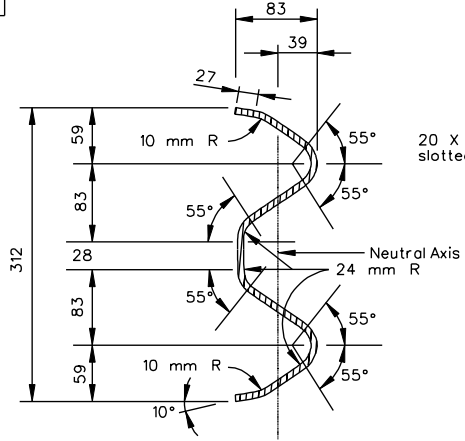
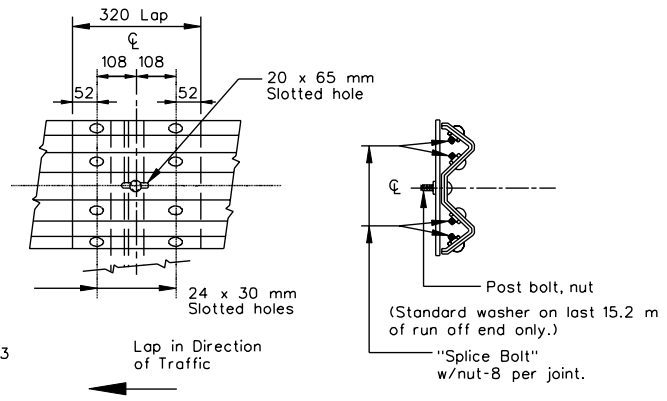
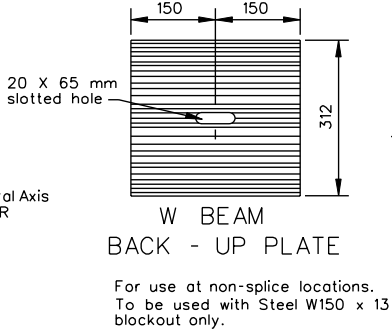


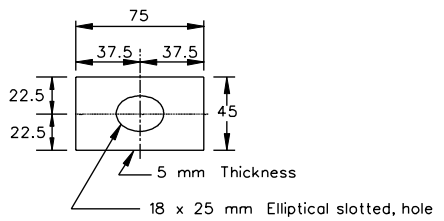
GR-HDW



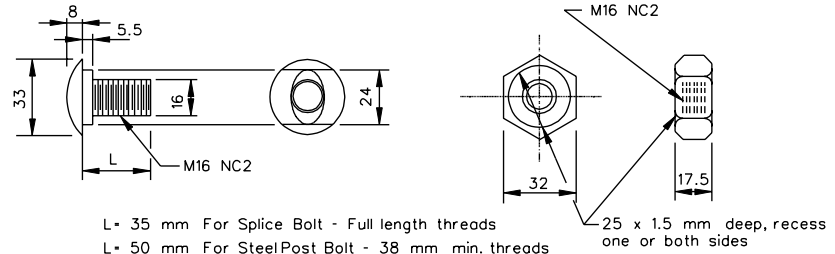
SECTION THRU RAIL ELEMENT AND W BEAM BACK-UP PLATE



DETAIL OF SPLICE JOINT



DETAIL OF STANDARD WASHER  
(For GR-2 and 2A,-MB-3 and 3A)  
To be used on last 15.2 m of Run off ends only.



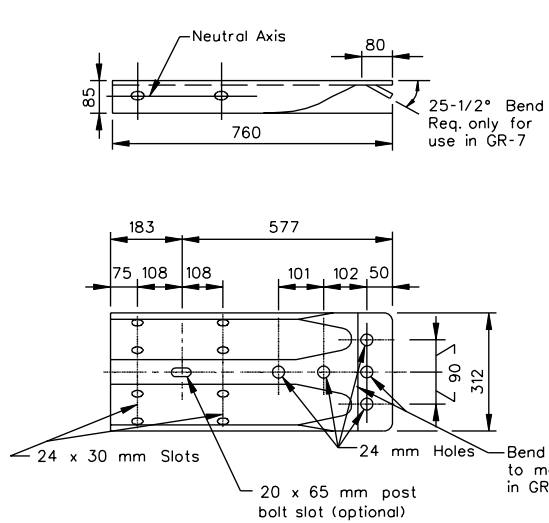
DETAIL OF BUTTON HEAD BOLT AND RECESS NUT  
L = 35 mm For Splice Bolt - Full length threads  
L = 50 mm For SteelPost Bolt - 38 mm min. threads  
L = 460 mm For Wood and Concrete Post Bolt - 63 mm min. threads  
L = 640 mm For MB Wood or Concrete Post - 50 mm minimum threads

Notes:

All hardware to be galvanized in accordance with the Specifications.

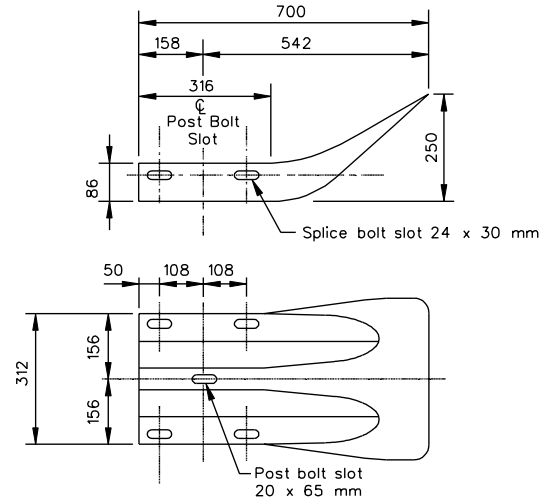
The guardrail and median barrier components depicted in AASHTO - AGC - ARTBA ("A Guide to Standardized Highway Barrier Hardware") may be substituted if interchangeable with the Standards for guardrail (GR) or median Barrier (MB) and approved by the Engineer.

STANDARD GUARDRAIL HARDWARE		SPECIFICATION REFERENCE
501.01	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	221 505
VIRGINIA DEPARTMENT OF TRANSPORTATION		

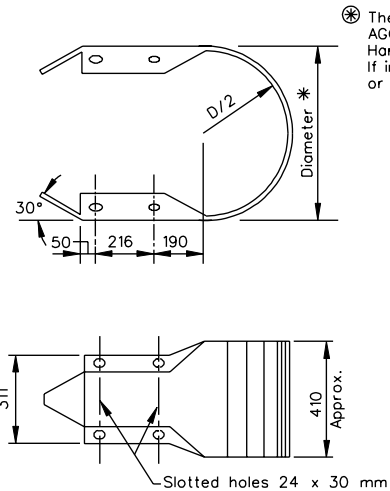


W BEAM TERMINAL CONNECTOR

Note:  
Lap in direction of traffic at splice joint



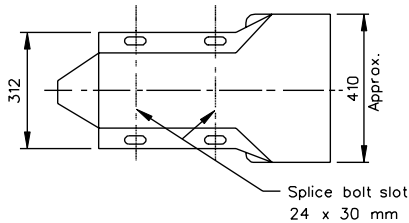
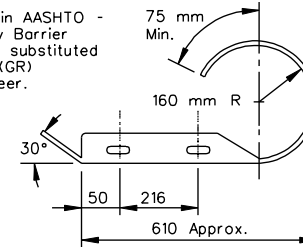
W BEAM END SECTION (FLARED)



\* Standard dimensions of 540, 610 and 760 mm are suggested.

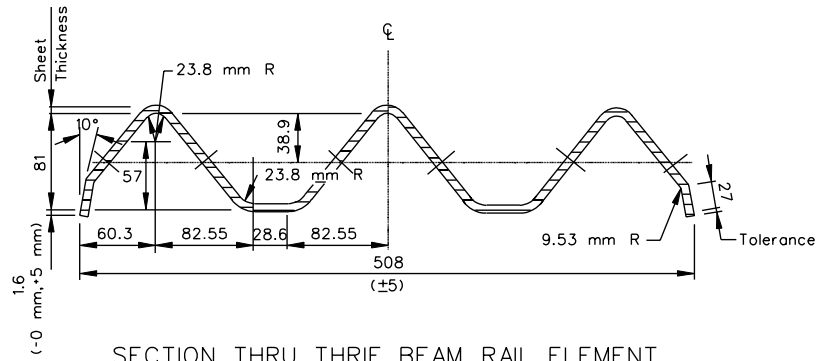
W BEAM END SECTION (BUFFER)

⊗ The guardrail median barrier components depicted in AASHTO - AGC - A.R.T.B.A. "A Guide to Standardized Highway Barrier Hardware" Technical Bulletin Number 268B may be substituted if interchangeable with the Standards for guardrail (GR) or median barrier (MB) and approved by the Engineer.

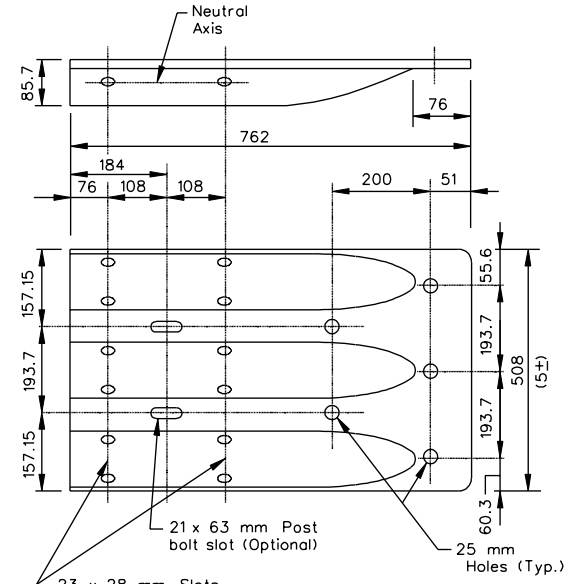


W BEAM END SECTION (ROUNDED)

SPECIFICATION REFERENCE	<h2 style="margin: 0;">STANDARD GUARDRAIL HARDWARE</h2> <h3 style="margin: 0;">W BEAM GUARDRAIL HARDWARE</h3> <p style="margin: 0;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>		<p style="margin: 0; font-size: small;">UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>
221 505			501.02

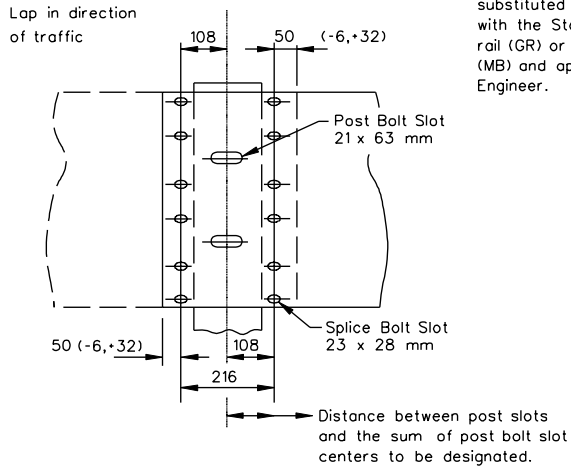


SECTION THRU THRIE BEAM RAIL ELEMENT

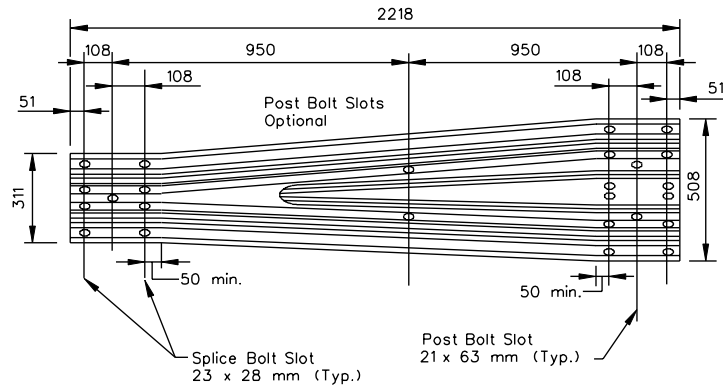


THRIE BEAM TERMINAL CONNECTOR DETAIL

⊗ 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.



SPLICE DETAIL



TRANSITION SECTION DETAIL (W-BEAM TO THRIE BEAM)

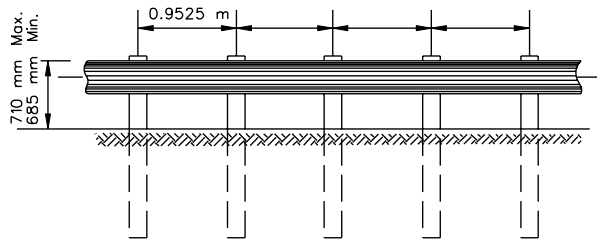
STANDARD GUARDRAIL HARDWARE  
THRIE BEAM GUARDRAIL HARDWARE

SPECIFICATION REFERENCE

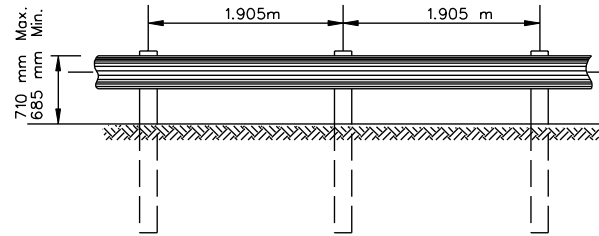
221  
505

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GR-2,2A



GR-2A  
(0.9525 m Post Spacing)



GR-2  
(1.905 m Post Spacing)

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, W Beam Back-up plate, and associated hardware see sheet nos. 501.01 and 501.02.

The Maximum Dynamic Deflection for Standard GR-2 is 1220 mm, for GR-2A deflection is less than 1220 mm since no test data is available.

Rail Elements are furnished shop curved for radii between 1.5 m and 46.0 m.

Sheet 1 of 2

SPECIFICATION  
REFERENCE

221  
505

STANDARD BLOCKED-OUT W BEAM GUARDRAIL (STRONG POST SYSTEM)

VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS  
ON THIS SHEET ARE IN MILLIMETERS

501.04

REVISED ON 8/97

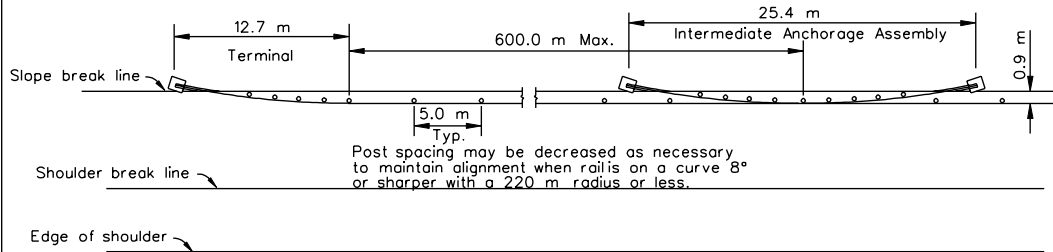
REVISED ON 7/98

REVISED ON 2/01

REVISED ON 7/01

<p>GR-2,2A</p> <p>Blockout for concrete post to be cut to fit post shape to prevent blockout from rotating.</p> <p>Dimensions shown in parenthesis indicate acceptable tolerances.</p> <p>150x200x360 mm treated pine block or Recycled Material</p> <p>20 mm holes to be cast in post</p> <p>13 mm chamfer on top 900 mm of post</p> <p>Chamfer may be extended entire length of post at the option of the fabricator.</p> <p>12 mm(+6 mm) chamfer all corners.</p> <p>M16x460 mm Bolt</p> <p>4 #13 deformed reinf. bars 100 mm less than height of post</p> <p>9-6 mm wire stirrups lapped 250 mm spacing varies 125 to 300 mm C-C</p> <p>180(+6)</p> <p>75</p> <p>200 200</p> <p>1830 mm Min.</p> <p>75</p> <p>All concrete to be Class 20</p> <p>CONCRETE POST</p>	<p>Post and blockout may be hot rolled or welded.</p> <p>150x160x360 mm treated pine block or Recycled Material.</p> <p>20 mm Holes</p> <p>M16x50 Machine Bolt</p> <p>W150x12 or W150x13, 150x160x360 Treated pine Block or Recycled Material</p> <p>M16x50 Bolt</p> <p>W150x12 or W150x13</p> <p>Holes in posts and brackets to be 20 mm dia.</p> <p>Optional hole to facilitate galvanizing.</p> <p>Back-up plate at non splice locations required with steel blockout.</p> <p>1830 mm Min.</p> <p>STEEL POST</p>	<p>** Ungalvanized thickness</p> <p>* Nominal dimensions</p> <p>19 mm (typ.)</p> <p>150</p> <p>110</p> <p>10 mm R (Typ.)</p> <p>52</p> <p>M16x50 mm Bolt</p> <p>20 mm Holes</p> <p>Optional hole to facilitate galvanizing</p> <p>1830 mm Min.</p> <p>Traffic Direction when Possible</p> <p>BENT PLATE POST</p>	
<p>M16x460 mm Bolt</p> <p>150x200x360 mm treated pine block or Recycled Material</p> <p>Southern Pine</p> <p>20 mm Hole</p> <p>Galv. steel 10d Common nail (Drive nail at center of block and post after bolt is installed)</p> <p>180</p> <p>200 200</p> <p>1830 mm Min.</p> <p>150X200 mm WOOD POST</p>	<p>M16x460 mm Bolt</p> <p>150x200x360 mm treated pine block or Recycled Material</p> <p>Southern Pine</p> <p>20 mm Hole</p> <p>Galv. steel 10d Common nail (Drive nail at center of block and post after bolt is installed)</p> <p>180 mm Dia. Min. (+6)</p> <p>200</p> <p>180</p> <p>1830 mm Min.</p> <p>Post to be gamed to accept blockout</p> <p>ROUND WOOD POST</p>	<p>All bolts, nuts, washers, and steel blockouts are to be galvanized.</p> <p>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.</p> <p>For details of guardrail element splice joint, hardware, etc. See sheet no's. 501.01 and 501.02</p> <p>The guardrail and median barrier components depicted in AASHTO - AGC - 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.</p> <p>Standard washer to be used on last 15 m of Run off end.</p>	
<p>STANDARD BLOCKED-OUT W BEAM GUARDRAIL (STRONG POST SYSTEM) POST AND BLOCKOUT DETAILS</p>			<p>Sheet 2 of 2</p> <p>SPECIFICATION REFERENCE</p> <p>221</p> <p>236</p> <p>505</p>
<p>501.05 UNLESS AND OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>	<p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>		

REVISED ON 2/01



Post spacing may be decreased as necessary to maintain alignment when rails on a curve 8° or sharper with a 220 m radius or less.

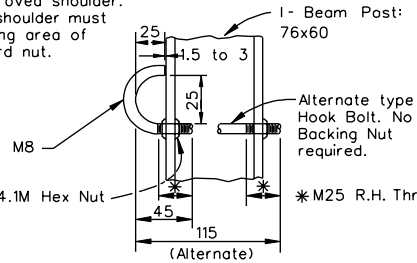
TYPICAL INSTALLATION

The Dynamic Deflection for Standard GR-3 is 3.3 m.

⊗ The guardrail and median barrier components depicted in AASHTO - AGC - 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.

For rock installation, 200 x 600 x 6.4 mm plate is to be eliminated. Drill or excavate hole for post, place post and backfill with crusher run aggregate to level of rock.

M8 ANSI B18.2.4.1M Hex Backing Nut or approved shoulder. Approved shoulder must equal bearing area of M8 standard nut.



HOOK BOLTS

Notes:

GR-3

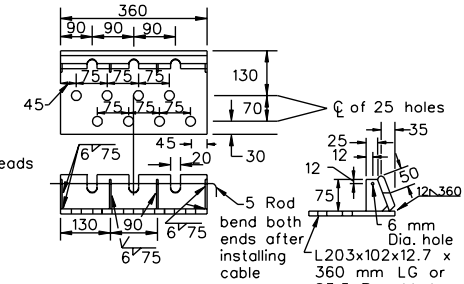
For arrangements of Spring Cable End assemblies (compensating devices) and Turnbuckle Cable End Assemblies, the following criteria shall apply:

Length of Cable Runs:

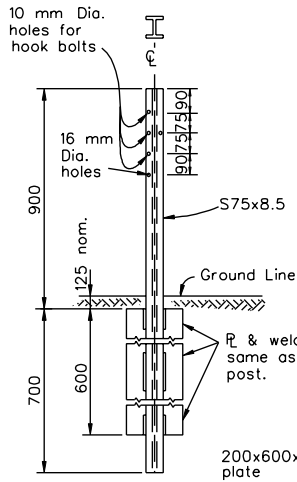
- To 150 m - Use compensating device on one end, and turnbuckle on the other end of each individual cable
- Over 150 m to 600 m - Use compensating device on each end of each individual cable.
- Over 600 m - Start new stretch by interlacing at last parallel post. (See typical installation)

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.

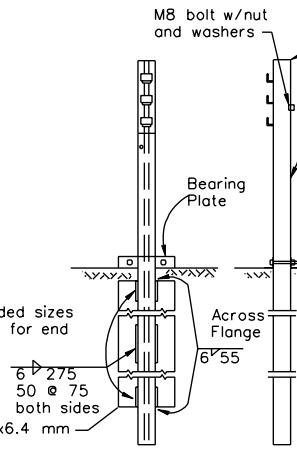
Single Cable Anchor Assembly-min. tensile strength=111.25 kN  
 Three Cable Anchor Assembly-min. tensile strength=445.0 kN  
 All fittings shall be hot dipped galvanized.



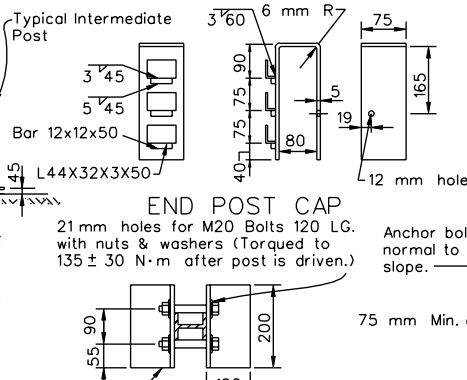
BREAKAWAY ANCHOR ANGLE



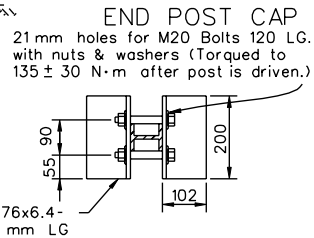
INTERMEDIATE POST DETAIL



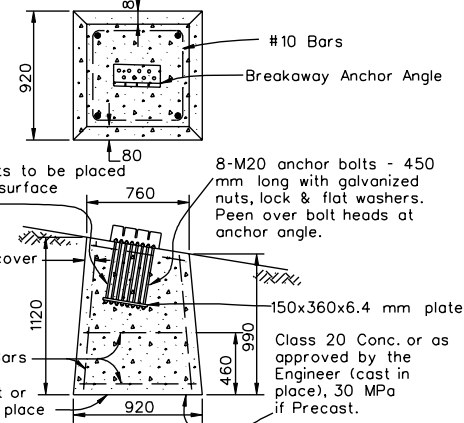
END POST DETAIL



BEARING PLATE DETAIL



END POST CAP



CONCRETE ANCHOR ASSEMBLY

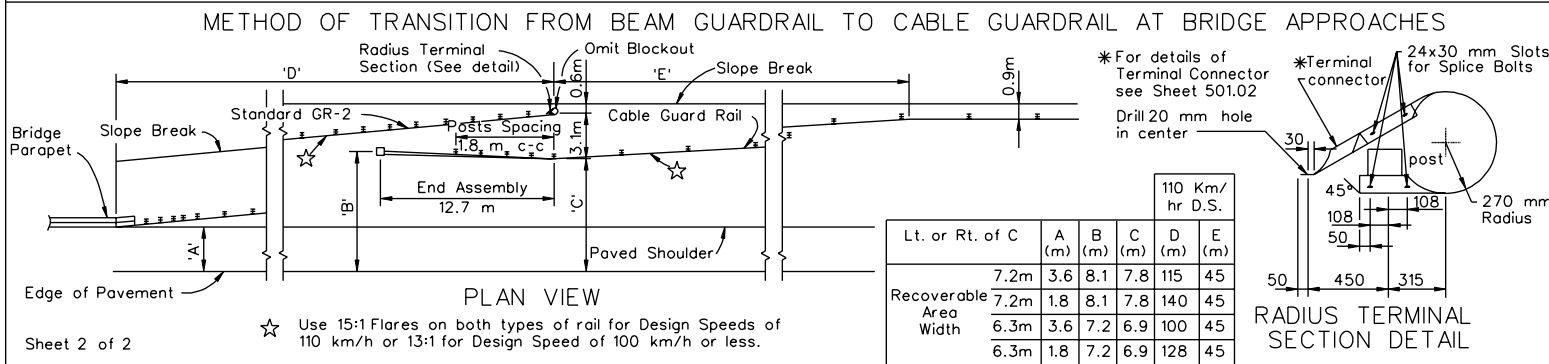
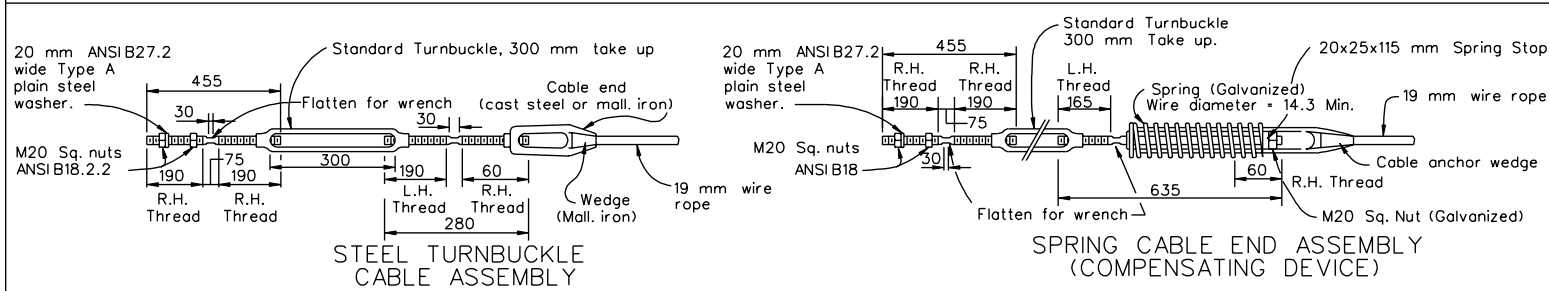
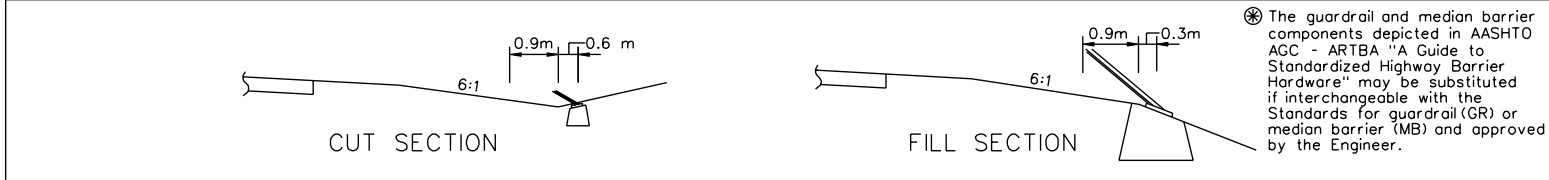
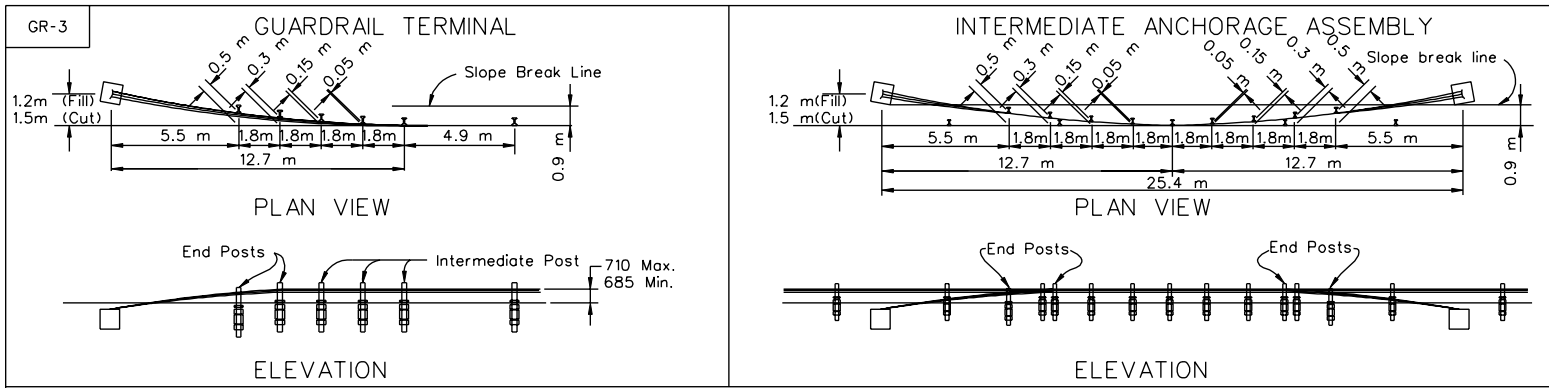
SPECIFICATION REFERENCE	
221	
505	

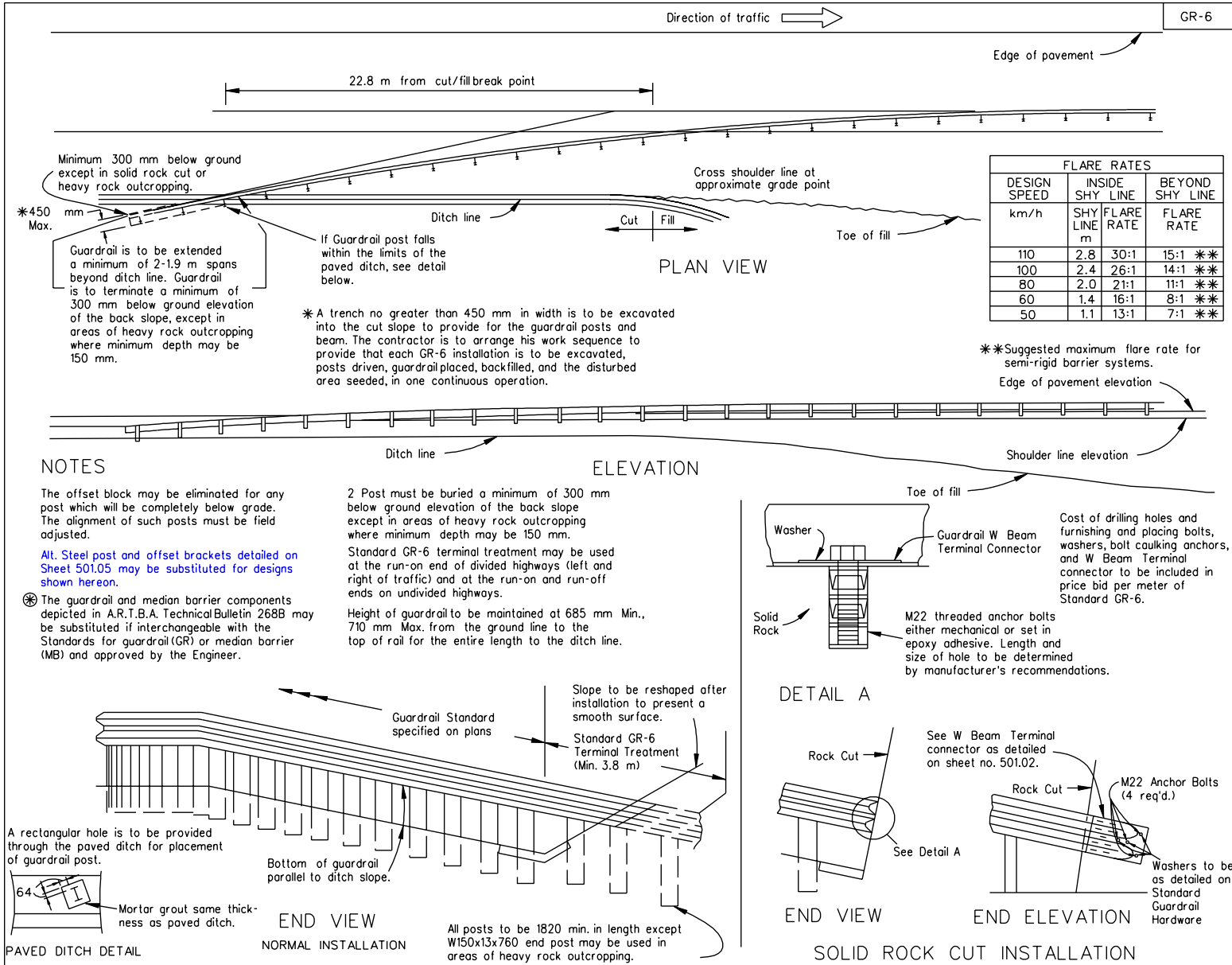
CABLE GUARDRAIL  
 VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

501.06

REVISED ON 2/01





SPECIFICATION REFERENCE	TERMINAL TREATMENT FOR W BEAM GUARDRAIL		501.08
505 221	VIRGINIA DEPARTMENT OF TRANSPORTATION		
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS			

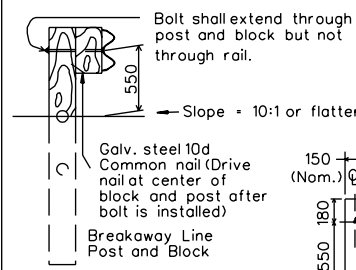
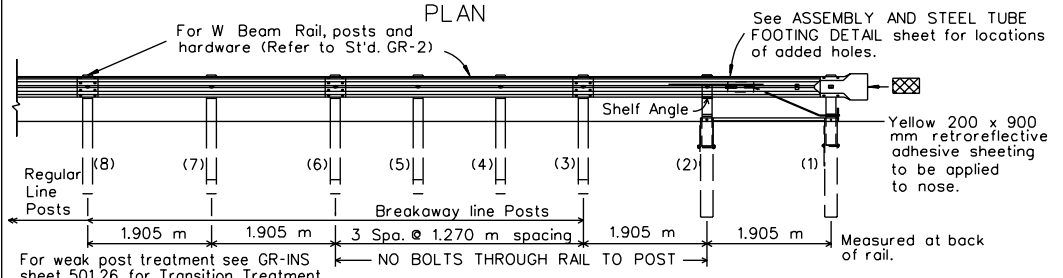
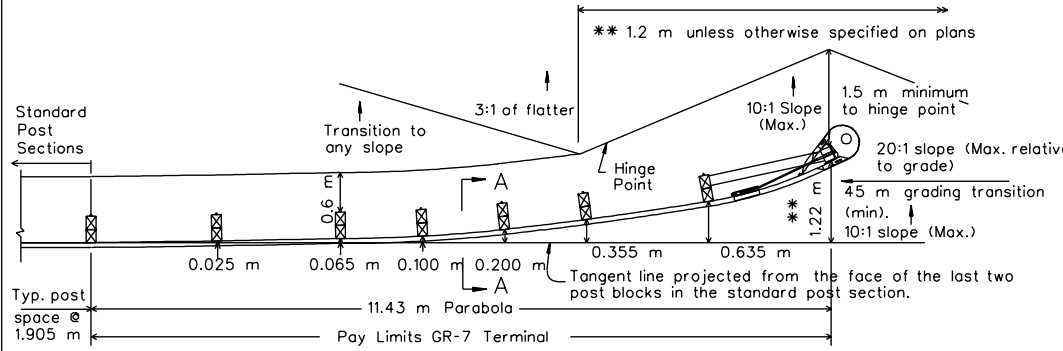


REVISED ON 7/98

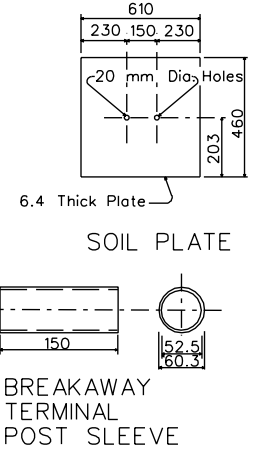
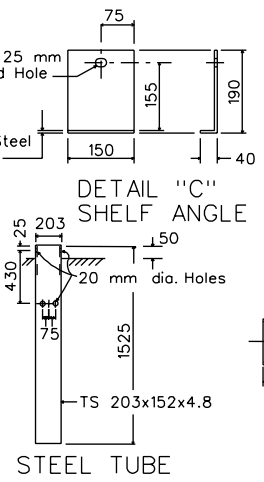
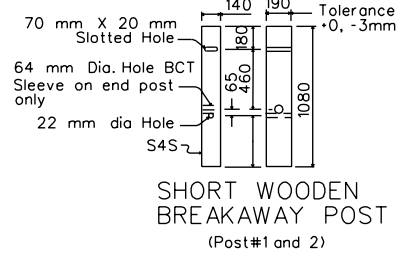
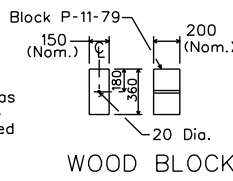
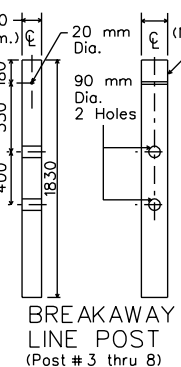
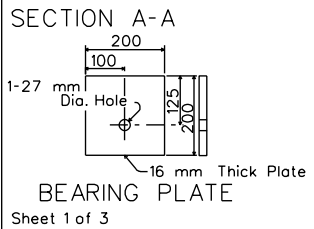
REVISED ON 2/01

REVISED ON 7/02

GR-7



ELEVATION



- GENERAL NOTES:
- Design conforms to the Modified Eccentric Loaded Terminal (MELT). The Slotted Rail Terminal (SRT350) as manufactured by Syro, Inc. may be used as an acceptable alternate if installed per the Manufacturer's recommendations and specifications.
  - All components detailed hereon are to be galvanized in accordance with the Specifications.
  - Other anchor cable assemblies meeting the approval of the Engineer may be used. Minimum breaking strength of the assembly is to be 178 kN.
  - For details of W Beam Rail, method of attaching rail to posts, splices, and other dimensions not shown hereon, see Sheet No's. 501.01, 501.05, 501.10 and 501.11.
  - The guardrail and median barrier components depicted in AASHTO - AGC - 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.
  - For details of Guardrail Terminal Installation Site Preparation Requirements see Sheet 501.15.
  - Optional holes are for insertion of Nose Expansion Block when required.
  - The post offset dimensions are given to the center of the traffic face of the blockouts, except at the first post, where the dimension is to the center of the traffic face of the post. Offset points are to be located by chord measurements at the back of rail equal to the nominal post spacings shown. Posts are to be set approximately radial to the railing at each post location.

BREAKAWAY CABLE TERMINAL  
1.2 m FLARE

VIRGINIA DEPARTMENT OF TRANSPORTATION

501.09 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

SPECIFICATION REFERENCE
221 505

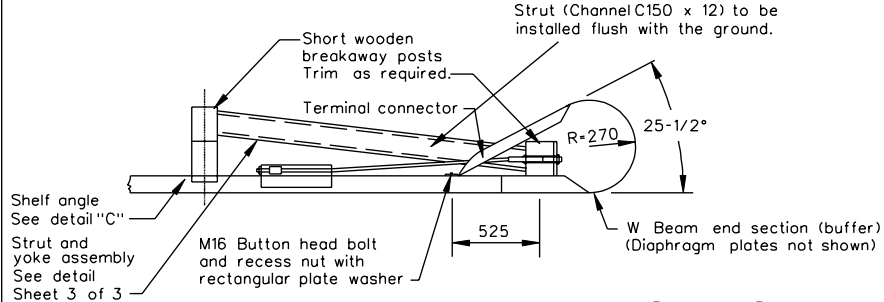
REVISED ON 7/98

REVISED ON 5/99

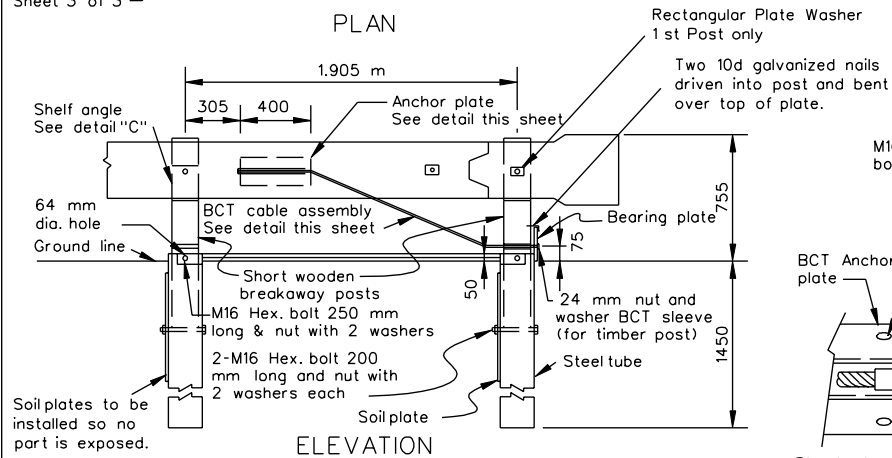
REVISED ON 2/01

REVISED ON 7/02

GR-7



PLAN



ELEVATION

BUFFERED END & ANCHORAGE ASSEMBLY

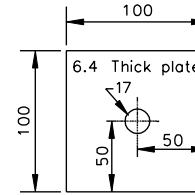
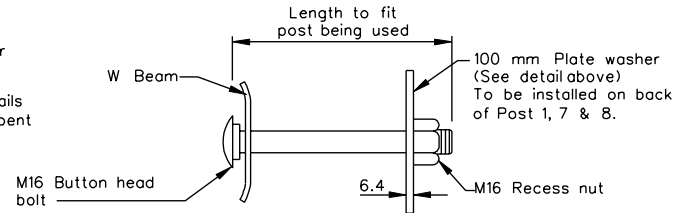
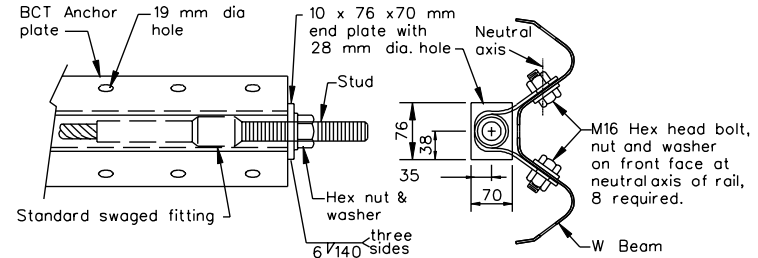


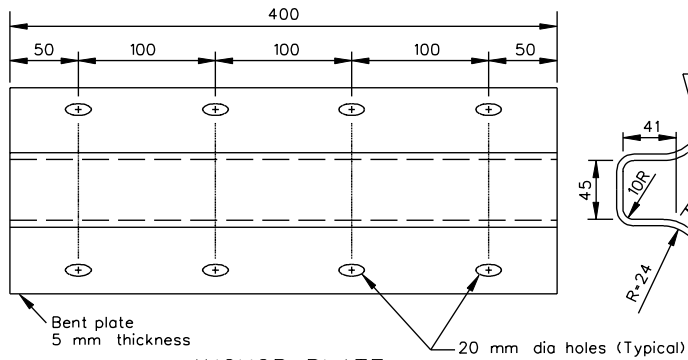
PLATE WASHER



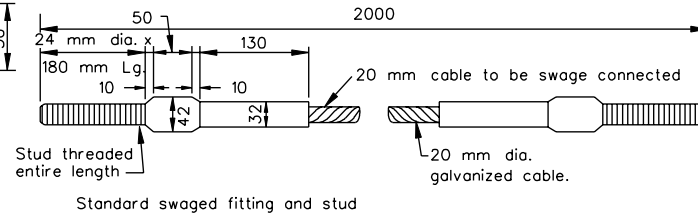
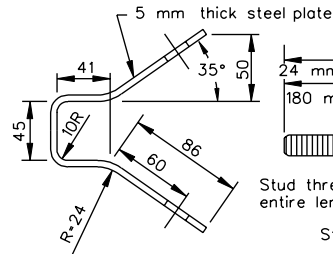
LINE POST BOLT ASSEMBLY



ANCHOR PLATE ASSEMBLY DETAILS



ANCHOR PLATE



CABLE ASSEMBLY

Cable to be installed taut.

Sheet 2 of 3

SPECIFICATION REFERENCE

221  
505

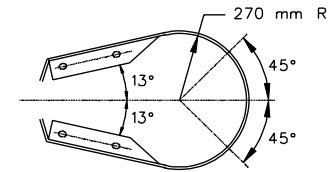
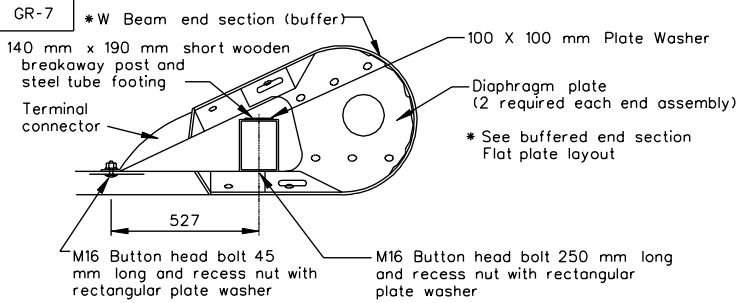
# BREAKAWAY CABLE TERMINAL TERMINAL ASSEMBLY DETAILS

VIRGINIA DEPARTMENT OF TRANSPORTATION

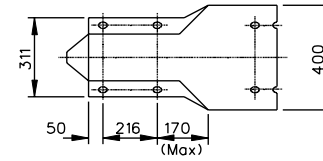
UNLESS OTHERWISE NOTED, ALL DIMENSIONS  
ON THIS SHEET ARE IN MILLIMETERS

501.10

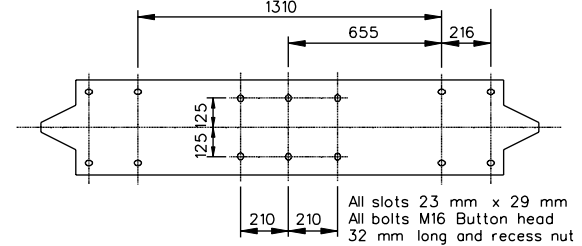
REVISED ON 7/98      REVISED ON 2/01



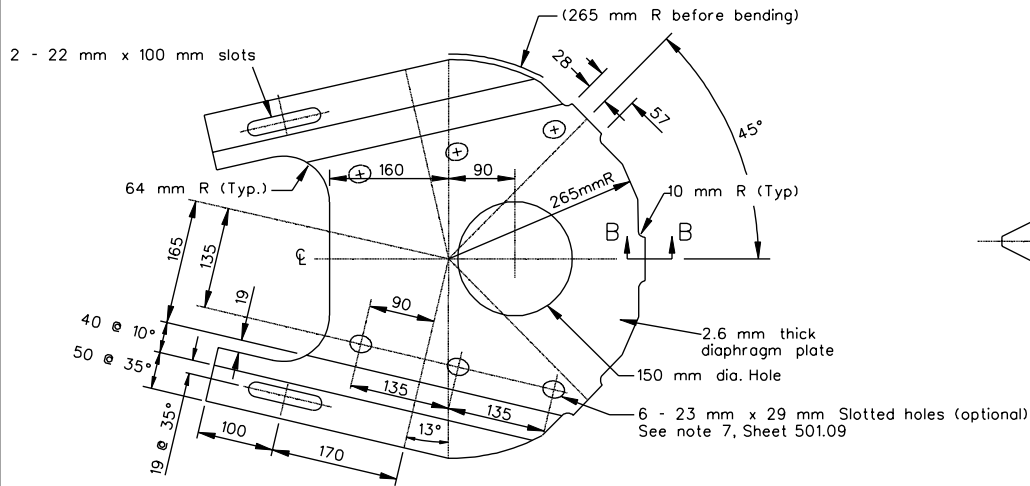
BUFFERED END SECTION PLAN



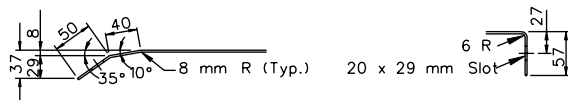
BUFFERED END SECTION ELEVATION



BUFFERED END SECTION FLAT PLATE LAYOUT

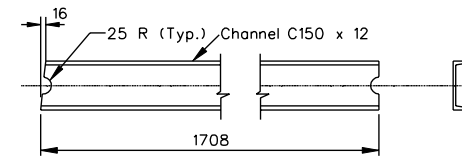


DIAPHRAGM PLATE DETAIL  
(2 Required each terminal)

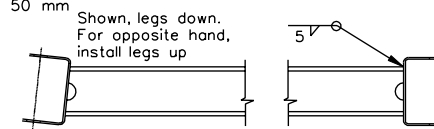


DIAPHRAGM PLATE DETAIL VIEW A-A      DIAPHRAGM PLATE DETAIL SECTION B-B

YOKE DETAILS



STRUT DETAILS



STRUT AND YOKE ASSEMBLY

Sheet 3 of 3

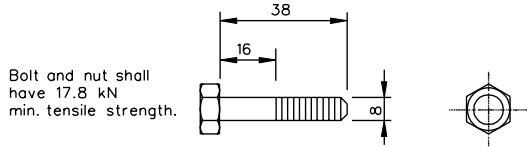
BREAKAWAY CABLE TERMINAL  
TERMINAL ASSEMBLY DETAILS

VIRGINIA DEPARTMENT OF TRANSPORTATION

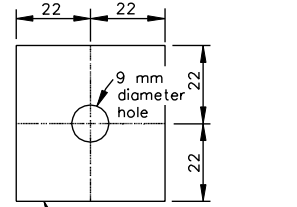
SPECIFICATION  
REFERENCE

221  
505

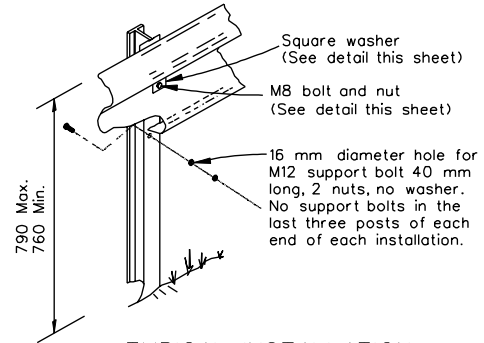
501.11 UNLESS OTHERWISE NOTED, ALL DIMENSIONS  
ON THIS SHEET ARE IN MILLIMETERS



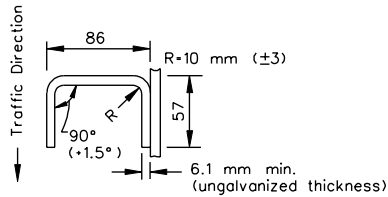
M8 HEX BOLT AND NUT



SQUARE WASHER

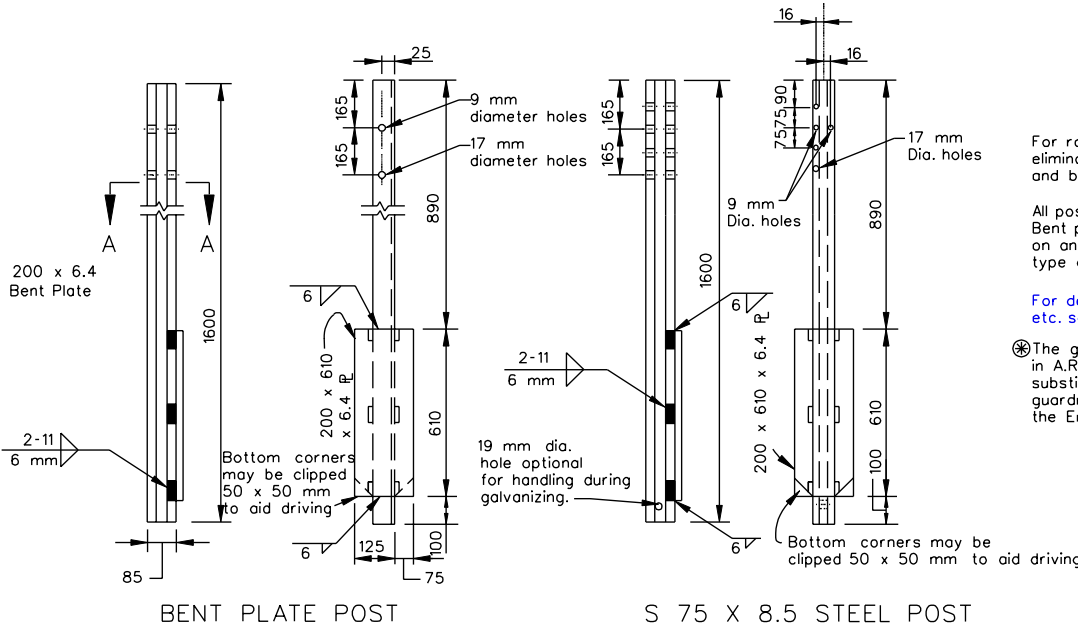


TYPICAL INSTALLATION



THIS UNIT IS ONLY TO BE USED WHEN DESIGN SPEED IS 70 km/h OR LESS.

STANDARD	POST SPACING	DEFLECTION
GR-8	3.8 m	2.20 m
GR-8A	1.9 m	1.85 m
GR-8B	0.95 m	1.40 m
GR-8C	1.27 m	1.55 m



BENT PLATE POST

S 75 X 8.5 STEEL POST

For rock installation, 200 x 610 x 6.4 mm 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. Bent plate post or S75 x 8.5 post may be interchanged on any one project with the restriction that the same type of post must be used in any single run of guardrail.

For details of guardrail element, splice joint, hardware, etc. see Sheet No. 501.01.

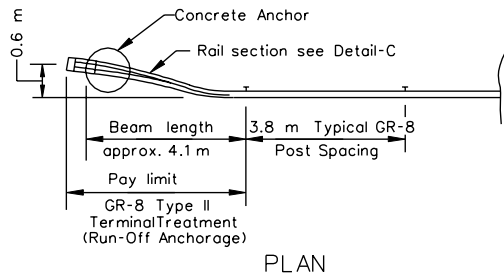
⊗ The guardrail and median barrier components depicted in A.R.T.B.A. Technical Bulletin Number 268B may be substituted if interchangeable with the Standards for guardrail (GR) or median barrier (MB) and approved by the Engineer.

POST SPACING ON CURVES	
Pavement $\bar{C}$ Radius	Post Spacing
26° > 67 m R	3.8 m
66.9 m - 33.6 m	1.9 m
33.5 m - 23.1 m	1.27 m
23.0 m - 15.0 m	0.95 m
< 15.0 m	Use not recommended

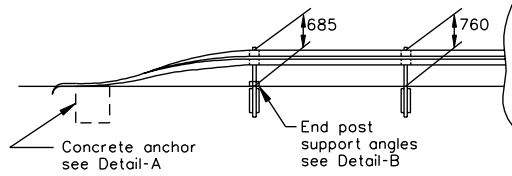
<p>SPECIFICATION REFERENCE</p> <p>221 505</p>	<h2>STANDARD W BEAM GUARDRAIL (WEAK POST SYSTEM)</h2> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>	<p>501.12</p>
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REVISED ON 7/01

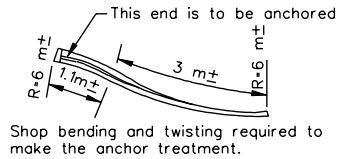
GR-8,8A,8B,8C



PLAN



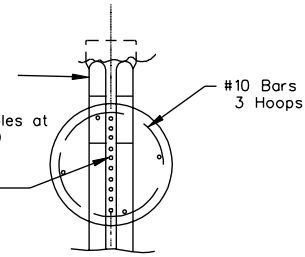
ELEVATION



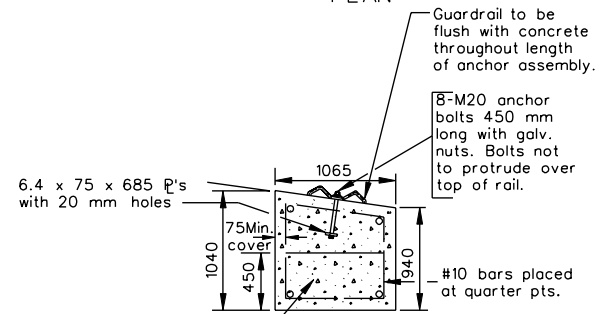
DETAIL-C  
SHOP CURVED RAIL

W Beam end section (Flared) for details see sheet No. 501.02

10-25 mm diameter holes at 75 mm O.C. for 8-M20 anchor bolts (two spare holes in rail for positioning)



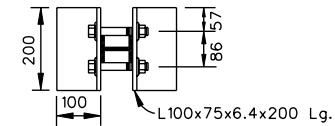
PLAN



Class 20 conc. or as approved by the Engineer (cast in place), 30 MPa if precast.

ELEVATION  
DETAIL A  
CONC. ANCHOR  
ASSEMBLY

20 mm diameter holes for M20 bolts 115 mm long W/nuts and washers. Bolts torqued to  $136 \pm 27$  N·m after post is driven.



DETAIL-B

END POST SUPPORT ANGLES

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

Sheet 2 of 3

STANDARD W BEAM GUARDRAIL (WEAK POST SYSTEM)

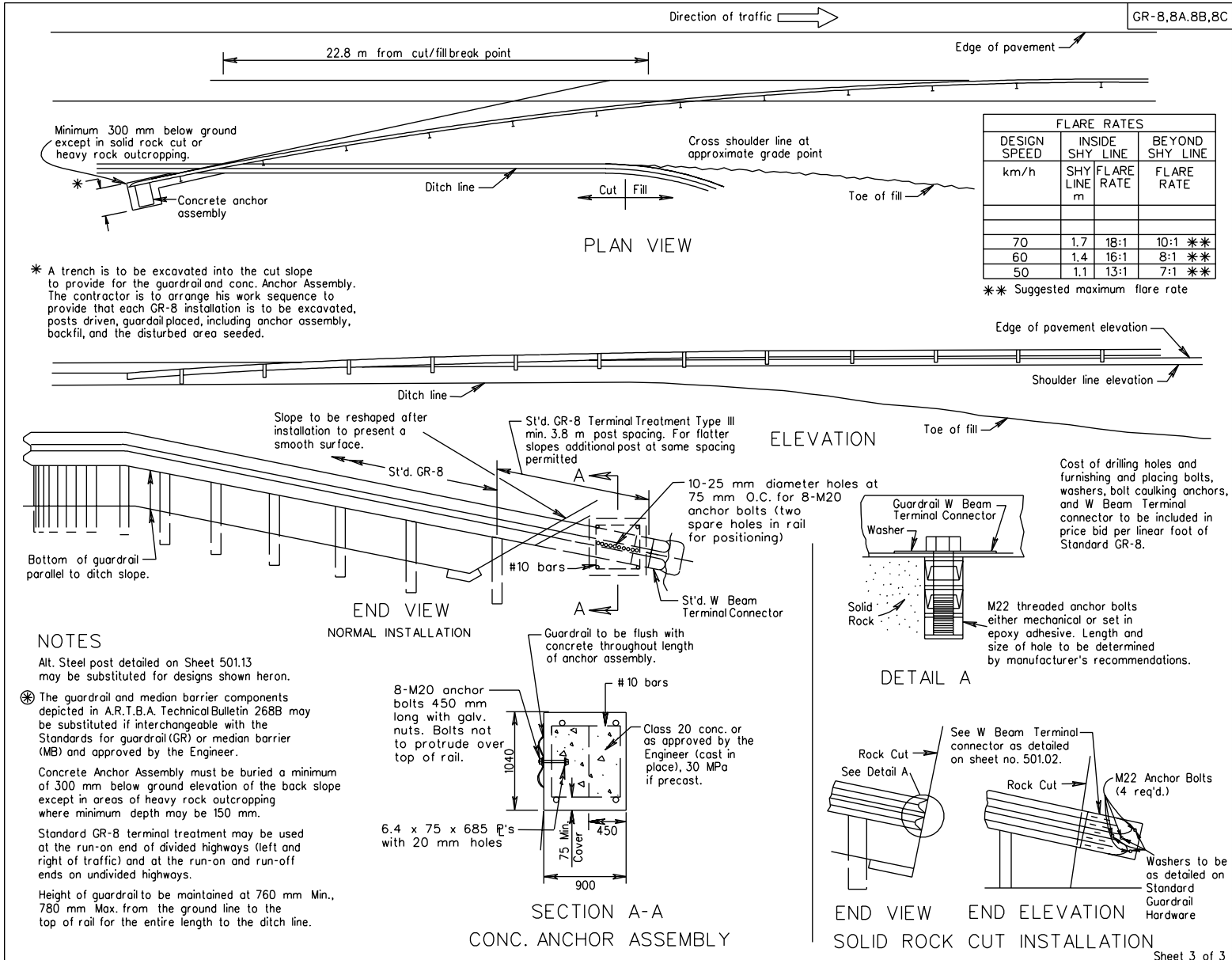
501.13 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION  
REFERENCE

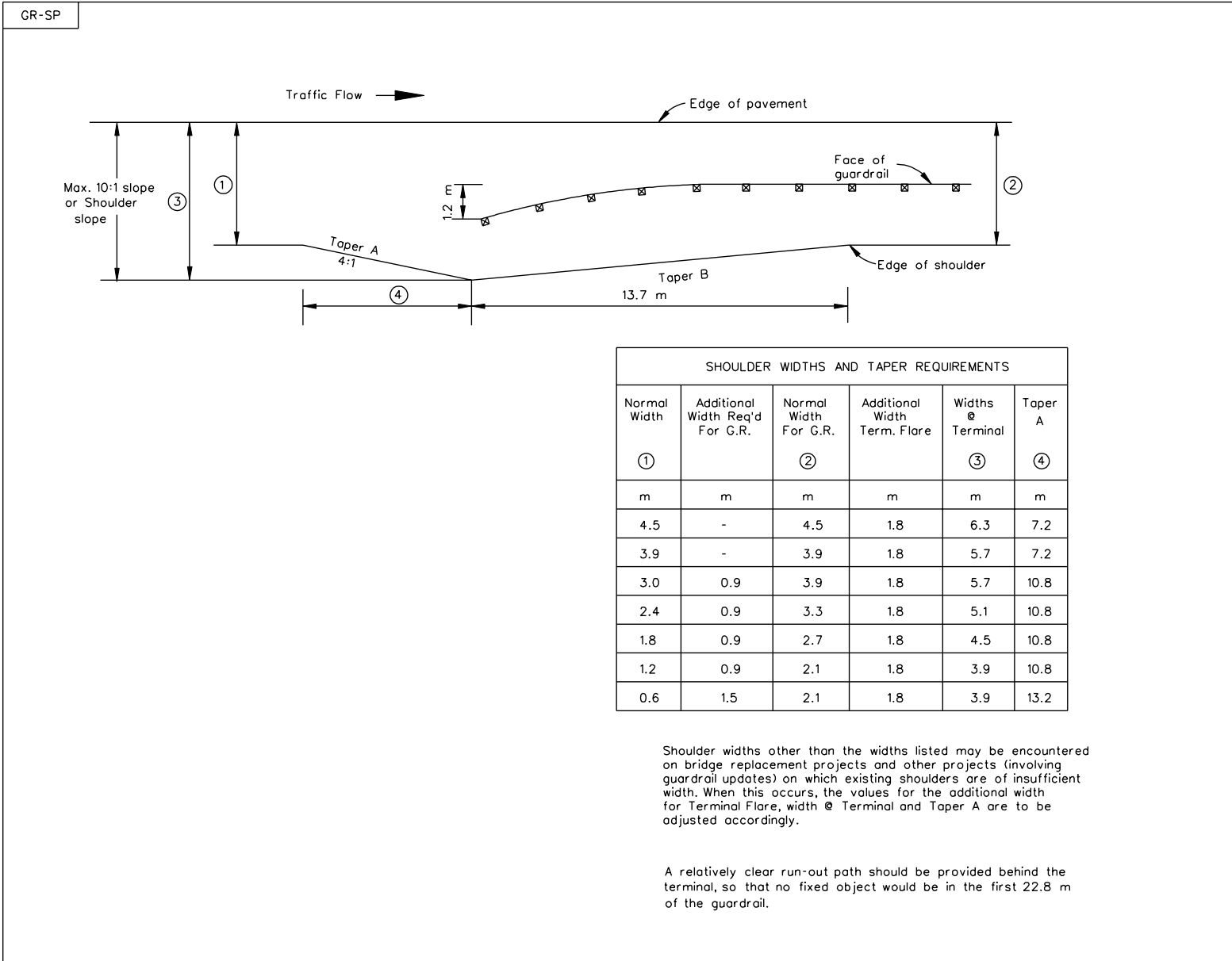
221  
505

VOID 7/15/98



Sheet 3 of 3

<p>SPECIFICATION REFERENCE</p> <p>505</p> <p>221</p>	<p>STANDARD W BEAM GUARDRAIL (WEAK POST SYSTEM)</p> <p>TYPE III</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>VOID 7/15/98</p> <p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>	<p>501.14</p>
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SHOULDER WIDTHS AND TAPER REQUIREMENTS					
Normal Width	Additional Width Req'd For G.R.	Normal Width For G.R.	Additional Width Term. Flare	Widths @ Terminal	Taper A
①		②		③	④
m	m	m	m	m	m
4.5	-	4.5	1.8	6.3	7.2
3.9	-	3.9	1.8	5.7	7.2
3.0	0.9	3.9	1.8	5.7	10.8
2.4	0.9	3.3	1.8	5.1	10.8
1.8	0.9	2.7	1.8	4.5	10.8
1.2	0.9	2.1	1.8	3.9	10.8
0.6	1.5	2.1	1.8	3.9	13.2

Shoulder widths other than the widths listed may be encountered on bridge replacement projects and other projects (involving guardrail updates) on which existing shoulders are of insufficient width. When this occurs, the values for the additional width for Terminal Flare, width @ Terminal and Taper A are to be adjusted accordingly.

A relatively clear run-out path should be provided behind the terminal, so that no fixed object would be in the first 22.8 m of the guardrail.

GUARDRAIL TERMINAL INSTALLATION SITE PREPARATION  
REQUIREMENTS FOR GR-7 AND GR-8

SPECIFICATION  
REFERENCE

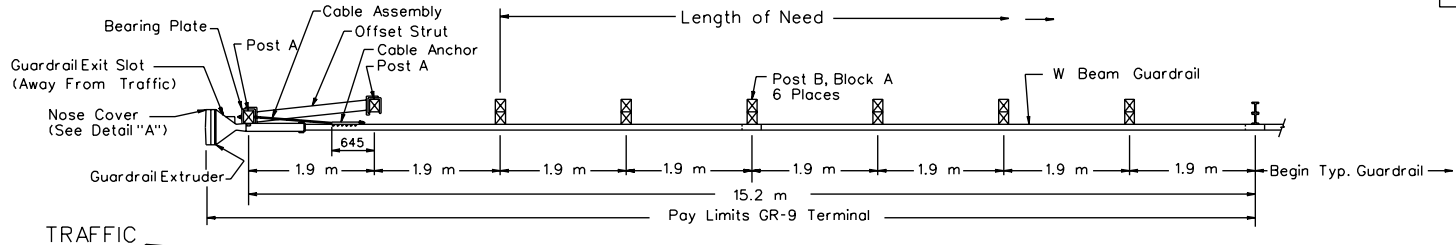
REVISED ON 8/97

REVISED ON 4/98

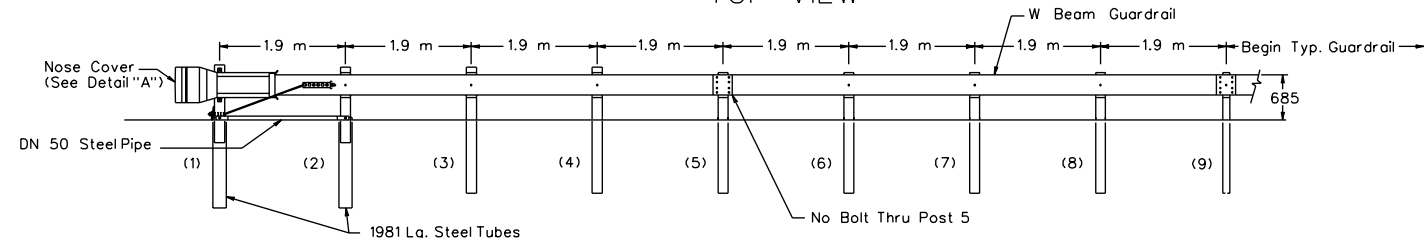
REVISED ON 2/01

REVISED ON 7/02

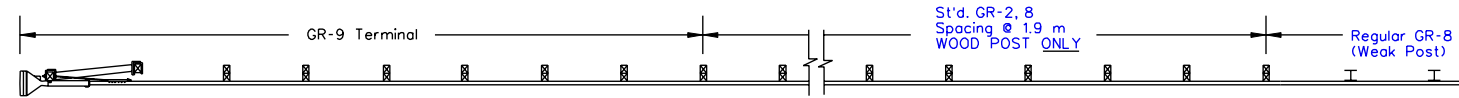
GR-9



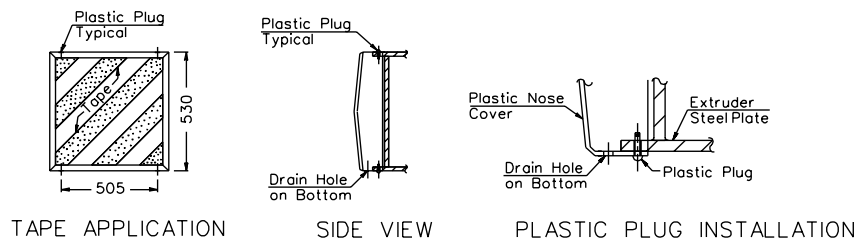
TOP VIEW



ELEVATION



TRANSITION FROM GR-9 TERMINAL TO WEAK POST GUARDRAIL



TAPE APPLICATION

SIDE VIEW

PLASTIC PLUG INSTALLATION

NOTE: Direction of tape shall conform to MUTCD application for diagonal stripes on object markers and bridge end panels. Color of tape shall be amber (yellow).

NOSE COVER DETAIL "A"

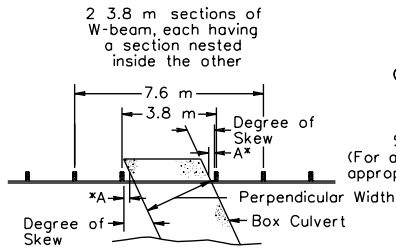
NOTES:  
 This design shall only be used after an analysis indicates it is more cost effective than providing the flare for a St'd. GR-7 or extending the guardrail to provide a St'd. GR-6 terminal.  
 Alternate Breakaway Cable Terminal (GR-9) is to be ET-2000 (as shown) manufactured by Syro Steel Company, CAT 350 as manufactured by Syro Steel Company, BRAKEMASTER as manufactured by Energy Absorption Systems, Inc., or other approved equal.  
 For details, dimensions, quantities and other information not shown hereon, see individual manufacturer's plans.

SPECIFICATION REFERENCE	ALTERNATE BREAKAWAY CABLE TERMINAL NO FLARE		
505.01	VIRGINIA DEPARTMENT OF TRANSPORTATION		UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS
			501.16



REVISED ON 2/01

GR-10



ONE POST OMITTED  
TOP VIEW

For details of guardrailposts and blockouts, see Standard GR-2, 2A.

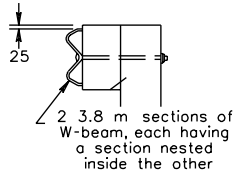
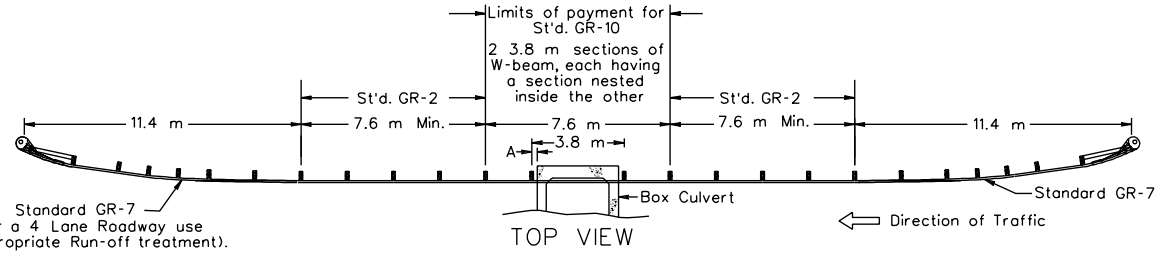


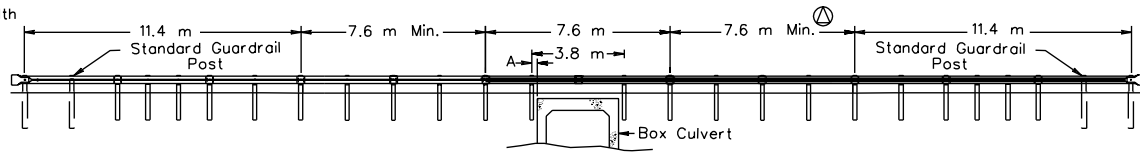
TABLE OF MAXIMUM  
ALLOWABLE STRUCTURE  
WIDTHS FOR THIS DESIGN

Type I-One Post Omitted			Type II-Two Posts Omitted		
Skew	A* (m)	Maximum Perpendicular Width (meters)	Skew	A* (m)	Maximum Perpendicular Width (meters)
0°	.230	3.2	0°	.230	5.1
5°	.230	3.2	5°	.230	5.1
10°	.230	3.1	10°	.230	5.0
15°	.230	3.0	15°	.230	4.9
20°	.230	2.9	20°	.230	4.7
25°	.230	2.8	25°	.230	4.5
30°	.230	2.7	30°	.230	4.3
35°	.230	2.5	35°	.230	4.0
40°	.230	2.4	40°	.230	3.8
45°	.230	2.1	45°	.230	3.5

\* "A" = the minimum allowable distance between closest point of post to structure.

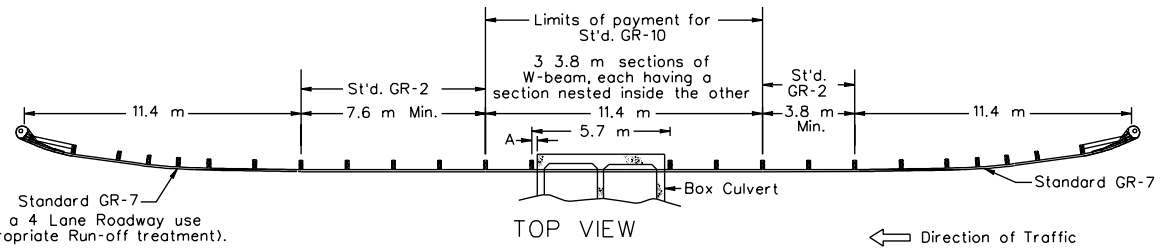


TOP VIEW

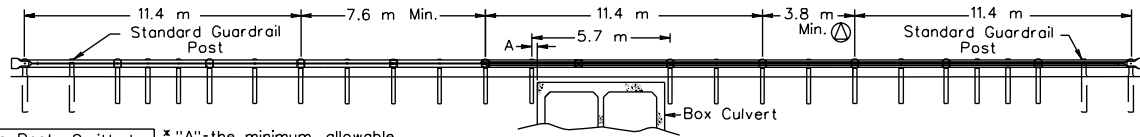


ELEVATION

TYPE I-ONE POST OMITTED



TOP VIEW



ELEVATION

TYPE II-TWO POSTS OMITTED

NOTES:

This sheet is applicable when guardrail is required and the depth of fill above the top slab of the box culvert is less than 1090 mm.

Guardrail installation to be in accordance with section 505 of the Specifications. Material requirement for components shall be in accordance with section 221 of the Specifications.

Guardrail post spacing to be in accordance with Standard GR-2.

Ⓢ This distance to be in accordance with VDOT policy on determining the length of need for guardrail with a minimum distance as shown.

GUARDRAIL AT LOW-FILL CULVERTS

501.17 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION  
REFERENCE

221  
505

REVISED ON 8/97

VOID 7/15/98

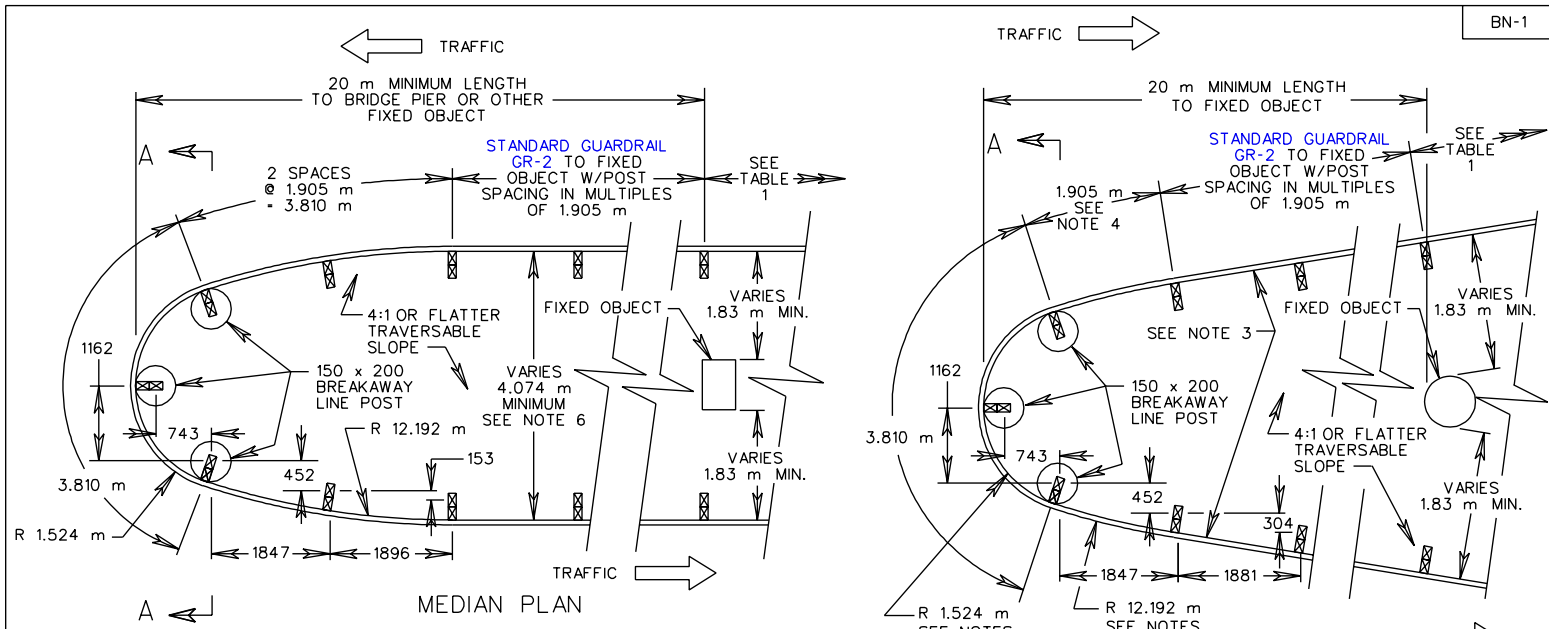
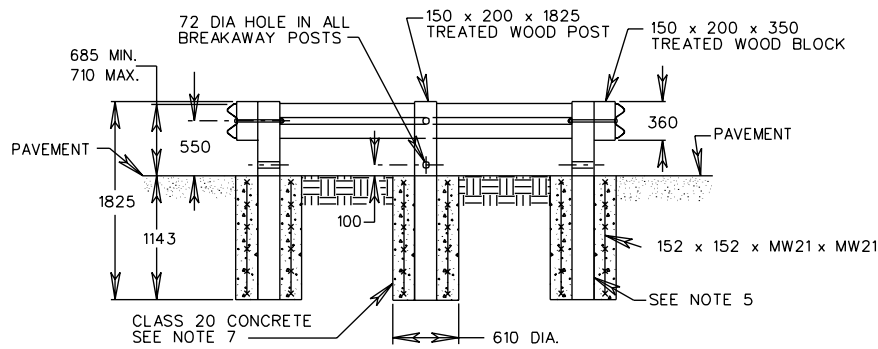


TABLE 1

MINIMUM DISTANCE BARRIER MUST PASS FIXED OBJECT	
7.6 m FOR GR-2	7.6 m PLUS A TYPE II FOR GR-8
3.8 m FOR GR-2A	0.3 m FOR MB-7C



SECTION A-A

NOTES

- ALL STEEL COMPONENTS ARE TO BE GALVANIZED IN ACCORDANCE WITH SPECIFICATIONS.
- FOR DETAILS OF W BEAM RAIL, METHOD OF ATTACHING RAIL TO POST, SPLICES AND OTHER DIMENSIONS AND/OR PERTINENT INFORMATION NOT SHOWN, SEE SHEET NUMBERS 501.01 AND 501.05.
- ANGLE (OFFSET) SHOWN IS FOR REPRESENTATIONAL PURPOSES ONLY. REFER TO ROADWAY PLAN SHEET(S) AND EXISTING FIELD CONDITIONS FOR DETERMINATION OF APPROPRIATE ANGLE (OFFSET). LIKEWISE THE LENGTH, ANGLE (OFFSET), AND POINT(S) OF TANGENCY FOR THE 12.192 m RADIUS MAY VARY FROM THIS ILLUSTRATION.
- THE 1.905 m POST SPACING SHALL BE HELD REGARDLESS OF THE LENGTH, ANGLE (OFFSET), AND POINT OF TANGENCY OF THE 12.192 m RADIUS.
- WRAP THE EMBEDDED PORTION OF THE ORIGINAL POSTS WITH 12 mm THICK POLYSTYRENE TO FACILITATE POST REPLACEMENT.
- SPECIAL DESIGN REQUIRED FOR WIDTHS LESS THAN 4.074 m.
- CONCRETE FOOTING MAY BE SUBSTITUTED WITH A TS 203 X 4.8 X 152 X 1525 L.G. STEEL TUBE ASSEMBLY PER GR-7.

SPECIFICATION REFERENCE
221
505

1.524 m RADIUS BULL NOSE  
IMPACT ATTENUATOR

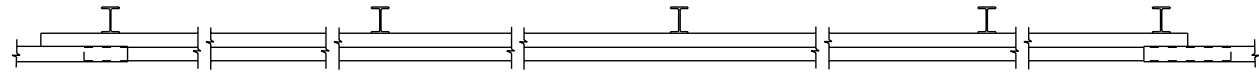
VIRGINIA DEPARTMENT OF TRANSPORTATION

VOID 7/15/98

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS 501.18

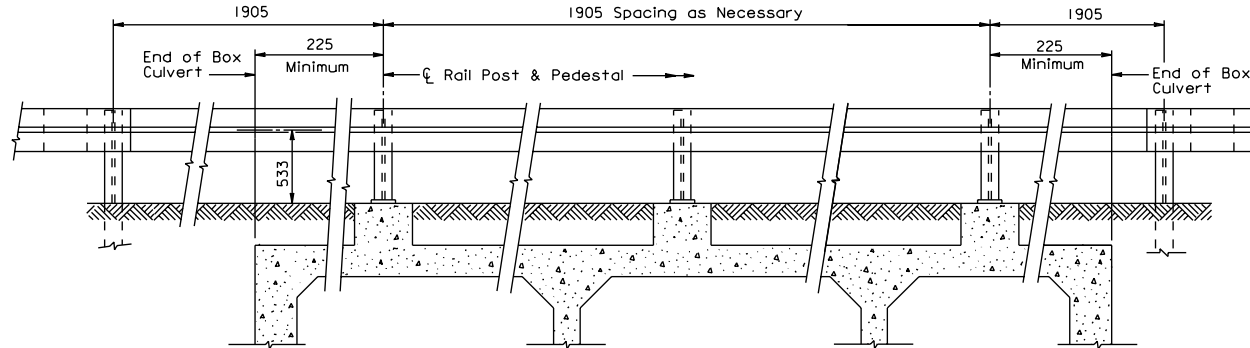
REVISED ON 2/01

BGR-01



PLAN

Note: Maintain 1905 mm post spacing wherever possible for use with 7620 mm standard rail section. Symmetry of post spacing is not necessary.



LONGITUDINAL SECTION

GENERAL NOTE

All structural steel, including bolts, nuts, and washers shall be galvanized.

For details of guardrail, see CR-2 of the Road and Bridge Standards.

The guardrail installation shall conform with Section 505 of the Virginia Department of Transportation Road and Bridge Specifications, 1995.

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 22 mm  $\phi$  ASTM A307 (or ASTM A709 Grade 250 threaded rods with tack welded nuts) with hex nuts and washers as shown. Threaded rods may be 20 mm min. diameter with rolled threads. Nuts shall conform to ASTM 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 200 mm into the concrete.

This rail has been successfully evaluated by full scale impact tests conducted in accordance with NCHRP Report 153. Test documentation may be found in Research Report 230-1, "Tubular W-Beam Bridge Rail", of Research Study 2-5-78-230 "Bridge Rail to Contain Heavy Trucks and Buses", Texas Transportation Institute, October 1978.

All dimensions are shown in millimeters (mm) unless otherwise noted. Symbol  $\phi$  = diameter.

Tubular guard rail shall be furnished and installed in 7620 mm 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 7620 mm standard sections. Approach guardrail posts shall be spaced at 1905 mm adjacent to the tubular rail since its flexibility is similar to the standard metal beam guardrail. Do not install additional posts at 953 mm centers. Fully anchored guardrail must be attached at both ends of tubular rail.

Tests have shown that although this rail deflects horizontally 600 to 900 mm, adequate vehicle containment and re-direction is achieved. The resulting more gradual deceleration thus produces a safer condition than afforded by other bridge railings.

The Contractor shall determine the number of pedestals required for guardrail installation across the box, pedestal height and dimensions of the BR Series reinforcing bars. The quantity of concrete (Class 30) and reinforcing steel used in the pedestals shall be field verified and paid for at the unit price bid for the corresponding box quantities. The railing (Texas T-6) shall be measured in 7620 mm sections and paid for at the contract unit price per meter in accordance with Section 410.04 of the Specifications. BR Series bars shall be #16 in size.

For details of box culverts, see the Box Culvert Standards.

This sheet is applicable when guardrail is required and the depth of fill above the top slab of the box culvert is less than 1100 mm.

Details shown are for installation on new box culverts. Installation of pedestals on existing box culverts shall be in accordance with Sec. 412.03 of the Specifications except that dowels shall be placed between 75 and 150 mm from the edge of the pedestal.

Precast boxes shall be treated as an existing box for pedestal installation.

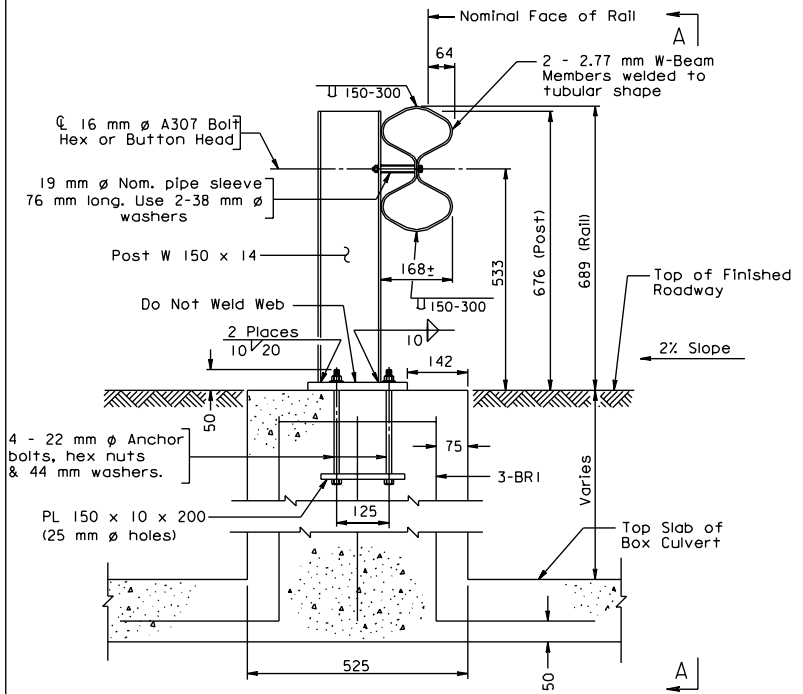
Sheet 1 of 3

STANDARD BOX CULVERT GUARDRAIL (TEXAS T-6)

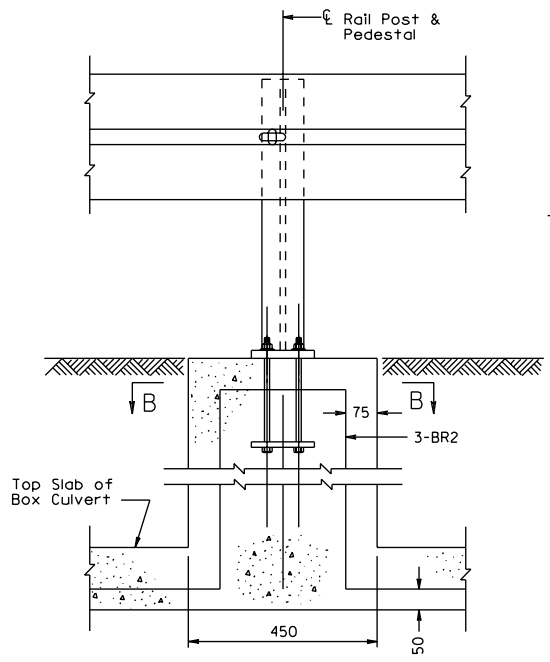
VIRGINIA DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

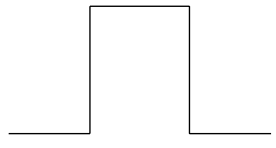
501.19



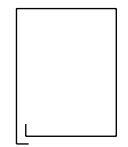
PART TRANSVERSE SECTION



SECTION A-A

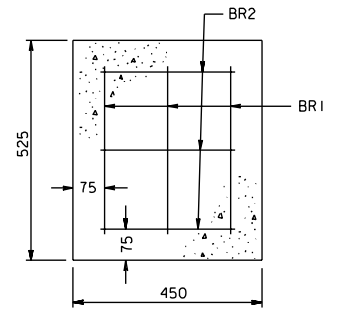


NEW BOX

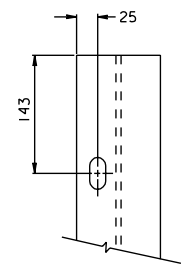


EXISTING BOX

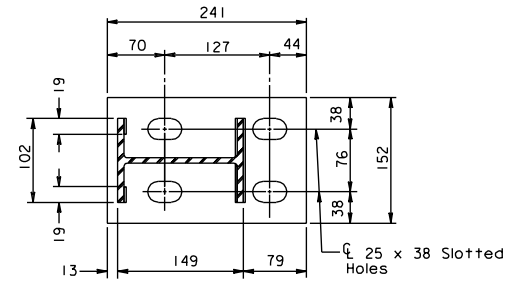
BR SERIES SHAPES



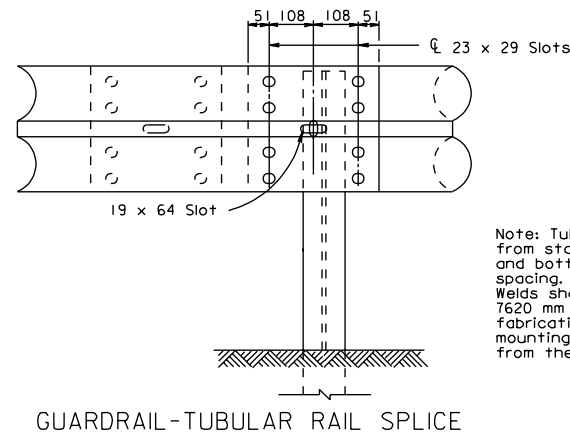
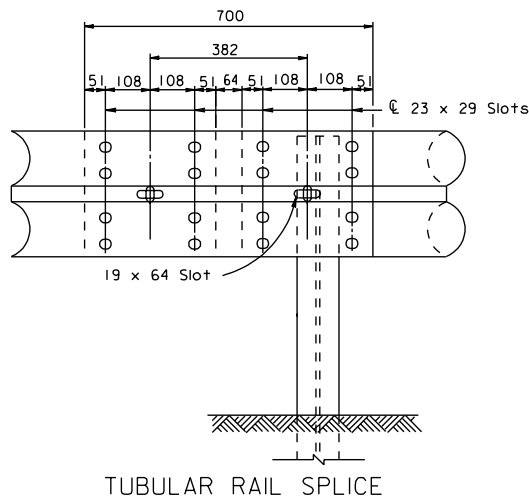
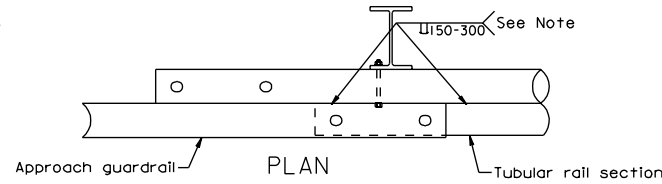
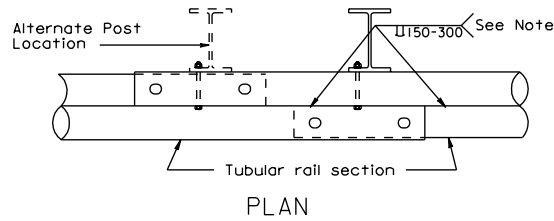
SECTION B-B  
(Anchor Bolts Not Shown)



19 mm x 38 mm SLOTTED HOLE IN POST

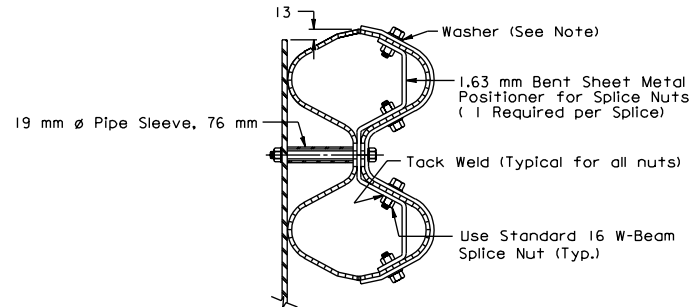


16 mm BASE PLATE  
(25 x 38 Slotted Holes)



Note: Tubular W-Beam Rail Member is to be fabricated from standard 7620 mm Nominal W-Beam sections. Top and bottom seams shall be butt welded 150 mm at 300 mm spacing. Continuous seam welding is also acceptable. Welds shall be chipped and cleaned and the complete 7620 mm tubular member shall be galvanized after fabrication. For Tubular Rail Splice, additional post mounting slots are to be made in each member 381 mm from the standard slots at 1905 mm centers.

Note: 8 - 16 mm 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 44 x 76 x 5 plate washer or a 51 mm diameter washer.



SPICE DETAIL

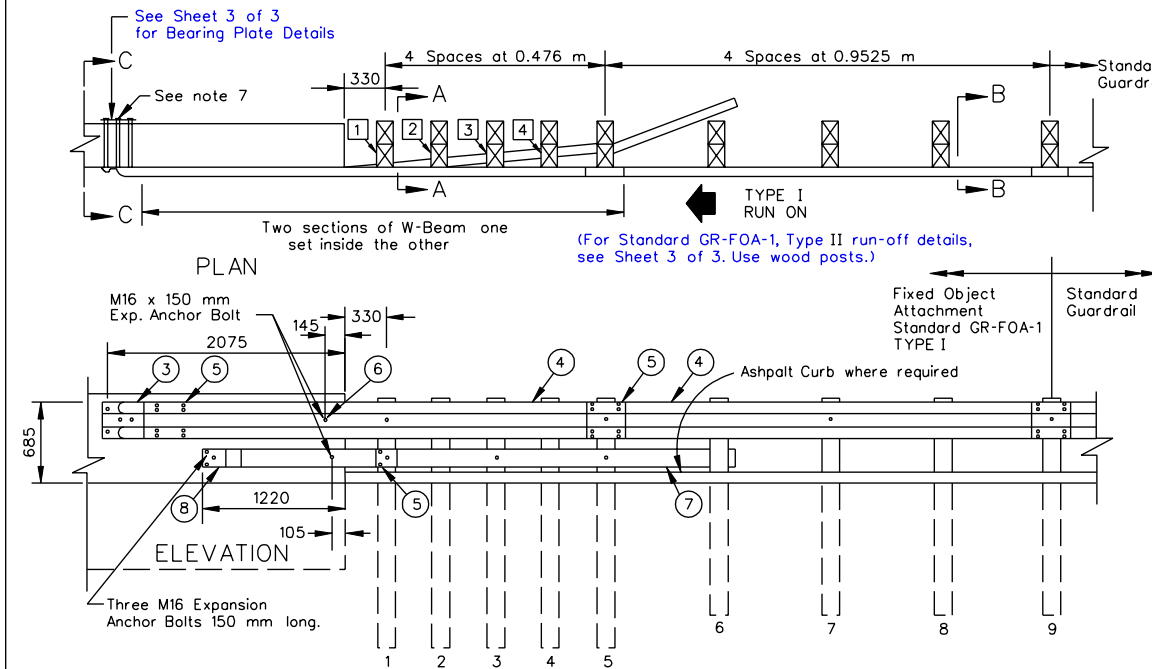
STANDARD BOX CULVERT GUARDRAIL  
(TEXAS T-6)

REVISED ON 7/98

REVISED ON 2/01

REVISED ON 7/01

GR-FOA-1



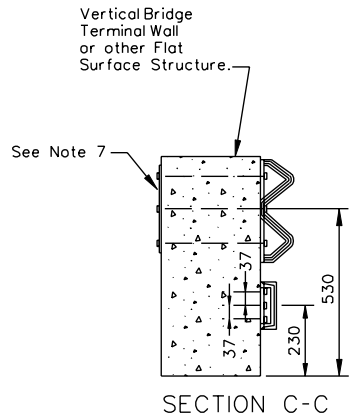
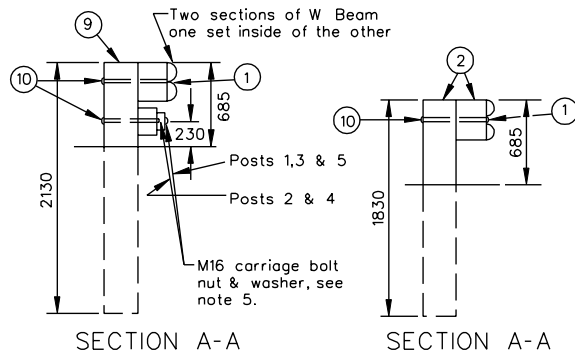
Notes:

1. Fixed objects may consist of bridge rails, abutments, piers, retaining walls, or other flat surfaced structures with a vertical face.
2. Bridge rail ends and bridge parapets must be of adequate strength to accept full impact loading.
3. Guardrail components to 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 M16 carriage bolts. (Length as required).
6. W-beam is not bolted to posts at posts 2,3,4,6 and 8; Bolt block directly to post.
7. Appropriate length M22 diameter ASTM A325M hex bolts must be used with thru drilled holes with a 16 mm bearing plate on the back side of the bridge parapet or Terminal wall.

RUBRAIL WOOD BLOCKS  
180 mm x 150 mm x THICKNESS

Post	Thickness
1	170
2	130
3	90
4	50

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.

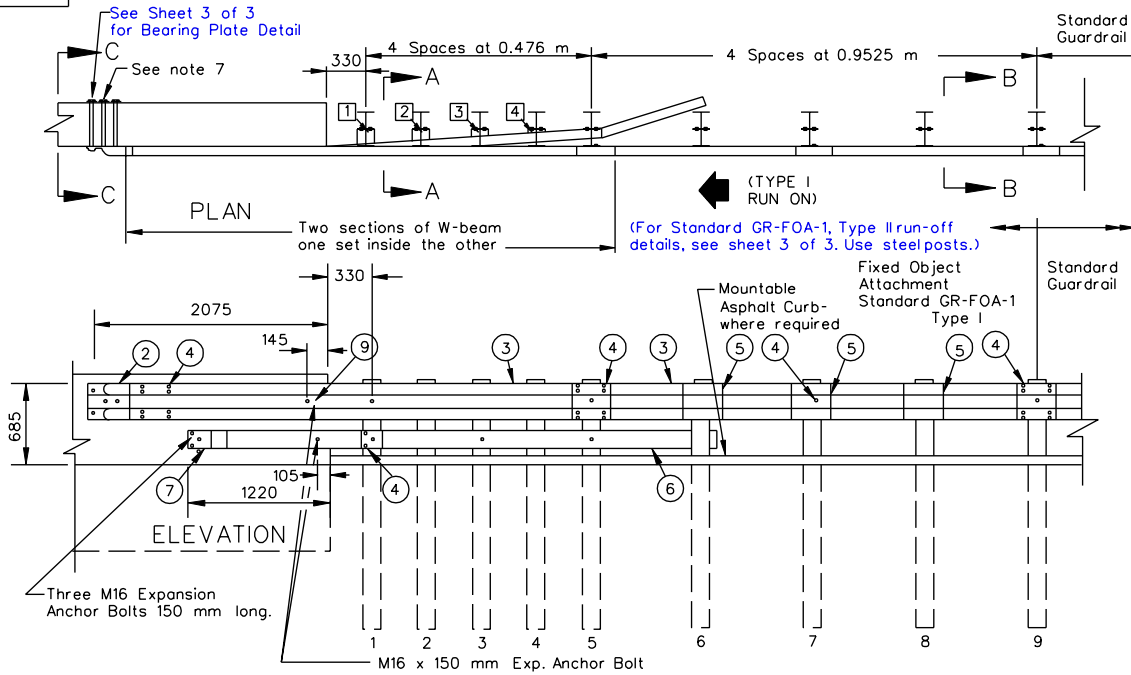


Item	Material/Specifications/Notes
1	M16 x 460 mm Guardrail bolt & Recessed nut
2	Standard 150 x 200 mm Wood post & Block
3	Standard W-beam terminal connector
4	Standard W-beam rail
5	M16 x 50 mm Guardrail bolt & Recessed nut (See Standard GR-HDW)
6	Rectangular Plate Washer (See Standard GR-HDW)
7	Bent plate rubrail (See sheet 3 of 3)
8	C150 x 12 rubrail (See sheet 3 of 3)
9	Mod. 150 x 200 mm Wood post & Standard block (2130 mm length post)
10	Washer for M16 bolt

Sheet 1 of 3

<p>SPECIFICATION REFERENCE</p> <p>505</p>	<p>W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT FOR USE BETWEEN VERTICAL FIXED OBJECTS AND GUARDRAIL (WOOD POSTS)</p>	<p>UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>	<p>501.22</p>
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GR-FOA-1



Notes:

1. Fixed objects may consist of bridge rails, abutments, piers, retaining walls, or other flat surfaced structures with a vertical face.
2. Bridge rail ends and bridge parapets must be of adequate strength to accept full impact loading.
3. Guardrail components to 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 M16 carriage bolts. (Length as required.)
6. W-beam is not bolted to posts 2,3,4,6 and 8; Bolt block directly to post.
7. Appropriate length M22 diameter ASTM A325M hex bolts must be used with thru drilled holes with a 16 mm bearing plate on the back side of the bridge parapet or Terminal wall.

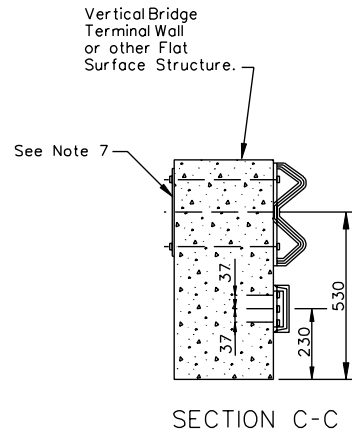
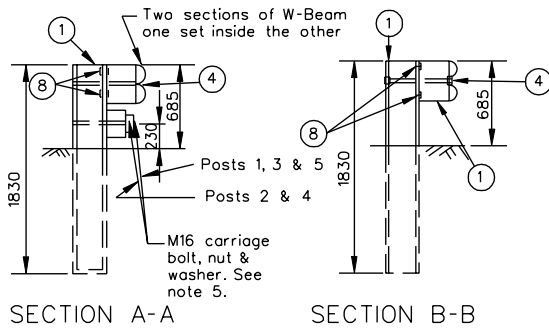
RUBRAIL WOOD BLOCKS  
180 mm x 150 mm x Thickness

Post	Thickness
1	125
2	100
3	70
4	35

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.



Item	Material/Specifications/Notes
1	Standard W150x13.5 Steel
2	Standard W-beam terminal connector
3	Standard W-beam rail
4	M16 x 50 Guardrail bolt & Recessed nut
5	Standard W-beam back-up plate
6	Bent plate rubrail (See sheet 3 of 3)
7	C150x12 rubrail (See sheet 3 of 3)
8	M16 x 40 hex bolt, nut & washer
9	Rectangular plate washer (See Standard GR-HDW)

Sheet 2 of 3

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

SPECIFICATION  
REFERENCE

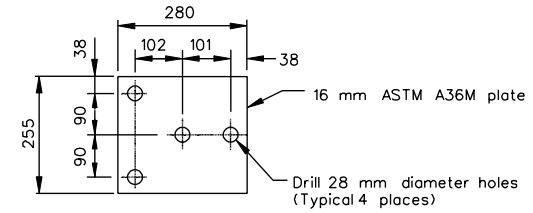
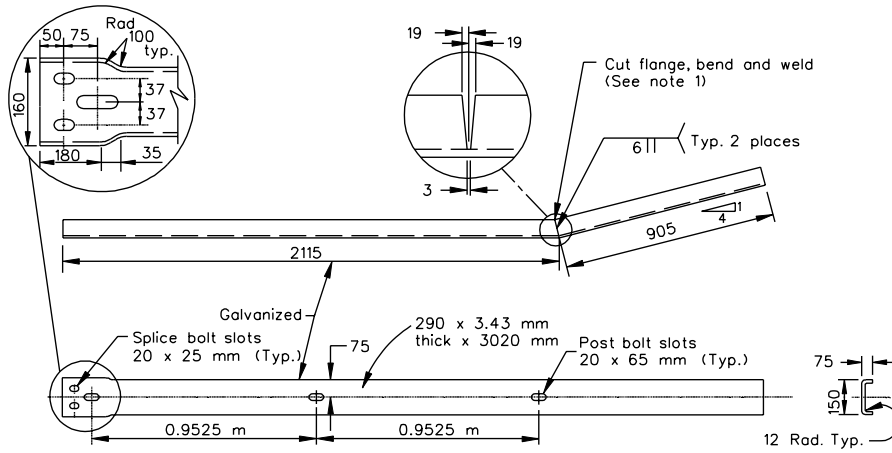
501.23 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

505

REVISED ON 7/01

GR-FOA-1



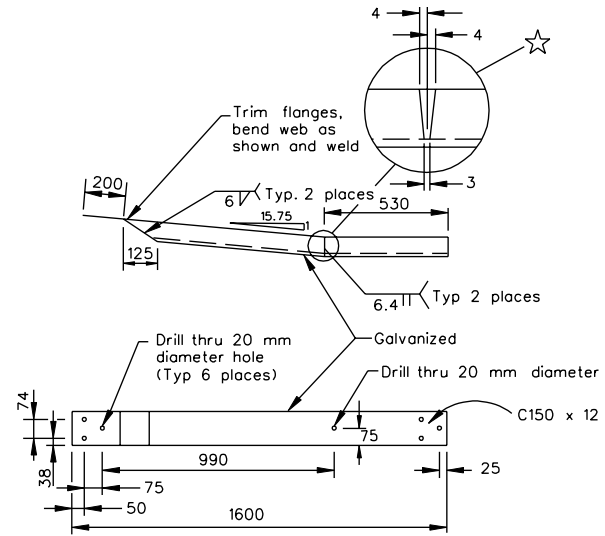
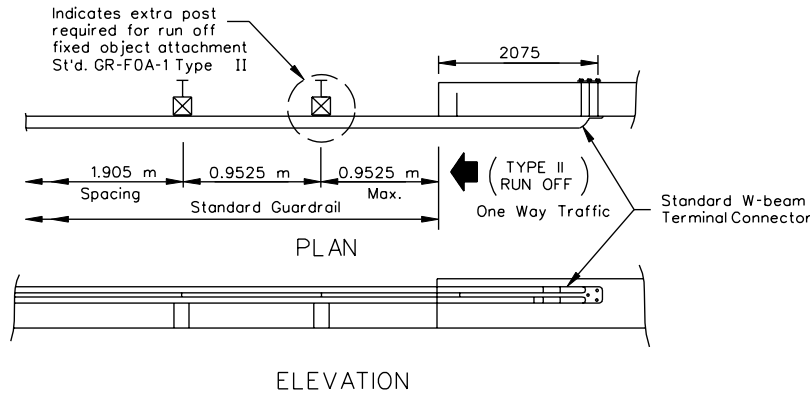
BEARING PLATE  
GALVANIZED

☆ Can be field cut and bent using heat.

Notes: 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.

ITEM ⑥ DETAIL



ITEM ⑦ DETAIL

Sheet 3 of 3

SPECIFICATION REFERENCE

W BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT  
RUBRAIL AND HARDWARE DETAILS

505

VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

501.24

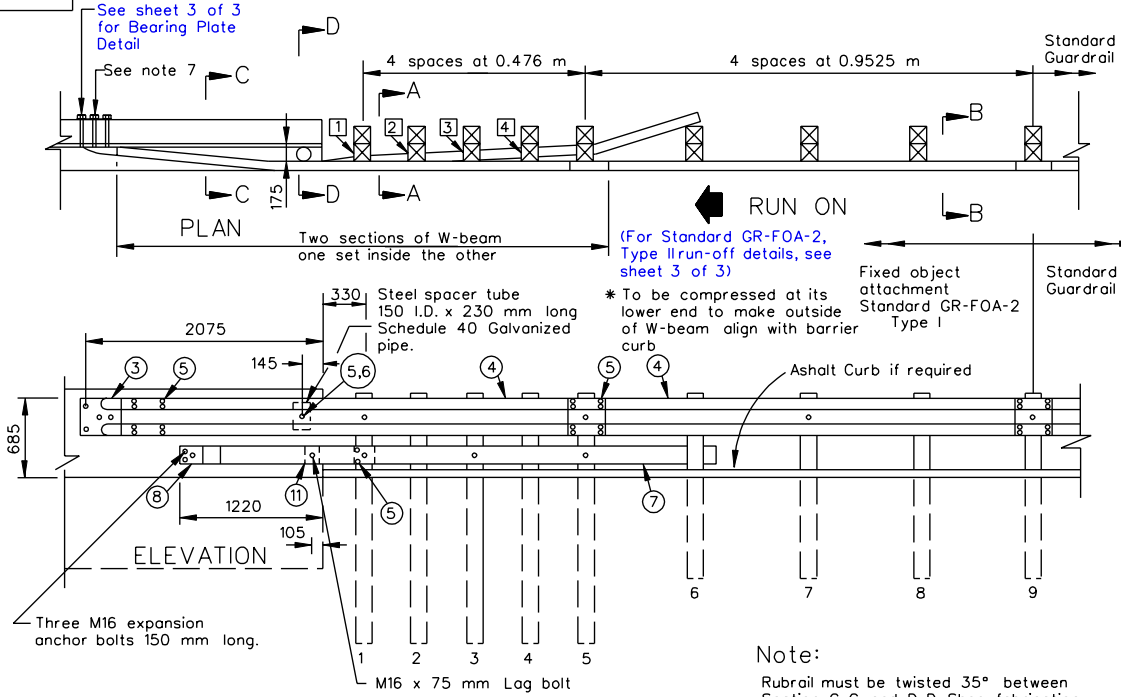


REVISED ON 7/98

REVISED ON 2/01

REVISED ON 7/01

GR-FOA-2



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 to 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 M16 carriage bolts. (Length as required)
6. W-beam is not bolted to posts at posts 2,3,4,6 and 8, Bolt block directly to post.
7. Appropriate length M22 ASTM A325M hex bolts must be used with thru drilled holes with a 16 mm bearing plate on the back side of the bridge parapet or concrete barrier.

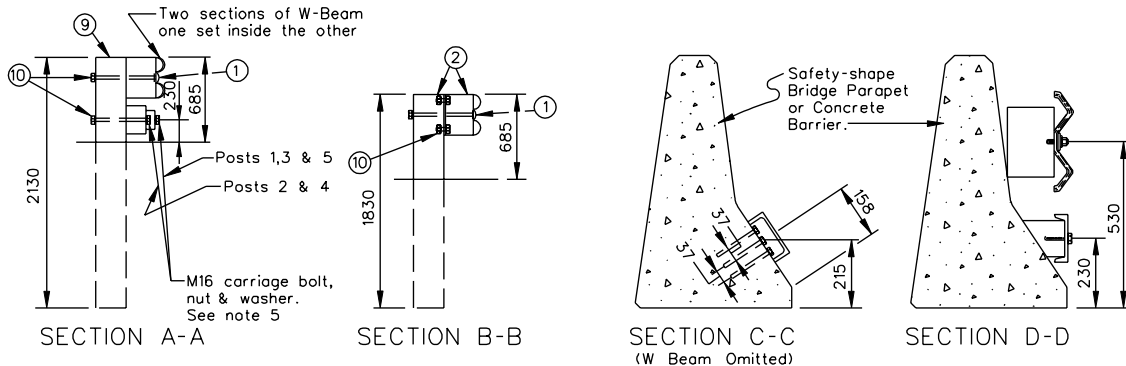
RUBRAIL WOOD BLOCKS  
180 mm x 150 mm

Post	Thickness
1	158
2	117
3	79
4	38

New Bridges - Attachments  
 One - Way Traffic-Run-on, 2-GR-FOA-2, Type I  
 -Run-off, 2-GR-FOA-2, Type II  
 Two - Way Traffic-Run-on, 4-GR-FOA-2, Type I  
 Existing bridge attachments as shown on plans.

Note:

Rubrail must be twisted 35° between Section C-C and D-D. Shop fabrication may be required. Right hand and left hand twists will be necessary.



Item	Material/Specifications/Notes
1	M16 x 450 Guardrail bolt & Recessed nut
2	Standard 150 x 200 Wood post & Block
3	Standard W-beam terminal connector
4	Standard W-beam rail
5	M16 x 50 Guardrail bolt & Recessed nut (See Standard GR-HDW)
6	Rectangular Plate Washer (See Standard GR-HDW)
7	Bent plate rubrail (see sheet 3 of 3)
8	C150 x 12 rubrail (See sheet 3 of 3)
9	Mod. 150 x 200 Wood post & Standard block (2.1 m length post)
10	Washer for M16 bolt
11	Wood blockout for rubrail (see sheet 3 of 3)

Sheet 1 of 3

W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT  
 FOR USE BETWEEN SAFETY SHAPE AND GUARDRAIL (WOOD POSTS)

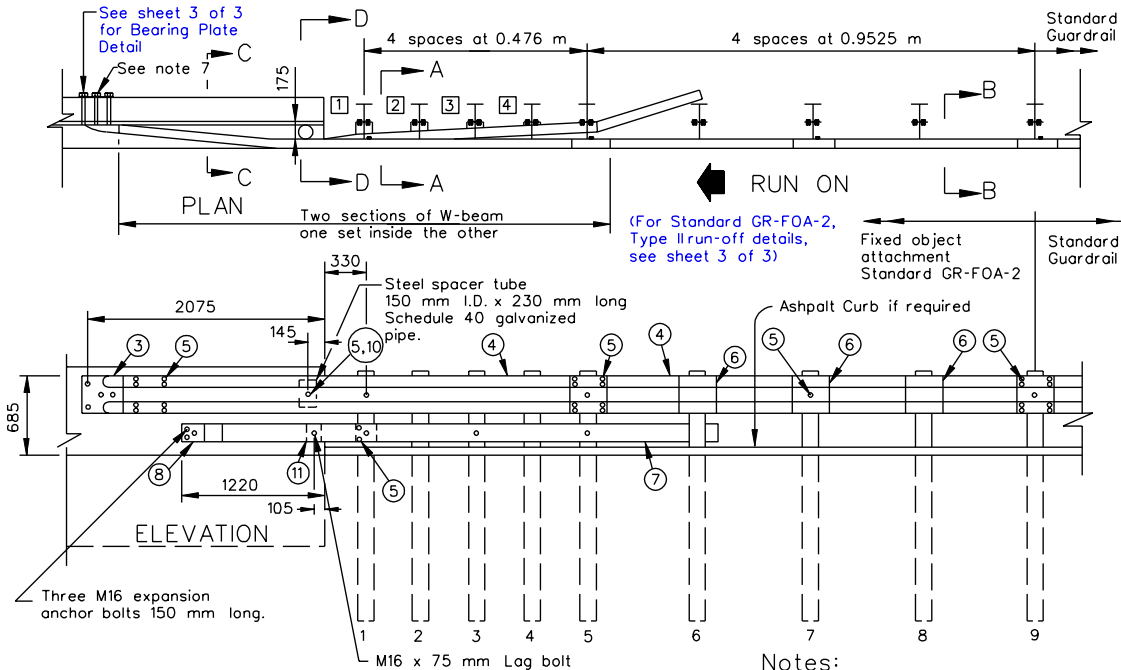
SPECIFICATION  
 REFERENCE

506

501.25

UNLESS OTHERWISE NOTED, ALL DIMENSIONS  
 ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION



Notes:

- Fixed objects may consist of safety shaped bridge parapets or concrete barriers.
- Bridge rail ends and bridge parapets must be of adequate strength to accept full impact loading.
- Guardrail components 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 center drilled and secured with M16 carriage bolts. (Length as required)
- W-beam is not bolted to posts at 2,3,4,6 and 8. Bolt block directly to post.
- Appropriate length M22 ASTM A325M hex bolts must be used with thru drilled holes with a M16 bearing plate on the back side of the bridge parapet or concrete barrier.

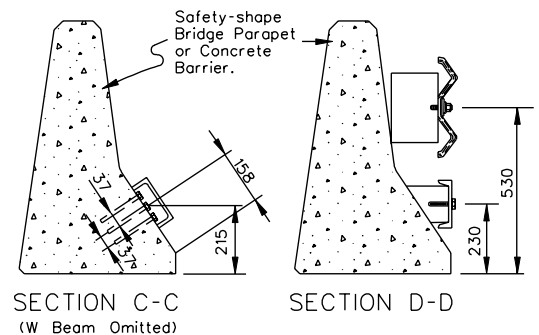
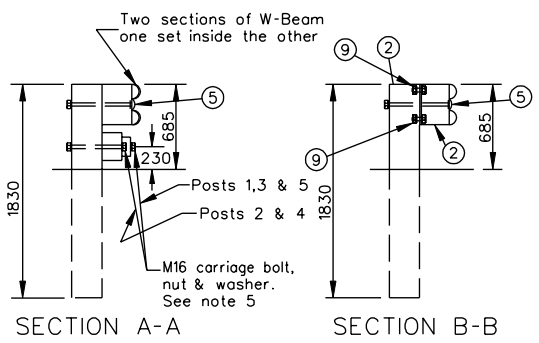
RUBRAIL WOOD BLOCKS

Post	Thickness
1	108
2	82
3	50
4	25

New Bridges - Attachments  
 One - Way Traffic-Run-on, 2-GR-FOA-2, Type I  
 -Run-off, 2-GR-FOA-2, Type II  
 Two - Way Traffic-Run-on, 4-GR-FOA-2, Type I  
 Existing bridge attachments as shown on plans.

Notes:

Rubrail must be twisted 35° between Section C-C and D-D. Shop fabrication may be required. Right hand and left hand twists will be necessary.

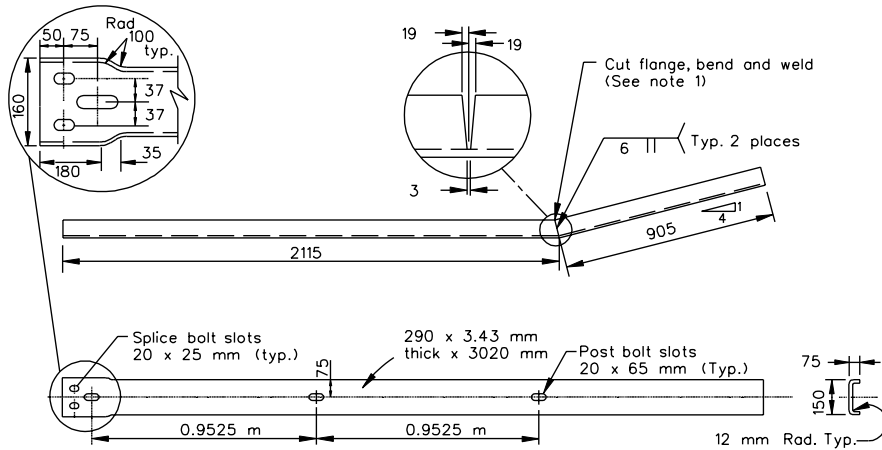


Item	Material/Specifications/Notes
1	M16 washer
2	St'd W150 x 13.5 steel
3	St'd W-beam terminal connector
4	Standard W-beam rail
5	M16 x 50 Guardrail bolt & Recessed nut
6	Standard W-beam back-up plate
7	Bent plate rubrail (see sheet 3 of 3)
8	C150 x 12 rubrail (See sheet 3 of 3)
9	M16 x 40 hex, bolt nut & washer
10	Rectangular plate washer (see Standard GR-HDW)
11	Wood breakout for rubrail (see sheet 3 of 3)

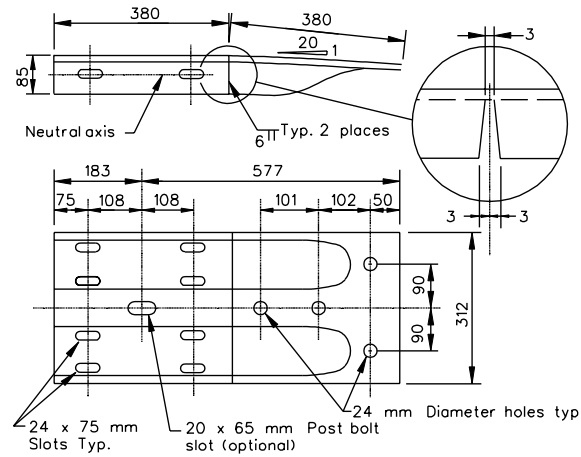
SPECIFICATION REFERENCE	W-BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT FOR USE WITH SAFETY SHAPE - STEEL POSTS		
506	VIRGINIA DEPARTMENT OF TRANSPORTATION	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	501.26

REVISED ON 7/01

GR-FOA-2 & 4



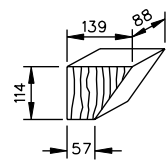
ITEM 7 DETAIL



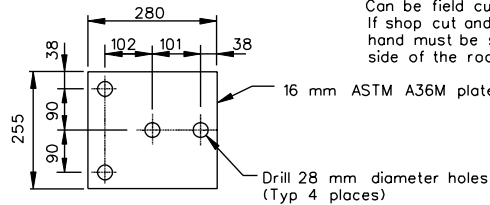
W-BEAM TERMINAL CONNECTOR (MOD.)

Notes:

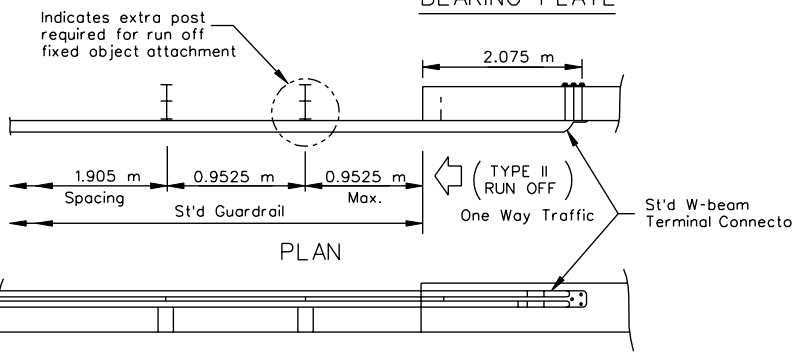
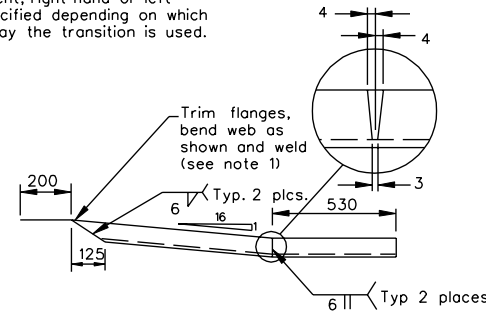
Can be field cut and bent using heat.  
If shop cut and bent, right hand or left hand must be specified depending on which side of the roadway the transition is used.



ITEM 11 DETAIL

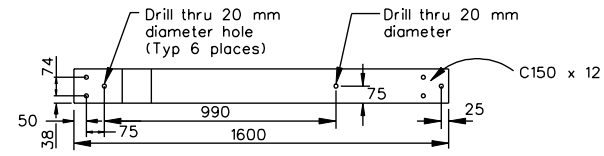


BEARING PLATE



PLAN

ELEVATION



ITEM 8 DETAIL

Sheet 3 of 3

W BEAM GUARDRAIL - FIXED OBJECT ATTACHMENT  
RUBRAIL AND HARDWARE DETAILS

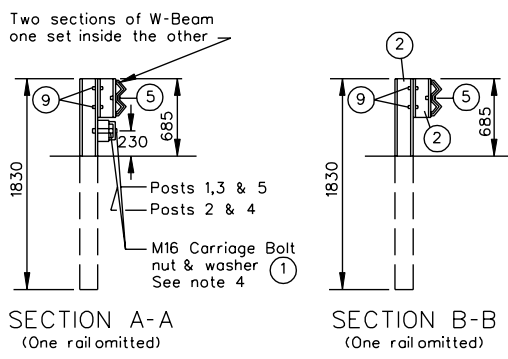
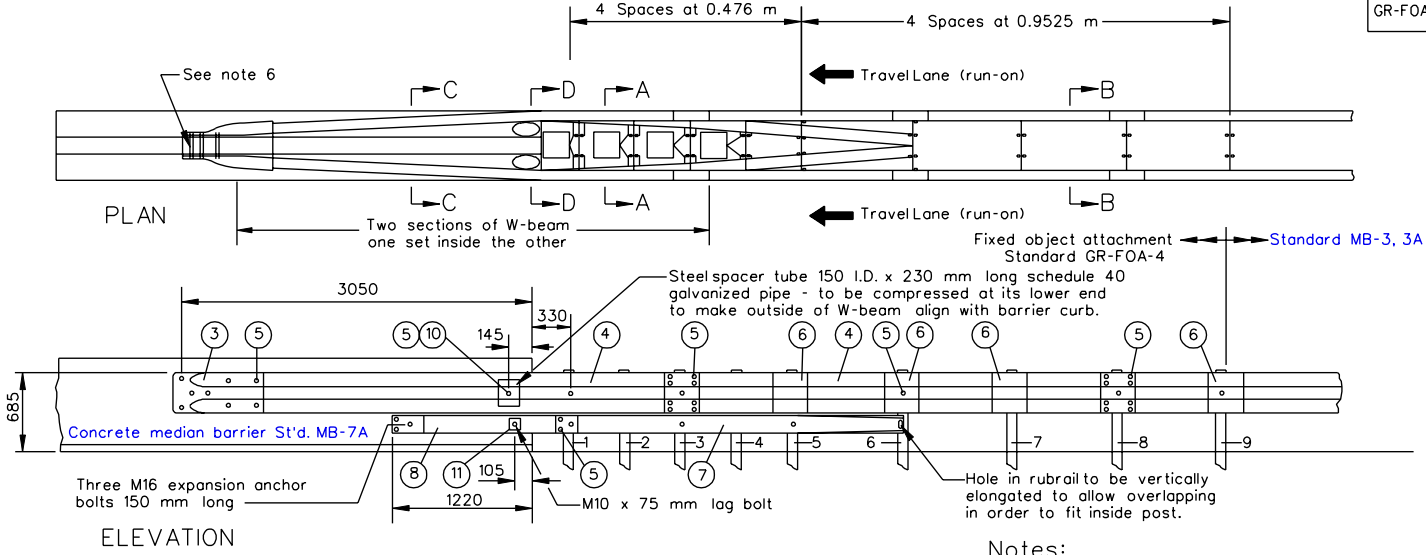
SPECIFICATION REFERENCE

506

501.27

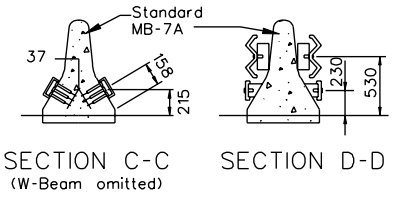
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION



TYPE I Two run-on sections (with two rubrails as shown)  
 TYPE II One run-on section (with one rubrail retained)  
 One run-off section (with one rubrail removed)  
 TYPE III Two run-off sections (with both rubrails removed)

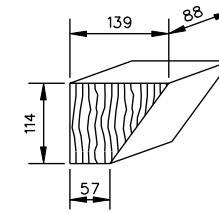
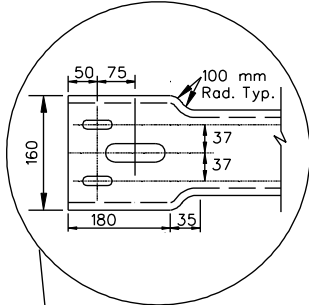
**Note:**  
 Rubrail must be twisted 35° between Sections C-C and D-D. Shop fabrication may be required. Right and left hand twists will be required.



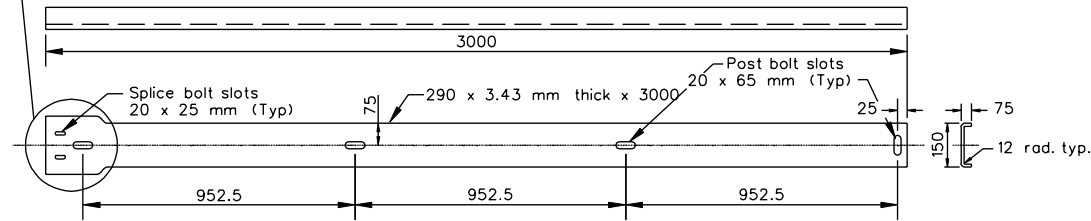
- Notes:**
1. All guardrail posts are to be steel.
  2. All guardrail components are to be in accordance with VDOT Road and Bridge Standards.
  3. Posts 1,2,3,4 and 5 require an additional hole to attach lower blocks and/or rubrail. Rubrail is not bolted to posts 2 and 4.
  4. Bottom wood blocks located on posts 1 through 4 are to be drilled and secured with M16 carriage bolts (length as required).
  5. W-beam is not bolted to posts 2,4,5 and 7. These blocks are to be bolted directly to posts.
  6. Appropriate length M22 ASTM A325M hex bolts are to be used with holes drilled through the concrete median barrier, attaching the W-beam terminal connectors on each side.

Rubrail Wood Blocks 175 x 100		Item Material / Specifications / Notes	
Post Thickness		Item	Material / Specifications / Notes
1	108	①	M16 washer
2	83	②	Standard W150x13.5 Steel
3	51	③	St'd. W-Beam terminal connector (Mod.)
4	25	④	Standard W-Beam rail
		⑤	M16x50 guardrail bolt & recessed nut
		⑥	Standard W-Beam backup plate
		⑦	Bent plate rubrail (See sheet 2 of 2)
		⑧	C150x12 rubrail (See sheet 2 of 2)
		⑨	M16x40 hex bolt nut and washer
		⑩	Rectangular plate washer (See Standard GR-HDW)
		⑪	Wood blockout for rubrail (See sheet 2 of 2)

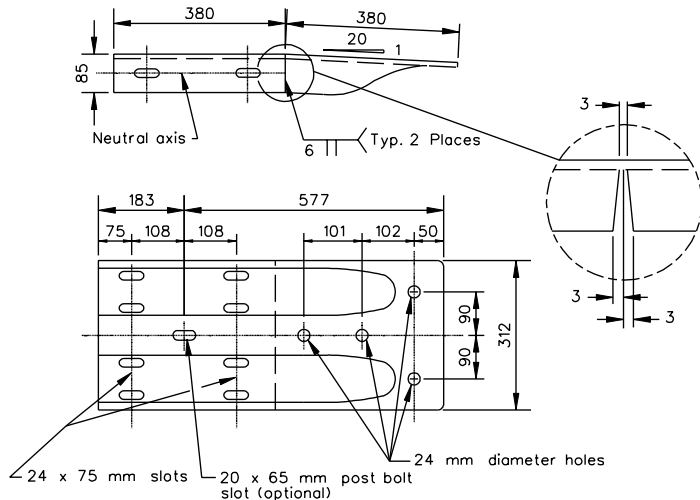
SPECIFICATION REFERENCE	BLOCKED-OUT W-BEAM MEDIAN BARRIER-FIXED OBJECT ATTACHMENT FOR USE BETWEEN STANDARD MB-7A AND STANDARD MB-3
505	VIRGINIA DEPARTMENT OF TRANSPORTATION
	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS



ITEM ⑪ DETAIL



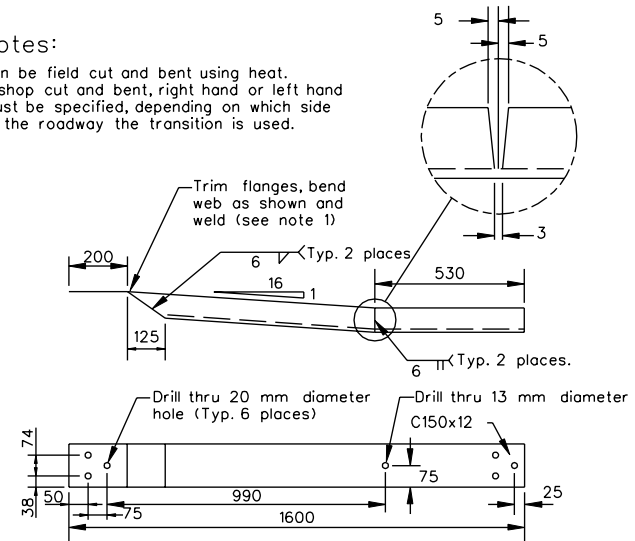
ITEM ⑦ DETAIL



W BEAM TERMINAL CONNECTOR (MOD.)

Notes:

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.



ITEM ⑧ DETAIL

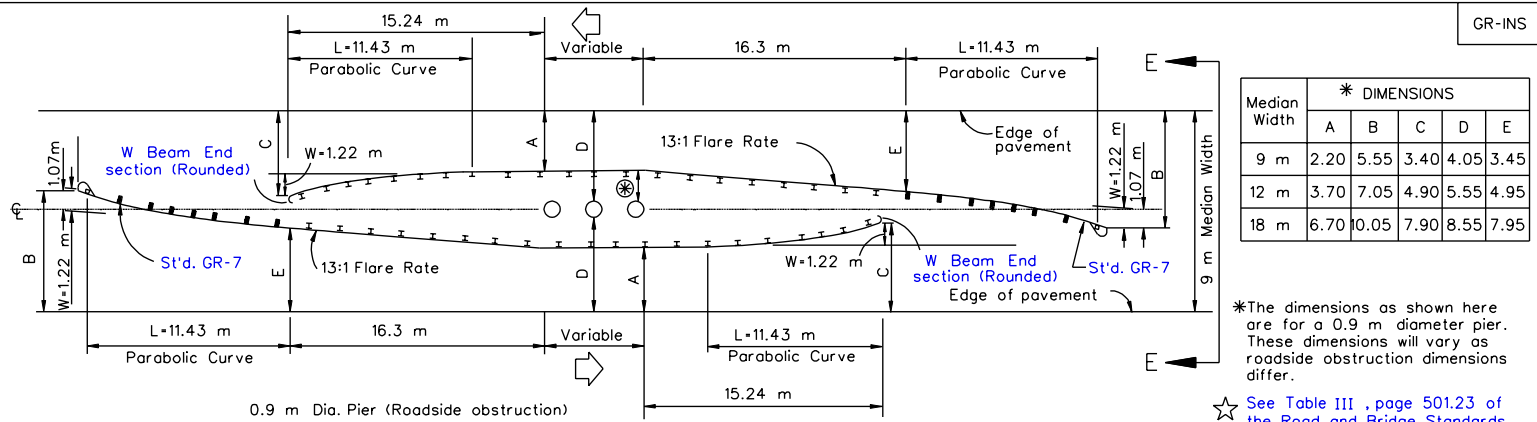
BLOCKED-OUT W-BEAM MEDIAN BARRIER-FIXED OBJECT ATTACHMENT  
RUBRAIL AND HARDWARE DETAILS

SPECIFICATION  
REFERENCE

REVISED ON 7/02

REVISED ON 3/03

GR-INS

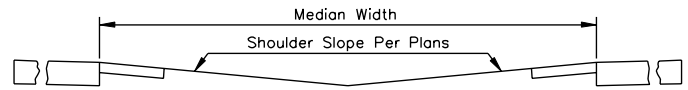


Median Width	* DIMENSIONS				
	A	B	C	D	E
9 m	2.20	5.55	3.40	4.05	3.45
12 m	3.70	7.05	4.90	5.55	4.95
18 m	6.70	10.05	7.90	8.55	7.95

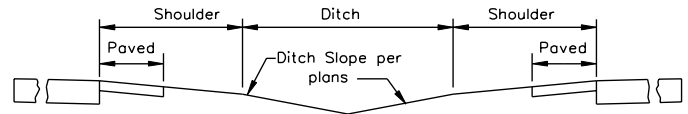
\*The dimensions as shown here are for a 0.9 m diameter pier. These dimensions will vary as roadside obstruction dimensions differ.

☆ See Table III, page 501.23 of the Road and Bridge Standards for definition of "X" and "Y".

Length L (m)	X (m)	Y (m) W=1.2 m
11.43	X <sub>1</sub>	1.905
	X <sub>2</sub>	3.810
	X <sub>3</sub>	5.715
	X <sub>4</sub>	7.620
	X <sub>5</sub>	9.525
	X <sub>6</sub>	11.430



SECTION E-E



TYPICAL SECTION

⊗ Face of guardrail is to be 1.83 m from face of object.

For median widths less than 8.2 m see Sheet 501.16.

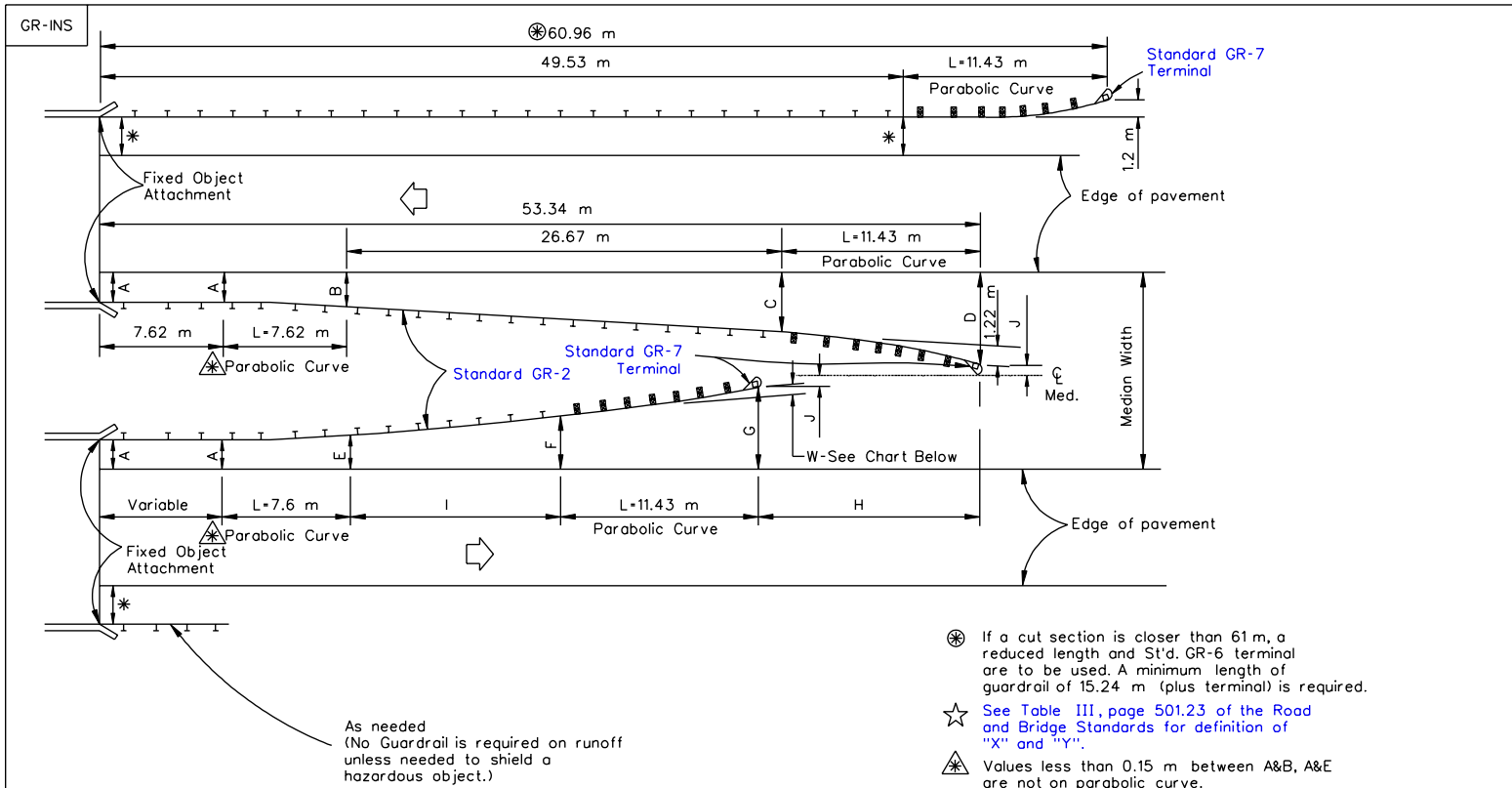
The guardrail design and placement shown above may also be used for shielding an overhead sign support, fixed objects or other types of Roadside obstructions.

DETAIL OF GUARDRAIL AT BRIDGE PIERS USING STANDARD GR-2

<p>SPECIFICATION REFERENCE</p> <p>221 505</p>	<h2 style="margin: 0;">W BEAM GUARDRAIL INSTALLATION CRITERIA</h2> <p style="margin: 0;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p style="font-size: small; margin: 0;">UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS</p>	<p>501.30</p>
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REVISED ON 8/97

REVISED ON 3/03



- ⊗ If a cut section is closer than 61 m, a reduced length and St'd. GR-6 terminal are to be used. A minimum length of guardrail of 15.24 m (plus terminal) is required.
- ☆ See Table III, page 501.23 of the Road and Bridge Standards for definition of "X" and "Y".
- ⚠ Values less than 0.15 m between A&B, A&E are not on parabolic curve.
- \* Right Bridge Offset Values are given in geometric standards for corresponding left Bridge Offset ("A" Dimensions) shown.

DIMENSIONS											
MEDIAN WIDTH	LEFT BRIDGE RAIL OFFSET	B	C	D	E	F	G	H	I	J	W
(Meters)	A m	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
9.00	1.5	1.68	2.13	3.35	1.65	1.83	2.44	16.45	10.21	1.2	6.00
12.00	1.5	1.83	3.20	4.88	1.83	3.05	4.88	13.41	13.10	1.2	7.60
12.00	2.4	2.56	3.50	5.18	2.68	3.29	5.18	14.63	11.88	.9	10.60
12.00	3.6	3.71	3.96	5.18	3.77	3.96	4.87	14.78	11.58	.9	9.10

☆ OFFSETS (Y) FOR INTRODUCED GUARDRAIL TRANSITIONS									
LENGTH L (Meters)	X	Y (mm)							
		W (mm)	W (mm)	W (mm)	W (mm)	W (mm)	W (mm)	W (mm)	W (mm)
		150	225	300	600	750	900	1050	1200
7.62	X 1	1,905	5	15	15	20	20	30	30
	X 2	3,810	35	55	75	85	100	115	130
	X 3	5,715	85	125	170	165	190	225	265
	X 4	7,620	150	225	300	270	335	405	475
11.43	X 5	9,525				420	530	630	740
	X 6	11,430				600	750	900	1050

Sheet 2 of 8

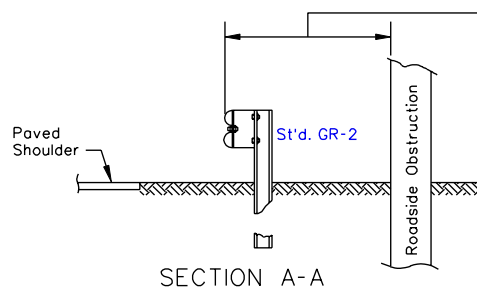
DETAIL OF GUARDRAIL AT DUAL BRIDGES

<h2 style="margin: 0;">W BEAM GUARDRAIL INSTALLATION CRITERIA</h2> <p style="margin: 0;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>		<p style="margin: 0;">SPECIFICATION REFERENCE</p> <p style="margin: 0;">221 505</p>
501.31	UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS	

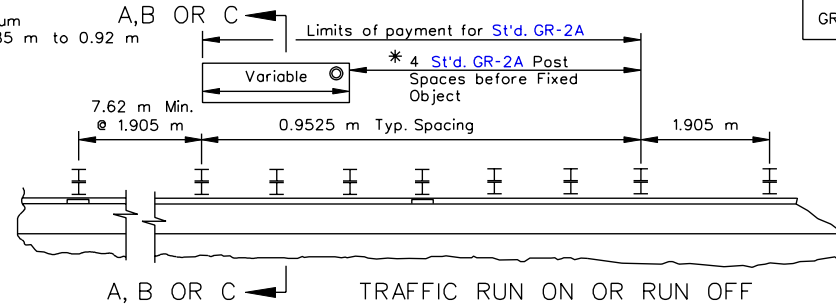
REVISED ON 6/98

REVISED ON 2/01

GR-INS



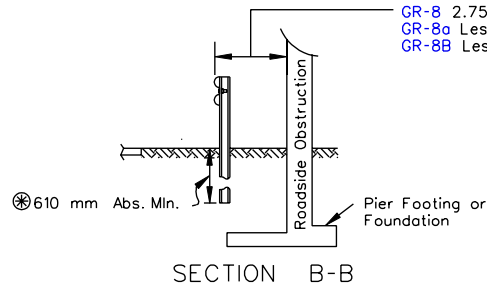
GR-2 1.83 m minimum  
GR-2A Less than 1.85 m to 0.92 m



\* For Two Way Traffic, use 4 Post Spacing Design from each end of fixed object.

⊙ Roadside Obstruction

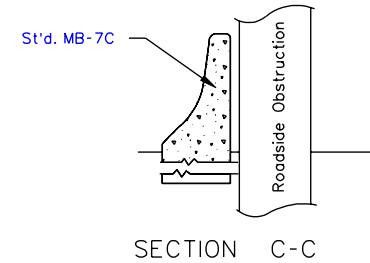
⊗ If 610 mm dimension cannot be obtained use St'd. MB-7C treatment shown Section C-C.



GR-8 2.75 m minimum  
GR-8a Less than 2.75 m to 2.15 m  
GR-8B Less than 2.15 m to 1.70 m

⊗ 610 mm Abs. Min.

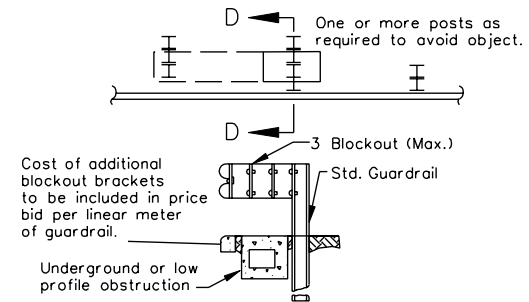
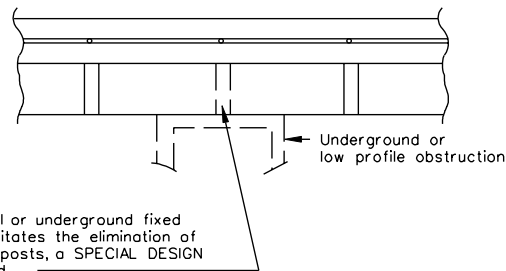
For use where distance face of rail to fixed object is less than 0.92 m.



Note:

If ground level or underground fixed object necessitates the elimination of one or more posts, a SPECIAL DESIGN will be required.

DETAIL OF SPECIAL DESIGN SITUATION



SECTION D-D  
DETAIL OF MULTIPLE BLOCK-OUT TO AVOID UNDERGROUND OR LOW PROFILE OBSTRUCTION

Sheet 3 of 8

SPECIFICATION REFERENCE

221  
505

# W BEAM GUARDRAIL INSTALLATION CRITERIA

VIRGINIA DEPARTMENT OF TRANSPORTATION

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

501.32



Guardrail installation criteria as shown on these sheets is to apply to those locations where guardrail has to be transitioned from the normal location.

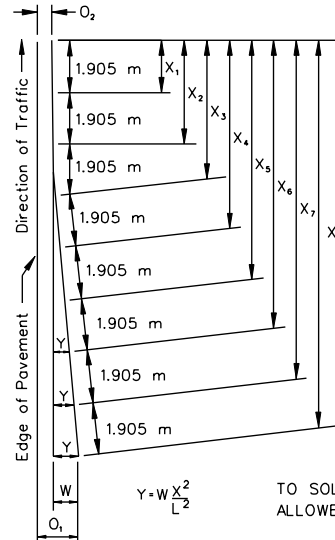
Length of transition (L) is to be in accordance with Table III or IV for applicable values of W or as directed by the Engineer.

Rail terminal sections in accordance with St'd. GR-6, GR-7 or GR-8 are to be installed at each terminus of guardrail where specified on plans.

All lengths (L) are applied along face of guardrail.

Offsets shown in tables are for 1.9 m spacing. For 3.8 m spacing (GR-8) use every second value for Y.

Installation methods shown on these sheets are applicable to St'd plans GR-2, GR-2A and GR-8.



W=Total lateral transition of guardrail  $O_1 - O_2$   
 $O_1$  -Offset from edge of pavement to face of guardrail maximum.  
 $O_2$  -Offset from edge of pavement to face of guardrail minimum.  
 $X_1 \dots X_n$  -Cumulative distance in increments of 1.9 m 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

$Y = \frac{W \cdot X^2}{L^2}$  TO SOLVE FOR "Y", USE THE MAXIMUM "L" ALLOWED FOR THE APPROPRIATE "W".

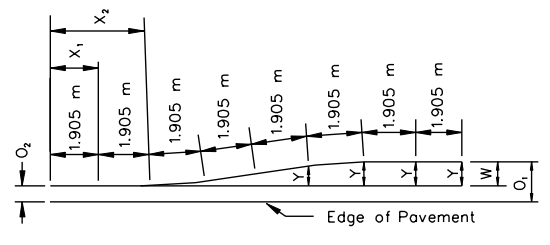
TABLE III  
 OFFSETS (Y) FOR INTRODUCED GUARDRAIL TRANSITIONS

LENGTH L Meters	X Meters	W (Meters)																				
		0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20	4.50	4.80	5.10	5.40	5.70	6.00		
		Y (Meters)																				
11.430	X 1	1.905	0.017	0.014	0.008	0.006	0.005	0.004	0.004	0.005	0.005	0.006	0.006	0.007	0.007	0.008	0.008	0.009	0.009	0.010	0.010	
11.430	X 2	3.810	0.067	0.056	0.033	0.023	0.018	0.015	0.017	0.019	0.021	0.023	0.025	0.027	0.029	0.031	0.033	0.035	0.038	0.040	0.042	
11.430	X 3	5.715	0.150	0.127	0.075	0.053	0.041	0.033	0.038	0.042	0.047	0.052	0.056	0.061	0.066	0.070	0.075	0.080	0.084	0.089	0.094	
11.430	X 4	7.620	0.267	0.225	0.133	0.094	0.072	0.058	0.067	0.075	0.083	0.092	0.100	0.108	0.117	0.125	0.133	0.142	0.150	0.158	0.167	
11.430	X 5	9.525	0.417	0.352	0.208	0.146	0.113	0.091	0.104	0.117	0.130	0.143	0.156	0.169	0.182	0.195	0.208	0.221	0.234	0.247	0.260	
11.430	X 6	11.430	0.600	0.506	0.300	0.211	0.162	0.131	0.150	0.169	0.188	0.206	0.225	0.244	0.263	0.281	0.300	0.319	0.338	0.356	0.375	
15.240	X 7	13.335		0.689	0.408	0.287	0.221	0.179	0.204	0.230	0.255	0.281	0.306	0.332	0.357	0.383	0.408	0.434	0.459	0.485	0.510	
15.240	X 8	15.240		0.900	0.533	0.375	0.288	0.233	0.267	0.300	0.333	0.367	0.400	0.433	0.467	0.500	0.533	0.567	0.600	0.633	0.667	
22.860	X 9	17.145			0.675	0.475	0.365	0.295	0.338	0.380	0.422	0.464	0.506	0.548	0.591	0.633	0.675	0.717	0.759	0.802	0.844	
22.860	X 10	19.050			0.833	0.586	0.450	0.365	0.417	0.469	0.521	0.573	0.625	0.677	0.729	0.781	0.833	0.885	0.938	0.990	1.042	
22.860	X 11	20.955			1.008	0.709	0.545	0.441	0.504	0.567	0.630	0.693	0.756	0.819	0.882	0.945	1.008	1.071	1.134	1.197	1.260	
22.860	X 12	22.860			1.200	0.844	0.648	0.525	0.600	0.675	0.750	0.825	0.900	0.975	1.050	1.125	1.200	1.275	1.350	1.425	1.500	
26.670	X 13	24.765				0.990	0.761	0.616	0.704	0.792	0.880	0.968	1.056	1.144	1.232	1.320	1.408	1.496	1.584	1.672	1.760	
26.670	X 14	26.670					1.148	0.882	0.715	0.817	0.919	1.021	1.123	1.225	1.327	1.429	1.531	1.633	1.735	1.838	1.940	2.042
30.480	X 15	28.575					1.318	1.013	0.820	0.938	1.055	1.172	1.289	1.406	1.523	1.641	1.758	1.875	1.992	2.109	2.227	2.344
30.480	X 16	30.480					1.500	1.152	0.933	1.067	1.200	1.333	1.467	1.600	1.733	1.867	2.000	2.133	2.267	2.400	2.533	2.667
38.100	X 17	32.385						1.301	1.054	1.204	1.355	1.505	1.656	1.806	1.957	2.107	2.258	2.408	2.559	2.709	2.860	3.010
38.100	X 18	34.290						1.458	1.181	1.350	1.519	1.688	1.856	2.025	2.194	2.363	2.531	2.700	2.869	3.038	3.206	3.375
38.100	X 19	36.195						1.625	1.316	1.504	1.692	1.880	2.068	2.256	2.444	2.632	2.820	3.008	3.196	3.384	3.572	3.760
38.100	X 20	38.100						1.800	1.458	1.667	1.875	2.083	2.292	2.500	2.708	2.917	3.125	3.333	3.542	3.750	3.958	4.167
45.720	X 21	40.005							1.608	1.838	2.067	2.297	2.527	2.756	2.986	3.216	3.445	3.675	3.905	4.134	4.364	4.594
45.720	X 22	41.910							1.765	2.017	2.269	2.521	2.773	3.025	3.277	3.529	3.781	4.033	4.285	4.538	4.790	5.042
45.720	X 23	43.815							1.929	2.204	2.480	2.755	3.031	3.306	3.582	3.857	4.133	4.408	4.684	4.959	5.235	5.510
45.720	X 24	45.720							2.100	2.400	2.700	3.000	3.300	3.600	3.900	4.200	4.500	4.800	5.100	5.400	5.700	6.000

W-BEAM GUARDRAIL INSTALLATION CRITERIA

SPECIFICATION REFERENCE

221  
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Guardrail installation criteria as shown on these sheets is to apply to those locations where guardrail has to be transitioned from the normal location.

Length of transition (L) is to be in accordance with Table III or IV for applicable values of W or as directed by the Engineer.

Rail terminal sections in accordance with St'd. GR-6, GR-7 or GR-8 are to be installed at each terminus of guardrail where specified on plans.

All lengths (L) are applied along face of guardrail.

Offsets shown in tables are for 1.9 m spacing. For 3.8 m spacing (GR-8) use every second value for Y.

Installation methods shown on these sheets are applicable to St'd plans GR-2, GR-2A and GR-8.

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

LENGTH L (Meters)	X (Meters)	W (Meters)																							
		0.60	0.60	0.90	0.90	1.20	1.20	1.50	1.50	1.80	1.80	2.10	2.10	2.40	2.40	2.70	2.70	3.00	3.00	3.30	3.30	3.60	3.60		
		RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF	RUN ON	RUN OFF
		Y (Meters)																							
11.430	X 1	1.905	0.012	0.012	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000	0.003	
11.430	X 2	3.810	0.090	0.090	0.057	0.057	0.009	0.009	0.006	0.012	0.003	0.015	0.003	0.015	0.003	0.018	0.003	0.021	0.003	0.024	0.003	0.027	0.003	0.027	
11.430	X 3	5.715	0.300	0.300	0.189	0.189	0.033	0.033	0.021	0.039	0.015	0.048	0.009	0.054	0.009	0.063	0.009	0.072	0.009	0.078	0.012	0.087	0.012	0.096	
11.430	X 4	7.620	0.510	0.510	0.450	0.450	0.075	0.075	0.048	0.093	0.033	0.114	0.024	0.132	0.018	0.150	0.021	0.168	0.024	0.189	0.027	0.207	0.027	0.225	
11.430	X 5	9.525	0.588	0.588	0.711	0.711	0.147	0.147	0.093	0.183	0.066	0.219	0.048	0.255	0.036	0.294	0.042	0.330	0.045	0.366	0.051	0.402	0.054	0.437	
11.430	X 6	11.430	0.600	0.600	0.843	0.843	0.252	0.252	0.162	0.315	0.114	0.381	0.084	0.444	0.063	0.507	0.072	0.570	0.078	0.633	0.087	0.696	0.096	0.759	
15.240	X 7	13.335			0.894	0.894	0.402	0.402	0.258	0.501	0.180	0.603	0.132	0.702	0.099	0.804	0.114	0.903	0.126	1.005	0.138	1.104	0.150	1.206	
15.240	X 8	15.240			0.900	0.900	0.600	0.600	0.384	0.750	0.267	0.900	0.195	1.050	0.150	1.200	0.168	1.350	0.189	1.500	0.207	1.650	0.225	1.800	
30.480	X 9	17.145					0.798	0.798	0.546	0.999	0.381	1.197	0.279	1.398	0.213	1.596	0.240	1.797	0.267	1.995	0.294	2.196	0.321	2.394	
30.480	X 10	19.050					0.948	0.948	0.750	1.185	0.522	1.419	0.384	1.656	0.294	1.893	0.330	2.130	0.366	2.367	0.402	2.604	0.438	2.841	
30.480	X 11	20.955					1.053	1.053	0.954	1.317	0.693	1.581	0.510	1.845	0.390	2.106	0.438	2.370	0.486	2.634	0.537	2.898	0.585	3.162	
30.480	X 12	22.860					1.125	1.125	1.116	1.407	0.900	1.689	0.660	1.968	0.507	2.250	0.570	2.532	0.633	2.814	0.696	3.093	0.759	3.375	
30.480	X 13	24.765					1.167	1.167	1.242	1.461	1.107	1.752	0.840	2.046	0.645	2.337	0.723	2.628	0.804	2.922	0.885	3.213	0.966	3.504	
30.480	X 14	26.670					1.191	1.191	1.338	1.488	1.278	1.785	1.050	2.085	0.804	2.382	0.903	2.679	1.005	2.976	1.104	3.273	1.206	3.573	
30.480	X 15	28.575					1.200	1.200	1.407	1.500	1.419	1.797	1.260	2.097	0.990	2.397	1.113	2.697	1.236	2.997	1.359	3.297	1.482	3.597	
30.480	X 16	30.480					1.200	1.200	1.452	1.500	1.533	1.800	1.440	2.100	1.200	2.400	1.350	2.700	1.500	3.000	1.650	3.300	1.800	3.600	
38.100	X 17	32.385							1.479			1.620		1.590		1.410		1.587		1.764		1.941		2.118	
38.100	X 18	34.290							1.494			1.689		1.716		1.596		1.797		1.995		2.196		2.394	
38.100	X 19	36.195							1.500			1.734		1.821		1.755		1.977		2.196		2.415		2.634	
38.100	X 20	38.100							1.500			1.767		1.905		1.893		2.130		2.367		2.604		2.841	
45.720	X 21	40.005										1.785		1.968		2.010		2.262		2.514		2.763		3.015	
45.720	X 22	41.910										1.797		2.016		2.106		2.370		2.634		2.898		3.162	
45.720	X 23	43.815										1.800		2.052		2.187		2.460		2.733		3.006		3.279	
45.720	X 24	45.720										1.800		2.076		2.250		2.532		2.814		3.093		3.375	
53.340	X 25	47.625												2.091		2.301		2.586		2.874		3.162		3.450	
53.340	X 26	49.530												2.097		2.337		2.628		2.922		3.213		3.504	
53.340	X 27	51.435												2.100		2.364		2.658		2.955		3.249		3.546	
53.340	X 28	53.340												2.100		2.382		2.679		2.976		3.273		3.573	
60.960	X 29	55.245														2.391		2.691		2.991		3.288		3.588	
60.960	X 30	57.150														2.397		2.697		2.997		3.297		3.597	
60.960	X 31	59.055														2.400		2.700		3.000		3.300		3.600	
60.960	X 32	60.960														2.400		2.700		3.000		3.300		3.600	

SPECIFICATION REFERENCE  
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W-BEAM GUARDRAIL INSTALLATION CRITERIA

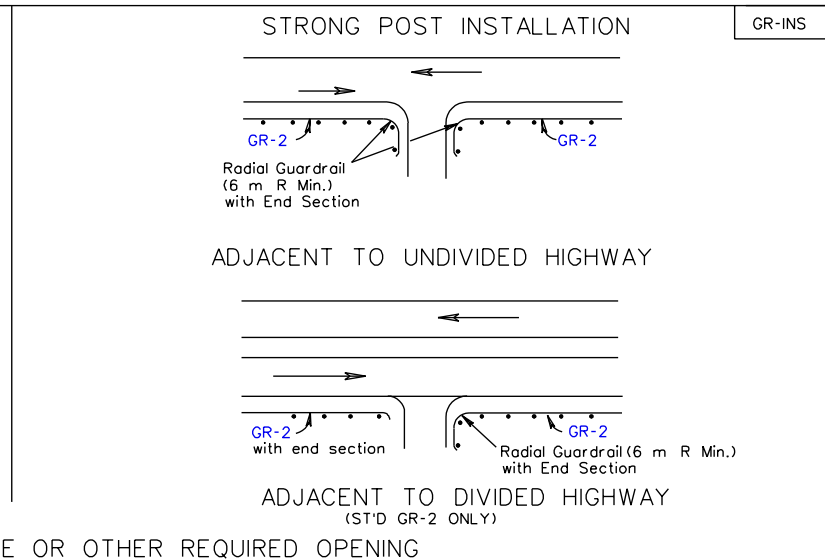
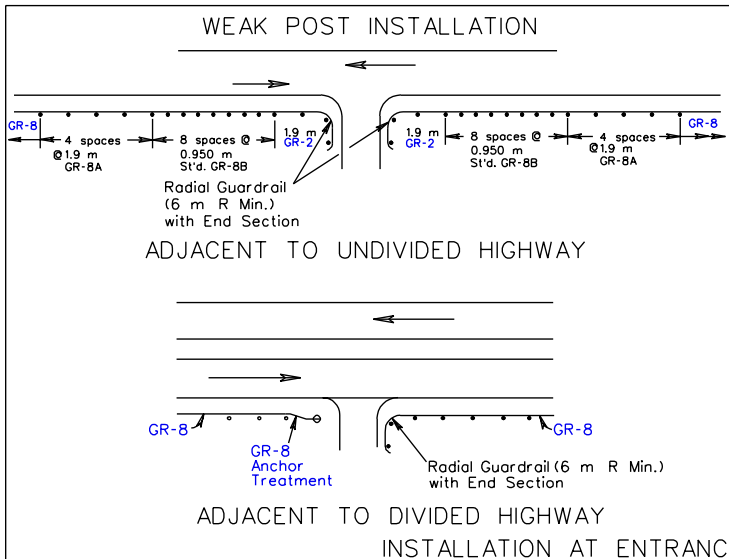
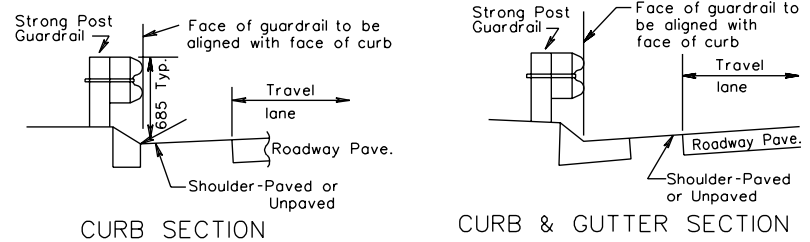


TABLE I  
NORMAL GUARDRAIL LOCATION-THROUGH TRAFFIC LANES LEFT OF TRAFFIC

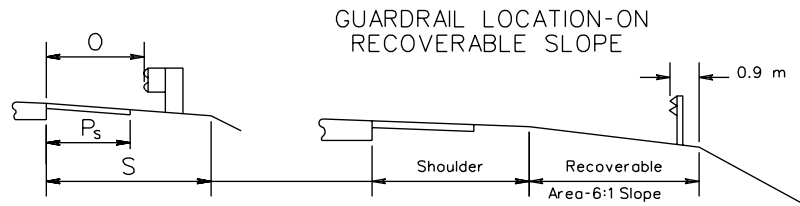
SHOULDER WIDTH (S)	PAVED SHOULDER WIDTH (P <sub>S</sub> )	OFFSET FROM EDGE OF PAVEMENT TO FACE OF GUARDRAIL (O)
4.5 m	0.9, 1.2, 3.0 or 3.6 m	3.6 m
3.9 m	0.9 m	3.0 m
3.6 m (Med. 6 lane)	3.0 m	3.0 m
3.3 m	0.9 m	2.4 m
2.4 m (Med.)	0.9 m or 1.2 m	1.5 m

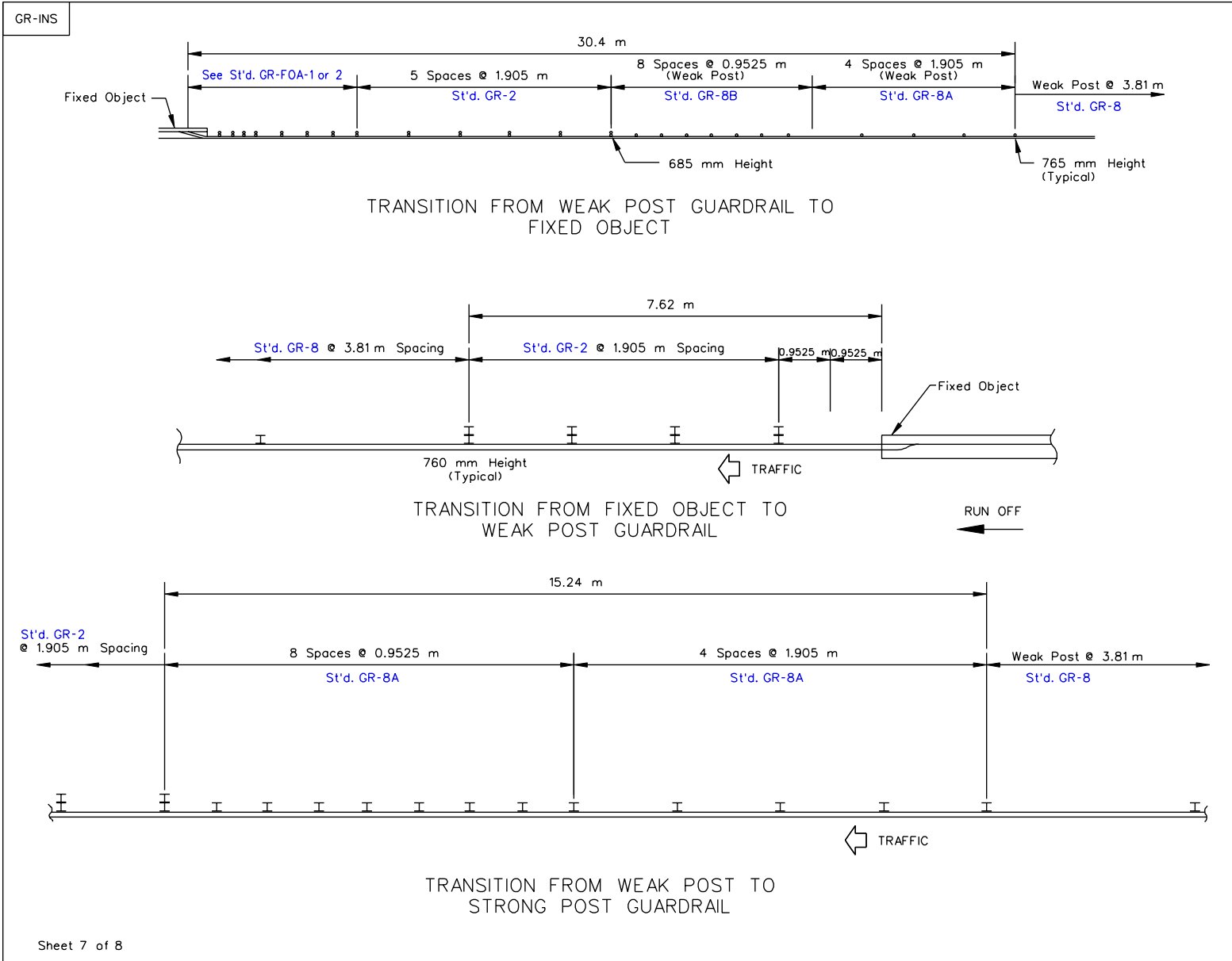
TABLE II  
NORMAL GUARDRAIL LOCATION-THROUGH TRAFFIC LANES RIGHT OF TRAFFIC

SHOULDER WIDTH (S)	PAVED SHOULDER WIDTH (P <sub>S</sub> )	OFFSET FROM EDGE OF PAVEMENT TO FACE OF GUARDRAIL (O)
4.5 m	1.8, 3.0 or 3.6 m	3.6 m
3.9 m	2.4 m	3.0 m
3.3 m	0, 0.9, 1.2 or 1.8 m	2.4 m
2.7 m	0, 0.9 or 1.2 m	1.8 m
2.1 m	0 or .09 m	1.2 m
1.5 m	0 or .09 m	0.6 m



INSTALLATION ADJACENT TO CURBED SECTIONS  
(NOT APPLICABLE TO URBAN DESIGN WITH SIDEWALK OR SIDEWALK SPACE)  
ALL CURBS MUST BE MOUNTABLE





Sheet 7 of 8

## W BEAM GUARDRAIL INSTALLATION CRITERIA

501.36 UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

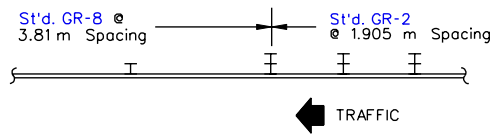
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REVISED ON 7/98

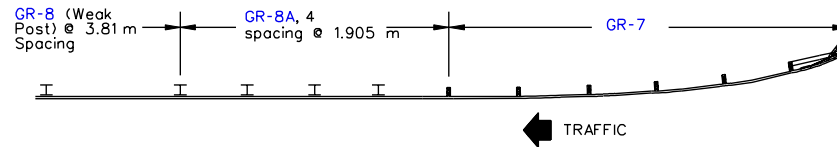
REVISED ON 2/01

REVISED ON 7/01

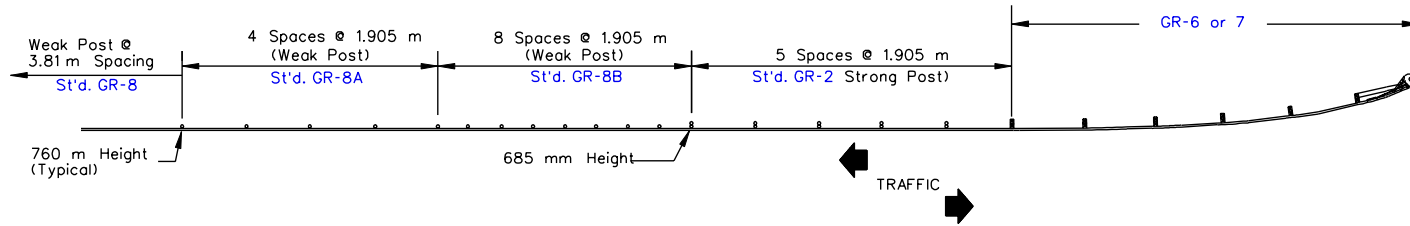
GR-INS



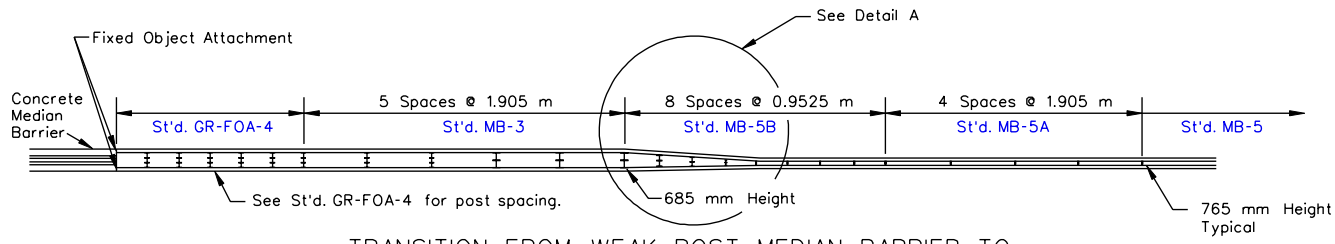
TRANSITION FROM STRONG POST TO WEAK POST GUARDRAIL



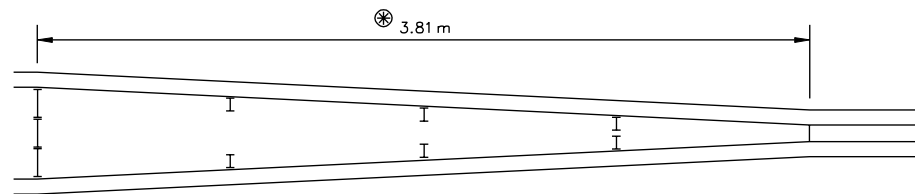
TRANSITION FROM GR-7 TERMINAL TO WEAK POST GUARDRAIL



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



TRANSITION FROM WEAK POST MEDIAN BARRIER TO CONCRETE MEDIAN BARRIER



DETAIL A

⊗ Cost of transition to be included in price bid for St'd. MB-5B Median Barrier.

Sheet 8 of 8

SPECIFICATION REFERENCE

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# W BEAM GUARDRAIL AND MEDIAN BARRIER INSTALLATION CRITERIA

VIRGINIA DEPARTMENT OF TRANSPORTATION

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