SECTION 500

GUARDRAIL, MEDIAN BARRIER, FENCING & MARKERS
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**2016 ROAD & BRIDGE STANDARDS**
SECTION 500 - GUARDRAIL, BARRIER AND FENCE

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SECTION THRU RAIL ELEMENT AND W BEAM BACK-UP PLATE

DETAIL OF SPLICE JOINT

DETAIL OF STANDARD WASHER

DETAIL OF BUTTON HEAD BOLT AND RECESS NUT

NOTES:

ALL HARDWARE IS TO BE GALVANIZED IN ACCORDANCE WITH THE SPECIFICATIONS.

THE GUARDRAIL AND MEDIAN BARRIER COMPONENTS DEPICTED IN ARTBA TECHNICAL BULLETIN NUMBER 268B MAY BE SUBSTITUTED IF INTERCHANGEABLE WITH THE STANDARDS FOR GUARDRAIL (GR) OR MEDIAN BARRIER (MB) AND APPROVED BY THE ENGINEER.
W BEAM TERMINAL CONNECTOR

W BEAM END SECTION (FLARED)

* THE GUARDRAIL MEDIAN BARRIER COMPONENTS DEPICTED IN A.R.T.B.A. TECHNICAL BULLETIN NUMBER 288B MAY BE SUBSTITUTED IF INTERCHANGEABLE WITH THE STANDARDS FOR GUARDRAIL (GRO) OR MEDIAN BARRIER (MB) AND APPROVED BY THE ENGINEER.

W BEAM END SECTION (BUFFER)

* STANDARD DIMENSIONS OF 12½", 24" AND 30" ARE SUGGESTED.

W-BEAM GUARDRAIL HARDWARE

2016 ROAD & BRIDGE STANDARDS

Virginia Department of Transportation

Specification Reference: 221 505

Sheet 2 of 3

Revision Date: 501.02
SECTION THRU THRIE BEAM RAIL ELEMENT

NOTES:
THE GUARDRAIL AND MEDIAN BARRIER COMPONENTS DEPICTED IN ARTBA TECHNICAL BULLETIN NUMBER 2888 MAY BE SUBSTITUTED IF INTERCHANGEABLE WITH THE STANDARDS FOR GUARDRAIL (GR) OR MEDIAN BARRIER (MB) AND APPROVED BY THE ENGINEER.

LAP IN DIRECTION OF TRAFFIC

DISTANCE BETWEEN POST SLOTS AND THE SUM OF POST BOLT SLOT CENTERS TO BE DESIGNATED.

TRANSITION SECTION DETAIL (W-BEAM TO THRIE BEAM)
**NOTES:**

Guardrail locations shown on plans are approximate only and can be adjusted during construction if and as directed by the engineer.

For details of post and blockouts see Sheet No. 501.05.

For details of rail element, rail splice joint, and associated hardware see Sheet Nos. 501.01 and 501.02.

Rail elements are furnished shop curved for radii between 5 feet and 150 feet.

All guardrail posts shall be set plumb. Post shall not be set with a variation of more than 1/4" per foot from vertical. W-beam blockouts, and posts shall be set and aligned without alteration or force, as per section 505 of the specifications.

All GR-2 and GR-2A rail shall be maintained at a height of 27½" min - 28½" max as measured per standard GR-INS.

All W-beam rails shall be lapped in the direction of vehicular travel for the finished roadway.

The optional GR-2A method of nesting the rail or use of an additional rail on the back of the post for standard GR-2A shall be approved by the engineer prior to installation.

**FLARE RATES**

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<td>60</td>
<td>8'</td>
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<td>50</td>
<td>6.5'</td>
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<td>40</td>
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<td>4'</td>
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* Suggested maximum flare rate for semi-rigid barrier systems.
**NOTES:**

1. **ALL BOLTS, NUTS, WASHERS, AND OTHER STEEL ITEMS ARE TO BE GALVANIZED.**

2. **ALTERNATE TYPE POSTS AND BLOCKOUT MAY BE INTERCHANGED ON ANY ONE PROJECT WITH THE RESTRICTION THAT THE SAME TYPE OF POST AND BLOCKOUT MUST BE USED IN ANY SINGLE RUN OF GUARDRAIL.**

3. **FOR DETAILS OF GUARDRAIL ELEMENT SPLICE JOINT, HARDWARE, ETC. SEE SHEET NOs. 501.01 AND 501.02.**

4. **DRIVE NAIL ON BOTH SIDES WITHIN 2" OF THE TOP OR BOTTOM OF BLOCKOUT AFTER 3/8" X 18 BOLT IS INSTALLED.**

---

**REFERENCE SPECIFICATION**

**STANDARD BLOCKED-OUT W-BEAM GUARDRAIL**

**(STRONG POST SYSTEM, POST AND BLOCKOUT DETAILS)**

**VIRGINIA DEPARTMENT OF TRANSPORTATION**

2016 ROAD & BRIDGE STANDARDS
NOTES:
1. FOR ARRANGEMENTS OF SPRING CABLE END ASSEMBLIES (COMPENSATING DEVICES) AND TURNBUCKLE CABLE END ASSEMBLIES, THE FOLLOWING CRITERIA SHALL APPLY:

2. LENGTH OF CABLE RUNS:
   - OVER 1000'-USE COMPENSATING DEVICE ON ONE END AND USE TURNBUCKLE ON THE OTHER END OF EACH INDIVIDUAL CABLE.
   - OVER 2000'-START NEW STRETCH BY INTERLACING AT LAST PARALLEL POST. SEE TYP.
     INSTALLATION.

3. FITTINGS: ALL FITTINGS SHALL BE SO DESIGNED AND BE OF SUCH SECTION AS TO DEVELOP THE FULL STRENGTH OF A SINGLE CABLE OR CABLE ASSEMBLIES, AS THE CASE MAY BE.
   - SINGLE CABLE ANCHOR ASSEMBLY-
     MIN. TENSILE STRENGTH..............25,000 LBS.
   - THREE CABLE ANCHOR ASSEMBLY-
     MIN. TENSILE STRENGTH.............100,000 LBS.
   - ALL FITTINGS SHALL BE HOT DIPPED GALVANIZED.

4. THE DYNAMIC DEFLECTION FOR STANDARD GR-3 IS 11 FT.

5. FOR ROCK INSTALLATION, 8"X24"X¼" PLATE SHALL BE ELIMINATED, DRILL OR ELEVATE HOLE FOR POST AND BACKFILL WITH CRUSHER RUN AGGREGATE TO LEVEL OF ROCK.

6. ¾" ANSI/B18.2.2 HEX. BACKING NUT OR APPROVED SHOULDER MUST EQUAL BEARING AREA OF ¾" STANDARD NUT.

7. THE GUARDRAIL AND MEDIAN BARRIER COMPONENTS DEPICTED IN AASHTO-ADG-ARTBA "A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" MAY BE SUBSTITUTED IF INTERCHANGEABLE WITH THE STANDARDS FOR GUARDRAIL (GR) OR MEDIAN BARRIER (MB) AND APPROVED BY THE ENGINEER.
2016 ROAD & BRIDGE STANDARDS
TERMINAL TREATMENT FOR W-BEAM GUARDRAIL

NOTES:


2. MAXIMUM DISTANCE BETWEEN BOTTOM OF THE LOWER W-BEAM RAIL AND GROUND LINE IS 18". WHEN DOUBLE RAIL IS REQUIRED, TAPER BOTH W-BEAM RAILS TO MAINTAIN THE 18" DISTANCE FROM THE GROUND.

3. BOTH W-BEAM RAILS TO BE 1'-0" BELOW FINISHED GRADE AT POST #1 (8'-0" OFFSET).

4. A 8'-0" LONG POST MUST BE USED WHEN UPPER AND LOWER W-BEAM RAILS ARE REQUIRED. FROM THE BEGINNING OF THE LOWER RAIL THROUGH POST #3.

5. STANDARD GR-6 TERMINAL TREATMENT MAY BE USED AT THE RUN-ON END OF DIVIDED HIGHWAYS (LEFT AND RIGHT OF TRAFFIC) AND AT THE RUN-ON AND RUN-OFF ENDS ON UNDIVIDED HIGHWAYS.

6. ALL POST SPACING 6'-3" C-C UNLESS OTHERWISE NOTED. THE POST MAY BE W6 X 8.5 STEEL OR 6 X 8 WOOD EXCEPT THE LAST 3 TERMINAL POSTS MUST BE W6 X 8.5 STEEL.

7. FOR SECTIONS D-E AND E-E, ALL TERMINAL RUN-ON OR RUN-OFF INSTALLATIONS SHALL BE INSTALLED WITH RAILS LAPPED IN THE DIRECTION OF ADJACENT TRAFFIC.


9. ATTACH LOWER W-BEAM RAIL TO POST W/½" BOLT.
TERMINAL TREATMENT FOR W-BEAM GUARDRAIL

NOTE:
1. 1/2" STEEL PLATE MAY BE WELDED OR BOLTED TO POST. IF PLATE IS BOLTED TO POST USE 4 - 3/8" X 2 1/2" LG. HEX HEAD BOLTS W/ HEX NUTS. IF PLATE IS WELDED TO POST DO NOT DRILL 3/8" Holes IN PLATE OR IN POST FLANGES.
2. CONCRETE END ANCHORAGE MAY BE USED IN PLACE OF STEEL POST AT 8'-0" OFFSET.

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.
NOTES:

1. GUARDRAIL TERMINAL, STD. GR-7 SHALL BE FROM VDOT'S APPROVED PRODUCTS LIST.

2. ALL TERMINALS SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND THE FOLLOWING VDOT REQUIREMENTS:
   A. ALL STANDARD GR-7 TERMINALS SHALL BE INSTALLED WITH A 4 FT. OFFSET.
   B. YELLOW 8" X 36" REFLECTIVE SHEETING, IN ACCORDANCE WITH VDOT SPECIFICATIONS, SHOULD BE APPLIED IN TERMINALS EMPLOYING W-BEAM END SECTIONS. FOR TERMINALS EMPLOYING IMPACT (EXTRUDER) HEADS, AMBER (YELLOW) REFLECTIVE SHEETING WITH BLACK DIAGONAL STRIPES SHOULD BE APPLIED TO THE FULL AREA INSIDE THE IMPACT HEAD WITH THE DIRECTION OF THE BLACK DIAGONAL STRIPES CONFORMING TO CURRENT MUTCD APPLICATION FOR TYPE 3 OBJECT MARKERS (OM-3).
   C. DO NOT CHANGE THE LAPPING OF TERMINAL FOR ANY INSTALLATIONS. INSTALL AS SHOWN BELOW REGARDLESS OF ADJACENT TRAFFIC DIRECTION.
   D. HEIGHT MEASURED AT TOP OF W-BEAM IS 27¾" MIN. - 28¾" MAX.

3. IF THE NECESSARY CLEAR RUNOUT AREA FOR THE GR-7 TERMINAL CANNOT BE OBTAINED, CONSIDER ALTERNATIVE TERMINAL OPTIONS.

4. THIS DRAWING IS REPRESENTATIONAL ONLY. DETAILS, DIMENSIONS, QUANTITIES, AND OTHER INFORMATION NOT SHOWN WILL VARY FOR EACH MANUFACTURER. SEE INDIVIDUAL MANUFACTURER'S PLANS FOR THIS INFORMATION.
FLARED TERMINAL PLACEMENT
3000 FT. RADIUS OR GREATER

If the offset is less than the standard section offset, the offset will be held at the standard section offset.

FLARED TERMINAL PLACEMENT ON INSIDE OF CURVE - LESS THAN 3000 FT. RADIUS

FLARED END TERMINAL
(4' FLARE)

TERMINAL END

TERMINAL END

GRADED SHOULDER

GRADED SHOULDER

TANGENTIAL LINE

TANGENTIAL LINE

INSTALLATION SITE PREPARATION

INSTALLATION SITE PREPARATION

STANDARD GR-2 RADIAL GUARDRAIL

STANDARD GR-2 RADIAL GUARDRAIL

STANDARD GR-7 TERMINAL

STANDARD GR-7 TERMINAL

TERMINAL END

TERMINAL END

TANGENT POINT OF STANDARD GUARDRAIL

TANGENT POINT OF STANDARD GUARDRAIL

TRAVEL LINES

TRAVEL LINES

3000 FT. RADIUS

3000 FT. RADIUS

FEET RADIUS

FEET RADIUS

INSTALLATION SITE PREPARATION

INSTALLATION SITE PREPARATION
NOTES:

1. The cross slope of the grade approaching the guardrail terminal and adjacent to for its full length must be 10:1. If the existing grade is flat or is a positive slope due to the super-elevation of the roadway pavement the min. offset from behind the post to the hinge point, as shown, is required.

2. The area immediately behind and beyond the terminal should be traversable 3:1 or flatter and free from fixed objects. If a clear run out is not attainable this area should at least be similar in character to the upstream un-shielded roadside areas.

3. For new construction, reconstruction, and 3R work the 10:1 slope grading must extend a minimum of 5'-0" behind the end post.

4. For proprietary guardrail terminals the manufacturer’s site preparation requirements take precedence over this standard.

SITE PREPARATION REQUIREMENTS FOR GR-7

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

2016 ROAD & BRIDGE STANDARDS
2016 ROAD & BRIDGE STANDARDS

STANDARD W-BEAM GUARDRAIL (WEAK POST SYSTEM)

TL-3 (>45 MPH)

Virginia Department of Transportation

**Table:**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Post Spacing</th>
<th>Deflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR-B</td>
<td>12'-6&quot;</td>
<td>7&quot;-0&quot;</td>
</tr>
<tr>
<td>GR-BA</td>
<td>8'-3&quot;</td>
<td>5&quot;-0&quot;</td>
</tr>
<tr>
<td>GR-BB</td>
<td>3'-3 1/2&quot;</td>
<td>4&quot;-0&quot;</td>
</tr>
<tr>
<td>GR-BC</td>
<td>4'-2&quot;</td>
<td>4'-6&quot;</td>
</tr>
</tbody>
</table>

FOR ROCK INSTALLATION, 8" X 24" X 1/4" PLATE IS TO BE ELIMINATED. DRILL OR EXCAVATE HOLE FOR POST, PLACE POST AND BACKFILL WITH CRUSHER RUN AGGREGATE TO LEVEL OF ROCK.

ALL POSTS, BOLTS, NUTS AND WASHERS ARE TO BE GALVANIZED.

FOR DETAILS OF GUARDRAIL ELEMENT, SPICE JOINT, HARDWARE, ETC. SEE SHEET NO. 501.01.

THE GUARDRAIL AND MEDIAN BARRIER COMPONENTS DEPICTED IN A.R.T.B.A. TECHNICAL BULLETIN NUMBER 268B MAY BE SUBSTITUTED IF INTERCHANGEABLE WITH THE STANDARDS FOR GUARDRAIL (GR) OR MEDIAN BARRIER (MB) AND APPROVED BY THE ENGINEER.

**Post Spacing on Curves**

<table>
<thead>
<tr>
<th>Pavement Q Radius</th>
<th>Post Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 220 FT. R</td>
<td>12'-6&quot;</td>
</tr>
<tr>
<td>219 FT. - 111 FT.</td>
<td>8'-3&quot;</td>
</tr>
<tr>
<td>110 FT. - 76 FT.</td>
<td>4'-2&quot;</td>
</tr>
<tr>
<td>75 FT. - 50 FT.</td>
<td>3'-1 1/2&quot;</td>
</tr>
<tr>
<td>&lt; 50 FT.</td>
<td>USE NOT RECOMMENDED</td>
</tr>
</tbody>
</table>

**Backup Plate Required Each Post**

2-Square Washers Required Each Post (See Detail This Sheet)

3/4" Bolt and Nut (See Detail This Sheet)

1/4" Dia Hole for 1/4" Support Bolt 1/4" Long, 2 Nuts, No Washer.

S 3 X 5.7 STEEL POST

*Height Tolerance: 3/4"*
2016 ROAD & BRIDGE STANDARDS

PLAN

MINIMUM 18 SPACES
@ 12'-6" + 225'-0" LENGTH OF
NEED REQUIRED WITH EACH
TERMINAL INSTALLATION.

PLAN

ELEVATION

W-BEAM END
SECTION (FLARED)

#3 BARS

2 SPlice BOLTS AND NUTS

10-1" Ø HOLES @ 3" O.C. FOR
8-7/8" X 18" LONG ANCHOR
BOLTS. 2 SPARE HOLES ARE
FOR POSITIONING.

ELEVATION

ANCHOR BLOCK DETAILS

#3 BARS, PLACED
AT EACH CORNER
VERTICALLY.

#3 BARS, 3 LOOPS,
HORizontally.

GR-8 TYPE II TERMINAL TREATMENT
(RUN-OFF ANCHORAGE)

STANDARD W-BEAM GUARDRAIL (WEAK POST SYSTEM)

TL-3 (>45 MPH)

VIRGINIA DEPARTMENT OF TRANSPORTATION
NOTES:

1. TANGENT END TERMINAL (GR-9) SHALL BE A VDOT APPROVED PRODUCT MEETING NCHRP 350 OR MASH TESTING CRITERIA. ANY TERMINAL USED FOR THE GR-9 SHALL BE FROM THE VDOT APPROVED PRODUCTS LIST. STANDARD MB-3 TERMINAL OPTIONS ARE INCLUDED WITH THE GR-9 TERMINALS ON THE APPROVED PRODUCTS LIST.

2. ALL TERMINALS SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND THE FOLLOWING VDOT REQUIREMENTS:
   A. ALL STANDARD GR-9 TERMINALS (SIMILAR TO AS SHOWN ABOVE) SHALL BE INSTALLED WITH A 1 FT. OFFSET ACCOMPLISHED WITH A 50:1 FLARE TO PREVENT THE GUARDRAIL TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER FOR 3R WORK WHERE RIGHT OF WAY IS LIMITED, THE OFFSET CAN BE DECREASED AS DIRECTED BY THE ENGINEER.
   B. DIRECTION OF THE REFLECTIVE TAPE ON THE TERMINAL HEAD SHALL CONFORM TO MUTCD APPLICATION FOR DIAGONAL STRIPES ON OBJECT MARKERS AND BRIDGE END PANELS. COLOR OF TAPE SHALL BE AMBER (YELLOW).
   C. DO NOT CHANGE THE LAPPING OF TERMINAL FOR ANY INSTALLATIONS, INSTALL AS SHOWN ABOVE REGARDLESS OF ADJACENT TRAFFIC DIRECTION.
   D. HEIGHT MEASURED AT TOP OF W-BEAM IS 27½" MIN. - 28½" MAX.

3. THIS DRAWING IS REPRESENTATIONAL ONLY. DETAILS, DIMENSIONS, QUANTITIES, AND OTHER INFORMATION NOT SHOWN WILL VARY FOR EACH MANUFACTURER. SEE INDIVIDUAL MANUFACTURER'S PLANS FOR THIS INFORMATION.
NOTES:


2. THE AREA IMMEDIATELY BEHIND AND BEYOND THE TERMINAL SHOULD BE TRAVERSABLE AND FREE FROM FIXED OBJECTS. IF A CLEAR RUN OUT IS NOT ATTAINABLE THIS AREA SHOULD AT LEAST BE SIMILAR IN CHARACTER TO THE UPSTREAM UNSHIELDED ROADSIDE AREAS.

3. FOR NEW CONSTRUCTION AND RECONSTRUCTION THE 10:1 SLOPE GRADING MUST EXTEND A MINIMUM OF 5'-0" BEHIND THE END POST.

4. FOR 3R WORK, THE GRADING SHOULD BE AS CLOSE AS POSSIBLE TO THE NEW CONSTRUCTION WITH SLOPE EXTENDING A MINIMUM OF 2'-0" BEHIND THE BLOCKED OUT POST. FROM THE HINGE POINT, TIE THE GRADED SLOPE INTO THE EXISTING DITCH SLOPE TO COVER THE FOUNDATION TUBES AND SOIL PLATES WITHOUT EXTENDING THIS SLOPE BEYOND THE DITCH BOTTOM. USE #21B AGGREGATE, OR OTHER SUITABLE MATERIAL AS APPROVED BY THE ENGINEER, AT ROADWAY SHOULDERS.


6. FOR PROPRIETARY GUARDRAIL TERMINALS THE MANUFACTURER'S SITE PREPARATION REQUIREMENTS TAKE PRECEDENCE OVER THIS STANDARD.

SITE PREPARATION REQUIREMENTS FOR GR-9
ONE POST OMITTED

TOP VIEW

FOR DETAILS OF GUARDRAIL POSTS, AND BLOCKOUTS, SEE STANDARD GR-2, 2A.

ELEVATION

TYPE I-ONE POST OMITTED

ELEVATION

TYPE II-TWO POSTS OMITTED

NOTES:
1. THIS SHEET IS APPLICABLE WHEN GUARDRAIL IS REQUIRED AND THE DEPTH OF
FILL ABOVE THE TOP SLAB OF THE BOX CULVERT IS LESS THAN 4'-0".

2. GUARDRAIL INSTALLATION SHALL BE IN ACCORDANCE WITH SECTION 505 OF THE
SPECIFICATIONS. MATERIAL REQUIREMENT FOR COMPONENTS SHALL BE IN
ACCORDANCE WITH SECTION 221 OF THE SPECIFICATIONS.

3. GUARDRAIL POST SPACING SHALL BE IN ACCORDANCE WITH STANDARD GR-2.

4. THIS DISTANCE SHALL BE IN ACCORDANCE WITH VDOT POLICY ON DETERMINING
THE LENGTH OF NEED FOR GUARDRAIL WITH A MINIMUM DISTANCE AS SHOWN.

5. ALL SPLICES IN NESTED W-BEAM SECTIONS MUST COINCIDE AT A COMMON POINT
AND BE BOLTED TOGETHER USING ONE SET OF BOLTS AT EACH SPLICE.

GUARDRAIL AT LOW-FILL CULVERTS

TABLE OF MAXIMUM ALLOWABLE STRUCTURE WIDTHS FOR THIS DESIGN

* "A" THE MINIMUM ALLOWABLE DISTANCE BETWEEN CLOSEST POINT OF POST TO STRUCTURE.

<table>
<thead>
<tr>
<th>SKEW A</th>
<th>MAX. PERPENDICULAR WIDTH (FEET)</th>
<th>SKEW A</th>
<th>MAX. PERPENDICULAR WIDTH (FEET)</th>
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<tbody>
<tr>
<td>0° 9&quot;</td>
<td>10.5</td>
<td>0° 9&quot;</td>
<td>16.75</td>
</tr>
<tr>
<td>5° 9&quot;</td>
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<td>10° 9&quot;</td>
<td>10.2</td>
<td>10° 9&quot;</td>
<td>16.4</td>
</tr>
<tr>
<td>15° 9&quot;</td>
<td>10.0</td>
<td>15° 9&quot;</td>
<td>16.0</td>
</tr>
<tr>
<td>20° 9&quot;</td>
<td>9.6</td>
<td>20° 9&quot;</td>
<td>15.5</td>
</tr>
<tr>
<td>25° 9&quot;</td>
<td>9.2</td>
<td>25° 9&quot;</td>
<td>14.9</td>
</tr>
<tr>
<td>30° 9&quot;</td>
<td>8.8</td>
<td>30° 9&quot;</td>
<td>14.2</td>
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<td>35° 9&quot;</td>
<td>8.2</td>
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<td>12.4</td>
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<tr>
<td>45° 9&quot;</td>
<td>7.0</td>
<td>45° 9&quot;</td>
<td>11.4</td>
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</table>
GUARDRAIL AT LOW-FILL CULVERTS

NOTE: FOR DETAILS OF GUARDRAIL POSTS AND BLOCKOUTS, SEE STANDARD GR-2, 2A.

CRT POST WITH DOUBLE BLOCKOUTS

THREE POSTS OMMITTED TOP VIEW

<table>
<thead>
<tr>
<th>SKEW</th>
<th>A*</th>
<th>MAX. PERPENDICULAR WIDTH (FEET)</th>
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<tbody>
<tr>
<td>0°</td>
<td>9&quot;</td>
<td>23.00</td>
</tr>
<tr>
<td>5°</td>
<td>9&quot;</td>
<td>22.90</td>
</tr>
<tr>
<td>10°</td>
<td>9&quot;</td>
<td>22.60</td>
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<tr>
<td>15°</td>
<td>9&quot;</td>
<td>22.10</td>
</tr>
<tr>
<td>20°</td>
<td>9&quot;</td>
<td>21.40</td>
</tr>
<tr>
<td>25°</td>
<td>9&quot;</td>
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<tr>
<td>30°</td>
<td>9&quot;</td>
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<tr>
<td>40°</td>
<td>9&quot;</td>
<td>17.10</td>
</tr>
<tr>
<td>45°</td>
<td>9&quot;</td>
<td>15.60</td>
</tr>
</tbody>
</table>

* "A" THE MINIMUM ALLOWABLE DISTANCE BETWEEN CLOSEST POINT OF POST TO STRUCTURE.

NOTES:
1. THIS SHEET IS APPLICABLE WHEN GUARDRAIL IS REQUIRED AND THE DEPTH OF FILL ABOVE THE TOP SLAB OF THE BOX CULVERT IS LESS THAN 4'-0".
2. GUARDRAIL INSTALLATION SHALL BE IN ACCORDANCE WITH SECTION 505 OF THE SPECIFICATIONS. MATERIAL REQUIREMENT FOR COMPONENTS SHALL BE IN ACCORDANCE WITH SECTION 221 OF THE SPECIFICATIONS.
3. GUARDRAIL POST SPACING SHALL BE IN ACCORDANCE WITH STANDARD GR-2.
4. TWO NESTED W-BEAM GUARDRAILS, SEE TABLE FOR ALLOWABLE WIDTHS (25'-0" MAXIMUM).
5. TWO NESTED W-BEAM GUARDRAILS, CRT WOOD POST 6'-3" SPACING, WITH TWO 6"x8"x14" WOOD OR RECYCLED MATERIAL BLOCKOUTS.
6. ALL SPLICES IN NESTED W-BEAM SECTIONS MUST COINCIDE AT A COMMON POINT AND BE BOLTED TOGETHER USING ONE SET OF BOLTS AT EACH SPLICE.
ALL STRUCTURAL STEEL, INCLUDING BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED.

TESTS HAVE SHOWN THAT ALTHOUGH THIS RAIL DEFLECTS HORIZONTALLY TWO OR THREE FEET, ADEQUATE VEHICLE CONTAINMENT AND RE-DIRECTION IS ACHIEVED. THE RESULTING MORE GRADUAL DECELERATION THUS PRODUCES A SAFER CONDITION THAN AFFORDED BY OTHER BRIDGE RAILINGS.

DETAILS ON THIS SHEET ARE TO BE USED FOR BOTH STRAIGHT AND WELDED NUTS) WITH HEX NUTS AND WASHERS AS SHOWN. THREADED RODS MAY BE 0.781 MIN. DIAMETER WITH ROLLED THREADS. NUTS SHALL CONFORM TO A307 REQUIREMENTS AND SHALL BE TAPPED OR CHASED AFTER GALVANIZING. BOLTS AND NUTS SHALL HAVE CLASS 2A AND 2B FIT TOLERANCES. BOLTS SHALL BE EMBEDDED 8" INTO THE CONCRETE.

TUBULAR GUARD RAIL SHALL BE FURNISHED AND INSTALLED IN 25 FT. SECTIONS. TUBULAR RAIL MEMBER SHALL BE EXTENDED AND CONNECTED TO AT LEAST THE FIRST SOIL EMBEDDED POST AT EACH END OF THE STRUCTURE. MORE SUCH POSTS SHALL BE USED TO UTILIZE 25 FT. STANDARD SECTIONS. APPROACH GUARDRAIL POSTS SHALL BE SPACED AT 6'-3" ADJACENT TO THE TUBULAR RAIL SINCE ITS FLEXIBILITY IS SIMILAR TO THE STANDARD METAL BEAM GUARDRAIL. DO NOT INSTALL ADDITIONAL POSTS AT 3'-1½" CENTERS. FULLY ANCHORED GUARDRAIL MUST BE ATTACHED AT BOTH ENDS OF TUBULAR RAIL.

TESTS HAVE SHOWN THAT ALTHOUGH THIS RAIL DEFLECTS HORIZONTALLY TWO OR THREE FEET, ADEQUATE VEHICLE CONTAINMENT AND RE-DIRECTION IS ACHIEVED. THE RESULTING MORE GRADUAL DECELERATION THUS PRODUCES A SAFER CONDITION THAN AFFORDED BY OTHER BRIDGE RAILINGS.


BR SERIES BARS SHALL BE 5 IN SIZE.

INSTALLATION.

PRECAST BOXES SHALL BE TREATED AS AN EXISTING BOX FOR PEDESTAL INSTALLATION.

GENERAL NOTE:

ALL STRUCTURAL STEEL, INCLUDING BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED.

FOR DETAILS OF GUARDRAIL, SEE GR-2 OF THE ROAD AND BRIDGE SPECIFICATIONS.

THE GUARDRAIL INSTALLATION SHALL CONFORM WITH SECTION 505 OF THE CURRENT VIRGINIA DEPARTMENT OF TRANSPORTATION ROAD AND BRIDGE SPECIFICATIONS.

RAIL POSTS MAY BE VERTICAL OR PERPENDICULAR TO ADJACENT ROADWAY GRADE AND CROSS SLOPE. TOP OF PEDESTAL SHALL BE SLOPED AS NECESSARY FOR PERPENDICULAR INSTALLATION.

DETAILS ON THIS SHEET ARE TO BE USED FOR BOTH STRAIGHT AND SKEWED BOXES.

ANCHOR BOLTS SHALL BE ½" 0A307 (OR A36 THREADED RODS WITH TACK WELDED NUTS) WITH HEX NUTS AND WASHERS AS SHOWN. THREADED RODS MAY BE 0.781 MIN. DIAMETER WITH ROLLED THREADS. NUTS SHALL CONFORM TO A307 REQUIREMENTS AND SHALL BE TAPPED OR CHASED AFTER GALVANIZING. BOLTS AND NUTS SHALL HAVE CLASS 2A AND 2B FIT TOLERANCES. BOLTS SHALL BE EMBEDDED 8" INTO THE CONCRETE.

THIS SHEET IS APPLICABLE WHEN GUARDRAIL IS REQUIRED AND THE DEPTH OF FILL ABOVE THE TOP SLAB OF THE BOX CULVERT IS LESS THAN 3'-7".

DETAILS SHOWN ARE FOR INSTALLATION ON NEW BOX CULVERTS. INSTALLATION OF PEDESTALS TO BOX CULVERTS SHALL BE IN ACCORDANCE WITH SEC. 412 OF THE SPECIFICATIONS EXCEPT THAT DOWELS SHALL BE PLACED BETWEEN 3 AND 6 INCHES FROM THE EDGE OF THE PEDESTAL.

THIS UNIT IS ONLY TO BE USED WHEN DESIGN SPEED IS 45 MPH OR LESS.

TESTED - NCHRP 350 TEST LEVEL 2
GUARDRAIL-TUBULAR RAIL SPLICE

NOTES:
TUBULAR W-BEAM RAIL MEMBER IS TO BE FABRICATED FROM STANDARD 20 NOMINAL W-BEAM SECTIONS. TOP AND BOTTOM SEAMS SHALL BE BUTT WELDED 8" AT 12" SPACING. CONTINUOUS SEAM WELDING IS ALSO ACCEPTABLE. WELDS SHALL BE CHIPPED AND CLEANED AND THE COMPLETE 25 FT. TUBULAR MEMBER SHALL BE GALVANIZED AFTER FABRICATION. FOR TUBULAR RAIL SPLICE ADDITIONAL POST MOUNTING SLOTS ARE TO BE MADE IN EACH MEMBER 1'-3" FROM THE STANDARD SLOTS AT 6'-3" CENTERS.

8-1/4" SPLICE NUTS SHALL BE TACK WELDED TO A BENT SHEET METAL POSITIONER AS SHOWN. OTHER SUITABLE POSITIONING METHODS OR DEVICES MAY BE SUBSTITUTED. THE COMPLETED SPLICE SHALL HAVE 8 BOLTS (16 BOLTS IF A TUBULAR RAIL SPLICE). EACH BOLT WILL INCLUDE A 3/4"X 3"X1/8" PLATE WASHER OR A 2 INCH DIAMETER WASHER.
NEW BRIDGES - ATTACHMENTS
ONE WAY TRAFFIC - RUN-ON, 2-GR-FOA-1, TYPE I
- RUN-OFF, 2-GR-FOA-1, TYPE II
TWO WAY TRAFFIC - RUN-ON, 4-GR-FOA-1, TYPE I
EXISTING BRIDGE ATTACHMENTS AS SHOWN ON PLANS.

SECTION A-A
SECTION B-B
SECTION C-C

W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT
FOR USE BETWEEN VERTICAL FIXED OBJECTS AND GUARDRAIL (WOOD POSTS)

ITEM MATERIAL/SPECIFICATIONS/NOTES
1 3/8" X 18" LONG GUARDRAIL BOLT AND RECESSED NUT
2 STANDARD 6" X 8" WOOD POST AND BLOCK
3 STANDARD W-BEAM TERMINAL CONNECTOR
4 STANDARD W-BEAM RAIL
5 3/8" X 2" LONG GUARDRAIL BOLT & RECESSED NUT (SEE STD. GR-HDW)
6 RECTANGULAR PLATE WASHER (SEE STD. GR-HDW)
7 BENT PLATE RUBRAIL (SEE SHEET 3 OF 3)
8 C6 X 8.2 RUBRAIL (SEE SHEET 3 OF 3)
9 W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT STANDARD GR-FOA-1 TYPE I
10 WASHER FOR 3/8" BOLT
W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT
FOR USE BETWEEN VERTICAL FIXED OBJECTS AND GUARDRAIL (STEEL POSTS)

NOTES:
1. FIXED OBJECTS MAY CONSIST OF BRIDGE RAILS, ABUTMENTS, PIERS, RETAINING WALLS, OR OTHER FLAT SURFACED STRUCTURES WITH VERTICAL FACE.
2. GUARDRAIL ENDS AND BRIDGE PARAPETS MUST BE OF ADEQUATE STRENGTH TO ACCEPT FULL IMPACT LOADING.
3. GUARDRAIL COMPONENTS SHALL BE IN ACCORDANCE WITH VDOT ROAD AND BRIDGE STANDARDS.
4. POSTS 1, 2, 3, 4, AND 5 REQUIRE AN ADDITIONAL HOLE TO ATTACH BLOCKS AND/OR RUBRAIL. RUBRAIL IS NOT BOLTED TO POSTS 2 AND 4.
5. BOTTOM WOOD BLOCKS LOCATED ON POSTS 1 THROUGH 4 ARE CENTER DRILLED AND SECURED WITH 5/8" GUARDRAIL BOLTS (LENGTH AS REQUIRED).
6. APPROPRIATE LENGTH 5/8" DIAMETER ASTM A449 HEX BOLTS WITH WASHERS MUST BE USED WITH THRU DRILLED HOLES AND A 5/8" BEARING PLATE ON THE BACK SIDE OF THE BRIDGE PARAPET OR TERMINAL WALL.
7. SEE SHEET 3 OF 3 FOR RUBRAIL BLOCKOUT DETAILS.

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A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

ROAD AND BRIDGE STANDARDS

W-Beam Guardrail - Fixed Object Attachment

FOR USE BETWEEN VERTICAL FIXED OBJECTS AND GUARDRAIL (STEEL POSTS)

2016 ROAD & BRIDGE STANDARDS

SPECIFICATION REFERENCE

505
ITEM 7 DETAIL

NOTE:
CAN BE FIELD CUT AND BENT USING HEAT.
IF SHARP CUT AND BENT, RIGHT HAND OR LEFT
HAND MUST BE SPECIFIED DEPENDING ON
WHICH SIDE OF THE ROADWAY THE TRANSITION
IS USED.

INDICATES EXTRA POST REQ'D FOR
RUN-OFF FIXED OBJECT ATTACHMENT
STANDARD GR-FOA-1 TYPE II

PLAN

ELEVATION

W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT
(RUBRAIL AND HARDWARE DETAILS)

SPECIFICATION REFERENCE
505

ROAD AND BRIDGE STANDARDS
VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS
W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT
FOR USE BETWEEN SAFETY SHAPE AND GUARDRAIL (WOOD POSTS)

NOTES:
1. FIXED OBJECTS MAY CONSIST OF SAFETY SHAPED BRIDGE PARAPETS OR CONCRETE BARRIERS.
2. BRIDGE RAIL ENDS AND BRIDGE PARAPETS MUST BE OF ADEQUATE STRENGTH TO ACCEPT FULL IMPACT LOADING.
3. GUARDRAIL COMPONENTS SHALL BE IN ACCORDANCE WITH VDOT ROAD AND BRIDGE STANDARDS.
4. POSTS 1, 2, 3, 4, AND 5 REQUIRE AN ADDITIONAL HOLE TO ATTACH LOWER BLOCKS AND/OR RUBRAIL. RUBRAIL IS NOT BOLTED TO POSTS 2 AND 4.
5. BOTTOM WOOD BLOCKS LOCATED ON POSTS 1 THROUGH 4 ARE CENTER DRILLED AND SECURED WITH ¾" GUARDRAIL BOLTS. LENGTH AS REQUIRED.
6. RUBRAIL MUST BE TWISTED 35° BETWEEN SECTION C-C AND D-D. SHIP FABRICATION MAY BE REQUIRED. RIGHT AND LEFT HAND TWISTS WILL BE NEEDED.
7. APPROPRIATE LENGTH ¼" ASTM A449 HEX BOLTS WITH WASHERS MUST BE USED WITH HOLES DRILLED AND A ¾" BEARING PLATE ON THE BACK SIDE OF THE BRIDGE PARAPET OR CONCRETE BARRIER.
8. DRIVE NAIL WITHIN 2" OF THE TOP OR BOTTOM OF BLOCKOUT AFTER ¾" X 18" BOLT IS INSTALLED.
9. SEE SHEET 3 OF 3 FOR RUBRAIL BLOCKOUT DETAILS.
NOTE: FIXED OBJECTS MAY CONSIST OF SAFETY SHAPED BRIDGE PARAPETS OR CONCRETE BARRIERS.

2. BRIDGE RAIL ENDS AND BRIDGE PARAPETS MUST BE OF ADEQUATE STRENGTH TO ACCEPT FULL IMPACT LOADING.

3. GUARDRAIL COMPONENTS SHALL BE IN ACCORDANCE WITH VDOT ROAD AND BRIDGE STANDARDS.

4. POSTS 1, 2, 3, 4, AND 5 REQUIRE AN ADDITIONAL HOLE TO ATTACH LOWER BLOCKS AND/OR RUBRAIL. RUBRAIL IS NOT BOLTED TO POSTS 2 AND 4.

5. BOTTOM WOOD BLOCKS LOCATED ON POSTS 1 THROUGH 4 ARE CENTER DRILLED AND SECURED WITH 3/8" GUARDRAIL BOLTS. (LENGTH AS REQUIRED).

6. RUBRAIL MUST BE TWISTED 35° BETWEEN SECTIONS C-C AND D-D. SHOP FABRICATION MAY BE REQUIRED. RIGHT HAND AND LEFT HAND TWISTS WILL BE NECESSARY.

7. APPROPRIATE LENGTH 5/8" ASTM A449 HEX BOLTS WITH WASHERS MUST BE USED WITH THRU DRILLED HOLES AND A 3/8" BEARING PLATE ON THE BACK SIDE OF THE BRIDGE PARAPET OR CONCRETE BARRIER.

8. SEE SHEET 3 OF 3 FOR RUBRAIL BLOCKOUT DETAILS.
**ELEVATION**

**PLAN**

**ITEM 7 DETAIL**

- **RUBRAIL AND HARDWARE DETAILS**

**ITEM 10 DETAIL**

- **BEARING PLATE**

**ITEM 8 DETAIL**

- **W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT**

**RUBRAIL BLOCKOUT DETAIL**

**NOTES:**

1. Can be field cut and bent using heat. If shop cut and bent, right hand or left hand must be specified depending on which side of the roadway the transition is used.
**BLOCKED-OUT W-BEAM MEDIAN BARRIER-FIXED OBJECT ATTACHMENT**

**FOR USE BETWEEN STANDARD MB-7D AND STANDARD MB-3**

**Virginia Department of Transportation**

### TYPE I
- Two run-on sections (with 2 rubrails shown)

### TYPE II
- One run-on section (with 1 rubrail retained)
- One run-off section (with 1 rubrail removed)

### TYPE III
- Two run-off sections (with 2 rubrails removed)

**NOTE:**
- All guardrail posts are to be steel.
- All guardrail components are to be in accordance with VDOT Road and Bridge Standards.
- Posts 1, 2, 3, 4, and 5 require an additional hole to attach lower blocks and/or rubrail. Rubrail is not bolted to posts 2 and 4.
- Bottom wood blocks located on posts 1 through 4 are to be drilled and secured with 3/4" guardrail bolts (length as required).
- Appropriate length 7/8" ASTM A449 hex bolts with washers are to be used with holes drilled through the concrete median barrier attaching the W-beam terminal connectors on each side. Bolts to project no more than 1/2" beyond nuts. Use lock washers under nuts.

### MATERIALS/SPECIFICATIONS/NOTES

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<thead>
<tr>
<th>ITEM</th>
<th>MATERIALS/SPECIFICATIONS/NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>STD. WS X 8.5 or WS X 9 STEEL POSTS, STD. 6&quot; X 8&quot; X 14&quot; LONG TREATED PINE BLOCK OR RECYCLED MATERIAL.</td>
</tr>
<tr>
<td>2</td>
<td>STD. W-BEAM TERMINAL CONNECTOR</td>
</tr>
<tr>
<td>3</td>
<td>STANDARD W-BEAM RAIL</td>
</tr>
<tr>
<td>4</td>
<td>3/4&quot; X 2&quot; LONG GUARDRAIL BOLT AND RECESSED NUT</td>
</tr>
<tr>
<td>5</td>
<td>RECTANGULAR PLATE WASHER (SEE STANDARD CR-HDW)</td>
</tr>
<tr>
<td>6</td>
<td>BENT PLATE RUBRAIL (SEE SHEET 2 OF 2)</td>
</tr>
<tr>
<td>7</td>
<td>WOOD BLOCKOUT FOR RUBRAIL (SEE SHEET 2 OF 2)</td>
</tr>
<tr>
<td>8</td>
<td>3/4&quot; X 10&quot; LONG GUARDRAIL BOLT AND RECESSED NUT</td>
</tr>
</tbody>
</table>

**A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.**
1. Holes, where shown, shall be formed with sleeves of 1/2" diameter nominal pipe.

2. Bolt lengths are to be established by the contractor and approved by the engineer. All bolts are to be 3/8" dia. hex head machine bolts with beveled washers and self-locking nuts.

3. For two-way traffic design, use run-on end transition (Type II).

4. Run off (Type I) guardrail to be used only when required for other reasons.

5. Cost of transition to be included in price bid per foot of traffic barrier service concrete.

6. These instructions applicable for temporary installation in construction zones only. Refer to Standard GR-FOA for instructions on permanent installation.
W-BEAM GUARDRAIL INSTALLATION CRITERIA

TYPICAL SECTION

GUARDRAIL SHALL BE PLACED SO THAT A HAZARD IS NOT WITHIN THE DEFLECTION LIMIT OF THE GUARDRAIL. THE GUARDRAIL DESIGN AND PLACEMENT SHOWN ABOVE MAY ALSO BE USED FOR SHIELDING AN OVERHEAD SIGN SUPPORT, FIXED OBJECTS OR OTHER TYPES OF ROAD SIDE OBSTRUCTIONS.

\[\times\] 25º ANGLE OF VEHICLE DEPARTURE.

SECTION E-E

NOTES:
1. DISTANCE "A" MUST BE GREATER THAN REQ'D CLEAR ZONE.
2. DISTANCE "B" IS LESS THAN REQ'D CLEAR ZONE.
NOTES:
1. IF A CUT SECTION IS CLOSER THAN 200', A STANDARD GR-6 TERMINAL IS PREFERRED.
2. NO GUARDRAIL IS REQUIRED ON RUN-OFF UNLESS NEEDED TO SHIELD A HAZARD WITHIN THE REQUIRED CLEAR ZONE.
3. NO GUARDRAIL IS REQUIRED ON RUN-OFF UNLESS NEEDED TO SHIELD A HAZARD WITHIN THE REQUIRED CLEAR ZONE.
   REFER TO SHEET 501.34 FOR BACK OF GUARDRAIL FROM THE OPPOSING LANE IS WITHIN THE REQUIRED CLEAR ZONE.

DETAIL OF GUARDRAIL AT DUAL BRIDGES

W-BEAM GUARDRAIL INSTALLATION CRITERIA

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE
221
505

ROAD AND BRIDGE STANDARDS
REVISION DATE
501.35

SHEET 2 OF 8
TABLE III

| LENGTH IN FEET | X IN FEET | W-2' | W-3' | W-4' | W-5' | W-6' | W-7' | W-8' | W-9' | W-10' | W-11' | W-12' | W-13' | W-14' | W-15' | W-16' | W-17' | W-18' | W-19' | W-20' |
|----------------|-----------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 37.50          | 6.25      | 0.06 | 0.05 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02  | 0.02  | 0.02  | 0.03  | 0.03  | 0.03  | 0.03  | 0.03  | 0.03  | 0.03  | 0.03  |
| 75.00          | 12.50     | 0.22 | 0.19 | 0.11 | 0.08 | 0.06 | 0.05 | 0.06 | 0.07 | 0.08  | 0.08  | 0.09  | 0.10  | 0.11  | 0.13  | 0.13  | 0.13  | 0.13  | 0.13  | 0.14  |
| 100.00         | 18.75     | 0.50 | 0.42 | 0.25 | 0.18 | 0.14 | 0.12 | 0.14 | 0.14 | 0.16  | 0.17  | 0.19  | 0.20  | 0.22  | 0.23  | 0.25  | 0.27  | 0.28  | 0.30  | 0.31  |
| 125.00         | 25.00     | 0.89 | 0.75 | 0.44 | 0.31 | 0.24 | 0.19 | 0.22 | 0.25 | 0.28  | 0.31  | 0.33  | 0.36  | 0.39  | 0.42  | 0.44  | 0.47  | 0.50  | 0.53  | 0.56  |
| 150.00         | 31.25     | 1.39 | 1.17 | 0.69 | 0.49 | 0.38 | 0.30 | 0.35 | 0.39 | 0.43  | 0.48  | 0.52  | 0.56  | 0.61  | 0.65  | 0.69  | 0.74  | 0.78  | 0.82  | 0.87  |
| 50.00          | 7.35      | 0.20 | 0.16 | 0.10 | 0.07 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08  | 0.08  | 0.09  | 0.10  | 0.12  | 0.13  | 0.13  | 0.13  | 0.13  | 0.14  | 0.14  |
| 75.00          | 12.50     | 0.64 | 0.54 | 0.44 | 0.30 | 0.24 | 0.19 | 0.22 | 0.25 | 0.28  | 0.30  | 0.33  | 0.36  | 0.39  | 0.42  | 0.44  | 0.47  | 0.50  | 0.53  | 0.56  |
| 100.00         | 18.75     | 1.33 | 1.13 | 0.65 | 0.46 | 0.32 | 0.27 | 0.31 | 0.35 | 0.39  | 0.44  | 0.49  | 0.54  | 0.59  | 0.64  | 0.69  | 0.74  | 0.79  | 0.84  | 0.90  |
| 125.00         | 25.00     | 2.05 | 1.68 | 1.08 | 0.90 | 0.83 | 0.77 | 0.85 | 0.89 | 0.95  | 1.02  | 1.10  | 1.17  | 1.25  | 1.35  | 1.45  | 1.55  | 1.65  | 1.75  | 1.88  |
| 150.00         | 31.25     | 3.51 | 2.50 | 1.68 | 1.12 | 0.96 | 0.89 | 0.94 | 1.02 | 1.12  | 1.25  | 1.33  | 1.44  | 1.54  | 1.64  | 1.75  | 1.86  | 1.97  | 2.09  | 2.22  |

W = TOTAL LATERAL TRANSITION OF GUARDRAIL O1 - O2
O1 = OFFSET FROM EDGE OF PAVEMENT TO FACE OF GUARDRAIL MAX.
O2 = OFFSET FROM EDGE OF PAVEMENT TO FACE OF GUARDRAIL MIN.
X = ...X1 CUMULATIVE DISTANCE IN INCREMENTS OF 6'-3" FROM FIRST GUARDRAIL POST MEASURED ALONG FACE OF GUARDRAIL.
Y = LATERAL OFFSET FROM FACE OF GUARDRAIL OF POST NEAREST TO PAVEMENT EDGE TO FACE OF GUARDRAIL AT EACH SUCCESSIVE POST.
L = TOTAL LENGTH OF TRANSITIONAL PORTION OF GUARDRAIL.

W-BEAM GUARDRAIL INSTALLATION CRITERIA

2016 ROAD & BRIDGE STANDARDS
### 2016 ROAD & BRIDGE STANDARDS

**NOTE:**

**LENGTH OF TRANSITION (L) IS TO BE IN ACCORDANCE WITH TABLE III OR IV FOR APPLICABLE VALUES OF L OR AS DIRECTED BY THE ENGINEER.**

**R A L  T E R M I N A L  S E C T I O N S  I N  A C C O R D A N C E  W I T H  S T A N D A R D  G R-6, G R-7 OR G R-8 ARE TO BE INSTALLED AT EACH TERMINUS OF GUARDRAIL WHERE SPECIFIED ON PLANS.**

**A L L  L E N G T H S  (L) ARE A P P L I E D  A L O N G  F A C E  O F  G U A R D R A I L.**

**O F F S E T S  S H O W N  I N  T A B L E S  A R E  F O R  6"-3" SPACING, FOR 12"-6" SPACING (G R-8) USE EVERY SECOND VALUE OF Y.**


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### TABLE IV

**OFFSETS (Y) FOR CONTINUOUS RUN-ON GUARDRAILS AND ALL RUN-OFF TRANSITIONS**

<table>
<thead>
<tr>
<th>LENGTH L IN FEET</th>
<th>X IN FEET</th>
<th>W-2'</th>
<th>W-3'</th>
<th>W-4'</th>
<th>W-5'</th>
<th>W-6'</th>
<th>W-7'</th>
<th>W-8'</th>
<th>W-9'</th>
<th>W-10'</th>
<th>W-11'</th>
<th>W-12'</th>
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<tr>
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</tr>
</tbody>
</table>

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**W-BEAM GUARDRAIL INSTALLATION CRITERIA**

**VIRGINIA DEPARTMENT OF TRANSPORTATION**

**SPECIFICATION REFERENCE**

**2016 ROAD & BRIDGE STANDARDS**

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**ROAD AND BRIDGE STANDARDS**

**SHEET 5 OF 8**

**REVISION DATE**

**501.38**
GR-2 INSTALLATION WITH CG-3 OR CG-7 CURB

FOR GUARDRAIL DESIGN POLICIES USING CURB & GUTTER
OR URBAN DESIGNS WITH SIDEWALK OR SIDEWALK SPACE
SEE APPENDIX I OF THE ROAD DESIGN MANUAL

GUARDRAIL LOCATION ON RECOVERABLE SLOPE

NOTE:
PAVED SHOULDER WIDTHS SHOWN ARE MINIMUM.
The PAVED SHOULDER MAY BE EXTENDED TO THE FACE OF THE RAIL. THE PAVED WIDTH USED SHALL BE IN ACCORDANCE WITH THE ROADWAY CLASSIFICATION AS DEFINED IN THE ROAD DESIGN MANUAL.

SEE STANDARD MC-4 FOR PAVING UNDER GUARDRAIL.

NORMAL GUARDRAIL LOCATION

<table>
<thead>
<tr>
<th>TOTAL SHOULDER WIDTH (Paved &amp; Graded)</th>
<th>PAVED SHOULDER WIDTH (Ps)</th>
<th>OFFSET FROM EDGE OF TRAVELED WAY TO FACE OF GUARDRAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>17'</td>
<td>12'</td>
<td>14'</td>
</tr>
<tr>
<td>15'</td>
<td>3', 4', or 10'</td>
<td>12'</td>
</tr>
<tr>
<td>13'</td>
<td>3', 4', or 8'</td>
<td>10'</td>
</tr>
<tr>
<td>11'</td>
<td>3' or 4'</td>
<td>8'</td>
</tr>
<tr>
<td>9'</td>
<td>3' or 4'</td>
<td>6'</td>
</tr>
<tr>
<td>8'</td>
<td>3' or 4'</td>
<td>5'</td>
</tr>
<tr>
<td>7'</td>
<td>0 or 2'</td>
<td>4'</td>
</tr>
<tr>
<td>5'</td>
<td>0</td>
<td>2'</td>
</tr>
</tbody>
</table>

W-BEAM GUARDRAIL INSTALLATION CRITERIA

VIRGINIA DEPARTMENT OF TRANSPORTATION

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

2016 ROAD & BRIDGE STANDARDS
TRANSITION FROM STRONG POST TO WEAK POST GUARDRAIL

TRANSITION FROM GR-7 & GR-9 TERMINAL TO WEAK POST GUARDRAIL

TRANSITION FROM GR-6, GR-7, OR GR-9 TERMINAL TO WEAK POST GUARDRAIL

TRANSITION FROM WEAK POST MEDIAN BARRIER TO CONCRETE MEDIAN BARRIER

DETAIL A
STANDARD MB-3 POST SPACING IS 6'-3".

ALL HOLES IN POST TO BE 3/8" DIAMETER.

6x8 WOOD POST

STEEL POST

BOLT ALL HOLES IN POST AND BRACKET TO STEEL POST 6'-0" MIN.

†" X 10" BOLT

W6X8.5 OR W6X9 ALL HOLES IN POST AND BRACKET TO BE 3/8" IN DIAMETER.

SUGGESTED MAXIMUM FLARE RATE FOR SEMI-RIGID BARRIER SYSTEMS.

NOTES:

STANDARD MB-3 POST SPACING IS 6'-3".

FOR DETAILS OF RAIL ELEMENT, RAIL SPLICE JOINT, W BEAM BACK UP PLATE, AND ASSOCIATED HARDWARE SEE SHEET NO. 501.01.

ALTERNATE TYPE POSTS AND BLOCKOUTS MAY BE INTERCHANGED ON ANY ONE PROJECT WITH THE RESTRICTION THAT THE SAME TYPE OF POST AND BLOCKOUT MUST BE USED IN ANY SINGLE RUN OF MEDIAN BARRIER.

ALL BOLTS, NUTS, WASHERS, STEEL POSTS, BENT PLATE POST, AND BLOCKOUTS ARE TO BE GALVANIZED.

IMPACT ATTENUATOR, CAT, BRAKEMASTER OR STANDARD GR-HDW W BEAM END SECTION (BUFFER), (BUFFER END SECTION MAY ONLY BE USED WHEN LOCATED OUTSIDE OF CLEAR ZONE.)

METHOD OF TREATMENT AT BRIDGE PIER OR MEDIAN OBSTRUCTION

FLARE RATES

<table>
<thead>
<tr>
<th>DESIGN SPEED</th>
<th>SHY LINE INSIDE</th>
<th>FLARE RATE</th>
<th>BEYOND SHY LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH</td>
<td>L5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>9'</td>
<td>30:1</td>
<td>15:1 *</td>
</tr>
<tr>
<td>60</td>
<td>8'</td>
<td>26:1</td>
<td>14:1 *</td>
</tr>
<tr>
<td>50</td>
<td>6.5'</td>
<td>21:1</td>
<td>11:1 *</td>
</tr>
<tr>
<td>40</td>
<td>5'</td>
<td>16:1</td>
<td>8:1 *</td>
</tr>
<tr>
<td>30</td>
<td>4'</td>
<td>13:1</td>
<td>7:1 *</td>
</tr>
</tbody>
</table>

* SUGGESTED MAXIMUM FLARE RATE FOR SEMI-RIGID BARRIER SYSTEMS.

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

BLOCKED-OUT W-BEAM MEDIAN BARRIER

VESTAL ENGINEERING CORPORATION
**SQUARE WASHER**

**5/8" HEX BOLT AND NUT**

**ROUND WASHER**

**2 SQUARE WASHERS**

**3/4" X 2 3/4" LONG HEX. BOLT**

**W-BEAM RAIL**

**W-BEAM BACK UP PLATE**

**GUARDRAIL POST CONNECTION DETAIL**

**2-SQUARE WASHERS REQUIRED EACH POST (SEE DETAIL THIS SHEET)**

**SUPPORT BOLT TO BE LOCATED UNDER BOTH RAIL BEAMS.**

**TYPICAL INSTALLATION**

**NOTES:**
- STANDARD MB-5 POST SPACING IS 12'-0"
- STANDARD MB-5A POST SPACING IS 6'-3"
- STANDARD MB-5B POST SPACING IS 3'-0"
- STANDARD MB-5 DEFLECTION IS 7'-0"
- ALL POSTS, BOLTS, NUTS AND WASHERS ARE TO BE GALVANIZED.
- FOR DETAILS OF GUARDRAIL ELEMENT, HARDWARE, ETC., SEE SHEET NO. 501.01.
- FOR DETAILS OF GUARDRAIL SPlice joint, SEE STD. GR-8
- DEPICTING AN NCHRP 350 TL-3 INSTALLATION.
TREATMENT FOR MEDIAN BARRIER CROSS-OVER

TRANSITION FROM WEAK POST
AS PER STANDARD GR-INS SHEET B OF 8
**NOTES:**

1. The contractor elects to use the optional construction joint. Transverse joints for crack control and expansion joints are to be provided in both footing and barrier at the same location. Transverse joints are to coincide with joints in adjacent pavement with a maximum spacing of 20 feet C-C. Concrete median barrier may be cast in place or slip-formed.

2. Precast barrier is not permitted for permanent installations. Horizontal reinforcing steel bars are to be separated at all expansion and contraction joints. A 2" concrete cover is required over the ends of the reinforcing steel.

3. Dowels and optional construction joint are to be in accordance with MB-7D.

4. Barrier delineator size, color, and spacing to be in accordance with the specifications. Cost of delineator to be included in the price bid for median barrier.

5. Reflective surface of barrier delineator in all instances, to be facing oncoming traffic.

6. Alternate top design shown on MB-7D, may also be applied to MB-7E and MB-7F. Concrete to be class A3 if cast in place, 4000 psi if precast.

7. Depth of concrete base may be extended at the contractor's option to coincide with bottom of pavement course in which base terminates; however, the cost of additional concrete shall be included in unit price bid per linear foot of barrier.

8. The contractor elects to use the optional construction joint. Transverse joints for crack control and expansion joints are to be provided in both footing and barrier at the same location. Transverse joints are to coincide with joints in adjacent pavement with a maximum spacing of 20 feet C-C. Concrete median barrier may be cast in place or slip-formed.

9. Precast barrier is not permitted for permanent installations. Horizontal reinforcing steel bars are to be separated at all expansion and contraction joints. A 2" concrete cover is required over the ends of the reinforcing steel.

10. Dowels and optional construction joint are to be in accordance with MB-7D.

11. Barrier delineator size, color, and spacing to be in accordance with the specifications. Cost of delineator to be included in the price bid for median barrier.

12. Reflective surface of barrier delineator in all instances, to be facing oncoming traffic.

13. Alternate top design shown on MB-7D, may also be applied to MB-7E and MB-7F. Concrete to be class A3 if cast in place, 4000 psi if precast.

14. Depth of concrete base may be extended at the contractor's option to coincide with bottom of pavement course in which base terminates; however, the cost of additional concrete shall be included in unit price bid per linear foot of barrier.
**PLAN VIEW**

1. **CONNECTOR**
2. **OPTIONAL 1/2" x 1/2" CHAMFER EACH END**
3. **1/3 DIA. x 3"**
4. **2'-7" NOMINAL DRAINAGE SLOT**
5. **1/3 DIA. x 4"**
6. **1/3 DIA. x 3"**
7. **10'-0" AND 20'-0"**
8. **#4 BAR**
9. **2'-8"**
10. **3'-0"**
11. **4'-0"**
12. **5'-0"**
13. **6'-0"**
14. **7'-0"**
15. **8'-0"**
16. **9'-0"**
17. **10'-0" AND 20'-0"**
18. **1'-10"**
19. **2'-7" NOMINAL DRAINAGE SLOT**
20. **2'-8"**
21. **3'-0"**
22. **4'-0"**
23. **5'-0"**
24. **6'-0"**
25. **7'-0"**
26. **8'-0"**
27. **9'-0"**
28. **10'-0"**
29. **1'-10"**
30. **2'-7" NOMINAL DRAINAGE SLOT**

**ELEVATION VIEW**

1. **NUMBER 4 BAR**
2. **NUMBER 6 BAR**
3. **NUMBER 4 STIRRUP**
4. **NUMBER 4 BAR**
5. **#4 BAR**
6. **#4 BAR**
7. **#6 BAR**
8. **#6 BAR**
9. **#6 BAR**
10. **2'-7" NOMINAL DRAINAGE SLOT**
11. **2'-8"**
12. **3'-0"**
13. **4'-0"**
14. **5'-0"**
15. **6'-0"**
16. **7'-0"**
17. **8'-0"**
18. **9'-0"**
19. **10'-0" AND 20'-0"**
20. **1'-10"**
21. **2'-7" NOMINAL DRAINAGE SLOT**
22. **2'-8"**
23. **3'-0"**
24. **4'-0"**
25. **5'-0"**
26. **6'-0"**
27. **7'-0"**
28. **8'-0"**
29. **9'-0"**
30. **10'-0"**
31. **1'-10"**
32. **2'-7" NOMINAL DRAINAGE SLOT**
33. **2'-8"**
34. **3'-0"**
35. **4'-0"**
36. **5'-0"**
37. **6'-0"**
38. **7'-0"**
39. **8'-0"**
40. **9'-0"**
41. **10'-0"**
42. **1'-10"**

**SECTION A-A**

1. **CONNECTOR**
2. **OPTIONAL 1/2" x 1/2" CHAMFER EACH END**
3. **1/3 DIA. x 3"**
4. **2'-7" NOMINAL DRAINAGE SLOT**
5. **1/3 DIA. x 4"**
6. **1/3 DIA. x 3"**
7. **10'-0" AND 20'-0"**
8. **#4 BAR**
9. **2'-8"**
10. **3'-0"**
11. **4'-0"**
12. **5'-0"**
13. **6'-0"**
14. **7'-0"**
15. **8'-0"**
16. **9'-0"**
17. **10'-0"**
18. **1'-10"**
19. **2'-7" NOMINAL DRAINAGE SLOT**
20. **2'-8"**
21. **3'-0"**
22. **4'-0"**
23. **5'-0"**
24. **6'-0"**
25. **7'-0"**
26. **8'-0"**
27. **9'-0"**
28. **10'-0"**
29. **1'-10"**
30. **2'-7" NOMINAL DRAINAGE SLOT**
31. **2'-8"**
32. **3'-0"**
33. **4'-0"**
34. **5'-0"**
35. **6'-0"**
36. **7'-0"**
37. **8'-0"**
38. **9'-0"**
39. **10'-0"**
40. **1'-10"**

**NOTES:**

1. At the option of the manufacturer, additional reinforcing may be added to the precast concrete barrier for handling.
2. Concrete shall be 4000 P.S.I. minimum.
3. BARRIER DELINEATOR SIZE, COLOR AND SPACING SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS.
4. Cost of delineator shall be included in the price bid for traffic barrier service.
5. OTHER PRECAST TRAFFIC BARRIER SERVICE CONCRETE DESIGNS THAT HAVE BEEN APPROVED BY VDOT AS AN ACCEPTABLE ALTERNATE TO THE STANDARD DESIGN MAY BE SUBSTITUTED.
6. A 1" RADIUS MAY BE USED AS AN ALTERNATE FOR THE 3/4" CHAMFER.
7. BARRIER DELINEATOR REFLECTIVE SURFACE IN ALL INSTANCES SHALL BE FACING ONCOMING TRAFFIC.
8. BARRIER VERTICAL PANELS SHALL BE SPACED IN ACCORDANCE WITH VIRGINIA WORK AREA PROTECTION MANUAL.

**WHEN USING VDOT STANDARD MB-7D PC WITH THE PIN AND LOOP POSITIVE CONNECTION, ALLOW FOR A 6'-0" DYNAMIC DEFLECTION, PROVIDE MIN. 60' OF BARRIER UPSTREAM AND DOWNSTREAM OF WORK ZONE FOR ANCHORAGE.**

**FOR APPROVED NON-VDOT DESIGNS, REFER TO MANUFACTURER’S INSTALLATION INSTRUCTIONS FOR DEFLECTIONS AND ANCHORAGE.**

**FLARE RATES**

<table>
<thead>
<tr>
<th>DESIGN SPEED</th>
<th>INSIDE SHY LINE</th>
<th>BEYOND SHY LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH</td>
<td>FLARE RATE</td>
<td>FLARE RATE</td>
</tr>
<tr>
<td>70</td>
<td>10'</td>
<td>3:1</td>
</tr>
<tr>
<td>60</td>
<td>8'</td>
<td>2:1</td>
</tr>
<tr>
<td>50</td>
<td>6.5'</td>
<td>2:1</td>
</tr>
<tr>
<td>40</td>
<td>5'</td>
<td>1:1</td>
</tr>
<tr>
<td>30</td>
<td>3.5</td>
<td>1:1</td>
</tr>
</tbody>
</table>

* Flare rates suggested maximum flared rate for rigid barrier systems.
1. PIN AND CONNECTORS SHALL BE ASTM-A36, REINFORCING STEEL BARS SHALL BE ASTM A 615 GRADE 60. ONE CONNECTOR PIN ASSEMBLY WITH EACH BARRIER SECTION.

**NOTES:**

- **TOP CONNECTOR**
- **BOTTOM CONNECTOR**
- **WASHER**
- **NUT**
- **BAR**
- **ASSEMBLY**
- **CONNECTOR PIN**
- **PLAIN GALVANIZED STEEL WASHER** FOR 1 1/4" PIN

**BOTTOM CONNECTOR**

- **GALVANIZE AFTER FORMING**

**NOTE:** ENTIRE CONNECTOR MAY BE GALVANIZED.

**TOP CONNECTOR**

- **GALVANIZE AFTER FABRICATION**

**CONNECTOR PIN ASSEMBLY**

- **1 1/4" DIA. STEEL Bar (ASTM A36)**
- **1 1/4" HEAVY HEX NUT**
- **1 1/4" DIA. ST. (FOR TEMPORARY USE)**
- **PLAIN GALVANIZED STEEL WASHERS**
- **THREADS BURRED AFTER ASSEMBLY**
- **TACK WELD NUT WHEN THREADED ROD IS USED**
- **1 1/4" PIN**
- **STEEL WASHER**
- **PLAIN GALVANIZED**
- **MAY BE GALVANIZED.**

**REFERENCE**

- **SPECIFICATION**
- **ROAD AND BRIDGE STANDARDS”**
- **VIRGINIA DEPARTMENT OF TRANSPORTATION**

**PRECAST TRAFFIC BARRIER SERVICE CONCRETE**

( FOR TEMPORARY USE )

2016 ROAD & BRIDGE STANDARDS
NOTE:
REINFORCING STEEL BARS SHOWN ARE BASED ON A 20' PANEL LENGTH.
ALL REINFORCING BARS ARE TO BE SIZE #4 GRADE 60 STEEL WITH A MINIMUM 1/2" CONCRETE COVER.

THE TYPICAL JOINT SPACING FOR CONSTRUCTION JOINTS IS 20' AND 80' FOR EXPANSION JOINTS FOR TYPE II AND III BARRIERS.

FOR DETAILS OF HOW JOINTS ARE TO BE FORMED & WATER STOP DETAILS SEE STD. RW-3.

TRANSVERSE JOINTS FOR TYPE I BARRIERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE ROAD AND BRIDGE SPECIFICATIONS EXCEPT NO SCORING OR SAWING WILL BE ALLOWED.

HORIZONTAL REINFORCING STEEL BARS B ARE TO BE SEPARATED AT ALL EXPANSION & CONTRACTION JOINTS. A 2" CONCRETE COVER IS REQUIRED OVER THE ENDS OF REINFORCING STEEL.

PERMISSIBLE CONSTRUCTION JOINT TO BE BONDED IN STRICT ACCORDANCE WITH SECTION 404 OF THE CURRENT VDOT ROAD AND BRIDGE SPECS.

MEASUREMENT AND PAYMENT
MEDIAN BARRIER MB-8A TYPE I, II OR III WILL BE PAID FOR AT THE CONTRACT UNIT PRICE PER LIN. FOOT, WHICH SHALL BE FULL COMPENSATION FOR FURNISHING AND INSTALLING CLASS AZ CONCRETE, REINFORCING STEEL, POROUS BACKFILL AND ALL TOOLS, LABOR, EQUIPMENT AND INCIDENTALS NECESSARY TO COMPLETE THE WORK.
ANY ADDITIONAL EXCAVATION, BACKFILL WITH SUITABLE MATERIAL AND COMPACTION WORK NECESSARY FOR THE CONCRETE MEDIAN BARRIER INSTALLATION IS TO BE CONSIDERED INCIDENTAL IN THE PRICE BID FOR THE CONCRETE MEDIAN BARRIER.

CONCRETE MEDIAN BARRIER
TYPE I, II OR III
VIRGINIA DEPARTMENT OF TRANSPORTATION

REINFORCING STEEL SCHEDULE

<table>
<thead>
<tr>
<th>PANEL</th>
<th>BARS &quot;A&quot; NO. LENGTH</th>
<th>BARS A-1 NO. LENGTH</th>
<th>BARS &quot;B&quot; NO. LENGTH</th>
<th>DOWELS NO. LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE I</td>
<td>2</td>
<td>19'-8&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE II</td>
<td>20</td>
<td>4'-0&quot;</td>
<td>9</td>
<td>19'-8&quot; 40 1'-0&quot;</td>
</tr>
<tr>
<td>TYPE III</td>
<td>20</td>
<td>4'-0&quot;</td>
<td>9</td>
<td>19'-8&quot; 40 1'-0&quot;</td>
</tr>
</tbody>
</table>
**BASIS OF PAYMENT**: CONCRETE MEDIAN BARRIER
12' TERMINAL SECTION IS TO BE MEASURED AND PAID FOR IN LIN. FT. STD. MB-7D, OR LIN. FT. OF TRAFFIC BARRIER SERVICE CONCRETE.

**NOTES:**
- CONCRETE TO BE CLASS A3.
- FOR USE WHERE THE OPERATING SPEED IS 40 M.P.H. OR LESS.
- LOCATION OF THE BARRIER END SECTIONS TO BE AS NOTED ON PLANS OR AS APPROVED BY THE ENGINEER.
- FOR POSITIVE CONNECTION DETAILS AND DIMENSIONS SEE STANDARD MB-INS.
- ONLY FOR USE OUTSIDE OF CLEAR ZONE.

* * DEPTH OF CONCRETE BASE MAY BE EXTENDED AT THE CONTRACTOR'S OPTION TO COINCIDE WITH BOTTOM OF PAVEMENT COURSE IN WHICH BASE TERMINATES; HOWEVER, THE COST OF ADDITIONAL CONCRETE SHALL BE INCLUDED IN UNIT PRICE BID PER LIN. FT. OF BARRIER.

**SECTION A-A**

CAST IN PLACE CONCRETE MEDIAN BARRIER
12 FT. TERMINAL SECTION

VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS
**PRECAST CONCRETE MEDIAN BARRIER**

**12 FT. TERMINAL SECTION**

**VIRGINIA DEPARTMENT OF TRANSPORTATION**

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**SPECIFICATION REFERENCE**

105

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**ROAD AND BRIDGE STANDARDS**

**REVISION DATE**

502.10

---

**NOTES:**

CONCRETE TO BE 4000 P.S.I.

REINFORCING STEEL TO BE GRADE 60.

ALL REINFORCING IS TO HAVE A MINIMUM CONCRETE COVER OF 1½".

FOR USE WHERE THE OPERATING SPEED IS 40 M.P.H. OR LESS.

LOCATION OF THE BARRIER END SECTIONS TO BE AS NOTED ON PLANS OR AS APPROVED BY THE ENGINEER.

FOR POSITIVE CONNECTION DETAILS AND DIMENSIONS SEE STANDARD MB-INS.

ONLY FOR USE OUTSIDE OF CLEAR ZONE.

---

**BASIS OF PAYMENT:** CONCRETE MEDIAN BARRIER 12' TERMINAL SECTION IS TO BE MEASURED AND PAID FOR IN LIN. FT. STD. MB-7D, OR LIN. FT. OF TRAFFIC BARRIER SERVICE CONCRETE.

---

**ISOMETRIC VIEW**

**ALTERNATE TOP**

**PLAN VIEW**

**ELEVATION VIEW**

1" I.D. METAL SLEEVE (REINFORCING STEEL SHALL SURROUND 1" I.D. METAL SLEEVE)

USE 3/8" x 9" EXPANSION BOLTS FOR RIGID PAVEMENT INSTALLATION ONLY (BOLTS TO BE REMOVABLE)

USE 3/8" x 3'-0" DRIFT PINS FOR FLEXIBLE PAVEMENT INSTALLATIONS.

MANUFACTURER'S REINFORCING STEEL DESIGN IS TO BE APPROVED BY ENGINEER

CONCRETE 4000 P.S.I. MIN.

4" x 4" - W4 x W4 WELDED WIRE FABRIC OR EQUIVALENT REQUIRED FOR HANDLING.
TRAFFIC BARRIER SERVICE CONCRETE PARAPET
(SINGLE FACE)
(FOR TEMPORARY INSTALLATION ON BRIDGE DECK EXTERIOR)

2016 ROAD & BRIDGE STANDARDS
DETAIL "A" NOTES:

1. BARRIER DELINEATOR TO BE SPACED IN ACCORDANCE WITH SECTION 702, OF THE ROAD AND BRIDGE SPECIFICATIONS AND THE BARRIER VERTICAL PANELS TO BE SPACED IN ACCORDANCE WITH VIRGINIA WORK AREA PROTECTION MANUAL REFLECTIVE SURFACE, IN ALL INSTANCES, TO BE FACING ONCOMING TRAFFIC.

2. CONCRETE 4000 PSI (MIN.). REINFORCING STEEL GRADE 60.

3. AFTER REMOVING TEMPORARY BARRIER, CUT ¾” Ø BOLT OR THREADED ROD AS LOW AS PRACTICAL BELOW ROADWAY SURFACE AND FILL RECESS WITH EPOXY BONDING COMPOUND EP-4 (DETAIL "A") OR REMOVE ¾” Ø BOLTS OR THREADED RODS AND FILL HOLES WITH GROUT BONDED WITH EPOXY BONDING COMPOUND EP-4 (DETAIL "A").

4. COST OF BARRIER DELINEATOR AND BARRIER VERTICAL PANELS TO BE INCLUDED IN PRICE BID PER LINEAR FOOT OF BARRIER SERVICE.

5. WHEN BARRIER IS LOCATED ON VERTICAL AND/OR HORIZONTAL CURVES, THE OPENING AT THE JOINT IS NOT TO EXCEED 1".

6. DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT.

NOTES:

1. BARRIER DELINEATOR IS TO BE SPACED IN ACCORDANCE WITH SECTION 702 OF THE ROAD AND BRIDGE SPECIFICATIONS AND THE BARRIER VERTICAL PANELS ARE TO BE SPACED IN ACCORDANCE WITH THE VIRGINIA WORK AREA PROTECTION MANUAL.

2. REFLECTIVE SURFACE IN ALL INSTANCES ARE TO BE FACING ONCOMING TRAFFIC.

3. COST OF BARRIER DELINEATOR AND BARRIER VERTICAL PANELS ARE TO BE INCLUDED IN PRICE BID PER LINEAR FOOT OF BARRIER SERVICE.

4. ANCHOR BOLTS SHALL BE INSTALLED ON TRAFFIC SIDE.

5. CONCRETE 4000 PSI (MIN.)

6. WELDED WIRE FABRIC MAY BE ONE SHEET BENT TO FIT CONFIGURATION OR TWO SEPARATE SHEETS, ONE ON EACH FACE.


8. FOR POSITIVE CONNECTION DETAILS AND DIMENSIONS SEE STANDARD MB-INS.

SPECIFICATION REFERENCE
105
512

ROAD AND BRIDGE STANDARDS
REVISION DATE 01/09
SHEET 2 OF 3
502.14
NOTES:

1. STAKING OF STANDARD MB-11A TO ASPHALT CONCRETE PAVEMENT, COMPACTED BASE MATERIAL, CONCRETE PAVEMENT, OR ASPHALT OVER CONCRETE PAVEMENT IS REQUIRED WHEN TRAFFIC BARRIER SERVICE CONCRETE IS PLACED WITHIN THE TWO (2) FOOT OFFSET OF A TRENCHING OPERATION (4' OR GREATER IN DEPTH) OR WHEN DETERMINED BY THE ENGINEER.

2. 2" MIN. FOR ASPHALT CONCRETE.

3. DRIVE STAKE HEAD BELOW FACE OF BARRIER TO PREVENT SNAGGING.

4. CONTRACTOR TO VERIFY PAVEMENT STRUCTURE PRIOR TO PLACING STAKES.

BARRIER TAPER FROM 50” TALL F-SHAPE TO A STANDARD MB-7A OR MB-7D BARRIER TO BE ACCOMPLISHED WITHIN THE 6’-0” AS INDICATED.

ST&D MB-7D F-SHAPE BARRIER

NEW JERSEY OR F-SHAPE BARRIER

TRANSITION FROM 50” TALL WALL TO 32” JERSEY OR F-SHAPE BARRIER

MB-12A ALTERNATE TOP DESIGN

IF BARRIER EXTENSION IS CONSTRUCTED AS A SEPARATE ITEM, ALL JOINTS ARE TO BE CONSTRUCTED AT THE SAME INTERVAL AS CONCRETE BARRIER. ALL VERTICAL BARS ARE #4 AT 24” MAX. SPACING. LENGTH OF DOWELS SHALL BE 20”, VERTICAL BARS MAY BE PLACED IN THE CONCRETE OR BONDED INTO DRILLED HOLES IN HARDENED CONCRETE. WHEN HOLES ARE DRILLED NON-SHRINK GROUT SHALL BE USED TO BOND THE BARS IN PLACE.

CONCRETE MEDIAN BARRIER (TALL WALL)
CONCRETE MEDIAN BARRIER (TALL WALL)

NOTES:

IF THE CONTRACTOR ELECTS TO USE THE OPTIONAL CONSTRUCTION,
TRANSVERSE JOINTS FOR CRACK CONTROL AND EXPANSION
JOINTS ARE TO BE PROVIDED IN BOTH FOOTING AND BARRIER AT
THE SAME LOCATION.

TRANSVERSE JOINTS ARE TO COINCIDE WITH JOINTS IN ADJACENT
PAVEMENT WITH A MAXIMUM SPACING OF 20 FT. C-C.

CONCRETE MEDIAN BARRIER MAY BE CAST IN PLACE OR SLIP-FORMED.

HORIZONTAL REINFORCING STEEL BARS ARE TO BE SEPARATE AT
ALL EXPANSION AND CONTRACTION JOINTS. A 2" CONCRETE COVER
IS REQUIRED OVER THE ENDS OF THE REINFORCING STEEL.

BARRIER DELINETER SIZE, COLOR AND SPACING SHALL BE IN
ACCORDANCE WITH THE SPECIFICATIONS. COST OF DELINETER SHALL
BE INCLUDED IN THE PRICE BID FOR MEDIAN BARRIER. REFLECTIVE
SURFACE OF BARRIER DELINETER, IN ALL INSTANCES, SHALL BE FACING
THE ONCOMING TRAFFIC.

CONCRETE SHALL BE CLASS A3 IF CAST IN PLACE, 4000 PSF PRECAST.

DEPTH OF CONCRETE BASE MAY BE EXTENDED AT THE CONTRACTOR'S
OPTION TO COINCIDE WITH BOTTOM OF PAVEMENT COURSE IN WHICH
BASE TERMINATES; HOWEVER, THE COST OF ADDITIONAL CONCRETE
SHALL BE INCLUDED IN UNIT PRICE BID PER LINEAR FT. OF BARRIER.
CONCRETE MEDIAN BARRIER

TYPE I, II, OR III

VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS

BENDING DIAGRAM

MEDIAN BARRIER MB-13 TYPE I, II, OR III

WILL BE PAID FOR AT THE CONTRACT UNIT PRICE PER LIN. FOOT, WHICH SHALL BE FULL COMPENSATION FOR FURNISHING AND INSTALLING CLASS A CONCRETE, REINFORCING STEEL, POROUS BACKFILL AND ALL TOOLS, LABOR, EQUIPMENT AND INCIDENTALS NECESSARY TO COMPLETE THE WORK. ANY ADDITIONAL EXCAVATION, BACKFILL WITH SUITABLE MATERIAL AND COMPACTION WORK NECESSARY FOR THE CONCRETE MEDIAN BARRIER INSTALLATION IS TO BE CONSIDERED INCIDENTAL IN THE PRICE BID FOR THE CONCRETE MEDIAN BARRIER.

REINFORCING STEEL SCHEDULE

<table>
<thead>
<tr>
<th>PANEL</th>
<th>NO. LENGTH</th>
<th>NO. LENGTH</th>
<th>NO. LENGTH</th>
<th>NO. LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE I</td>
<td>2</td>
<td>19' - 8&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE II</td>
<td>20</td>
<td>5' - 10 1/4&quot;</td>
<td>20</td>
<td>5' - 6&quot;</td>
</tr>
<tr>
<td>TYPE III</td>
<td>20</td>
<td>5' - 10 1/4&quot;</td>
<td>20</td>
<td>5' - 6&quot;</td>
</tr>
</tbody>
</table>

© PERMISSIBLE CONSTRUCTION JOINT TO BE BONDED IN STRICT ACCORDANCE WITH SEC. 404 OF THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS.
**NOTE:**

REINFORCING STEEL BARS SHOWN ARE BASED ON A 20' PANEL LENGTH.

ALL REINFORCING BARS ARE TO BE SIZE #4 GRADE 60 STEEL WITH A MINIMUM 1 1/2" CONCRETE COVER.

THE TYPICAL JOINT SPACING FOR CONSTRUCTION JOINTS IS 20' AND 80' FOR EXPANSION JOINTS FOR TYPE I AND II BARRIERS.

FOR DETAILS OF HOW JOINTS ARE TO BE FORMED & WATER STOPS SEE STD. RW-3.

TRANSVERSE JOINTS FOR TYPE I BARRIERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE ROAD AND BRIDGE SPECIFICATIONS EXCEPT NO SCORING OR SAWING WILL BE ALLOWED.

HORIZONTAL REINFORCING STEEL BARS B ARE TO BE SEPARATED AT ALL EXPANSION & CONTRACTION JOINTS. A 2" CONCRETE COVER IS REQUIRED OVER THE ENDS OF REINFORCING STEEL.

① TRANSITIONED TO BE PAID FOR AS MEDIAN BARRIER MB-13 TYPE II OR III.

② MAXIMUM FLARE RATE FOR RIGID BARRIER SYSTEMS.

**CONCRETE MEDIAN BARRIER**

**TYPE I, II OR III**

**FLARE RATES**

<table>
<thead>
<tr>
<th>MPH</th>
<th>SHY LINE LS</th>
<th>FLARE RATE</th>
<th>BEYOND SHY LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>10'</td>
<td>30 : 1</td>
<td>20 : 1</td>
</tr>
<tr>
<td>60</td>
<td>8'</td>
<td>26 : 1</td>
<td>18 : 1</td>
</tr>
<tr>
<td>50</td>
<td>6.5'</td>
<td>21 : 1</td>
<td>14 : 1</td>
</tr>
<tr>
<td>40</td>
<td>5'</td>
<td>16 : 1</td>
<td>10 : 1</td>
</tr>
<tr>
<td>30</td>
<td>3.5'</td>
<td>13 : 1</td>
<td>8 : 1</td>
</tr>
</tbody>
</table>
NOTES:

1. BASIS OF PAYMENT:
   TRAFFIC BARRIER SERVICE LATERAL SUPPORT
   WILL BE MEASURED AND PAID FOR IN UNITS OF
   EACH COMPLETE IN PLACE AND SHALL INCLUDE
   FURNISHING AND PLACING PRECAST CONCRETE
   BARRIERS (TBS CONCRETE) AND MAINTENANCE,
   REMOVAL WHEN NO LONGER NECESSARY, AND
   ALL MATERIALS, LABOR, TOOLS, EQUIPMENT,
   AND INCIDENTALS NEEDED TO COMPLETE
   THE WORK.

2. FOR POSITIVE CONNECTION DETAILS AND
   DIMENSIONS SEE STANDARD MB-7D PC.

3. FOR DIMENSIONS NOT SHOWN, REFER TO STD.
   MB-7D PC AND MB-10A.
NOTES:

1. BASIS OF PAYMENT:
   TRAFFIC BARRIER SERVICE LATERAL SUPPORT
   WILL BE MEASURED AND PAID FOR IN UNITS OF
   EACH COMPLETE IN PLACE AND SHALL INCLUDE
   FURNISHING AND PLACING PRECAST
   CONCRETE BARRIERS (TBSC CONCRETE) AND SAND
   BAGS, MAINTENANCE, REMOVAL WHEN NO LONGER
   NECESSARY, AND ALL MATERIALS, LABOR, TOOLS,
   EQUIPMENTS, AND INCIDENTALS NECESSARY TO
   COMPLETE THE WORK.

2. FOR POSITIVE CONNECTION DETAILS AND
   DIMENSIONS SEE STANDARD MB-7D PC.

3. FOR DIMENSIONS NOT SHOWN, REFER TO ST'D.
   MB-7D PC AND MB-10A.
GENERAL NOTES - FENCING

FARM FENCE

BARBED WIRE
BARBED WIRE IS TO CONFORM TO ONE OF THE TYPES ALLOWED BY THE SPECIFICATIONS.
UNLESS OTHERWISE NOTED ON PLANS FOUR STRANDS WILL BE PROVIDED.
SPACING OF STRANDS SHOWN IS SUGGESTED ONLY. ANY OTHER SPACING APPROVED BY THE ENGINEER MAY BE USED.

WOOD POSTS
WOOD POSTS TO BE SQUARE CUT OR ROUND TO THE DIMENSIONS SHOWN ON THE DRAWINGS.
POSTS TOPS MAY BE FLAT OR CUT AT A 30° ANGLE.
FOR WOVEN WIRE FABRIC, STAPLES ARE TO BE USED AT TOP AND BOTTOM STRANDS AND AT A MINIMUM OF THREE INTERMEDIATE STRANDS PER POST.
ONE STAPLE PER STRAND IS TO BE USED FOR BARBED WIRE FENCE.
WHERE GATE, CORNER, OR BRACE POSTS FALL IN ROCK OR MARSHY AREAS THEY SHALL BE SET IN CLASS A3 OR C1 CONCRETE.

METAL POSTS
METAL POSTS ARE TO BE ONE OF THE TYPES SHOWN ON THE STANDARD DRAWINGS AND CONFORMING TO THE SPECIFICATIONS.
AT EACH CORNER AND STRETCHER POST WIRE FABRIC IS TO BE CUT AND ALL HORIZONTAL STRANDS SECURELY WRAPPED AROUND POST.
BRACES ON CORNER, STRETCHER AND END POSTS ARE TO BE SECURED 1'-0" FROM TOP OF POST WITH 1/2" BOLTS.
IN LIEU OF SETTING POSTS IN CONCRETE, MANUFACTURER'S ANCHORING DEVICES MEETING THE SPECIFICATION REQUIREMENTS MAY BE USED WHEN APPROVED BY THE ENGINEER.

BRACES
MAXIMUM SPACING BETWEEN BRACES TO BE 500'.
CORNER BRACES TO BE PROVIDED WHERE CORNER ANGLE IS 15° OR OVER.
LINE BRACES TO BE PROVIDED WHERE VERTICAL ALIGNMENT CHANGES 15° OR MORE AND WHERE SPACING REACHES 500'.

MISCELLANEOUS
FENCE IS TO BE LOCATED AS SHOWN ON THE PLANS OR DIRECTED BY THE ENGINEER.
The side of the post to which fabric is to be attached will be determined by the engineer.
FENCE TO BE GROUNDED IN ACCORDANCE WITH DETAIL SHOWN ON STANDARD FE-6 WHERE REQUIRED.
UNLESS SPECIFIED ON PLANS, THE CONTRACTOR WILL HAVE THE OPTION OF FURNISHING EITHER METAL OR WOOD POSTS. POSTS TYPES ARE NOT TO BE INTERMIXED ON ANY ONE INSTALLATION.

CHAIN LINK FENCE

WIRE FABRIC
 WIRE FABRIC SHALL HAVE A 2" MESH.

MISCELLANEOUS
IN LIEU OF SETTING POSTS IN CONCRETE, MANUFACTURER'S ANCHORING DEVICES MEETING THE SPECIFICATION REQUIREMENTS MAY BE USED WHEN APPROVED BY THE ENGINEER.
FOR GATES EXCEEDING 6'-0" IN WIDTH ROLLED FORMED STEEL POST WILL NOT BE ALLOWED.
CHAIN LINK FENCE TO BE GROUNDED IN ACCORDANCE WITH DETAILS SHOWN ON STANDARD FE-6, WHERE REQUIRED.
STANDARD FENCE

METAL POST

CORNER BRACE

LINE BRACE

LINE BRACE AT END LOCATION

NOTES:

SEE GENERAL NOTES - FENCING FOR ADDITIONAL DETAILS AND INSTRUCTIONS.

LINE POSTS ARE TO BE OF THE TYPES SHOWN OR EQUIVALENT MEETING THE APPROVAL OF THE ENGINEER.

ALL POSTS ARE TO HAVE A MINIMUM WEIGHT OF 1.25 LBS./FT.

A MINIMUM OF FIVE CLAMPS FOR ATTACHING FABRIC TO POST ARE TO BE INCLUDED IN COST OF EACH LINE POST.

METAL LINE POST

CONCRETE FOOTING

FLANGED FLANGE

TYPE "U" TYPE "T"

ALTERNATE ANCHOR DEVICES

METHOD OF ATTACHING ANGLE BRACES TO STRETCHER POSTS

WOVEN WIRE FABRIC

Virginia Department of Transportation

2016 Road & Bridge Standards

Sheet 1 of 1

Revision Date

503.02

7/13

2016 Road & Bridge Standards

Specification

Reference

242

507

236
## 2016 ROAD & BRIDGE STANDARDS

### Corner Brace
- **Wood Post**
  - 3/4" x 4" galvanized steel dowel (all ends)
  - Min. 4" brace
  - 6" x 6" corner post
  - 6" x 6" ground line
  - 6" x 6" pay line (exclusive of fabric)
- **Metal Post**
  - 2 1/2" x 2 1/2" x 4" post with 2 1/2" O.D. post @ 3.65±.5 lbs./ft.
  - With 1 3/4" O.D. braces @ 2.27±.5 lbs./ft.
  - Line posts are to be of the types shown or equivalent meeting the approval of the engineer.
  - All posts are to have a minimum weight of 1.25 lbs./ft.
  - A minimum of five clamps for attaching fabric to post are to be included in cost of each line post.

### Line Brace
- **Diagonal 4" brace to be placed in direction of pull.**
  - Post to be notched for diagonal 4" braces. All diagonal 4" braces to have two galvanized 12d nails at each end.
- **Wire**
  - 1/4" x 4" galvanized steel dowels
  - Min. 4" brace
  - 6" x 6" ground line
  - 6" x 6" pay line (exclusive of fabric)

### Line Brace at End Location
- **4 point barbed wire**
  - 4" x 4" ground line
  - 6" x 6" pay line (exclusive of fabric)
- **Line post**
  - (Typical spacing between all line posts)
- **12" x 12" x 12" concrete block**
  - (Typical spacing between all line posts)

### Notes:
- See general notes fencing for additional details and instructions.

### Method of Attaching Angle Braces to Stretcher Posts
- L2x2x4/8 to be cut to fit around L2x2x2x4/8 stretcher post.
- L2x2x2x4/8 bracket bolted to stretcher post.

### Alternate Anchor Devices
- For use in lieu of setting posts in concrete. Devices shown are representational only. See general notes.
GROUND LINE

CONCRETE FOOTING

LINE POST

TYPICAL SPACING BETWEEN ALL LINE POSTS.

#9 GAUGE WIRE TIES OR CLIPS TO BE USED TO ATTACH FABRIC TO POST. (6 PER POST)

GROUND LINE

LINE POST

LINE POST

CONCRETE FOOTING

3/4" MIN. TRUSS ROD WITH TRUSS ROD TIGHTENER END/CORNER POST

1/2" MIN. TRUSS ROD WITH TRUSS ROD TIGHTENER END/CORNER POST

1" MIN. O.D. GATE POST

1" MIN. O.D. GATE POST

3/4" MIN. ROUND ROD

1/2" MIN. ROUND ROD

GROUND LINE

CONCRETE FOOTING

500'

TOP AND BOTTOM SELVAGE TO BE BARBED.

TENSION WIRE #7 GAUGE GALVANIZED COIL SPRING WIRE STRETCHED TAUT

#11 GAUGE X 1" BEVELED GALVANIZED STEEL BAND WITH BOLT & NUT.

END/CORNER POST

NOTES:

SEE GENERAL NOTES-FENCING FOR ADDITIONAL DETAILS AND INSTRUCTIONS.

A MOISTURE-EXCLUDING CAP IS REQUIRED ON TUBULAR POSTS.

MATERIAL FOR CAP SHALL CONFORM TO THE ALLOWABLE TYPES FOR OTHER LISTED FITTINGS.

CORNER BRACE - TO BE USED WHEN HORIZONTAL ALIGNMENT CHANGES 15° OR MORE.

LINE BRACE - TO BE USED WHEN VERTICAL ALIGNMENT CHANGES 15° OR MORE.

END/CORNER POSTS SHALL BE USED WITH ALL LINE AND CORNER BRACES.

BRACES SHALL BE INSTALLED HALF THE HEIGHT ABOVE THE GROUND LINE OF THE POST WHEN A TOP RAIL IS USED, OR TWO THIRDS THE HEIGHT ABOVE THE GROUND LINE WHEN A TENSION WIRE IS USED IN LIEU OF A TOP RAIL.

CHAIN LINK FENCE GREATER THAN 6 FEET IN HEIGHT SHALL BE SUBMITTED TO THE STANDARDS & SPECIAL DESIGN SECTION FOR APPROVAL.

STANDARD FENCE

CHAIN LINK

VIRGINIA DEPARTMENT OF TRANSPORTATION

ROAD AND BRIDGE STANDARDS

SHEET 1 OF 1

REVISION DATE 7/11

SPECIFICATION REFERENCE 242 507

2016 ROAD & BRIDGE STANDARDS
METAL GATE - METAL POSTS - WOVEN WIRE

WOOD GATE - WOOD POSTS - WOVEN WIRE

WOOD GATE

BRACES ARE TO BE BOLTED AT EXTREMITIES AND INTERSECTIONS WITH A MIN. OF (2) 5/8" DIA. GALV. BOLTS, NUTS, AND WASHERS. ALL OTHER POINTS OF CONTACT ARE TO BE NAILED FROM BOTH SIDES WITH A MIN. OF 3-10D GALV. NAILS.

LUMBER FOR GATE IS TO BE ANY DRESSED, TRUE TYPE MEETING THE APPROVAL OF THE ENGINEER IT IS TO BE TREATED WITH PRESERVATIVES OTHER THAN CRESOTINE.

WOOD GATE IS TO HAVE TWO COATS OF EXTERIOR WHITE PAINT UNLESS OTHERWISE DIRECTED BY THE ENGINEER. PAINT IS TO MEET THE REQUIREMENTS OF THE CURRENT ROAD AND BRIDGE SPECIFICATIONS.

METAL GATE

GATE FRAME AND CENTER BRACE TO BE TO THE DIMENSIONS SHOWN ON THE DRAWING EXCEPT THAT A 3" WIDTH GATE CAN HAVE A MIN. 1" FRAME WITH NO CENTER BRACE.

GATE IS TO BE HOT DIPPED GALVANIZED OR ELECTROPLATE GALVANIZED IN ACCORDANCE WITH ASTM A-164 TYPE GS.

GATE FABRIC IS TO BE ALL #11 GAUGE EXCEPT TOP AND BOTTOM STRANDS WHICH ARE TO BE #9 VERTICAL STRANDS ARE TO BE SPACED 6" APART.

MISCELLANEOUS

IF LOCATIONS OF GATES ARE NOT SPECIFIED ON PLANS, THEY ARE TO BE ERECTED AT THE SITES DESIGNATED BY THE ENGINEER.

GATE HINGE AND LATCH ASSEMBLIES MAY BE OF ANY TYPE MEETING THE APPROVAL OF THE ENGINEER, EXCEPT THAT ALL HINGES ARE TO BE OF A BOLT-THROUGH TYPE. ALL FITTINGS ARE TO BE HOT DIPPED GALVANIZED.

ANY COMBINATION OF GATE AND FENCE TYPES MEETING THE APPROVAL OF THE ENGINEER WILL BE ACCEPTABLE AND IS NOT LIMITED TO THE EXAMPLES SHOWN HEREON.

WHERE WOOD GATES POSTS FALL IN ROCK OR Marshy AREAS THEY ARE TO BE SET IN CLASS A3 OR C1 CONCRETE.

STANDARD FENCE GATES

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE
242
507
236

ROAD AND BRIDGE STANDARDS

REVISION DATE
503.05

SHEET 1 OF 1

2016 ROAD & BRIDGE STANDARDS
WATER GATES IN FENCE LINES

NOTES:
- WATER GATES MAY BE USED WITH STANDARD FE-W1, FE-W2 OR FE-B FENCE.
- GATE IS TO BE FABRICATED TO CONFORM TO INDIVIDUAL CHANNEL REQUIREMENTS.
- WOOD FILLER BOARDS TO BE 1" TREATED PINE BOLTED TO FRAME. SMOOTH WOOD FRAME IS TO FACE UPSTREAM.
- TYPE I GATE IS TO HAVE TWO 8" END POSTS AS SPECIFIED FOR THE TYPE OF FENCE USED. THE ADJACENT TO END POST AND BRACING MAY BE ELIMINATED.
- TYPE II GATE IS TO HAVE TWO 8" END POSTS, ADJACENT TO END POSTS, BRACING, ETC. AS SPECIFIED FOR THE TYPE OF FENCE USED.
NOTES:
APPROXIMATE MATERIALS PER INSTALLATION:
1-3/4" DIAMETER BY 10'-0" LONG COPPER CLAD GROUNDING ELECTRODE.
1 GROUNDING ELECTRODE CLAMP
1/2"-0" 6 AWG SOLID COPPER CONDUCTOR
3* COMPRESSION CONNECTORS (SUITE FOR COPPER AND ALUMINUM)

MINIMUM 3 CONNECTORS FOR 47" FENCE FABRIC TO 
BE SECURED TO TOP, BOTTOM AND ONE INTERMEDIATE 
HORIZONTAL WIRE STRAND. ONE ADDITIONAL CONNECTOR 
TO BE FURNISHED FOR EACH STRAND OF BARBED WIRE.

ON BARBED WIRE INSTALLATIONS, ONE CONNECTOR IS TO 
BE FURNISHED FOR EACH STRAND.

GROUNDING CONDUCTOR IS TO BE IN CONTACT WITH HORIZONTAL 
WIRE OF FENCE BY COMPRESSION CONNECTORS AS 
SHOWN.

GROUNDING ELECTRODE TO BE LOCATED ON POST SIDE OF FENCE
AND AS CLOSE AS POSSIBLE TO POST AND FENCE.

UNLESS OTHERWISE CALLED FOR IN THE PLANS OR DIRECTED BY THE 
ENGINEER, FENCE GROUNDING WILL BE REQUIRED FOR 
METAL FENCES INCLUDING PLASTIC COATED FENCE FABRIC
AT THE FOLLOWING LOCATIONS.

*WHEN HIGH VOLTAGE LINES CROSS 
ABOVE THE FENCE. GROUNDING SYSTEMS SHALL BE INSTALLED 50' 
BEYOND THE OVERHEAD CROSSING POINT OF THE OUTER 
MOST CONDUCTORS OF THE HIGH VOLTAGE LINES.

*WHEN THE HIGH VOLTAGE LINES 
ARE PARALLEL TO AND WITHIN 50' HORIZONTALLY OF THE 
FENCE. GROUNDING SYSTEMS SHALL BE INSTALLED AT 50' 
INTERVALS ALONG THE PARALLEL SECTIONS OF FENCE 
AND HIGH VOLTAGE LINES.

COST FOR FURNISHING AND PLACING ALL GROUNDING MATERIALS 
IS TO BE INCLUDED IN PRICE BID PER LINEAR FOOT OF FENCE.

DETAILS SHOWN HEREIN ARE TO APPLY TO ALL METAL FENCES AND 
HANDRAILS. FENCES WILL BE GROUNDED ONLY WHEN INDICATED ON THE 
PLANS OR AS RECOMMENDED BY THE ENGINEER.

DETAIL FOR GROUNDING STEEL POST OF CHAIN LINK FENCE & HANDRAIL (HR-1)

CAST BRONZE 
PLAIN FINISH

RAILING POST

3/4" DIA. CADMIUM PLATED 
PLUS GOLD CHROMATED STEEL U-BOLT AND NUT.

COPPER GROUNDING 
CONDUCTOR

DRILL & TAP 
COPPER BOLT

COPPER LUG

ALTERNATE

FOR EACH GROUNDING CONDUCTOR/ELECTRODE: 
ONE CLAMP CONNECTION AT POST BASE AND 
TWO COMPRESSION CONNECTORS ON THE CHAIN 
LINK AT MIDDLE AND TOP.

GROUNDING ELECTRODE CLAMP

COMPRESSIVE TYPE CONNECTOR

GROUNDING CONDUCTOR

#6 AWG 
COPPER WIRES

COPPER GROUNDING 
CONDUCTOR

FOR CHAIN LINK 
FENCE GROUNDING, SEE DETAIL, BELOW.

ELEVATION

GROUND ELECTRODE 
IDEAL CONTACT WITH SOIL

GROUND ELECTRODE 
IDEAL CONTACT WITH SOIL

ELEVATION

6'±

6'±
CENTER OF BACK OF MONUMENT TO BE
CORRECT FOR STATION AND ALIGNMENT.

REINFORCEMENT TO BE #3
STEEL RODS, SECURELY HELD
IN CASES BY SPOT WELDED
W 9 WIRES ATTACHED TO
ALL BARS APPROXIMATELY 8"
FROM EACH END TO INSURE
PROPER PLACING.

MINIMUM CLEARANCE 1"
GROUND LINE

GUARD
STAKE

HUB TO BE ACCURATELY
SET BY SURVEY PARTY.

BEFORE HUB IS DISTURBED IN SETTING MONUMENTS
FOUR LINER STAKES ARE TO BE SET, SO THAT TWO LINES
STRETCHED BETWEEN STAKES WILL INTERSECT EXACTLY
OVER TACK IN HUB TOPS OF STAKES TO BE MORE
THAN 9" ABOVE GROUND AT MONUMENT.

NOTES:
The letters "VDOT" are to be
indented in the top of each
right-of-way monument.
In entrances and yards
where the monuments would
be unsightly, they may be
set with the top flush with
the ground.

ALTERNATE METHODS OF
PLACING WIRES

Wires on all 4 sides
welded to all 4 bars.

Wires on 3 sides
welded to all 4 bars.

ALL LETTERING TO BE 1/2" STANDARD FOUNDRY LETTERS.

RIGHT-OF-WAY MONUMENTS

NOTES:
RIGHT-OF-WAY MONUMENTS ARE TO PLACED AT ALL P.C.'S AND
P.T.'S AND AT INTERVALS ON TANGENTS SO AS TO BE VISIBLE
FROM EACH, BUT NOT MORE THAN 2500' APART, AND AT ALL
BREAKS IN THE RIGHT-OF-WAY LINES. IN THE CASE OF SLOPES
ACQUIRED AS EASEMENT, THE MONUMENTS ARE TO BE SET ON
NORMAL RIGHT-OF-WAY LINES.
RIGHT-OF-WAY MONUMENTS ARE TO BE SET PLUMB.
CAP TO BE SET FLUSH WITH GROUND LINE

STEEL PIN OR REINFORCING BAR

NOTE:
LOCATOR POST TO BE U-TYPE ROLLED RAIL STEEL @ 2 LBS./FT. OR ALUMINUM ALLOY 6063-T6 @ 0.78 LBS./FT. IN ACCORDANCE WITH THE SPECIFICATIONS.

STANDARD PLAN AND METHOD OF SETTING RIGHT-OF-WAY MONUMENTS

RIGHT-OF-WAY MONUMENTS ARE TO BE PLACED AT ALL P.C.'S AND P.T.'S AND AT INTERVALS ON TANGENTS SO AS TO BE VISIBLE FROM EACH, BUT NOT MORE THAN 2500' APART, AND AT ALL BREAKS IN THE RIGHT-OF-WAY LINES. IN THE CASE OF SLOPES ACQUIRED AS EASEMENT, THE MONUMENTS ARE TO BE SET ON NORMAL RIGHT-OF-WAY LINES.

RIGHT-OF-WAY MONUMENTS ARE TO BE SET PLUMB.

NOTES:
LOCATOR POST AND PIN TO BE SET BY THE SURVEY PARTY AT THE TIME OF ORIGINAL STAKING.

PIN TO BE ACCURATELY SET BY SURVEY PARTY AND CAP PUNCHED TO INDICATE R/W LINE.

LANDOWNER SIDE

R/W LINE HIGHWAY SIDE

NOTES:
METAL CAP IS TO BE CADMIUM PLATED BRASS OR STAINLESS STEEL, SECURED WITH ROUND HEAD DRIVE SCREW #4 X 1/2" TYPE U. 1-1/8" DIAMETER

PLASTIC CAP IS TO BE HIGH VISIBILITY ORANGE WITH STAMPED, BLACK LETTERS. 1-1/4" DIAMETER

CAPS TO BE FURNISHED BY VDOT

METAL CAP DETAIL

LOCATOR POST IS TO BE ELIMINATED IN URBAN AREAS.

RIGHT-OF-WAY MONUMENTS

2016 ROAD & BRIDGE STANDARDS

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

219
503

ROAD AND BRIDGE STANDARDS

REVISION DATE SHEET 1 OF 1

504.02

2016 ROAD & BRIDGE STANDARDS
1. Design shown is representational only. See manufacturer's drawings for components and installation instructions.

2. Impact attenuator shall be selected from VDOT's provisionally approved MASH list. All units must have successfully passed the MASH 2016 TL-3 testing criteria and deemed reimbursable by FHWA.

3. All steel hardware components shall be galvanized.

4. Impact attenuator manufacturer must furnish details for required anchoring system for dimensions of unit and concrete foundation see manufacturer's drawings and specifications.

5. Cross slope of the pad shall not exceed a 8% (12:1) slope.

6. Any location where there is reverse direction traffic, a transition panel shall be supplied by the manufacturer and installed in accordance with the manufacturer's drawings and specifications.

7. Due to the varying lengths of proprietary impact attenuators, the designer should allow 30' for the length of the attenuator.

8. Fluorescent prismatic lens yellow sheeting shall be used on the reflective markers. All reflective sheeting is to be in accordance with section 701 of the road and bridge specifications. Stripes shall slope down toward the side of the obstruction on which traffic is to pass.

   - Color:
     - Field - yellow (reflectorized)
     - Message - black stripes (non-reflectorized)

9. Paint chevron stripes and install reflective markers on pavement at the front of the unit for maximum visibility.

10. Measurement and payment:
    - Type 1 impact attenuator will be measured in units of each complete-in-place.
    - Payment shall be full compensation for furnishing and installing impact attenuator, reflectorized marker, Portland concrete foundation, required backup, transition panel, and all materials, labor, excavation, tools, equipment and any incidentals necessary to complete the work.

A reinforced concrete foundation is required. Design details are to be furnished by the impact attenuator manufacturer. Minimum compressive strength of concrete shall be 4000 PSI.
A PLAN VIEW

TRAFFIC

VIRGINIA DEPARTMENT OF TRANSPORTATION

IMPACT ATTENUATOR

TRAFFIC

PLAN VIEW

(BI-DIRECTIONAL)

THE MINIMUM DISTANCE SHOWN IS A MINIMUM CLEAR SPACE REQUIRED FOR THE
PROPER OPERATION OF THE IMPACT ATTENUATOR. STANDARD SHOULDER WIDTHS
SHOULD BE DESIGNED AND MAINTAINED IN ACCORDANCE WITH CURRENT VDOT
POLICY.

4' MIN.

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

PLAN VIEW

(UNI-DIRECTIONAL)

SUB-BASE TO BE
COMPACTED UNDER
CONC. FOUNDATION

SECTION A-A

3' MIN.

SECTION B-B

3' MIN.

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE 4' MIN.

3' MIN.

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE 4' MIN.
The minimum distance shown is a minimum clear space required for the proper operation of the impact attenuator. Standard shoulder widths should be designed and maintained in accordance with current VDOT policy.

Normal slope hinge point

Edge of traveled way

Slope hinge point

50' min. clear of curbing and fixed objects

3' min. 5' min.

3:1 max.

12:1 max.

25' minimum for grading

SITE PREPARATION REQUIREMENTS FOR IMPACT ATTENUATOR ON A SHOULDER

IMPAKT ATTENUATOR

TYPE 1 RE-DIRECTIVE PERMANENT INSTALLATION (TL-3 > 40 MPH)

VIRGINIA DEPARTMENT OF TRANSPORTATION

MASH 2016
NOTES
1. DESIGN SHOWN IS REPRESENTATIONAL ONLY. SEE MANUFACTURER'S DRAWINGS FOR COMPONENTS AND INSTALLATION INSTRUCTIONS.

2. IMPACT ATTENUATOR SHALL BE SELECTED FROM VDOT'S PROVISIONALLY APPROVED MASH LIST. ALL UNITS MUST HAVE SUCCESSFULLY PASSED THE MASH 2016 TL-2 TESTING CRITERIA AND DEEMED REIMBURSABLE BY FHWA.

3. ALL STEEL HARDWARE COMPONENTS SHALL BE GALVANIZED.

4. IMPACT ATTENUATOR MANUFACTURER MUST FURNISH DETAILS FOR REQUIRED ANCHORING SYSTEM. FOR DIMENSIONS OF UNIT AND CONCRETE FOUNDATION SEE MANUFACTURER'S DRAWINGS AND SPECIFICATIONS.

5. CROSS SLOPE OF THE PAD SHALL NOT EXCEED A 8% (12:1) SLOPE.

6. ANY LOCATION WHERE THERE IS REVERSE DIRECTION TRAFFIC, A TRANSITION PANEL SHALL BE SUPPLIED BY THE MANUFACTURER AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S DRAWINGS AND SPECIFICATIONS.

7. DUE TO THE VARYING LENGTHS OF PROPRIETARY IMPACT ATTENUATORS, THE DESIGNER SHOULD ALLOW 15' FOR THE LENGTH OF THE ATTENUATOR.

8. FLUORESCENT PRISOMATIC LENS YELLOW SHEETING SHALL BE USED ON THE REFLECTIVE MARKERS. ALL REFLECTIVE SHEETING IS TO BE IN ACCORDANCE WITH SECTION 701 OF THE ROAD AND BRIDGE SPECIFICATIONS. STRIPES SHALL SLOPE DOWN TOWARD THE SIDE OF THE OBSTRUCTION ON WHICH TRAFFIC IS TO PASS.

COLOR:
FIELD - YELLOW (REFLECTORIZED)
MESSAGE - BLACK STRIPES (NON-REFLECTORIZED)

9. PAINT CHEVRON STRIPES AND INSTALL REFLECTIVE MARKERS ON PAVEMENT AT THE FRONT OF THE UNIT FOR MAXIMUM VISIBILITY.

10. MEASUREMENT AND PAYMENT:
TYPE 1 IMPACT ATTENUATOR WILL BE MEASURED IN UNITS OF EACH COMPLETE-IN-PLACE.
PAYMENT SHALL BE FULL COMPENSATION FOR FURNISHING AND INSTALLING IMPACT ATTENUATOR, REFLECTORIZED MARKER, PORTLAND CONCRETE FOUNDATION, REQUIRED BACKUP, TRANSITION PANEL, AND ALL MATERIALS, LABOR, EXCAVATION, TOOLS, EQUIPMENT AND ANY INCIDENTALS NECESSARY TO COMPLETE THE WORK.

11. SEE PAGE 505.03 FOR SITE PREPARATION REQUIREMENTS WHEN IMPACT ATTENUATOR IS INSTALLED ON A SHOULDER.

FINISHED GRADE
2'-8 3/4" MIN.

A REINFORCED CONCRETE FOUNDATION IS REQUIRED. DESIGN DETAILS ARE TO BE FURNISHED BY THE IMPACT ATTENUATOR MANUFACTURER. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 4000 PSI.

ELEVATION VIEW

ITEM CODE 13606 STD. IA-2 IMPACT ATTEN. (TL-2, < 40 MPH DES.SP.) EACH

IMPACT ATTENUATOR
TYPE 1 RE-DIRECTIVE PERMANENT INSTALLATION ( TL-2 < 40 MPH )
VIRGINIA DEPARTMENT OF TRANSPORTATION
MASH 2016
The minimum distance shown is a minimum clear space required for the proper operation of the impact attenuator. Standard shoulder widths should be designed and maintained in accordance with current VDOT policy.

A copy of the original sealed and signed standard drawing is on file in the central office.
NOTES

1. DESIGN SHOWN IS REPRESENTATIONAL ONLY, SEE MANUFACTURER’S DRAWINGS FOR COMPONENTS AND INSTALLATION INSTRUCTIONS.
2. IMPACT ATTENUATOR SHALL BE SELECTED FROM VDOT’S PROVISIONALLY APPROVED MASH LIST FOR TYPE 1 RE-DIRECTIVE LOW MAINTENANCE CATEGORY. ALL UNITS MUST HAVE SUCCESSFULLY PASSED MASH 2016 TL-3 TESTING CRITERIA AND BEEN ACCEPTED BY FHWA.
3. ALL STEEL HARDWARE COMPONENTS SHALL BE GALVANIZED.
4. IMPACT ATTENUATOR MANUFACTURER MUST FURNISH DETAILS FOR REQUIRED ANCHORING SYSTEM FOR DIMENSIONS OF UNIT AND CONCRETE FOUNDATION SEE MANUFACTURER’S DRAWINGS AND SPECIFICATIONS.
5. CROSS SLOPE OF THE PAD SHALL NOT EXCEED A 8% (12:1) SLOPE.
6. ANY LOCATION WHERE THERE IS REVERSE DIRECTION TRAFFIC A TRANSITION PANEL SHALL BE SUPPLIED BY THE MANUFACTURER AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS DRAWINGS AND SPECIFICATIONS.
7. DUE TO THE VARYING LENGTHS OF PROPRIETARY IMPACT ATTENUATORS THE DESIGNER SHOULD ALLOW 30’ FOR THE LENGTH OF THE ATTENUATOR.
8. FLUORESCENT PRISMATIC LENS YELLOW SHEETING SHALL BE USED ON THE REFLECTIVE MARKERS. ALL REFLECTIVE SHEETING IS TO BE IN ACCORDANCE WITH SECTION 701 OF THE ROAD AND BRIDGE SPECIFICATIONS. STRIPES SHALL SLOPE DOWN TOWARD THE SIDE OF THE OBSTRUCTION ON WHICH TRAFFIC IS TO PASS.

COLOR:
FIELD - YELLOW (REFLECTORIZED)
MESSAGE - BLACK STRIPES (NON-REFLECTORIZED)
9. PAINT CHEVRON STRIPES AND INSTALL REFLECTIVE MARKERS ON PAVEMENT AT THE FRONT OF THE UNIT FOR MAXIMUM VISIBILITY.
10. MEASUREMENT AND PAYMENT:
LOW MAINTENANCE TYPE 1 IMPACT ATTENUATOR WILL BE MEASURED IN UNITS OF EACH COMPLETE-IN-PLACE. PAYMENT SHALL BE FULL COMPENSATION FOR FURNISHING AND INSTALLING IMPACT ATTENUATOR, REFLECTORIZED MARKER, PORTLAND CONCRETE FOUNDATION, REINFORCING STEEL, REQUIRED BACKUP, TRANSITION PANEL, AND ALL MATERIALS, LABOR, EXCAVATION, TOOLS, EQUIPMENT AND ANY INCIDENTALS NEEDED TO COMPLETE THE WORK.
11. SEE PAGE 505.03 FOR SITE PREPARATION REQUIREMENTS WHEN IMPACT ATTENUATOR IS INSTALLED ON A SHOULD.

A REINFORCED CONCRETE FOUNDATION IS REQUIRED, DESIGN DETAILS ARE TO BE FURNISHED BY THE IMPACT ATTENUATOR MANUFACTURER. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 4000 PSI.

ELEVATION VIEW

FINISHED GRADE 2'-8 1/4" MIN.

STANDARD MB-7F, CONSTANT SLOPE BARRIER, BRIDGE PARAPET TERMINAL WALLS.

ITEM CODE 13603 IMPACT ATTENUATOR TY. 1 (TL-3, LOW MAINTENANCE) EACH

IMPACT ATTENUATOR LOW MAINTENANCE TYPE 1 RE-DIRECTIVE IMPACT ATTENUATOR (TL-3 > 40 MPH)

MASH 2016
IMPACT ATTENUATOR

LOW MAINTENANCE TYPE 1 RE-DIRECTIVE IMPACT ATTENUATOR

( TL-3 ≥ 40 MPH )

VIRGINIA DEPARTMENT OF TRANSPORTATION

ROAD AND BRIDGE STANDARDS

SHEET 2 OF 2

505.11

REVISION DATE

12/18

MASH 2016

VDO T

A COPY OF THE ORIGINAL SEALED AND SIGNED STANDARD DRAWING IS ON FILE IN THE CENTRAL OFFICE

IMPACT ATTENUATOR

LOW MAINTENANCE TYPE 1 RE-DIRECTIVE IMPACT ATTENUATOR

( TL-3 ≥ 40 MPH )

VIRGINIA DEPARTMENT OF TRANSPORTATION

ROAD AND BRIDGE STANDARDS

SHEET 2 OF 2

505.11

REVISION DATE

12/18

MASH 2016

VDO T

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PLAN VIEW

(UNI-DIRECTIONAL)

PLAN VIEW

(BI-DIRECTIONAL)

TRAFFIC

TRAFFIC

TRAFFIC

TRAFFIC

TRANSITION PANEL REQUIRED WITH TWO WAY TRAFFIC

SECTION A-A

SECTION B-B

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

SUB-BASE TO BE COMPACTED UNDER CONC. FOUNDATION

SUB-BASE TO BE COMPACTED UNDER CONC. FOUNDATION

SUB-BASE TO BE COMPACTED UNDER CONC. FOUNDATION

SUB-BASE TO BE COMPACTED UNDER CONC. FOUNDATION

THE MINIMUM DISTANCE SHOWN IS A MINIMUM CLEAR SPACE REQUIRED FOR THE PROPER OPERATION OF THE IMPACT ATTENUATOR. STANDARD SHOULDER WIDTHS SHOULD BE DESIGNED AND MAINTAINED IN ACCORDANCE WITH CURRENT VDOT POLICY.

A COPY OF THE ORIGINAL SEALED AND SIGNED STANDARD DRAWING IS ON FILE IN THE CENTRAL OFFICE

IMPACT ATTENUATOR

LOW MAINTENANCE TYPE 1 RE-DIRECTIVE IMPACT ATTENUATOR

( TL-3 ≥ 40 MPH )

VIRGINIA DEPARTMENT OF TRANSPORTATION

ROAD AND BRIDGE STANDARDS

SHEET 2 OF 2

505.11

REVISION DATE

12/18

MASH 2016

VDO T

A COPY OF THE ORIGINAL SEALED AND SIGNED STANDARD DRAWING IS ON FILE IN THE CENTRAL OFFICE

PLAN VIEW

(UNI-DIRECTIONAL)

PLAN VIEW

(BI-DIRECTIONAL)

TRAFFIC

TRAFFIC

TRAFFIC

TRAFFIC

TRANSITION PANEL REQUIRED WITH TWO WAY TRAFFIC

SECTION A-A

SECTION B-B

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

VARIABLE BASED ON MANUFACTURER

SUB-BASE TO BE COMPACTED UNDER CONC. FOUNDATION

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THE MINIMUM DISTANCE SHOWN IS A MINIMUM CLEAR SPACE REQUIRED FOR THE PROPER OPERATION OF THE IMPACT ATTENUATOR. STANDARD SHOULDER WIDTHS SHOULD BE DESIGNED AND MAINTAINED IN ACCORDANCE WITH CURRENT VDOT POLICY.

A COPY OF THE ORIGINAL SEALED AND SIGNED STANDARD DRAWING IS ON FILE IN THE CENTRAL OFFICE

IMPACT ATTENUATOR

LOW MAINTENANCE TYPE 1 RE-DIRECTIVE IMPACT ATTENUATOR

( TL-3 ≥ 40 MPH )

VIRGINIA DEPARTMENT OF TRANSPORTATION

ROAD AND BRIDGE STANDARDS

SHEET 2 OF 2

505.11

REVISION DATE

12/18

MASH 2016
SECTION THRU RAIL ELEMENT AND W BEAM BACK-UP PLATE

DETAIL OF MID-SPAN SPLICE JOINT

DETAIL OF BUTTON HEAD BOLT AND RECESS NUT (GUARDRAIL BOLT)

NOTES:
ALL HARDWARE IS TO BE GALVANIZED IN ACCORDANCE WITH THE SPECIFICATIONS.

L= 1/4" FOR SPLICE BOLT-FULL LENGTH THREADS
L= 2" FOR SPLICE BOLT-FULL LENGTH THREADS ON NESTED W BEAMS.
L= 14" FOR STEEL POST WITH 12" BLOCKOUT BOLT-1/2" MIN. THREADS
L= 18" FOR STEEL POST WITH 16" BLOCKOUT DEPTH BOLT-2" MIN. THREADS
L= 26" FOR STEEL POST WITH 24" BLOCKOUT DEPTH BOLT-2" MIN. THREADS

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

MGS STANDARD GUARDRAIL HARDWARE

VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS
W BEAM TERMINAL CONNECTOR

26'-1/2"
25'

9 1/2" x 2 1/2" SLOTTED HOLES AT 3'-1/2" SPACING

STANDARD 25' W-BEAM SECTION

13'-6/2"
12'-6"

5 1/2" x 2 1/2" SLOTTED HOLES AT 3'-1/2" SPACING

STANDARD 12'-6" W-BEAM SECTION

LAP IN DIRECTION OF TRAFFIC AT SPLICE JOINT.

STANDARD DIMENSIONS OF 12'-6", 24" AND 30" ARE SUGGESTED.

W BEAM END SECTION (BUFFER)

W BEAM END SECTION (ROUNDED)

APPROX.

3" MIN.

SPLICE BOLT SLOT

NOTES:
ALL HARDWARE IS TO BE GALVANIZED IN ACCORDANCE WITH THE SPECIFICATIONS.

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

MGS STANDARD GUARDRAIL HARDWARE

VIRGINIA DEPARTMENT OF TRANSPORTATION

MGS-HDW

MGS STANDARD GUARDRAIL HARDWARE

ROAD AND BRIDGE STANDARDS

2016 ROAD & BRIDGE STANDARDS

SPECIFICATION REFERENCE

505.02
NEW 02/17

221

505

2016 ROAD & BRIDGE STANDARDS
**ASYMMETRICAL TRANSITION SECTION DETAIL (W-BEAM TO THRIE BEAM)**

**SYMmetrical TRANSITION SECTION DETAIL (W-BEAM TO THRIE BEAM)**

**SECTION THRU THRIE BEAM RAIL ELEMENT**

**SPlice DETAIL**

**THRIE BEAM TERMINAL CONNECTOR DETAIL**

NOTES:
ALL HARDWARE IS TO BE GALVANIZED IN ACCORDANCE WITH THE SPECIFICATIONS.

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

MGS STANDARD GUARDRAIL HARDWARE

THRIE BEAM GUARDRAIL HARDWARE

VIRGINIA DEPARTMENT OF TRANSPORTATION
NOTES:

1. Guardrail locations shown on plans are approximate only and can be adjusted during construction if and as directed by the Engineer.
2. For details of post and blockouts see sheet no. 506.05.
3. For details of rail element, and associated hardware see sheets 506.01 and 506.02.
4. Rail elements with radius less than, or equal to, 150 feet shall be shop curved and paid for as radial GR-MGS1, GR-MGS1A.
5. All GR-MGS1 and GR-MGS1A rail shall be maintained at a height of 30" min. - 32" max as measured per standard GR-INS.
6. All guardrail posts shall be set plumb. Post shall not be set with a variation of more than 1/8" per foot from vertical. W-beam, blockouts, and posts shall be set and aligned without alteration or force, as per section 505 of the specifications.
7. All W-beam rails shall be lapped in the direction of vehicular travel for the finished roadway.
8. Adjusting existing guardrail to meet the MGS1 standard is not permitted.

FLARE RATES

<table>
<thead>
<tr>
<th>DESIGN SPEED</th>
<th>INSIDE SHY LINE</th>
<th>BEYOND SHY LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH</td>
<td>FLARE RATE</td>
<td>FLARE RATE</td>
</tr>
<tr>
<td>70</td>
<td>9'</td>
<td>15:1</td>
</tr>
<tr>
<td>60</td>
<td>8'</td>
<td>14:1</td>
</tr>
<tr>
<td>50</td>
<td>6.5'</td>
<td>13:1</td>
</tr>
<tr>
<td>40</td>
<td>5'</td>
<td>8:1</td>
</tr>
<tr>
<td>30</td>
<td>4'</td>
<td>7:1</td>
</tr>
</tbody>
</table>

* Suggested maximum flare rate for semi-rigid barrier systems.

DESCRIPTION | ITEM CODE  | QUANTITY |
-------------|------------|----------|
GUARDRAIL GR-MGS1 | 13280 | LF |
GUARDRAIL GR-MGS1A | 13281 | LF |
GUARDRAIL GR-MGS1, 9' POST | 13282 | LF |
GUARDRAIL RADIAL GR-MGS1 | 13283 | LF |
GUARDRAIL RADIAL GR-MGS1A | 13284 | LF |
GUARDRAIL RADIAL GR-MGS1, 9' POST | 13285 | LF |
**NOTES:**

1. ALL BOLTS, NUTS, WASHERS, AND OTHER STEEL ITEMS ARE TO BE GALVANIZED.

2. BLOCKOUTS OTHER THAN SHOWN SHALL BE A VDOT APPROVED PRODUCT MEETING MASH TESTING CRITERIA. BLOCKOUTS SHALL BE FROM THE VDOT APPROVED PRODUCTS LIST. APPROVED BLOCKOUTS MAY BE INTERCHANGED ON ANY ONE PROJECT WITH THE RESTRICTION THAT THE SAME TYPE OF BLOCKOUT MUST BE USED IN ANY SINGLE RUN OF GUARDRAIL.

3. WOOD BLOCKOUTS SHALL BE TREATED WITH A WOOD PRESERVATIVE IN ACCORDANCE WITH THE SPECIFICATIONS.

4. DIMENSION MAY VARY PLUS OR MINUS ¼" DUE TO MANUFACTURING TOLERANCES IN GUARDRAIL COMPONENTS.
NOTES:

1. TANGENT END TERMINAL (GR-MGS2) SHALL BE A VDOT APPROVED PRODUCT MEETING MASH TESTING CRITERIA. ANY TERMINAL USED FOR THE GR-MGS2 SHALL BE FROM THE VDOT APPROVED PRODUCTS LIST.

2. ALL TERMINALS SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER’S INSTALLATION INSTRUCTIONS AND THE FOLLOWING VDOT REQUIREMENTS:
   A. ALL STANDARD GR-MGS2 TERMINALS (SIMILAR TO AS SHOWN ABOVE) SHALL BE INSTALLED WITHOUT AN OFFSET.
   B. INSTALLING GR-MGS2 TERMINAL ON A RADIUS IS NOT PERMITTED.
   C. DIRECTION OF THE REFLECTIVE TAPE ON THE TERMINAL HEAD SHALL CONFORM TO MUTCD APPLICATION FOR DIAGONAL STRIPES ON OBJECT MARKERS AND BRIDGE END PANELS. (SEE NOTE 4)
   D. DO NOT CHANGE THE LAPPING OF TERMINAL FOR ANY INSTALLATIONS, INSTALL AS SHOWN IN THE MANUFACTURER’S INSTALLATION INSTRUCTIONS REGARDLESS OF ADJACENT TRAFFIC DIRECTION. (SEE DETAIL THIS SHEET)
   E. HEIGHT MEASURED AT TOP OF W-BEAM IS 30" MIN. - 32" MAX.

3. THIS DRAWING IS REPRESENTATIONAL ONLY. DETAILS, DIMENSIONS, QUANTITIES, AND OTHER INFORMATION NOT SHOWN WILL VARY FOR EACH MANUFACTURER. SEE INDIVIDUAL MANUFACTURER’S PLANS FOR THIS INFORMATION.

4. FLUORESCENT PRISMATIC LENS YELLOW SHEETING SHALL BE USED ON THE REFLECTIVE MARKERS. ALL REFLECTIVE SHEETING IS TO BE IN ACCORDANCE WITH SECTION 701 OF THE ROAD AND BRIDGE SPECIFICATIONS. STRIPES SHALL SLOPE DOWN TOWARD THE SIDE OF THE OBSTRUCTION ON WHICH TRAFFIC IS TO PASS.

COLOR:
FIELD - YELLOW (REFLECTORIZED)
MESSAGE - BLACK STRIPES (NON-REFLECTORIZED)

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

MIDWEST GUARDRAIL SYSTEM
(TANGENT END TERMINAL)
VIRGINIA DEPARTMENT OF TRANSPORTATION
SITE PREPARATION REQUIREMENTS FOR GR-MGS2

NOTES:


2. THE AREA IMMEDIATELY BEHIND AND BEYOND THE TERMINAL SHALL BE TRAVERSABLE AND FREE FROM FIXED OBJECTS. IF A CLEAR RUN OUT IS NOT ATTAINABLE, THIS AREA SHALL AT LEAST BE SIMILAR IN CHARACTER TO THE UPSTREAM UNSHIELDED ROADSIDE AREAS.

3. FOR NEW CONSTRUCTION AND RECONSTRUCTION, THE 10:1 SLOPE GRADING SHALL EXTEND A MINIMUM OF 6'-0" MEASURED FROM THE FACE OF RAIL.

4. FOR PROPRIETARY GUARDRAIL TERMINALS, THE MANUFACTURER'S SITE PREPARATION REQUIREMENTS TAKE PRECEDENCE OVER THIS STANDARD IF ADDITIONAL GRADING IS REQUIRED.
**LIMITED USE SITE PREPARATION REQUIREMENTS FOR GR-MGS2**

**NOT FOR USE ON INTERSTATES, FREEWAYS, OR NEW CONSTRUCTION, UNLESS APPROVED BY THE ENGINEER.**

**NOTES:**


2. **THE AREA IMMEDIATELY BEHIND AND BEYOND THE TERMINAL SHOULD BE TRAVERSABLE AND FREE FROM FIXED OBJECTS. IF A CLEAR RUN OUT IS NOT ATTAINABLE THIS AREA SHOULD AT LEAST BE SIMILAR IN CHARACTER TO THE UPSTREAM UNSHIELDED ROADSIDE AREAS.**

3. **NOT FOR USE ON INTERSTATES, FREEWAYS, OR NEW CONSTRUCTION, UNLESS APPROVED BY THE ENGINEER. MAY BE USED WHEN SPECIFIED IN THE PLANS FOR 3R WORK THAT CANNOT CONFORM TO THE SITE PREPARATION REQUIREMENTS ON PAGE 506.07.**

4. **FOR LIMITED APPLICATIONS AS DESCRIBED IN NOTE 3, THE GRADING SHOULD BE AS CLOSE AS POSSIBLE TO THE SITE PREPARATION REQUIREMENTS ON PAGE 506.07. THE SLOPE SHALL EXTEND A MINIMUM OF 4'-0" FROM THE FACE OF RAIL AND GRADING SHALL CONFORM TO THE DETAILS ABOVE. USE 21B AGGREGATE, OR OTHER SUITABLE MATERIAL AS APPROVED BY THE ENGINEER.**
1. USE OF THIS TRAILING END ANCHORAGE IS RESTRICTED TO RUN-OFF CONDITIONS ON DIVIDED HIGHWAYS.
2. STEEL POST, BLOCKOUT, AND SPLICE SHALL BE IN ACCORDANCE WITH THE GR-MGS1 STANDARD AND LOCATED AS SHOWN IN THE DETAILS ABOVE.
3. ALL BOLTS, NUTS, WASHERS, AND OTHER STEEL ITEMS ARE TO BE GALVANIZED.
4. WOOD POSTS SHALL BE TREATED WITH A WOOD PRESERVATIVE IN ACCORDANCE WITH THE SPECIFICATIONS.

MIDWEST GUARDRAIL SYSTEM
(TRAILING END ANCHORAGE)

NOTE: A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

SPECIFICATION REFERENCE
271
236
505

ROAD AND BRIDGE STANDARDS
REVISION DATE
NEW 02/17

SHEET 1 OF 2
505.09

2016 ROAD & BRIDGE STANDARDS
NOTES:

1. HEIGHT TRANSITION FROM 31" GR-MGS1 TO 27%" GR-2 WILL REQUIRE
   2 - STANDARD 12'-6" SECTIONS OF W-BEAM (SPlices AS SHOWN) OR A
   SINGLE 25' W-BEAM WITH %" x 2½" SLOTTED HOLES AT 3'-1½" SPACING.
2. POSTS, BLOCKOUTS, AND SPLICES WILL BE IN ACCORDANCE WITH THE GR-MGS1
   STANDARD AND LOCATED AS SHOWN IN THE DETAILS ABOVE.
3. STANDARD 6 FOOT POSTS WILL BE USED UNLESS OTHERWISE NOTED ON PLANS
4. STANDARD GR-MGS4 TRANSITION WILL BE PAID FOR AS EACH COMPLETE IN PLACE.
5. END TERMINAL WILL BE A VDOT APPROVED PRODUCT MEETING MASH TESTING CRITERIA.
6. THE BLOCKOUT DEPTH OF THE GR-MGS4 TRANSITION WILL MATCH THE BLOCKOUT
   DEPTH OF THE GR-MGS2 TERMINAL WHEN THE TERMINAL TIES DIRECTLY TO THE
   GR-MGS4 HEIGHT TRANSITION.

ITEM CODE 13288 GUARDRAIL HEIGHT TRANSITION GR-MGS4 EACH

MIDWEST GUARDRAIL SYSTEM
(TRANSITION FROM MGS 31" HEIGHT TO GR-2 27½" HEIGHT)
VIRGINIA DEPARTMENT OF TRANSPORTATION

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.
MEASURING GUARDRAIL HEIGHT ON FRONT SLOPE RELATIVE TO SHOULDER HINGE POINT

× HEIGHT PER STANDARD GR-MGS1

MEASURING GUARDRAIL HEIGHT & RAIL OFFSET FROM FACE OF CURB OR CURB & GUTTER
APPLICABLE FOR DESIGN SPEEDS OF 45 MPH AND LESS.

× HEIGHT PER STANDARD GR-MGS1

FOR GUARDRAIL DESIGN POLICIES USING CURB OR CURB & GUTTER
SEE CHAPTER 2E OF THE VDOT ROAD DESIGN MANUAL

MEASURING GUARDRAIL HEIGHT ADJACENT TO CURB OR CURB & GUTTER

× HEIGHT PER STANDARD GR-MGS1

WHERE COMBINATION CURB & GUTTER IS USED THE HEIGHT OF THE GUARDRAIL SHALL BE MEASURED FROM THE PROJECTED PAVEMENT ELEVATION AT THE FACE OF CURB.

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

MGS W-BEAM GUARDRAIL INSTALLATION CRITERIA

VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS
**ROADSIDE OBSTRUCTION**

For two-way traffic, use 8 post spacing design from each end of fixed object.

**SECTION A-A**

For traffic run on or run off, use 8 post spacing. Design from each end of fixed object.

**TABLE I**

<table>
<thead>
<tr>
<th>Total Shoulder Width (S)</th>
<th>Paved Shoulder Width (P)</th>
<th>Offset from Edge of Traveled Way to Face of Guardrail (O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18'</td>
<td>12'</td>
<td>14'</td>
</tr>
<tr>
<td>16'</td>
<td>4' or 10'</td>
<td>12'</td>
</tr>
<tr>
<td>14'</td>
<td>4' or 8'</td>
<td>10'</td>
</tr>
<tr>
<td>12'</td>
<td>3', 4', 5', or 6'</td>
<td>8'</td>
</tr>
<tr>
<td>10'</td>
<td>3' or 4'</td>
<td>6'</td>
</tr>
<tr>
<td>9'</td>
<td>0 or 4'</td>
<td>5'</td>
</tr>
<tr>
<td>8'</td>
<td>0 or 2'</td>
<td>4'</td>
</tr>
<tr>
<td>6'</td>
<td>0</td>
<td>2'</td>
</tr>
</tbody>
</table>

**SECTION D-D**

Double standard blockouts or combinations of blockouts greater than 16" up to 24" deep shall be limited to one in any 100 ft length of guardrail. Blockout depth of 16" may be used for a series of posts. This will be accomplished with a combination of a 4" and a 12" blockout or 2 MASH approved 8" blockouts. Cost of additional blockouts to be included in price bid per linear foot of guardrail.

**NORMAL GUARDRAIL LOCATION**

See Standard MC-4 for paving under guardrail.
GR-MGS2 TERMINAL TO GR-MGS4 HEIGHT TRANSITION

TRANSITION FROM GR-MGS1 GUARDRAIL TO WEAK POST GUARDRAIL

GR-MGS1

GR-B (WEAK POST) @ 12'-6" SPACING

1 SPACE @ 3'-1½"
3 SPACES @ 6'-3"

ADJUST FOR RAIL HEIGHT DIFFERENCE

TRAFFIC (ONE WAY)

WEAK POST @ 12'-6" SPACING

STD. GR-B

32½" HEIGHT (TYP.)

TRANSITION FROM GR-MGS2 TERMINAL TO WEAK POST GUARDRAIL

GR-MGS2

GR-B (WEAK POST) @ 12'-6" SPACING

1 SPACE @ 3'-1½"
7 SPACES @ 6'-3"

ADJUST FOR RAIL HEIGHT DIFFERENCE

TRAFFIC (ONE WAY)

STD. GR-B

31" HEIGHT

MGS W-BEAM GUARDRAIL INSTALLATION CRITERIA

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

Virginia Department of Transportation
TRANSITION FROM WEAK POST (STANDARD GR-8) TO GR-MGS1 GUARDRAIL
MGS W-BEAM GUARDRAIL INSTALLATION CRITERIA
(LEAVE-OUT FOR STANDARD GUARDRAIL POST INSTALLATION)

NOTES:
1. LEAVE-OUT ALLOWS FOR PROPER POST ROTATION.
2. DO NOT SHORTEN POST. POST SHALL HAVE FULL EMBEDMENT.
3. INSTALL POST AFTER OPENING IS BACKFILLED AND COMPACTED IN 6" LIFTS.

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

2016 ROAD & BRIDGE STANDARDS
### Materials/Specifications/Notes

<table>
<thead>
<tr>
<th>Item</th>
<th>Material/Specifications/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standard W-Beam Rail</td>
</tr>
<tr>
<td>2</td>
<td>1½&quot; x 1½&quot; long guardrail splice bolt &amp; recessed nut (see STD. MGS-HDW)</td>
</tr>
<tr>
<td>3</td>
<td>2½&quot; x 2½&quot; guardrail splice section (2 sections nested)</td>
</tr>
<tr>
<td>4</td>
<td>¾&quot; x 10&quot; long guardrail bolt &amp; recessed nut (see STD. MGS-HDW)</td>
</tr>
<tr>
<td>5</td>
<td>6½&quot; x 12½&quot; guardrail splice section</td>
</tr>
<tr>
<td>6</td>
<td>10 gauge asymmetrical thrie-beam transition</td>
</tr>
<tr>
<td>7</td>
<td>¾&quot; x 1½&quot; long guardrail bolt &amp; recessed nut (see STD. MGS-HDW)</td>
</tr>
<tr>
<td>8</td>
<td>Standard w-beam rail</td>
</tr>
<tr>
<td>9</td>
<td>W6 x 15, 8½&quot; long steel post with 6½&quot; x 8½&quot; x 19½&quot; timber blockout (posts 1, 2, 3)</td>
</tr>
<tr>
<td>10</td>
<td>W6 x 8.5 or W6 x 9.72&quot; long steel post with 6½&quot; x 12½&quot; x 19½&quot; lg. treated pine block (posts 4, 5, 6)</td>
</tr>
<tr>
<td>11</td>
<td>¾&quot; dia. x 1½&quot; long heavy hex bolt and nut</td>
</tr>
<tr>
<td>12</td>
<td>W6 x 8.5 or W6 x 9.72&quot; long steel post with 6½&quot; x 12½&quot; x 19½&quot; lg. treated pine block (posts 10, 11)</td>
</tr>
<tr>
<td>13</td>
<td>3½&quot; x ¾&quot; long 0.315&quot; square plate washer ASTM A572 GR. 50</td>
</tr>
</tbody>
</table>

### Notes:

1. Thrie-beam fixed object attachment is for use with the CPSR, SSCP, and Kansas Corral Vertical face terminal walls.
2. ¾" bolts shall be ASTM A325, A449 hex bolts with ASTM A563 GR. DH or A194 GR. 2H nuts. A 3½" x ¾" x 0.315" A36 square plate washer is required for each bolt on the back side of the bridge terminal wall.
4. W-beam rail will be included with the approach guardrail or terminal post 11 is included with the FOA-5.
5. Splice location is dependent on the length of W-beam rail used. If 12½" rail is used a splice will be at this location.
6. Standard CG-3 curb is required from post 11 to the terminal wall. The curb will transition from the face of rail to the front of the terminal wall chamfer over a 3½" distance.
7. Standard CG-3 curb is not included with the FOA-5 and will be quantified and paid as a separate bid item in accordance with the specifications.
8. Drop inlets or flumes are not permitted within the pay limits of the GR-FOA-5.
9. Guardrail components shall be in accordance with VDOT road and bridge standards.
10. All bolts, nuts, washers, and other steel items are to be galvanized.
11. Installation of the FOA-5 on a radius or flare is not permitted.
12. 4½' wide grading from the face of rail to the hinge point shall extend a minimum of 3½' past the end of the terminal wall to support FOA posts.
THRIE-BEAM - FIXED OBJECT ATTACHMENT
FOR USE WITH VERTICAL FACE TERMINAL WALLS AND MGS GUARDRAIL

A36 SQUARE PLATE WASHER

6"x12"x19" TREATED WOOD BLOCKOUT
6"x8"x19" TREATED WOOD BLOCKOUT

STEEL POST

1/4" HOLE
1/4" HOLE

1/4" HOLE
1/4" HOLE

STEEL POST

1/4" DIA. HOLE
1/4" DIA. HOLE

1/4" DIA. HOLE
1/4" DIA. HOLE

1/4" x 2 1/2" SLOTTED HOLES AT 1'6" SPACING
1/4" x 2 1/2" SLOTTED HOLES AT 1'6" SPACING

STANDARD 12'-6" THRIE-BEAM SECTION
STANDARD 6'-3" THRIE-BEAM SECTION
NOTES:
1. THE TEMPORARY CONCRETE BARRIER SHALL BE PRECAST BY A VDOT APPROVED PRECAST MANUFACTURER. THE MANUFACTURER SHALL SUBMIT SHOP DRAWINGS FOR APPROVAL BY THE STANDARDS & SPECIAL DESIGN SECTION. MODIFICATIONS TO THIS DESIGN ARE NOT PERMITTED.
2. BARRIER SHALL HAVE A UNIFORM NATURAL CONCRETE FINISH. THE BARRIER SHALL NOT BE PAINTED OR COATED OTHER THAN MARKINGS NECESSARY TO IDENTIFY THE MANUFACTURER.
3. THE RECESSED LETTERING IN THE TOP OF THE BARRIER CONTAINING MASH 2016 ALONG WITH MONTH AND YEAR OF MANUFACTURE IS REQUIRED FOR EACH BARRIER SEGMENT PRODUCED.
4. CONCRETE SHALL BE A MINIMUM OF 5000 PSI.
5. ALL REINFORCING STEEL SHALL BE IN ACCORDANCE WITH ASTM-A615 GRADE 60.
6. ALL REINFORCING STEEL SHALL HAVE A MINIMUM COVER OF 2" UNLESS OTHERWISE SHOWN.
7. LOOP BARS SHALL NOT BE USED TO LIFT, MOVE, OR REPOSITION THE BARRIER.
8. ONLY ONE TYPE OF TEMPORARY BARRIER IS PERMITTED IN A RUN. MIXING TEMPORARY CONCRETE BARRIERS WITH OTHER TEMPORARY CONCRETE BARRIERS IS NOT PERMITTED.
9. OTHER PRECAST TEMPORARY CONCRETE BARRIERS SHALL BE FROM THE MASH PROVISIONALLY APPROVED LIST. BARRIERS THAT HAVE BEEN APPROVED BY VDOT ON THE MASH PROVISIONALLY APPROVED LIST MAY BE SUBSTITUTED FOR THIS STANDARD.
10. MAXIMUM CROSS SLOPE FOR PLACEMENT OF TEMPORARY BARRIER WILL BE 10:1.
11. BARRIER DELINEATOR SIZE, COLOR AND SPACING SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS.
12. BARRIER DELINEATOR REFLECTIVE SURFACE IN ALL INSTANCES SHALL BE FACING ONCOMING TRAFFIC.
13. COST OF DELINEATOR SHALL BE INCLUDED IN THE PRICE BID FOR TEMPORARY CONCRETE BARRIER.
14. BARRIER VERTICAL PANELS SHALL BE SPACED IN ACCORDANCE WITH VIRGINIA WORK AREA PROTECTION MANUAL.

ELEVATION VIEW

LIFT SLOT

1" CHAMFER

8" X 12" BARRIER VERTICAL PANELS AS REQUIRED. (SEE NOTE 14)

SECTION A-A
LONGITUDINAL REINFORCEMENT SPACING MEASURED TO THE CENTER OF THE BAR

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

TEMPORARY CONCRETE BARRIER
(MASH FREESTANDING PRECAST PIN AND LOOP FOR TEMPORARY USE)

VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS
FLARE RATES

DESIGN SPEED INSIDE SHY LINE BEYOND SHY LINE MPH FLARE RATE FLARE RATE

70 10' 30:1 20:1
60 8' 26:1 18:1
50 6.5' 21:1 14:1
40 5' 16:1 10:1
30 3.5' 13:1 8:1

* FLARE RATES

WHEN USING VDOT STANDARD TCB-1 WITH THE PIN AND LOOP POSITIVE CONNECTION, ALLOW FOR A 6'-8" DYNAMIC DEFLECTION. PROVIDE MIN. 60' OF BARRIER UPSTREAM AND DOWNSTREAM OF WORK ZONE FOR ANCHORAGE. FOR APPROVED NON-VDOT DESIGNS, REFER TO MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR DEFLECTIONS AND ANCHORAGE.

CONNECTOR PIN

LOOP Connector Joint

REINFORCING STEEL & LOOP BAR SCHEDULE

<table>
<thead>
<tr>
<th>Work No.</th>
<th>Size</th>
<th>Length X</th>
<th>Material</th>
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</thead>
<tbody>
<tr>
<td>RV0401</td>
<td>14</td>
<td>7'-8&quot;</td>
<td>A615 Gr. 60</td>
</tr>
<tr>
<td>ML01</td>
<td>6</td>
<td>12'-2&quot;</td>
<td>A615 Gr. 60</td>
</tr>
<tr>
<td>ML02</td>
<td>2</td>
<td>12'-2&quot;</td>
<td>A615 Gr. 60</td>
</tr>
<tr>
<td>A1</td>
<td>2</td>
<td>7&quot;-1&quot;</td>
<td>A709 Gr. 70</td>
</tr>
<tr>
<td>B1</td>
<td>2</td>
<td>7&quot;-1&quot;</td>
<td>A709 Gr. 70</td>
</tr>
<tr>
<td>C1</td>
<td>2</td>
<td>8&quot;-1/2&quot;</td>
<td>A709 Gr. 70</td>
</tr>
</tbody>
</table>

Dimensions in bending diagram are out-to-out of bars, except as shown. X DENOTES LENGTH OF ONE (1) BAR.

A COPY OF THE ORIGINAL SEALED AND SIGNED DRAWING IS ON FILE IN THE CENTRAL OFFICE.

TEMPORARY CONCRETE BARRIER
(MASH FREESTANDING PRECAST PIN AND LOOP FOR TEMPORARY USE)

ROAD AND BRIDGE STANDARDS

SHEET 2 OF 3 REVISION DATE NEW 04/20

2016 ROAD & BRIDGE STANDARDS
TCB-1 FREE STANDING BARRIER

**Roadway Paving**

BARRIER SHALL BE PLACED ON A PAVED SURFACE OR A COMPACTED AGGREGATE BASE A MINIMUM OF 6" IN DEPTH. PLACEMENT OF BARRIER ON GRASS, SOIL, OR ANY NON-PAVED AREA IS NOT PERMITTED.

**Maximum Cross Slope for BARRIER Placement**

1'-0" MIN.

**Normal Earth**

EXISTING ASPHALT CONCRETE PAVEMENT, HYDRAULIC CEMENT CONCRETE PAVEMENT, OR A MINIMUM 6" OF 21A OR 21B COMPACTED AGGREGATE, 4" WIDTH MINIMUM.

**Surface Requirements for Barrier Placement**

**Traffic Side**

TCB-1 FREE STANDING BARRIER

**Dynamic Deflection Area**

6'-8"

**Area to Remain Free of Equipment, Stored Materials, and Workers**

**Minimum Work Area and Anchorage**

**Notes:**

1. THE SPACE BEHIND THE 5 SEGMENTS OF ANCHORAGE BARRIER SHALL REMAIN FREE OF EQUIPMENT, STORED MATERIALS, AND WORKERS.

2. BARRIERS EXTENDED ON A FLARE TO THE ROADWAY CLEAR ZONE SHALL HAVE A MINIMUM OF 2 BARRIER SEGMENTS PLACED BEYOND THE ROADWAY CLEAR ZONE AT THE SAME FLARE RATE.

**Minimum Work Area and Anchorage**

**Temporary Concrete Barrier**

(MASH Freestanding Precast Pin and Loop for Temporary Use)

Virginia Department of Transportation

2016 ROAD & BRIDGE STANDARDS