DESIGN VALUES ARE PRESENTED IN THIS DOCUMENT IN BOTH METRIC AND U.S. CUSTOMARY UNITS AND WERE DEVELOPED INDEPENDENTLY WITHIN EACH SYSTEM. THE RELATIONSHIP BETWEEN THE METRIC AND U.S. CUSTOMARY VALUES IS NEITHER AN EXACT (SOFT) CONVERSION NOR A COMPLETELY RATIONALIZED (HARD) CONVERSION. THE METRIC VALUES ARE THOSE THAT WOULD HAVE BEEN USED HAD THIS DOCUMENT BEEN PRESENTED EXCLUSIVELY IN METRIC UNITS; THE U.S. CUSTOMARY VALUES ARE THOSE THAT WOULD HAVE BEEN USED IF THIS DOCUMENT HAD BEEN PRESENTED EXCLUSIVELY IN U.S. CUSTOMARY UNITS. THEREFORE, THE USER IS ADVISED TO WORK COMPLETELY IN ONE SYSTEM AND NOT ATTEMPT TO CONVERT DIRECTLY BETWEEN THE TWO.
# SECTION I - BARRIER

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   (2011) - 1 TYPE 1
   (2011) - 2 TYPE 2
   (2011) - 3 TYPE 3

T-4 - CATCH BASINS
   (2005) - 1 TYPES M & M
   (2005) - 2 TYPES P & R

T-5 - POLE BASES
   (2011) - 1 ROUND BASE, SQUARE BASE
   (2011) - 2 TYPICAL SECTION AND INSTALLATION (BASES 1, 2, 3, 4, 5, 6, 7)
   (2011) - 3 TYPICAL SECTION (BASES 5 AND 6), TYPE 7 GROUND ROD DETAIL, AND POLE BASE DATA CHART
   (2011) - 4 TYPICAL SECTION (BASE 8) AND ANCHOR DETAIL

T-6 (2011) - SPECIAL POLE BASE

T-7 (2005) - SIGN FOUNDATION

T-8 (2005) - LOOP DETECTOR TO CONDUIT JUNCTION WERE CONNECTION

T-9 (2005) - TYPE #1 LOOP DETECTOR

T-10 (2005) - TYPE #2 LOOP DETECTOR

T-11 - MESSENGER WIRE ATTACHMENT
   (2005) - 1 INTERMEDIATE MESSENGER WIRE ATTACHMENT ON WOOD POLES
   (2005) - 2 ANGULAR INTERMEDIATE MESSENGER WIRE ATTACHMENT

T-12 - MESSENGER WIRE ATTACHMENT
   (2005) - 1 SPAN WIRE ATTACHMENT BETWEEN POLES
   (2005) - 2 END MESSENGER WIRE ATTACHMENT

T-13 - CONDUIT JUNCTION WELLS
   (2005) - 1 TYPE 1
   (2005) - 2 TYPE 2
   (2005) - 3 TYPES 3 AND 4

T-14 - EMERGENCY PREEMPTION RECEIVER
   (2006) - 1 UPRIGHT MOUNT
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T-16 (2010) - WOOD BARRICADE DETAILS
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<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>W6 X 9 (W150 x 13.5) STEEL POST</td>
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</table>
| 3A 3B   | 3A - 6" (150) x 12" (300) x 14" (350) OFFSET BLOCK  
3B - 6" (150) x 8" (200) x 14" (350) OFFSET BLOCK |
| 4       | SPLICE - REQUIRES EIGHT (8) 3/8" (16) GUARDRAIL BOLTS (L=11/4" (35)) WITH RECESS NUTS |
| 5       | W-BEAM TERMINAL CONNECTOR |
| 6       | 3/8" (16) GUARDRAIL BOLT (L=11/4" (35)) AND RECESS NUT |
| 7A 7B   | 7A - 3/8" (16) GUARDRAIL BOLT (L=14" (455)) AND RECESS NUT  
7B - 3/8" (16) GUARDRAIL BOLT (L=10" (255)) AND RECESS NUT |
| 8       | 3/8" (16) GUARDRAIL BOLT (L=10" (255)), STEEL WASHER, AND RECESS NUT |
| 9       | 3/8" (22) HIGH STRENGTH STRUCTURAL HEX BOLT (L=VARIES)  
AND HEX NUT |
| 10      | 3/8" (16) CARRIAGE BOLT (L=VARIES), STEEL WASHER, AND HEX NUT |
| 11      | BEARING PLATE |
TYPE 1-31 GUARDRAIL
POST SPACING 6'-3" (1900m)

SOLID / OBSTRUCTION

REQUIRED CLEARANCE
2'-0" (600m) MIN.

SEE NOTE *1

EDGE OF SHOULDER
SHOULDER

EDGE OF TRAVEL LANE

TYPE 1-31 GUARDRAIL
TYPICAL GUARDRAIL TREATMENT
WHEN THE REQUIRED 3'-0" (900m) CLEARANCE TO OBSTRUCTION IS AVAILABLE

TYPE 2-31 GUARDRAIL
POST SPACING 3'-10½" (1075m)

SOLID / OBSTRUCTION

REQUIRED CLEARANCE
2'-0" (600m) MIN.

SEE NOTE *1

EDGE OF SHOULDER
SHOULDER

EDGE OF TRAVEL LANE

TYPE 2-31 GUARDRAIL
TYPICAL GUARDRAIL TREATMENT
WHEN 2'-0" (600) TO 3'-0" (900) OF CLEARANCE TO OBSTRUCTION IS AVAILABLE

GUARDRAIL FLARE RATE

EDGE OF TRAVEL LANE

FLARE RATES

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<th>FLARE RATE</th>
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<td>60 MPH (100 km/h)</td>
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<td>55 MPH (90 km/h)</td>
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<td>50 MPH (80 km/h)</td>
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<tr>
<td>45 MPH (70 km/h)</td>
<td>10/1</td>
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<tr>
<td>40 MPH (60 km/h)</td>
<td>9/1</td>
</tr>
<tr>
<td>30 MPH (50 km/h)</td>
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</table>

TYPE 3-31 GUARDRAIL
TYPICAL MEDIAN GUARDRAIL TREATMENT

NOTES:

1. THE DISTANCE FROM THE EDGE OF THE TRAVEL LANE OR SHOULDER TO THE FACE OF GUARDRAIL SHOULD BE MAXIMIZED. THIS AREA SHALL BE GRADING NO. 7 OR FLATTER.

2. PLACE GUARDRAIL DELEMITATORS AT THE INTERVALS SPECIFIED IN THE DELAWARE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

DELTA WER
DEPARTMENT OF TRANSPORTATION

TYPES 1-31, 2-31, AND 3-31 GUARDRAIL APPLICATIONS

STANDARD NO. B-1 (2010) SHT. 1 OF 3

APPROVED SIGNATURE ON FILE 12/28/2010

RECOMMENDED SIGNATURE ON FILE 12/27/2010

12/5/22/10
**NOTES:**

1. FLARE THE END TREATMENT AT 25:1 BEGINNING 50' (15 m) FROM THE END OF THE IMPACT HEAD, UNLESS THE CONSTRUCTION PLANS OR SPECIFICATIONS SPECIFY A SMALLER FLARE.

2. THIS DETAIL WAS SOLELY CREATED TO SHOW THE GRADING REQUIRED FOR THIS TYPE OF ATTENUATOR AND IS APPLICABLE REGARDLESS OF THE HEIGHT OF THE GUARDRAIL SYSTEM.

3. THE GUARDRAIL END TREATMENT ATTENUATOR SHALL BE INSTALLED AS PER THE MANUFACTURER'S AND THE DEPARTMENT OF TRANSPORTATION'S SPECIFICATIONS.

4. IF CURB IS PRESENT, DEPRESS THE CURB TO A MAXIMUM HEIGHT OF 2" (50 mm) WITHIN THE LIMITS OF THE END TREATMENT AND THROUGHOUT THE LENGTH OF THE TAPER GRADING.
NOTES:

1. FLARE SHALL BE 4' (1200) UNLESS THE CONSTRUCTION PLANS OR SPECIFICATIONS SPECIFY A SMALLER FLARE. FLARE MAY BE PARABOLIC OR STRAIGHT BASED ON MANUFACTURER'S SPECIFICATIONS.

2. THIS DETAIL WAS SOLELY CREATED TO SHOW THE GRADING REQUIRED FOR THIS TYPE OF ATTENUATOR AND IS APPLICABLE REGARDLESS OF THE HEIGHT OF THE GUARDRAIL SYSTEM.

3. THE GUARDRAIL END TREATMENT ATTENUATOR SHALL BE INSTALLED AS PER THE MANUFACTURER'S AND THE DEPARTMENT OF TRANSPORTATION'S SPECIFICATIONS.

4. IF CURB IS PRESENT, DEPRESS THE CURB TO A MAXIMUM HEIGHT OF 2" (50) WITHIN THE LIMITS OF THE END TREATMENT AND THROUGHOUT THE LENGTH OF THE TAPER GRADING.
SECTION A-A
GRADING FOR END TREATMENT ATTENUATOR, TYPE 3

NOTES:
1. THIS DETAIL WAS SOLELY CREATED TO SHOW THE GRADING REQUIRED FOR THIS TYPE OF ATTENUATOR AND IS APPLICABLE REGARDLESS OF THE HEIGHT OF THE GUARDRAIL SYSTEM.
2. 6.1 OR FLATTER GRADING IS ALLOWABLE WHEN THE BARRIER IS LOCATED 12' (3.65m) OR MORE FROM THE OUTSIDE EDGE OF THE SHOULDER.
3. THIS END TREATMENT CAN ALSO BE USED IN RAMPS GROVES OR OTHER AREAS WHERE TWO RAILS OF W-BEAM COME TOGETHER AND TERMINATE WITH ONE END TREATMENT.
4. WHEN OPPORTUNITIES HAVE EQUAL ELEVATIONS THE GUARDRAIL SYSTEM SHOULD BE PLACED ON THE OPPOSITE SIDE OF THE DITCH FROM APPROACHING TRAFFIC.
5. THE GUARDRAIL END TREATMENT ATTENUATOR SHALL BE INSTALLED AS PER THE MANUFACTURER'S AND THE DEPARTMENT OF TRANSPORTATION'S SPECIFICATIONS.
6. IF CURB IS PRESENT, EXPRESS THE CURB TO A MAXIMUM HEIGHT OF 2" (50mm) WITHIN THE LIMITS OF THE END TREATMENT AND THROUGHOUT THE LENGTH OF THE TAPER GRADING.
NOTES:
1. ALL W-BEAMS ARE 12'-6½" (3.81m) IN LENGTH.
2. PLACE GUARDRAIL DÉLIÉNATEURS À L'INTERVALLE SPÉCIFIÉ DANS LA MANUEL DU TRAFFIC UNIFORME DE LA DELAWARE.
3. POSTS 1, 2, 5, 6, 7, 10 ARE TO BE W16X9 (16x9.15) STEEL POSTS. POSTS 3 THROUGH 8 ARE TO BE TYPE 31 LONG WOOD BREAKAWAY POSTS.
4. THE RAIL SHALL BE ATTACHED AT POSTS 3 THROUGH 8 WITH A ½" (13 x 22" (560) GUARDRAIL BOLT, STEEL WASHER, AND RECESS NUT.
NOTES:
1. ADDITIONAL HORT BLkHz FOR ANCHOR PLATE SHALL BE DRILLED PRIOR TO GALVANIZING.
   (SEE STANDARD HARDWARE SHEET FOR HOLE SPACING INFORMATION).
2. CONTRACTOR HAS THE OPTION OF USING A 6'-0" STEEL TUBE WITHOUT A SOIL PLATE
   ON A 5'-0" STEEL TUBE WITH A SOIL PLATE.
3. PLACE A ¾" WIDE PLASTIC RETAINING TIE STRAP AROUND THE SHORT TIMBER
   BREAKAWAY POST AND TIMBER BEARING PLATE TO ENSURE THE PROPER ORIENTATION
   OF THE TIMBER BEARING PLATE.
4. REFER TO DETAIL B-23, SHEET 8 OF 10 FOR PROPER TIMBER BEARING PLATE ORIENTATION.

REFER TO DETAIL B-13, SHEET 8 OF 10 FOR PROPER TIMBER BEARING PLATE ORIENTATION.
RUB RAIL OFFSET BLOCKS

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**RUB RAIL OFFSET BLOCKS**

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<td>4</td>
<td>1 (25)</td>
<td>2 (50)</td>
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**NOTES:**

1. THE RUB RAIL TO BARRIER CONNECTION END MUST BE ATTACHED FLUSH WITH THE SLOPED TOE OF THE SAFETY BARRIER. INSTALLATION CAN BE SIMPLIFIED BY FABRICATING OR SHAPING THE RUB RAIL END TO BE CONSISTENT WITH THE SLOPE OF THE BARRIER, HOWEVER, FIELD BENDING USING HEAT IS NOT PERMITTED.

2. STEEL SPACER TUBE IS SCHEDULE 40 GALVANIZED PIPE, 6" (150) x 9" (225).

3. ALL HARDWARE ON THIS DETAIL IS COMPATIBLE WITH GUARDRAIL TO BARRIER CONNECTION, TYPES 3-1 AND 3-27.
NOTE:
ALL HARDWARE ON THIS DETAIL IS COMPATIBLE WITH GUARDRAIL TO BARRIER CONNECTION, TYPES 1-31 AND 1-37.

DELAWARE
DEPARTMENT OF TRANSPORTATION

GUARDRAIL TO BARRIER CONNECTION, BENT PLATE RUB RAIL

STANDARD NO.  B-6 (2010)  SHT.  3 OF  6

APPROVED

RECOMMENDED

SIGNATURE ON FILE  12/28/2010

SIGNATURE ON FILE  12/27/2010
ELEVATION

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 OFFSET BLOCKS AND/OR BENT RAIL.
3. DO NOT ATTACH RAILS TO POSTS 1, 2, 3, 5, OR 7.
4. POSTS 1 AND 2 ARE WRX13, 7'-6" LONG. ALL OTHER POSTS IN TRANSITION ARE W6X9, 6'-0" LONG.
5. ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.
6. BENT RAIL MAY BE SHOP BENT TO FACILITATE INSTALLATION OR MAY BE FIELD BENT USING HEAT.
7. APPROVED CONCRETE INSERTS MAY BE USED IN NEW CONSTRUCTION TO ATTACH TERMINAL CONNECTORS TO PARAPET.
8. PLACE GUARDRAIL DELINEATORS 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" (200) OR HIGHER AND CANNOT BE REMOVED, THE BOTTOM RAIL CAN BE ELIMINATED.
10. A 6" x 8" x 14" OFFSET BLOCK IS USED AT POSTS 1 THROUGH 6 AND A 6" x 12" x 14" OFFSET BLOCK IS USED AT POSTS 7 THROUGH 9.

DELAWARE DEPARTMENT OF TRANSPORTATION

GUARDRAIL TO BARRIER CONNECTION, APPROACH, TYPE 2-31

STANDARD NO. B-5 (2012) SHT. 4 OF 6

APPROVED

SIGNATURE ON FILE
01/07/2013

SIGNATURE ON FILE
12/20/2012

RECOMMENDED

12/4/2012
### Bent Rail Offset Blocks

**Scale:** 1" = 1'-0"

- **Thickness:** 3" (75), 4" (100), 5" (125), 6" (150)
- **Bolt Length:** 8" (200), 6" (150), 6" (150), 4" (100)

**NOTES:**

1. Bottom offset blocks located on posts 1-4 are offset drilled to 5/16" square holes on the post flange and secured with M16 carriage bolts. See bent rail offset block table for bolt length.
2. All hardware on this detail is compatible with guarding to barrier connection, types 2-31 and 2-27.

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**Guardrail to Barrier Connection, Type 2 Hardware**

**DEPARTMENT OF TRANSPORTATION**

**STANDARD NO.:** B-5 (2010)

**SHT.:** 5 of 6

**APPROVED:**

**RECOMMENDED:**

**SIGNATURE ON FILE:**

**DATE:** 12/28/2010

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**SIGNATURE ON FILE:**

**DATE:** 12/27/2010

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**SIGNATURE ON FILE:**

**DATE:** 09/15/2010
CONCRETE INSERTS MAY BE USED IN NEW CONSTRUCTION TO ATTACH TERMINAL CONNECTOR TO PARAPET.
2. GUARDRAIL SECTION AND TERMINAL CONNECTIONS SHALL BE OVERLAPPED IN THE DIRECTION OF TRAVEL.
3. INSTALLATION SHOWN ABOVE WITH AN "T"-TYPE BARRIER FACE.
GUARDRAIL SECTION OF BARRIER CONNECTION SHALL BE ADJUSTED HORIZONTALLY IN ORDER TO BE FLUSH AGAINST VARIOUS TYPES OF WALLS AND BARRIERS.
NOTES:
1. BRIDGE RAIL RETROFIT, TYPE 1 SHALL BE USED WHEN THE PARAPET MONOLITHIC CURB IS 18" (450) OR LESS.
2. BRIDGE RAIL RETROFIT, TYPE 2 SHALL BE USED WHEN THE PARAPET MONOLITHIC CURB IS 18" (450) OR WIDER, AND DEAD LOAD CONSIDERATIONS ARE A CONCERN.
3. ADHESIVE ANCHORS SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS AND SHALL BE GALVANIZED.
4. OFFSET BLOCK THICKNESS SHALL BE ADJUSTED TO ALLOW THE FACE OF THE THREE BEAM TO BE FLUSH WITH THE BOTTOM OF THE CURB MINIMUM THICKNESS SHALL BE 4" (100).
5. SEE DETAIL B-6, SHEET 3 OF 5 FOR BRIDGE RAIL RETROFIT, TYPE 2 HARDWARE DETAILS.
6. TYPICAL LATERAL SPACING OF OFFSET BLOCKS OR STEEL POSTS THROUGHOUT THE BRIDGE RAIL SECTION SHALL BE 6'-0" (1800), HOWEVER, SPACING MAY NEED TO BE REDUCED TO ACCOMMODATE LINING UP BLOCKS OR POSTS AT THE END OF THE PARAPET.
7. USE A THREE BEAM EXPANSION SECTION AT BRIDGE EXPANSION JOINTS.
8. PLACE CURBAND DELINERATORS IN THE UPPER VALLEY OF THE THREE BEAM AT THE INTERVALS SPECIFIED IN THE DELAWARE Manual ON UNIFORM TRAFFIC CONTROL DEVICES.
9. SEE DETAIL B-6, SHEET 10 OF 5 FOR ENTRANCE AND END APPLICATION DETAILS.
PLAN

SECTION A-A

NOTE: STANDARD GUARDRAIL TO BARRIER CONNECTIONS SHALL BE CONNECTED TO THE ENDS OF THE NEW BRIDGE BARRIER AND TRANSITIONED TO THE EXISTING GUARDRAIL.

DELTA
DEPARTMENT OF TRANSPORTATION

BRIDGE RAIL RETROFIT, TYPE 3

STANDARD NO. B-6 (2010)

SHT. 4 OF 5

APPROVED

SIGNATURE ON FILE 12/28/2010

RECOMMENDED

SIGNATURE ON FILE 12/27/2010

12/06/2010
THREE-BEAM BEARING PLATE DETAIL

NOTES:

1. BRIDGE RAIL RETROFIT, TYPE 4 SHALL BE USED WHEN THE EXISTING PARAPET HEIGHT IS BETWEEN 22" (5500) AND 28" (6600).
2. USE A THREE-BEAM EXPANSION ELEMENT AT BRIDGE RETROFIT JOINTS.
3. PLACE GUARDIAN DECELERATORS IN THE UPPER VALLEY OF THE THREE-BEAM AT THE INTERVAL SPECIFIED IN THE DELAWARE MANUAL ON URBAN TRAFFIC CONTROL DEVICES.
4. SEE DETAIL D-6, SHEET 1 OF 5 FOR ENTRANCE AND EXIT APPLICATION DETAILS AND NOTES.
5. SIZING OF WOOD POSTS MAY NEED TO BE REDUCED TO ACCOMMODATE LINING UP POSTS AT THE END OF THE PARAPET.
7. ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.
W-BEAM ELEVATION

W-BEAM SECTION

NOTE:
II. FOUR ADDITIONAL 3/8 (20) x 2 1/2" (65) SLOTS SHALL BE PROVIDED AT 3'-1" (952) SPACING FOR A 20'-4" (6160) BEAM LENGTH.
THREE BEAM STEEL POST AND OFFSET BLOCK

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

NOTE:
ALL HOLES SHALL BE 1/4" (6.4MM) BOLT HOLE
PATTERN IS SYMMETRICAL, WITH RESPECT TO THE VERTICAL AXIS OF THE POST.
HARDWARE

8

B-13 (2012)

ANCHOR PLATE

STEEL POST SLEEVE

POST SLEEVE

TIMBER BEARING PLATE

1.25" x 6" SWAGED CONNECTION SLEEVE

SWAGED CABLE ASSEMBLAGE AND RELATED HARDWARE ASSEMBLY

STEEL POST SLEEVE

POST SLEEVE

TIMBER BEARING PLATE

3/8" THICKNESS

END PLATE

SWAGE CONNECTION SLEEVE

1/4" DIA. (6x19) SWAGE CONNECTED GALVANIZED CABLE

NOTES:
1. PLACE A 3/8" WIDE GALVANIZED RETAINING TIE STRAP AROUND THE SHORT TIMBER BREAKAWAY POST AND TIMBER BEARING PLATE TO ENSURE PROPER ORIENTATION OF THE TIMBER BEARING PLATE.
2. TIGHTEN ASSEMBLY UNTIL CABLE IS TIGHT.
3. ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.