NOTES

GENERAL: Components shown on this drawing are used in a variety of guardrail systems. See individual guardrail drawing for specific applications.

See CMS 606 for guardrail specifications not covered on these drawings.

Refer to AASHTO M 180 for dimensional details of W-Beam and Thrie-Beam rail elements, related buffer and end sections, beam splices, post and splice bolts, nuts, and Type 1 W-Beam to Thrie-Beam Transition sections.

RAIL ELEMENTS: W-Beam Rail has an effective length of 12'-6" unless otherwise specified, with 7/8" x 2 1/2" post bolt slots on 6'-3" centers regardless of post spacing. Field punch or drill bolt holes or slots for irregularly spaced posts as specified in CMS 606.04.

RAIL SPLICES: Lap splices between two rail elements or between a rail and terminal connector in the direction of traffic. Lap the buffer or flared end sections in between a rail and terminal connector in the direction of traffic.

For details of Type 1 Transition Section (Symmetric), refer to AASHTO M 180, Figure 4.

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See CMS 606 for guardrail specifications not covered on drawing for specific applications.
MEASURING GUARDRAIL HEIGHT

GUARDRAIL HEIGHT: For initial installation, construct the guardrail within 4" of the standard height, h, or 29" to the top of W-Beam rail. For MEASURING GUARDRAIL HEIGHT: Height of existing guardrail. The finished height is to be within 2 1/2" of the standard height.

POST EMBEDMENT DEPTH: Standard embedment is 3'-5" min. Where less than 2 1/2' of graded shoulder width, install longer posts as detailed here. As a general guide for the longer posts will be made at the unit price bid for ITEM 608-

SPECIAL POST MOUNTINGS: Install posts located over a drainage inlet or similar device as detailed here. Where satisfactory, install an embedded pipe or pile as detailed here. (See GUARDRAIL HEIGHT: Note.)

Normal Offset

Greater Than 2' or Less

Normal Offset

Slopes extended: Measure 4' from ground line where graded shoulder slopes are steeper than 5:1. Expanded shield anchors may be substituted except where concrete deterioration has occurred. Use either cement or non-metallic, non-absorbent grout. Expansion shield anchors as specified in CMS 712.07 may be substituted except where concrete deterioration has occurred, as determined by the Engineer. Where self-drilling anchors are used, drill the holes with a drill bit and install the shield flush with the concrete surface.

PROTECTIVE COATING: In lieu of the complying with CMS 710.06, coat expansion shields, anchors and concrete insert anchor assemblies with a coating to be of stainless steel, hot zinc coated (nom.) or ASTM A 500 Grade B. Where self-drilling anchors are used, drill the holes with a drill bit and install the shield flush with the concrete surface.

NOTES

GUARDRAIL HEIGHT: For initial installation, construct the guardrail within 4" of the standard height, h, or 29" to the top of W-Beam rail. For MEASURING GUARDRAIL HEIGHT, height of existing guardrail. The finished height is to be within 2 1/2" of the standard height.

POST EMBEDMENT DEPTH: Standard embedment is 3'-5" min. Where less than 2 1/2' of graded shoulder width, install longer posts as detailed here. As a general guide for the longer posts will be made at the unit price bid for ITEM 608-GUARDRAIL POST, 9', Each.

SPECIAL POST MOUNTINGS: Install posts located over a drainage inlet or similar device as detailed here. Where satisfactory, install an embedded pipe or pile as detailed here. (See GUARDRAIL HEIGHT: Note.)

Normal Offset

Greater Than 2' or Less

Normal Offset

Slopes extended: Measure 4' from ground line where graded shoulder slopes are steeper than 5:1. Expanded shield anchors may be substituted except where concrete deterioration has occurred, as determined by the Engineer. Where self-drilling anchors are used, drill the holes with a drill bit and install the shield flush with the concrete surface.

PROTECTIVE COATING: In lieu of the complying with CMS 710.06, coat expansion shields, anchors and concrete insert anchor assemblies with a coating to be of stainless steel, hot zinc coated (nom.) or ASTM A 500 Grade B. Where self-drilling anchors are used, drill the holes with a drill bit and install the shield flush with the concrete surface.

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GUARDRAIL HEIGHT: For initial installation, construct the guardrail within 4" of the standard height, h, or 29" to the top of W-Beam rail. For MEASURING GUARDRAIL HEIGHT, height of existing guardrail. The finished height is to be within 2 1/2" of the standard height.

POST EMBEDMENT DEPTH: Standard embedment is 3'-5" min. Where less than 2 1/2' of graded shoulder width, install longer posts as detailed here. As a general guide for the longer posts will be made at the unit price bid for ITEM 608-GUARDRAIL POST, 9', Each.

SPECIAL POST MOUNTINGS: Install posts located over a drainage inlet or similar device as detailed here. Where satisfactory, install an embedded pipe or pile as detailed here. (See GUARDRAIL HEIGHT: Note.)

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PROTECTIVE COATING: In lieu of the complying with CMS 710.06, coat expansion shields, anchors and concrete insert anchor assemblies with a coating to be of stainless steel, hot zinc coated (nom.) or ASTM A 500 Grade B. Where self-drilling anchors are used, drill the holes with a drill bit and install the shield flush with the concrete surface.
STANDARD SWAGED FITTING AND STUD
CABLE ANCHOR

END PLATE

PLAN

YOKE
Two required in Assembly

CONCRETE INSERT ANCHOR ASSEMBLY
(W-BEAM ONLY)

See ANCHORS and PROTECTIVE COATINGS Notes on Sheet 2

ANCHOR BRACKET

ANCHOR BRACKET ASSEMBLY DETAILS

POST SLEEVE

BEARING PLATE

SOIL PLATE
NOTES

RAILS: Use W-beam rail meeting AASHTO M 180 Type II Class 4, as specified in CMS 606.

POSTS: Posts may be constructed of wood or steel. Wood posts may be round or 6 x 8" square-sawn.

Use round wood posts on runs of single-sided rail. The round posts shall be 4 1/2" in diameter at the top and not more than 3" larger at the butt with a uniform taper.

Fabricated wood posts with square ends. Posts shall be pressure-treated as per CMS 704. A. Bore bolt holes out, if required, from the tops of posts after the posts are set.

Steel posts are to be No. 1 or No. 5 galvanized steel. Use the same type of post throughout the length of the project. Welded beam guardrail posts may be used for Item 606, Guardrail, provided the web and flange sizes are as shown here. Welding of the web to the flanges must comply with ASTM A 769, Class 1, using Grade 36 steel [250 MPa yield point].

 компания Approved List are permitted as an equal substitute when installed according to the manufacturer's instructions and within the limitations shown on the Approved List.

Blockouts: Blockout dimensions are dependent on post used. Wood blockouts are to be pressure-treated as specified in CMS 704. A. Bore bolt holes. Approved alternate blockouts may be used in lieu of the wood blockouts shown. The approved list is maintained by the Office of Roadway Engineering.

Washers: Install appropriate sized standard galvanized steel washers on the nut side of bolts installed on wood posts.

Delineation: For barrier reflectors, see CMS 626.

MISCELLANEOUS: For other guardrail details, see SCD GR-1.1.

STEEL BEAM POSTS (English)

<table>
<thead>
<tr>
<th>Size</th>
<th>Depth</th>
<th>Flange width</th>
<th>Flange thickness</th>
<th>Web thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolled W6x8.5</td>
<td>5.8&quot;</td>
<td>3.94&quot;</td>
<td>0.92&quot;</td>
<td>0.10&quot;</td>
</tr>
<tr>
<td>Rolled W6x9</td>
<td>6.0&quot;</td>
<td>3.94&quot;</td>
<td>0.92&quot;</td>
<td>0.10&quot;</td>
</tr>
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</tr>
</tbody>
</table>

SEC. 11.2 Test reports of tensile properties for each lot shall accompany each shipment.

SEC. 12 Beams that have imperfections required by welding shall not be accepted for use in Item 606.

SEC. 13 Random samples shall be tested by the Department from materials delivered to the project site, or other locations designated by the laboratory.

ALT. POSTS: Engineered guardrail posts having met NCHRP 350 criteria, and listed in the Office of Materials Management's Approved List are permitted as an equal substitute when installed according to the manufacturer's instructions and within the limitations shown on the Approved List.

WOOD POSTS: Steel posts are to be W6x9 or W6x8.5 galvanized steel. Fabricated wood posts with square ends. Posts shall be pressure-treated as per CMS 704. A. Bore bolt holes out, if required, from the tops of posts after the posts are set.

Steel posts are to be No. 1 or No. 5 galvanized steel. Use the same type of post throughout the length of the project. Welded beam guardrail posts may be used for Item 606, Guardrail, provided the web and flange sizes are as shown here. Welding of the web to the flanges must comply with ASTM A 769, Class 1, using Grade 36 steel [250 MPa yield point].

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**Barrier Design**

**Standard Design**

- Installing Post Bolt.
- Of Block and Post after rotation (drive at center).

**Notes**

- See POSTS and BLOCKOUTS Notes on Sheet 1.

**Square Wood Post**

- See POSTS Note, Sheet 1.

**Steel Post**

- Permissible radius on exterior corners.

**Notched Blockouts for Steel Posts**

- See BLOCKOUTS Note on Sheet 1.

**Round Wood Posts**

- New or reusable 6x8 Wood Blockout.
- Old bolt hole.

**Raising Existing Guardrail Height**

- Existing Wood Post.
- Old bolt required, to prevent blockout rotation.

Alternate methods of placing the Blockouts on round Posts may be submitted for consideration and approved by the Engineer.

**Guardrail Type 5 & 5A**

Single Sided runs only (Standard Design).
TUBING SPLICE DETAIL

Bolts in slotted holes shall not be drawn up too tight as this may cause the tube and the channel to become misaligned. The tube and the channel should be aligned as shown.

1 1/4" dia. Open Joint

1 1/4" dia. Open Joint in Tubing

3" 3" 3" 9" 3" 1"

Bolt Type 1

1 1/4" dia. Bolt

Washer

Nut

4" 2 1/4"

4" 4" 1/2"

3/16" x 1/2" Slotted Holes in Tube

3/16" x 1/2" Slotted Holes in Tube

1 1/4" dia. Hole in Tube

1/2" dia. Hole in Tube

1/2" dia. Hole in Tube

1 1/4" dia. Bolt

Tubular Backup Rail

Holes in Tubing

Holes in Tube

3/16" x 1/2" Slotted Holes in Tube

1 1/4" dia. Bolt

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3/16" x 1/2" Slotted Holes in Tube
METHODS FOR ANCHORING POSTS

Methods for Anchoring Posts

For methods of securing guardrail posts, see the following guidelines:

- For cover depth greater than 3" - 5", use M8x38 or M8x28.
- For cover depth less than or equal to 4", use M6x25 or M6x28.
- For cover depth less than or equal to 2" - 4", use M6x9.

For details of special washers, see AASHTO M 180.

Embed plate in sealant as per Federal Specification TT-S-00350C, Type II.

LEGEND

- For details of special washer, see AASHTO M 180.
- Embed plate in sealant as per Federal Specification TT-S-00350C, Type II.

Methods for Anchoring Posts

- Cover depth greater than 3" - 5":
  - Use nested W-beam rail:
    - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
    - Use M6x9 with special washer.

- Cover depth equal to or greater than 2" - 4", but less than 3" - 5":
  - Use standard W-beam rail:
    - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
    - Use M6x25 or M6x28 with special washer.

- Cover depth less than or equal to 2" - 4":
  - Use standard W-beam rail:
    - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
    - Use M6x9 with special washer.

- Cover depth less than or equal to 2":
  - Use standard W-beam rail:
    - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
    - Use M6x9 with special washer.

- Cover depth less than or equal to 1":
  - Use standard W-beam rail:
    - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
    - Use M6x9 with special washer.

- Cover depth less than or equal to 1/2":
  - Use standard W-beam rail:
    - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
    - Use M6x9 with special washer.

Methods for Anchoring Posts

- Use nested W-beam rail:
  - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
  - Use M6x9 with special washer.

- Use standard W-beam rail:
  - Tubular backup rail, 6" long at each post over structure and first post off each end of structure.
  - Use M6x9 with special washer.

- Use standard W-beam rail:
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  - Use M6x9 with special washer.

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NOTES

Culvert Headwall for flared options. See FLARED ENDS Note for flared options.

PLAN

| Rail | A | A | Rail

Number:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

B B C

ELEVATION

SECTION A-A

SECTION B-B

SECTION C-C

NOTES

APPLICATION: This drawing details the 25'-0" Long-span Guardrail cross section option, which meets the requirements of NCHRP 350 Test Level 3. 25'-0" Span posts may be eliminated such that a minimum of one rail splice is located within the unsupported length. A 25'-0" length of nested W-Beam rail may be used to eliminate a splice when 12'-6" long rail elements are used throughout the guardrail run.

CRT POSTS: For Details see SCD GR-1.1. Place holes parallel to traffic. The CRT Posts should have a 3'-7" embedment depth.

COVER DEPTH: This depth is measured at the locations of the missing posts. For cover depths greater than or equal to 2'-6", see SCD GR-2.1.

FLARED ENDS: Install the system with either one or both ends flared away from the traveled way. For installations where a guardrail flare will be used, the minimum recommended length of tangent section adjacent to the guardrail is 25'. Taper rates should be as shown on SCD GR-3.1.

MATERIALS: All posts, blockouts, rails, and hardware shall comply with Item 606, Guardrail Type 5 as detailed on SCD GR-2.1 except as noted. For other details not shown, see SCD GR-1.1.

PAYMENT: Item 606 - Guardrail Type 5, 25' Long-Span is paid for in Feet for the length specified in the plans and includes the double rail elements, block outs, posts, and the other hardware, materials and labor required to construct the guardrail as shown.
**NOTES**

**APPLICATION:** This drawing covers two span lengths, 12'-6" to 18'-9". Do not use on the NHS. See SCD GR-2.4 for NCHRP 350 Test Level 3 design.

**12'-6" Span:** The post to be eliminated must be at a rail splice location, as shown of Post No. 1. If conditions are such that the post to be eliminated would occur at a nonsplice location, then the 12'-6" span design should be used, eliminating Post No. 4.

**18'-9" Span:** The posts to be eliminated may be of Post No. 4 and No. 6 as shown or of Post No. 3 and No. 4.

**COVER DEPTH:** This depth is measured at the locations of the missing posts. For cover depths greater than or equal to 2'-6", see SCD GR-2.4.

**FLARED ENDS:** Install these systems with either one or both ends flared away from the traveled way. For locations where a guardrail flare will be used, the minimum recommended length of tangent section adjacent to the unsupported length is 25'. Taper rates should be as shown on SCD GR-1.1.

**MATERIALS:** All posts, blockouts, rails, and hardware shall comply with Item 606, Guardrail Type 5 as detailed on SCD GR-2.4. For other details not shown, see SCD GR-2.1.

**PAYMENT:** Item 606 - Guardrail, Type 5, Long-span is paid for materials and labor required to construct the guardrail as shown.

**APPLICATION:** This drawing covers two span lengths, 12'-6" to 18'-9". Do not use on the NHS. See SCD GR-2.4 for NCHRP 350 Test Level 3 design.

**12'-6" Guardrail Span**

**18'-9" Guardrail Span**

**Notes:**

- Cover Depth: This depth is measured at the locations of the missing posts. For cover depths greater than or equal to 2'-6", see SCD GR-2.4.
- Flared Ends: Install these systems with either one or both ends flared away from the traveled way. For locations where a guardrail flare will be used, the minimum recommended length of tangent section adjacent to the unsupported length is 25'. Taper rates should be as shown on SCD GR-1.1.
- Materials: All posts, blockouts, rails, and hardware shall comply with Item 606, Guardrail Type 5 as detailed on SCD GR-2.4. For other details not shown, see SCD GR-2.1.
- Payment: Item 606 - Guardrail, Type 5, Long-span is paid for materials and labor required to construct the guardrail as shown.
NOTES

GENERAL: For additional details, see SCD GR-1.1.

APPLICATION: Use Type 1 Bridge Terminal Assembly to connect guardrail runs to bridges having deflector Parapet or Concrete Barrier installations. Use Type 1 Bridge Terminal Assembly to connect guardrail runs to the approach ends of Concrete Barrier runs SCD NM-4.6.

On undivided, bi-directional roadways, Type 1's may be used to anchor guardrail runs to the trailing ends of Deflector Parapets or Concrete Barrier installations.

THREE BEAM TRANSITION: SynchroCool W-Beam to Thrie Beam transition panel shall be 10 gauge.

POSTS: Posts may be set in drilled holes or driven to grade. See SCD BM-4 for additional Post embedment details.

WOOD POSTS - Use square sawed pressure treated wood posts. Use wood blockouts only, steel or plastic blockouts are not permitted. Use notched blockouts with steel posts.

STEEL POSTS - are allowed as an alternate. Use W6x20 for 10"x10" wood posts and use W6x14 for 8"x8" posts. Use same post material throughout assembly.

BLOCKOUTS: Use wood blockouts only, steel or plastic blockouts are not permitted. Use notched blockouts with steel posts.

CURB: Provide a Type 4A or 4C concrete curb minimum of 20", or larger as shown on plans, including a 10' taper (from curb height to flush). Front of curb to be flush with face of guardrail.

FLARED GUARDRAIL: Provide standard Guardrail Flares as shown on SCD GR-3.1 preferably at or beyond Post No. 7; however, the flare may begin at Post No. 5.

PAYMENT: Item 606 - Bridge Terminal Assembly, Type 1, each, includes the cost of extra components, in excess of normal guardrail, for additional and different sizes of posts and blockouts, nested Thrie-Beam, transition and connector sections, Bearing Plates, bolts, washers, nuts, and other hardware.

The curb is required in this design, and is paid separately under Item 609 - Curb, Type 4A or 4C, per foot for the curb and taper sections, including materials, forming and labor needed to construct as shown.
**APPLICATION:** Use Type 2 Bridge Terminal Assembly to connect guardrail to the railing and of Parapet or Concrete Barriers (see SCD RM-4.4 for barrier) on one-directional roadways. Do not use if located within clear zone of opposing traffic.

**POSTS:** Posts shall be of standard size and material specified in SCD GR-2.1.

Wood or plastic blockouts are permitted. Flare may begin at Post No. 2. Preferably at or beyond Post No. 4, however, the flare may begin at Post No. 2.

Begin Standard Guardrail Flares as shown on SCD RM-4.6 or W6x8.5 (Typ.)

If located within clear zone of opposing traffic.

Do not use if located within clear zone of opposing traffic.

Barriers (see SCD RM-4.6 for barrier) on one-directional roadways.

For additional rail and post details, see SCD GR-1.1.

Payment: Item 606 - Bridge Terminal Assembly, Type 2, Each. Includes the cost of each component, in excess of normal turnouts, including Bearing Plates, Bolts, washers, nuts, and other hardware.
NOTES

GENERAL: For additional rail and post details, see SCD GR-1.

APPLICATION: Use Type 3 Bridge Terminal Assembly to connect guardrail runs for both the approach and trailing ends of Thrie Beam bridge railings. The design detailed on this sheet is approved to NCHRP 350 Test Level 3. See Structural Engineering's SCD TBR-1-11 for the associated bridge railing.

THRIE BEAM TRANSITION: The asymmetrical W-Beam to Thrie Beam transition panel shall be 10 gauge.

FLARED GUARDRAIL: Start Standard Guardrail Flares as shown on SCD GR-3.3 at or beyond Post No. 9; however, where sight constraints exist, the flare may begin at Post No. 1.

POSTS: Use steel posts only. Wood posts are not permitted in this design. Posts may be set in drilled holes, backfill, or tamp disturbed soils. See SCD GR-1.1 for additional post embedment details.

BLOCKOUTS: Steel posts in this design require the use of notched wood blockouts similar to those shown on SCD GR-3.3. The blockout's notch shall be sized to accept the post's flange. Steel or plastic blockouts are not permitted.

PAYMENT: ITEM 606 - Bridge Terminal Assembly, Type 3, Each, includes the cost of extra components in excess of normal guardrail, for additional and different types of posts and blockouts, nested Thrie-beam, transition and connector sections, and other hardware.

LEGEND

- Posts 2, 3, 4, 6, 7, 8, 9:
  - #W6x25x6'0" Steel Post with 6'-3" Notched Wood Blockout
  - #B6x20x6" Steel Post with 6'-3" Notched Wood Blockout
  - #W6x24x8'0" Steel Post with 8'-0" Notched Wood Blockout

- Post 5:
  - #B6x20x6" Steel Post with 6'-3" Notched Wood Blockout
### GENERAL

- POST No. 1
- APPLICATION
- PAYMENT
- BLOCKOUTS
- POSTS

For additional post and rail details, see CURB:

<table>
<thead>
<tr>
<th>BLOCKOUTS</th>
<th>THRIE BEAM TRANSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSTS may be set in drilled holes or driven to grade. See SCD GR-1.1 for additional Post embedment details.</td>
<td></td>
</tr>
</tbody>
</table>

- WOOD POSTS - Use square sawed pressure treated wood as per CMS 710.14 and fabricate with square ends. Bore bolt holes and trim the tops of posts, if required, after the posts are set.

### NOTES

- Steel Posts are allowed as an alternate. Use routed blockouts with steel posts.

#### BLOCKOUTS

- Use wood blockouts only. Steel or plastic blockouts are not permitted. Use routed blockouts with steel posts.

#### Curb

- Provide a Type 4-A or 4-C concrete curb minimum of 20", or longer as shown on plans, including a 10' taper (from curb to flush). Front of curb to be flush with face of guardrail.

#### PAYMENT

- Payment for the Guardrail Transition Section will be made at the unit price bid per each for Item 606 - Bridge Terminal Assembly, Type 1, Barrier Design, to connect Type 5 Barrier Guardrail or Type 1 Impact Attenuators to Concrete Median Barriers.

### ELEVATION

- Reinforcing not shown.
- SECTION C-C

### PLAN

- Two nested THRIE BEAM Sections nested
- Single Type 1 THRIE BEAM Transition Section each side

### SECTION A-A

- LEGEND

<table>
<thead>
<tr>
<th>1 Posts 1 &amp; 2</th>
<th>8&quot;x8&quot;x22&quot; Wood Post with 8&quot;x8&quot;x22&quot; Wood Blockouts</th>
</tr>
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<tbody>
<tr>
<td>2 Post 3</td>
<td>8&quot;x6&quot;x14&quot; Wood Post with 8&quot;x6&quot;x14&quot; Wood Blockouts</td>
</tr>
<tr>
<td>3 Post 4</td>
<td>8&quot;x6&quot;x14&quot; Wood Post with 8&quot;x6&quot;x14&quot; Wood Blockouts</td>
</tr>
<tr>
<td>4 Posts 5 &amp; 6</td>
<td>8&quot;x6&quot;x14&quot; Wood Post with 8&quot;x6&quot;x22&quot; Wood Blockouts</td>
</tr>
</tbody>
</table>

### VIEW B-B

- Front of curb to be flush with face of guardrail.
**APPLICATION:** On non-NHS roadways, it may be used in the clear zone, with restrictions. See Section 603, Location & Design Manual, Volume 1.

**GENERAL:** See SCD GR-1.1 for the general guardrail type. Galvanize all steel parts.

**OFFSETS:** See SCD GR-5.1 for standard guardrail flows. The 18' flow offset from normal type of rail, shown in the plan view (for single rail installations) will be utilized only where shoulder is insufficient for providing standard flows.

**POSTS:** Steel posts W6x9 are shown, but W6x8 posts are also permitted. See SCD GR-1.1 for additional embedment details.

**SPACERS:** Post B Spacers shall be made of 5/8" Steel Plate as specified in CMS 710.15 or two sections of W6x9 or W6x10 cut in the web case dashed line on POST B Detail and welded together on both sides.

All steel spacers and posts may be provided with additional bolt holes so that these items will not be required to be made right and left handed.

Spacers shall be fastened to Posts with two 5/8" hex head bolts and nuts with standard washers on both sides.

**RAILS:** All washers indicated on this drawing are standard galvanized steel of the appropriate size.

**CONCRETE ANCHOR:** Form top 4" of anchor and slope the top to conform to slope of the adjacent ground. The 36" diameter anchor may be replaced by a 2'-6" square anchor at the contractor's option.

**PAYMENT:** Include all materials and labor for the 5'-0" single rail, Type A Anchor Assembly in the unit price bid for Item 606 - Anchor Assembly, Type A, Each. Pay for all materials and labor for the 25'-0" Barrier Rail under the unit bid price Item 606 - Anchor Assembly, Barrier Design, Type A, Each.
Bearing Plate Detail

Plan

Direction of traffic flow for trailing end

Concrete foundation

Direction of traffic flow for trailing end

Concrete foundation

Type 1 Anchor Assembly

Type 5 Guardrail

6'-6" x 6'-6"

12'-6" x 12'-6"

Wire Mesh

Cable Anchor (with nuts and washers)

Anchor Bracket Assembly

Concrete foundation

Blackout attached to post with bolt and nut, and round washer under nut.

Std. Type 5 Post

Std. Type 5 Blackout

Blackout attached to post with bolt and nut, and round washer under nut.

Side

Front

Rounded End Section

6'-0" x 6'-0"

Breakaway CRT Post

5'-4" Type 1

See DETAIL C

12"-6" W-Beam Terminal Rail

4" x 2"

Post Sleeve

6" x 8" wood

Sloped to Drain

6" x 6" x 66#

Welded Wire Fabric

Wrap post in 1/2" thick polyethylene sheeting or double layer of composition paper to aid in removal.

Footing

For specific embedment of Std. posts, see SCD GR-4.2.

5" Cable Anchor, length of cable assembly is 8'-6"

6'4" by 6'0" Wood Post, See POSTS Note.

6'4" Type 1 Guardrail Post

5'-4" Guardrail Bolt and Nut with round washer under nut.

8 Splice Bolts

Cable Anchor and Bracket Assembly

Cable nut and washer

Rail Splice, rails lapped in direction of traffic

Concrete foundation

W-Beam Terminal Rail

4" Rail (with bracket slots)

Cable Anchor (with nuts and washers)

Anchor Bracket Assembly

See DETAIL C

Elevation - Concrete Footer

See SCD GR-4.2 for Type 1 Guardrail, CRT Flats Steel, Welded Round End Section, Cable Anchor and Bracket Assembly details.
Payment Limits for Item 606 Guardrail, Type 8

**POSTS & BLOCKOUTS:** Shall comply with Guardrail, Type 5 (See SCD GR-2.1 except posts shall be 8'-0" long unless otherwise specified. 

**LENGTH OF NEED** Where backslips along the length of the Terminal to the warranting feature are 2:1 or flatter, at least 75'-0" of guardrail must be provided upstream from the warranting feature before the guardrail crosses the ditch line. The warranting feature is often the intersection of the ditch and slope as shown, but may be at some other point. Where backslips are steeper than 2:1, this minimum distance is not applicable. 

**PAYMENT:** Item 606 Guardrail, Type 8 shall be in Linear Feet for the length specified in the plans and shall include rails, 8'-0" posts, grading, excavation, embankment and all other hardware, materials and labor required to construct the guardrail as shown except for the End Anchor. Payment for Item 606 - Post End Anchor (or Concrete Block End Anchor) Each, shall include the extra cost of concrete blocks or steel posts and all other hardware, materials and labor required to construct the end anchor.

**END ANCHORS:** A Post End Anchor is the preferred treatment. A Concrete Block End Anchor may be installed in any location that does not permit the installation of posts. Concrete blocks may be either pre-cast or cast-in-place and shall meet the requirements of SCD 606.02. The finished ground line over the end anchor should be smooth and consistent with the surrounding topography, i.e. embankment shall not be mounded over the end anchor to achieve the proper amount of cover.

**MISCELLANEOUS:** For details not shown see SCD GR-P.1.

**NOTES:**
- For Sections see Sheet 2.
- Item 606 Post End Anchors shown (see Detail on Sheet 3). For alternate End Anchor see Sheet 3.

**PLAN VIEW**
- Height of guardrail is parallel to edge of pavement until the distance between the bottom of the lower rail and the finished grade reaches 1'-4". At this point taper both rails to maintain 1'-4" maximum clearance to finished grade. (See Section C-C, on Sheet 2.)

**ELEVATION VIEW (Profile Along Rail)**
SECTION A-A
(See Sheet 1)

SECTION B-B
(See Sheet 1)

SECTION C-C
(See Sheet 1)

SECTION D-D
(See Sheet 1)

SECTION E-E
(See Sheet 1)
Bolts shall be either mechanical or set in epoxy adhesive. Length of bolt and size of hole to be determined by manufacturer’s recommendation.

Posts 1 and 2 are not used in concrete option.

The 7⁄8” Steel Plate may be welded or bolted to the Post. If the Plate is bolted to the Post use four 7⁄8”x3⁄4” long Hex Nut Bolt with Hex Nut. If the Plate is welded to the Post do not drill 1⁄4” holes in the Plate or the Post flanges.
TAPERED GUARDRAIL OFFSETS (Feet)

<table>
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<tr>
<th>Post No.</th>
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</table>

NOTES

STANDARD GUARDRAIL FLARE: Construct the flare shown here when indicated in the construction plans and in conjunction with GDB GR-0.2.

FLARE RATES AND OFFSET SPEEDS: Use the Design Speed shown on the plans to determine Flare rates and offsets. Where a Design Speed is not shown or available, use the legal posted speed limit.

ANCHOR ASSEMBLY: Use a Type B Anchor Assembly with standard guardrail flares (otherwise specified). The Type A can be used, with restrictions. Location and Design Manual, Volume I, Section 603.

CONTROL POINT: The point shown designates the extent of the hazard being protected and is shown for design use only.

ANCHOR ASSEMBLY Note): Use a Type B Anchor Assembly with standard guardrail flares unless otherwise specified. The type B can be used, with restrictions. Location and Design Manual, Volume I, Section 603.

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FLARED ANCHOR ASSEMBLIES

APPLICATION: Utilize details shown here only where approach foreslopes are 6:1 or flatter.

SLOPES: Slopes designated by * are 6:1 or flatter. Construct slopes indicated "A" or "B" as specified in the plans.

DISTANCES: The distance from the control point to the beginning of the hazard being shielded and is shown in the plans. "D" is the lateral offset of the flare.

APPLICATION: FLARED ANCHOR ASSEMBLIES for more information.

NOTES

ANCHOOR ASSEMBLY: Install Type B Anchor Assemblies according to the Manufacturer’s instructions. Products are install either on a curved flare or straight flare.

LOCATION OF OBSTRUCTION

(Bridge Pier, Sign Support, etc.)

Outfield

Infield

Normal Offset

Foreslopes

N.D.E.

Offset (D)

5' min. to slope break

B26' min.

Normal Offset

Offset (D)

Edge of Travelled Way

Backslope

Hinge Point

Normal Offset

Offset (D)

Distance or

Offset (D)

Tangent line projected from the normal barrier offset

Type B Anchor Assembly (Curved Flare shown)

FLARED ANCHOR ASSEMBLIES

Flared Anchor Assemblies are considered gating terminals, and thus, an area 20' by 75' behind and beyond should be reasonably traversable and free from fixed objects hazards.

SECTION A-A

SECTION B-B

FLARED ANCHOR ASSEMBLIES

Note: Any obstruction located behind and beyond the barrier considered gating terminals and thus should be reasonably traversable.

Obstruction in Fill Conditions, use above details.

GRADING PLAN FOR FLARED ANCHOR ASSEMBLIES
**FILL TO FILL**

- Slopes designated by "A" and "B" shall be 3:1 or flatter. Slopes labeled "C" and "D" shall be 10:1 or flatter.

**CUT TO FILL**

- The Length of Need (LON) represents the distance from the control point to the beginning of the end treatment. The control point shown designates the extent of the hazard being shielded and is shown for design use only. See Section 602 of the Location & Design Manual, Volume 1, Section 602, for the design shown may be specified on the plans where it is deemed detrimental to lose effective shoulder width due to the dimensions of the hazard being shielded.

**NOTES**

**APPLICATION:** Utilize details shown here only where approach foreslopes are steeper than 6:1, but not steeper than 3:1.

**SLOPES:** Slopes labeled "A" and "B" shall be 10:1 or flatter. Slopes labeled "C" and "D" shall be 3:1 or flatter.

**"LON" DISTANCE:** The Length of Need, LON, represents the distance from the control point to the beginning of the end treatment. The control point shown designates the extent of the hazard being shielded and is shown for design use only. See Section 602 of the Location & Design Manual, Volume 1, Section 602.

**GUARDRAIL END TERMINALS:** Terminals utilized for the situations shown here shall be Type E Anchor Assemblies unless otherwise specified in the plans.

**OBSTRUCTION INSTALLATION:** Use this installation for one-directional roadways only.

**OFFSET DESIGN**

- The design shown may be specified on the plans where it is deemed detrimental to lose effective shoulder width due to the dimensions of the hazard being shielded. The Type E which represents the final 50' of guardrail tapering back to the normal width to 10' as shown.

**OBSTRUCTION**

- The design shown may be specified on the plans where it is deemed detrimental to lose effective shoulder width due to the dimensions of the hazard being shielded. The control point shown designates the extent of the hazard being shielded and is shown for design use only. See Section 602 of the Location & Design Manual, Volume 1, Section 602.
INTRODUCED GUARDRAIL APPROACH INSTALLATIONS

DESIGN A
Narrow Median (See NOTE 2)

NOTES

1) The length of guardrail needed shall be determined according to methods contained in the Location and Design Manual, Volume 1, Section 402. Quantities shown on this sheet are based on these methods, using a lateral offset of 90° for the area of concern, a runoff length of 472', and a guardrail flare rate of 8:1.

2) Use DESIGN A* in narrow medians where the end of the guardrail run extends into the clear zone of the opposite side traffic. In medians where the guardrail run would otherwise extend beyond the centerline of the median, turn the guardrail run to follow the centerline using a standard flare arc. The plans shall clearly indicate what portion of the flared guardrail run is to be constructed using barrier guardrail.

3) Use DESIGN B* (see Sheet 3 of 2) where the guardrail run lies outside of the clear zone of the opposite side traffic. In this case, the design of the guardrail flare in the median would be similar to that of the guardrail approach on the outside shoulder. Estimated quantities are provided in the box below.

4) Use a 25'-0" Standard Flare Arc per SCD GR-61.

5) Provide dip or flatter cross-slopes in front of guardrail. Dip into the median at other locations are the recommended practice, although other slopes may be designated in the plans.

GUARDRAIL OFFSET TRANSITIONS

<table>
<thead>
<tr>
<th>English (ft)</th>
<th>L Total Length</th>
<th>T Target Length on Flares</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Difference offset</td>
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<td>87.5</td>
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</tr>
<tr>
<td>10</td>
<td>175.0</td>
<td>125.0</td>
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</table>
INTRODUCED GUARDRAIL APPROACH INSTALLATIONS

DESIGN B

Wide Median (See NOTE 3 on Sheet 1)

SECTION A-A

RECOMMENDED LENGTHS FOR GUARDRAIL FLARES AT BRIDGE APPROACHES

<table>
<thead>
<tr>
<th>English (ft)</th>
<th>F</th>
<th>G</th>
<th>H</th>
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<tbody>
<tr>
<td>Guardrail Offset At Bridge</td>
<td>Length of Panel (ft)</td>
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<tr>
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</tr>
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<td>12'</td>
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<tr>
<td>16'</td>
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<td></td>
</tr>
</tbody>
</table>

1. Including the 25'-0" Standard Flare Arc coming off the Bridge, but excluding the Anchor Assembly/Attenuator device.
2. For use with a DESIGN "B" Median (see this sheet) or on the outside Shoulder approach to the Bridge.
3. Lengths are based on using whole numbers of Guardrail panels (12'-6" long).
NOTES

2. The length of guardrail needed shall be determined according to methods contained in the Location & Design Manual, Volume I, Section 602.

3. Use DESIGN "A" in the narrow medians where the end of the guardrail run extends into the clear zone of traffic.

In medians where the guardrail run would otherwise extend beyond the centerline of the median, the guardrail run should be turned to follow the centerline using a standard flare arc. The plans shall clearly indicate the location of the flare arc.

4. Use a type A or type B anchor assembly (See Note 4) when the end of the guardrail run is also outside the clear zone of the approaching traffic. Where the end is inside the clear zone of the approaching traffic, use a type A or type B anchor assembly.

5. Use a 90° standard flare arc as per SCD GR-2.5.

6. Provide 10:1 or flatter cross-slopes in front of guardrail. Other slopes are shown in the median to suggest a grading and drainage plan, however for complete details see the construction plans.

7. Install Type T Anchor Assembly (See Note 3) on the trailing ends of the guardrail beyond the bridge piers (downstream from traffic flow).

8. The "HIGH SIDE" and the "LOW SIDE" designations are shown in the reference to the drainage design and are dependent upon the longitudinal slope in the median.
MEASURING GUARDRAIL HEIGHT

**MEASURING GUARDRAIL HEIGHT**

For initial installation, construct the guardrail within a foot of the standard height, or 29" to the top of railing. Use MEASURING GUARDRAIL, which shows the height of existing guardrail; the finished height is to be within ±1" of the standard height.

**POST EMBEDMENT DEPTH**

Standard embedment is 3'-5" min. Where less than 2' of graded shoulder width exists, measured from the face of the guardrail, use longer posts so that a minimum of 6'-6" embedment depth is provided. Payment for the longer posts will be made at the unit price bid for Item 608 GUARDRAIL, POST, 9', Each.

**POST MOUNTING**

Install posts located over a drainage inlet or culvert with the footing anchor, or anchor per SCD GR-2.2.

Install posts located over a footing with a cover of less than 4'-4" with a footing anchor as detailed here, a plate, as detailed on SECTION B-B SCD GR-2.2, may be used as an alternative attachment method. Where the cover is between 4'-4" and 6'-6", the footing anchor may be omitted and the post encased instead with 4" (min.) of concrete.

Do not drive posts located over a culvert with less than 4'-4" of cover; instead set in drilled or dug holes. Where the available post embedment depth is less than 3'-4", choose the post with a minimum of 4" of concrete.

All costs associated with special post mountings are included in the unit price bid of Item 608 Guardrail of the type specified in the plans.

**ANCHORS**

Holes and grouting shall comply with CMS 510. Use either cement or nonmetallic, nonferrous grout.

Expansion shield anchors as specified in CMS 712.01 may be substituted except where concrete deterioration has occurred, as determined by the Engineer. Where self-drilling anchors are used, drill the holes and install the shield flush with the concrete surface.

**PROTECTIVE COATING**

In lieu of the complying with CMS 710.06, coat expansion shield anchors and concrete insert anchors with a protective coating, either paint or a 28-day minimum strength of 4 ksi. Embedding devices are listed in CMS 710.06. (See sheet 3 for Concrete Insert Anchor assembly detail.)