This application for use in end anchorage only.

**Short Timber Breakaway Post**
- Timber Bearing Plate
- Post Sleeve
- Nail (see note)

**Timber Bearing Plate**
- 1½ (28) DIA HOLE
- ⅛ (16) STEEL PLATE

**Nail (see note)**

**Post Sleeve**
- 5⅞ (140)

**Swaged Cable Assembly and Related Hardware Assembly**

**Section A-A**
- 9/32 (7) STEEL PLATE
- 9/32 (7) STEEL PLATE
- 9/32 (7) STEEL PLATE

**Anchor Plate to W-Beam Connection Detail**
- Drill 4 Holes: 5/8 (16) DIA, 4½ (100) O.C. (Upper Bolt A)
- Drill 4 Holes: 5/8 (16) DIA, 4½ (100) O.C. (Lower Bolt A)

**Notes:**
1. To ensure that the timber bearing plate remains in position, secure the bearing plate to prevent rotation with two 10G galvanized nails.
2. 10G galvanized steel nails shall be driven in the short timber breakaway post and bent over bearing plate.
3. Tighten assembly until cable is taught.
4. All holes shall be drilled prior to galvanizing.
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 BURRED.
4. GUARDRAIL POSTS UPON WHICH RAIL IS TO BE INSTALLED SHALL BE SHOP DRILLED FOR THE RAIL BRACKETS DURING FABRICATION.
5. ALL RAIL SPACERS WILL BE AT RAIL SUPPORT BRACKETS, THE SAME BOLT USED TO ATTACH THE RAIL TO THE BRACKET WILL BE USED TO SECURE THE SPICE 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.

DELAWARE DEPARTMENT OF TRANSPORTATION

GUARDRAIL MOUNTED RAIL

STANDARD NO. B-15 (2010) SHT. 10 OF 10

APPROVED SIGNATURE ON FILE 12/28/2010

RECOMMENDED SIGNATURE ON FILE 12/27/2010

08/23/2010
SECTION

TYPICAL CAST-IN-PLACE OR SLIP-FORM CONSTRUCTION

ELEVATION

SCHEDULE BELOW

L 18'-0" (30000 MIN. TO 20'-0" (6000 MAX.)

BAR OFFSETS

<table>
<thead>
<tr>
<th>NOMINAL LENGTH</th>
<th>X</th>
<th>NO. REQ'D FOR EACH BARRIER SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; (6000)</td>
<td>3' 0&quot; (1000)</td>
<td>4</td>
</tr>
<tr>
<td>5' (15000)</td>
<td>4' 0&quot; (1200)</td>
<td>4</td>
</tr>
<tr>
<td>6' (15000)</td>
<td>4' 0&quot; (1200)</td>
<td>4</td>
</tr>
<tr>
<td>14' (45000)</td>
<td>3' 0&quot; (1000)</td>
<td>4</td>
</tr>
<tr>
<td>12' (36000)</td>
<td>3' 0&quot; (1000)</td>
<td>4</td>
</tr>
<tr>
<td>8' (12000)</td>
<td>2' 0&quot; (1500)</td>
<td>4</td>
</tr>
</tbody>
</table>

BAR LIST

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>NO.</th>
<th>LENGTH</th>
<th>TYPE</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>481</td>
<td>4&quot; (133)</td>
<td>**</td>
<td>5'-4&quot; (12250)</td>
<td>1</td>
<td>7'-17&quot; (21000)</td>
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<td>N/A</td>
</tr>
<tr>
<td>482</td>
<td>4&quot; (133)</td>
<td>4</td>
<td>4'-0&quot; (12000)</td>
<td>*</td>
<td>5-1/2&quot; (17500)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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

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

NOTICE: 1. CONCRETE CLEAR COVER FOR REINFORCING BARS SHALL BE 1/2" (10) MIN.

2. BARS SHALL BE CUT AT EVERY JOINT IF MADE USING CONTINUOUS SLIP-FORM CONSTRUCTION.

DELAWARE DEPARTMENT OF TRANSPORTATION

32" (960 CONCRETE SAFETY BARRIER (F SHAPE))

STANDARD NO. B-14 (2009) SHT. 1 OF 4

APPROVED SIGNATURE ON FILE 12/28/2010

RECOMMENDED SIGNATURE ON FILE 12/27/2010

2/21/2021
Typical Precast Construction

T-Shape Barrier Section

Typical Precast Reinforcement Details

Bar List

Notes:
1. Concrete cover for reinforcing bars shall be 1/2" (12.5 mm) min.

Delaware
Department of Transportation


Approved  Signature On File  12/28/2010

Recommended  Signature On File  12/27/2010

09/18/2009
SECTION

ELEVATION

BAR OFFSETS

<table>
<thead>
<tr>
<th>Nominal Length of Barrier Section (ft)</th>
<th>No. Req'd for Each Barrier Section</th>
</tr>
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<tbody>
<tr>
<td>20' (6000)</td>
<td>1</td>
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<tr>
<td>18' (5500)</td>
<td>12</td>
</tr>
<tr>
<td>15' (4500)</td>
<td>10</td>
</tr>
<tr>
<td>14' (4200)</td>
<td>9</td>
</tr>
<tr>
<td>12' (4000)</td>
<td>8</td>
</tr>
<tr>
<td>10' (3000)</td>
<td>6</td>
</tr>
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</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>481</td>
<td>4 (13)</td>
<td>4</td>
<td>8'-6&quot;</td>
<td>2286</td>
<td>1</td>
<td>6</td>
<td>55</td>
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<tr>
<td>482</td>
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<td>7</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

- *The length of bar 482 shall be 8'-6" 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.*

TYPICAL CAST-IN-PLACE OR SLIP-FORM CONSTRUCTION

NOTES:
1. Concrete Clear Cover for reinforcing bars shall be 12" (300) min.
2. Bars shall be cut at every joint if made using continuous slip-form construction.

DELAWARE DEPARTMENT OF TRANSPORTATION

42" (1060) CONCRETE BARRIER DETAILS (C-SHAPE)

STANDARD NO. B-14 (2009) SHT. 3 OF 4 RECOMMENDED

APPROVED SIGNATURE ON FILE 12/28/2010

SIGNATURE ON FILE 12/27/2010
STEEL CONNECTOR PLATE

SLOT DIMENSIONS
CONCRETE SAFETY BARRIER, PRECAST CONSTRUCTION
T-SHAPE BARRIER SECTION

SECTION A-A

SECTION B-B

ASTM A709,
GRADE 50W (345MN)

25'6" (7.8m)

4" (100)

21/6" (160)

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

APPROVED SIGNATURE ON FILE 12/28/2010

09/18/2009
TYPE 2-27

NOTE: OVERLAP W-BEAMS IN DIRECTION OF TRAVEL.
NOTE:
1. ALL W-BEAM ARE 12'-6" (3800) IN LENGTH
2. PLACE GUARDRAIL ELEMTENCS AT THE INTERVALS SPECIFIED IN THE DELAWARE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES.
**CURVED GUARDRAIL SECTION**

**PLAN**

- Type 27 guardrail placement or appropriate end treatment or guardrail to barrier connection.
- Area behind guardrail to be maintained free of fixed objects or other hazards.

**SECTION A-A**

- Type 27 long wood breakaway post.
- Slope = 15:1 or flatter.
- 4" (1000) rounding.

**ENTRANCE SPECIAL END ANCHORAGE**

- Secure cable loop with 5 cable clips.
- 1" (25) x 7-3/4" (220) galvanized rod w/ welded eye.
- 6" (150) hook or 5" (125) DA washer & nut.

**DELaware DEPARTMENT OF TRANSPORTATION**

**CURVED GUARDRAIL SECTION**

**STANDARD NO.** B-16 (2010) **SHT. 1 OF 1**

**APPROVED**

- **SIGNATURE ON FILE**
  - 12/28/2010

**RECOMMENDED**

- **SIGNATURE ON FILE**
  - 12/27/2010

**SCALE: N.T.S.**

**RADIUS**  
- 8'-0" (2400)  
- 17'-0" (5200)  
- 25'-6" (7700)  
- 35'-0" (10700)

**MIN. REQUIRED AREA FREE OF FIXED OBJECTS**

<table>
<thead>
<tr>
<th>Radius</th>
<th>L x W</th>
</tr>
</thead>
<tbody>
<tr>
<td>8'-0&quot;</td>
<td>29&quot; x 15&quot; (760 x 4500)</td>
</tr>
<tr>
<td>17'-0&quot;</td>
<td>30&quot; x 15&quot; (940 x 4500)</td>
</tr>
<tr>
<td>25'-6&quot;</td>
<td>40&quot; x 20&quot; (1200 x 6000)</td>
</tr>
<tr>
<td>35'-0&quot;</td>
<td>50&quot; x 20&quot; (1500 x 6000)</td>
</tr>
</tbody>
</table>

**NOTES:**
1. No washers are used on the rail side of the long wood breakaway posts.
2. The curved guardrail section shall be shop bent.
3. Place guardrail delineators at the intervals specified in the Delaware Manual on Uniform Traffic Control Devices.
4. If curb is used in conjunction with curved guardrail section, the curb cannot be higher than 2" (50).
5. On the 28'-0" (8400) radius system only, the rail is not to be bolted to the center post.

- **SEE ANCHOR PLATE DETAIL, SHEET B-15, B OF 13**

- **2'-0" (610) x 2'-0" (610) x 2'-0" (610) CONCRETE ANCHOR**

- **8" (200) x 8" (200) POST & OFFSET BLOCK**

- **3/4" (19) CABLE**
NOTES:
1. ADDITIONAL HOLES FOR ANCHOR PLATE SHALL BE DRILLED PRIOR TO GALVANIZING. SEE STANDARD HARDWARE SHEET FOR HOLE SPACING INFORMATION.
2. CONTRACTOR MANS THE OPTION OF USING A 6” × 18” STAINLESS STEEL TUBE WITHOUT A SOIL PLATE OR A 5” × 10” STEEL TUBE WITH A SOIL PLATE.

END ANCHORAGE, TYPE 27

DELTAWATER DEPARTMENT OF TRANSPORTATION

STANDARD NO. B-19 (2010) SHT. 1 OF 1 RECOMMENDED

APPROVED SIGNATURE ON FILE 12/28/2010

END ANCHORAGE, TYPE 27

SCALE: 1/2" = 1'-0"
NOTES:
1. CURB SHALL NOT BE USED AT THE FACE OF RAIL WITHIN THE LIMITS OF THIS INSTALLATION.
2. POSTS 1, 2, 3, 4, AND 6 REQUIRE AN ADDITIONAL HOLE TO ATTACH WOOD BLOCKS AND/OR BENT RAIL.
3. DO NOT ATTACH BENTS TO POSTS 1, 2, 3, 5, OR 7.
4. POSTS 1 AND 2 ARE 96x13 (9200x19.3), 7'-0" (2130mm) LONG. ALL OTHER POSTS IN TRANSITION ARE 96x9 (950x15.3), 5'-0" (1520mm) LONG.
5. BENT RAIL MAY BE SHAPED TO FACILITATE INSTALLATION OR MAY BE FIELD BENT USING HEAT.
6. APPROVED CONCRETE INSERTS MAY BE USED IN NEW CONSTRUCTION TO ATTACH TERMINAL CONNECTORS TO PARAPET.

ELEVATION
7. ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.
8. PLACE GUARDRAIL DELINERATORS AT THE INTERVALS SPECIFIED IN THE DELAWARE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
9. FOR INSTALLATIONS WHERE CURB EXISTS, IF THE EXISTING CURB IS 8'-0" (2400mm) OR HIGHER AND CANNOT BE REMOVED, THE BOTTOM RAIL CAN BE ELIMINATED.
10. SEE DETAIL B-5, SHEET 5 OF 6 FOR HARDWARE DETAILS.
11. BENT RAIL SHALL BE BOLTED TO THE BACK OF POST 6 WITH A 5/8" (16mm) GUARDRAIL BOLT, 4" (1200mm) LONG, WASHED, AND NUT.
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 OR AS PER THE JOINT FILLER TO SEAL WORK TO BE PAID UNDER RESPECTIVE CURB AND GUTTER ITEM.
2. DEPRESS CURB AT ENTRANCE 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 3" WHEN 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 1:12.

DELAWARE
DEPARTMENT OF TRANSPORTATION

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

APPROVED

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

RECOMMENDED

SIGNATURE ON FILE 01/10/2010

SIGNATURE ON FILE 01/14/2010

01/12/2009
DETECTABLE WARNING TRUNCATED DOME DETAILS

NOTES:
A. THE AREA OF DETECTABLE WARNING TRUNCATED DOMES SHALL BE 24'X600', LONG AND THE FULL WIDTH OF THE RAMP OR DEPRESSED CURB.
B. SEE SPECIFICATION FOR ADDITIONAL INFORMATION.

ELEVATION A-A

SECTION B-B

MAXIMUM DIFFERENCE IN GRADE
FOR EXAMPLE, IF THE CURB RAMP AND DEPRESSED CURB SLOPE (X) IS 5.0% AND THE PAVEMENT SLOPE (Y) IS 4.0%, THEN TO DETERMINE THE DIFFERENCE IN GRADE, ADD X + Y TO GET 9.0%, WHICH IS GREATER THAN THE 5% PREFERRED BUT LESS THAN THE 6% MAXIMUM.

CURB RAMP, TYPE 1 PERPENDICULAR CURB RAMP

DEPARTMENT OF TRANSPORTATION

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

APPROVED

D/6/2008

D/O/2008
Sample layout of detectable warning truncated domes along a curb radius. Detectable warnings shall be placed the full width of the depressed curb.

Curbs ramp, type 2.

Curbs ramp, type 3.

Curbs ramp, type 4.

Notes:
1. Where a 12maximum slope ramp will not meet the sidewalk grade within a length of 0.5 meters due to steep adjacent roadway, the ramp length may be limited to 0.5 meters, and the ramp slope allowed to exceed 6%. 
2. Transition to existing sidewalk width over the length of the ramp. 
3. Ramp and sidewalk cross slope shall be 5%. 
4. If grading will be steeper than 6% adjacent to the curb ramp or sidewalk, then a type I curb or retaining wall should be used to eliminate the need for the steep slope. 
5. For the curb ramp, type 3, if the width of the fully depressed curb at the street is more than 0.6 meters, the detectable warning truncated domes shall follow the radius of the curb continuously without gaps for the entire length of the depressed curb. 
6. The maximum difference in grade between the sidewalk or curb and the pavement shall be 0.25 meters, however, it is preferred. See standard no. C-2, sheet 1 of 4.
7. If the width of the fully depressed curved curb at the street is 0.6 meters or less, then a rectangular piece of detectable warning truncated domes may be used.
ENTRANCE WITH SIDEWALK AND GRASS STRIP

- (O) joint
- Expansion material

SECTION A-A

ENTRANCE WITHOUT SIDEWALK

NOTE: IF WIDTH OF DRIVEWAY IS 15'-4.5" OR GREATER, THE FLARE AND EXTENSIONS CAN BE OMITTED.
PLAN VIEW
SHOWN WITHOUT GRATE

NOTE: SAFETY END STRUCTURE TO BE PRECAST
**Dimensions**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot; (175)</td>
<td>9'-0&quot; (2850)</td>
<td>2'-5&quot; (750)</td>
<td>6'-0&quot; (1800)</td>
</tr>
<tr>
<td>8&quot; (250)</td>
<td>9'-0&quot; (2850)</td>
<td>2'-9&quot; (880)</td>
<td>10'-0&quot; (3000)</td>
</tr>
<tr>
<td>10&quot; (275) OR 24&quot; (7350)</td>
<td>3'-0&quot; (900)</td>
<td>12'-0&quot; (3600)</td>
<td>11'-5&quot; (3500)</td>
</tr>
</tbody>
</table>

**Approximate Quantities**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Concrete FT^2 (m^2)</th>
<th>Rein 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>
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</thead>
<tbody>
<tr>
<td>5&quot; (175)</td>
<td>215 (740)</td>
<td>51,43 (23,32)</td>
<td>2</td>
<td>3'-0&quot; (900)</td>
<td>215,92 (22,83)</td>
<td>215,92 (22,83)</td>
</tr>
<tr>
<td>8&quot; (250)</td>
<td>335 (12,00)</td>
<td>72,07 (32,68)</td>
<td>3</td>
<td>10'-0&quot; (3000)</td>
<td>215,92 (22,83)</td>
<td>215,92 (22,83)</td>
</tr>
<tr>
<td>10&quot; (275) OR 24&quot; (7350)</td>
<td>3' (900)</td>
<td>10'-0&quot; (3000)</td>
<td>3</td>
<td>12'-0&quot; (3600)</td>
<td>215,92 (22,83)</td>
<td>215,92 (22,83)</td>
</tr>
</tbody>
</table>

**Bending Diagram**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>X</th>
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</thead>
<tbody>
<tr>
<td>5&quot; (175)</td>
<td>9&quot;-2&quot; (275)</td>
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<tr>
<td>8&quot; (250)</td>
<td>10'-0&quot; (3000)</td>
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<tr>
<td>10&quot; (275) OR 24&quot; (7350)</td>
<td>10'-0&quot; (3000)</td>
</tr>
</tbody>
</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>C-Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot; (175)</td>
<td>4 (M3)</td>
<td>8 (2000)</td>
<td>72&quot; (1830)</td>
<td>4 (M3)</td>
<td>5 (2000)</td>
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<tr>
<td>8&quot; (250)</td>
<td>4 (M3)</td>
<td>8 (2000)</td>
<td>72&quot; (1830)</td>
<td>4 (M3)</td>
<td>6 (2000)</td>
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<td>10&quot; (275) OR 24&quot; (7350)</td>
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<td>72&quot; (1830)</td>
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<td>6 (2000)</td>
</tr>
</tbody>
</table>

**Delaware Department of Transportation**

**61 Safety End Structure**

**Approved**

**Standard No.** D-1 (2001)  **Shlt. 2 of 2**  **Recommended**
PLAN VIEW
SHOWN WITHOUT GRATE

NOTE: 10" SAFETY END STRUCTURE TO BE PRECAST

SECTION A-A
* REQUIRED ONLY FOR PIPE SIZE OF 24" (625) OR 24" (600)

FRONT VIEW

DELAWARE
DEPARTMENT OF TRANSPORTATION

181 SAFETY END STRUCTURE
STANDARD NO. D-2 (2001)
SHT. 1 OF 2
APPROVED
RECOMMENDED

04/07/2001
FRAME & GRATE ASSEMBLY DETAIL

DELAWARE
DEPARTMENT OF TRANSPORTATION

SAFETY GRATES

STANDARD NO. D-3 (2005)

SH. 1 OF 2

APPROVED

12/5/05

RECOMMENDED

11/20/05

1/23/2005

GRATE DETAIL

2" (50) DIAM. BAR @ 10.68 LBS./FT. 0.588 kg/m

L 2" (50) x 2" (50) x 1/8" (10)

L 2½" (65) x 3½" (85) x 1/8" (6)

L 1" (25) x 4" (100) SHEAR STUD CONNECTOR @ 2" (50) O.C.