION**

---

**61 SAFETY END STRUCTURE**

---

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

---

**APPROVED**
**RECOMMENDED**

---

**SIGNED**

---

**DATE: 6/12/01**
PLAN VIEW
SHOWN WITHOUT GRATE

NOTE: SAFETY END STRUCTURE TO BE PRECAST

SECTION A-A
* REQUIRED ONLY FOR PPE SIZE OF 2" (529) OR 2" (600)

FRONT VIEW
1. Personnel Safety Grates (PSG) shall only be installed on the inlets of storm water pipes 12' (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) ± $\frac{1}{16}$.

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.

Notes:

- Field-drilled bolt holes (typ).
- All bars shall be $\frac{1}{16}$" (64) in diameter.
- All crossmembers and stiffeners shall be $\frac{1}{16}$" (16) in diameter.

DELTA ESTATE
DEPARTMENT OF TRANSPORTATION

SAFETY GRATES

STANDARD NO.  D-3   (2007)  

SHT.  2  OF  2

APPROVED

RECOMMENDED

08/01/2007
1. Inlet boxes shall be pre-cast or cast-in-place.
2. Pipes shall not be installed through any corner of the inlet box.
3. Riser sections may be used for deep inlet boxes.
4. Pipes may be installed near or through joints for riser sections.
5. When the cover above the pipe is less than 4" (100) to the cover slab or top unit opening, the portion of box wall above the pipe may be removed as shown in the optional pipe opening detail. The area above the pipe shall then be formed and filled with high-strength, non-shrink grout mixed with coarse aggregate in a 1:1 ratio by weight.
6. Concrete flow channel shall be warped for positive drainage.
7. When inlet box is precast, pipe opening shall be between 3" (75) and 4" (100) larger than outside diameter of pipe and shall not encroach on adjacent wall.
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 labeled "Only rain down the storm drain." Also, drainage inlet grates Type 1 and Type 4 shall be labeled with "water flow" and an arrow indicating flow direction as shown in the example detail.
3. The Type 1 drainage inlet grate shall be labeled with "curbside" as shown on the example detail. All labeling on the Type 1 shall be on both top and bottom sides due to the Type 1 being reversible.
DELTA:
DEPARTMENT OF TRANSPORTATION

34" (865) x 18" (455) DRAINAGE INLET DETAILS

STANDARD NO. D-6 (2008) SHIT. 7 OF 9

S504 BENDING DIAGRAM
S504 IS NOT REQUIRED TO BE ONE CONTINUOUS BAR. IF MORE THAN ONE BAR IS USED, THERE MUST BE A 12"(300) OVERLAP BETWEEN BARS.

SECTION B-B
SEE OPTIONAL PIPE OPENING DETAIL ON STANDARD D-4, SHEET 10 OF 1.

NOTES:
1. REFER TO PREVIOUS SHEETS FOR REINFORCEMENT REQUIREMENTS.
2. THE HEIGHT OF THIS INLET IS LIMITED TO 4' (1220) MAXIMUM. THEREFORE STEPS WILL NOT BE REQUIRED AND SHOULD NOT BE INSTALLED ON THIS INLET.

TOP UNIT DETAILS

SCALE: 1 N.T.S.
LIMITS OF PAYMENT H-6' (1850mm) FOR DOUBLE GRATE

TRANSITION FROM PCC CURB AND GUTTER TYPE 2 TO 8" (200mm) PCC CURB TYPE 1 WITH CURB OPENING (TYP.)

50" (1270mm) FOR SINGLE GRATE

44" (1120mm) (TYP.)

0" (250mm)

COVER SLAB OPENING

NORMAL GUTTER SLOPE

NORMAL ROADWAY CROSS SLOPE

NORMAL ROADWAY CROSS SLOPE

5500

4" (100mm)

6" (150mm)

6" (150mm)

COVER SLAB WIDTH

LIMITS OF PAYMENT H-6' (1850mm)

TRANSITION FROM PCC CURB AND GUTTER TYPE 2 TO 8" (200mm) PCC CURB TYPE 1 WITH CURB OPENING (TYP.)

88" (2235mm)

44" (1120mm) (TYP.)

W (250mm)

COVER SLAB OPENING

NORMAL GUTTER SLOPE

NORMAL ROADWAY CROSS SLOPE

5500

4" (100mm)

6" (150mm)

6" (150mm)

COVER SLAB WIDTH

SINGLE GRATE SETUP

EDGE OF GUTTER

STEPS IN FRONT WALL

3/4" (195mm)

*4 (15) REBAR @ 15" (380mm) FOR SINGLE GRATE, 17" (430mm) FOR DOUBLE GRATE (TYP.)

DOUBLE GRATE SETUP

EDGE OF GUTTER

STEPS IN FRONT WALL

3/4" (195mm)

*4 (15) REBAR @ 15" (380mm) FOR SINGLE GRATE, 17" (430mm) FOR DOUBLE GRATE (TYP.)

NOTES:

1. MINIMUM BOX SIZE TO BE 34" (850mm) X 24" (600mm).
2. PIPE OPENINGS IN THE FRONT WALL SHALL NOT INTERFERE WITH THE STEPS. THE PIPE SHALL BE SHIFTED HORIZONTALLY TO AVOID THE STEPS. IT MAY BE NECESSARY TO USE A LARGER BOX TO AVOID CONFLICT BETWEEN STEPS AND PIPE OPENING.
3. SEE DETAIL D-5, SHEET 2 OF 9 FOR 5500 BAR DIAGRAM.