GENERAL NOTES:

1. INSTALLATION: Construct guardrail in accordance with Specification Section 536.

This Index, along with the plans and the manufacturers’ drawings on the Approved Products List (APL), is sufficiently detailed for installation of General Guardrail, Low-Speed Guardrail, End Treatment assemblies, and their connecting options shown herein. This precludes requirements for shop drawing submittals unless otherwise specified in the plans.

2. COMPATIBILITY: The General Guardrail in this Index is based on the Midwest Guardrail System (MGS) design, with an approximate height of 31" at the top of the Panel (2'-1" mounting height at vertical edge of Panel) and a midspan panel splice as shown on Sheet 2. Guardrail components included on the APL, which are compatible with this Index, may also be identified as 33" or MGS Guardrail.


4. BUTTON-HEAD BOLTS: Install Button-Head Bolts where indicated using bolts, nuts, and washers as shown on Sheet 22. Place washers under nuts; washers are optional against steel flanges. Do not place washers between bolt heads and panels, except where otherwise shown in this Index.

5. HEX-HEAD BOLTS: Install Hex-Head Bolts where indicated using bolts, nuts, and washers in accordance with material properties of Specification Section 967. Place washers under nuts; washers are optional against steel flanges.

6. MISCELLANEOUS ASPHALT PAVEMENT: Install Miscellaneous Asphalt Pavement where indicated with a tolerance of ± ¾" deep and in accordance with Specification Section 339.

7. ADJACENT SIDEWALKS & SHARED USE PATHS: When guardrail posts are placed within 4'-0" of a sidewalk or shared use path, use timber posts, or use steel posts only if treated with Pipe Rail as shown on Sheet 20.

When timber posts are used, one of the following safety treatments is required for the bolts(s) protruding from the back face of the posts:

   a. After tightening the nut, trim the protruding post bolt flush with the nut and galvanize per Specification Section 562.
   b. Use post bolts 15" in length and countersink the washer and nut between 1" and 1 ½" deep into the back face of the post.
   c. Use 15" post bolts with sleeve nuts and washers.

When End Treatment posts are within 4'-0" of a sidewalk or shared use path, steel posts are not permitted within the End Treatment segment. Terminate the Pipe Rail outside of End Treatment segments, as noted per Sheet 20.

8. NESTED W-BEAM: Where called for in the plans, install two W-beam Panel’s mounted flush per location, securing all panels with Button-Head Bolts threaded through aligned slots and holes. Button-Head Bolts are permitted for panel splice locations.

9. CONNECTION TO RIDGE RAILING (RR): The connections to Rigid Barriers in this Index only apply to newly constructed bridge Traffic Railings and Concrete Barriers or where the complete Approach Transition Connection to Rigid Barrier shown herein can be installed without conflicting with existing Traffic Railings, structures, or approach slabs.

For connecting guardrail to existing guardrail or concrete barriers, see the layouts and details of Indexes 536-001, 521-404, and 421-405.

10. CONNECTION TO EXISTING GUARDRAIL: Where a transition to existing guardrail at 27" height is required, linearly transition the guardrail height over a distance ranging from 29'-0" to 31'-3". Provide an immediate transition to the required midspan splice using the available panel options on Sheet 4 (9'-40" or 11'-70" panel).

11. PLANS CALLOUTS: Begin/End Station labels are shown throughout this Index as they correspond to the station and offset callouts specified in the plans.

In the plans, Begin/End Guardrail Station refers to the General TL-3 Guardrail Pay Item, and it may be abbreviated as Begin/End GR. Station. Where the Low-Speed TL-2 Guardrail Pay Item is specifically required, the callout in the plans will then specify Begin/End TL-2 GR. Station.

12. QUANTITY MEASUREMENT: Measure guardrail and corresponding components as defined in Specification Section 536. The Guardrail length is measured along the centerline of installed Panels, between the points labeled Begin/End Guardrail Station shown on the following Index Sheets and defined in the plans (typically measured from the edge of the panel’s post bolt slots at the approach or trailing ends).
GENERAL GUARDRAIL DETAILS

NOTES:

1. GENERAL: Install the General Guardrail configuration where indicated in the plans. This may include tapered segments if called for in the plans.

Use 12'-6" or longer W-Beam Panels. A single 6'-3" Panel may be used at the end of the run to meet the nominal Begin/End Guardrail Sta. requirements.

Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. For reverse lane conditions, orient the Splice Ridge downstream of the lane direction with the highest traffic volume. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.


5. POST & OFFSET BLOCK DETAILS: See Sheet 5.

6. GUARDRAIL SECTIONS: For Sections showing typical mounting heights, grading, and lateral offsets in relation to adjacent roadway features, see Sheet 6.

7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalks, or shallow depth conditions are encountered, see Sheet 2 for additional post mounting options.

8. DEFINED SEGMENTS: The General Guardrail shown provides the base configuration, including Post Spacing and splice locations, for defined segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

GENERAL, TL-3 GUARDRAIL DETAILS
LOW-SPEED GUARDRAIL
INSTALLED ELEVATION

LOW-SPEED GUARDRAIL
INSTALLED PLAN

NOTES:
1. GENERAL: Install the Low-Speed Guardrail configuration where indicated in the plans. Low-Speed Guardrail may include tapered segments if called for in the plans.

Use 12'-6" or 25'-0" W-Beam Panels for normal spans, and use 9'-4" Panels for end connections to adjoining segments as shown. A single 6'-3" Panel may be used at the end of the Low-Speed Guardrail run along with a single reduced 6'-3" post spacing to meet the nominal Begin/End Guardrail Sta. required.

Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the Plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. For reverse lane conditions, orient the Splice Ridge downstream of the lane direction with the highest traffic volume. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.


5. POST & OFFSET BLOCK DETAILS: See Sheet 5.

6. GUARDRAIL SECTIONS: For Sections showing typical mounting heights, grading, and lateral offsets in relation to adjacent roadway features, see Sheet 6.

7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

8. RESTRICTIONS: Low-Speed Guardrail segments are not permitted for use with items including, but not limited to, Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, and/or Rub Rail.
1. STANDARD POSTS: Where Standard Posts are called for in this Index, use either a Timber Post or Steel Post at the Length, "L", shown for Standard Posts. Use a single post material type consistently per each run of guardrail. Only where specified in the Plans, use the Deep Post "L" for Slope Break Conditions as shown on Steel 6.

2. OFFSET BLOCKS: For each Panel type, install the corresponding Offset Block type as shown. For General, 1'-2" (Single Faced) Approach Transitions only, use the 1'-6" Thrie-Beam Block (See Steel 13).

3. BOLT HOLES: For each Panel type, install the corresponding Bolt & Nut shown in the Index. The threaded portion is not permitted to extend beyond 1/3" from the face of the tightened nut. Trim the threaded portion as needed and galvanize in accordance with Specification Section 562.

4. DOUBLE FACED GUARDRAIL: Orient Post Bolts with the Button-Head located on the side nearest the traffic lane. The bolt's threaded portion is not permitted to extend beyond 1/3" from the face of the tightened nut. Trim the threaded portion as needed and galvanize in accordance with Specification Section 562.

5. MODIFIED THRIE-BEAM NESTED BACK-UP PLATE: At each post connection, install a Nested Back-up Plate between the Thrie-Beam Panel and the post. The Nested Back-up Plate has a cross-section and material matching the Thrie-Beam Panel Section.

6. BLOCK STOP-NAI: Drive one nail per Standard Offset Block as shown to prevent Block rotation. The steel offset blocks are only permitted for Thrie-Beam Panel Section.

7. MATERIALS: Use timber and steel posts and offset blocks in accordance with Specification Section 562. Composite offset blocks may be substituted as approved on the APL. Use a single offset block type consistently per each run of guardrail. Steel offset blocks are only permitted for Modified Thrie-Beam Panel Section.
GUARDRAIL TYPES - MOUNTING HEIGHTS & POST DEPTHS

GUARDRAIL SECTIONS - CURB & GUTTER

GUARDRAIL SECTIONS - SHOULders

GUARDRAIL HEIGHT SUMMARY TABLE:

<table>
<thead>
<tr>
<th>Type:</th>
<th>Min. Depth 'D'</th>
<th>Mounting Height 'H'</th>
<th>Post Length 'L'</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-Beam (Single and Double Faced)</td>
<td>3'-10&quot;</td>
<td>2'-1&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>Thrie-Beam (Single and Double Faced)</td>
<td>3'-10&quot;</td>
<td>1'-9&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>Modified Thrie-Beam</td>
<td>3'-17&quot;</td>
<td>2'-0&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>Timber Deep Post</td>
<td>4'-10&quot;</td>
<td>See Above</td>
<td>7'-6&quot;</td>
</tr>
<tr>
<td>Steel Deep Post</td>
<td>6'-4&quot;</td>
<td>See Above</td>
<td>9'-0&quot;</td>
</tr>
</tbody>
</table>

NOTES:
1. GUARDRAIL SECTIONS: Construct Sections as indicated in the plans. The details shown herein depict W-Beam guardrail, but are applicable to the other defined guardrail types placed at the corresponding height. 'H' Use components per Sheets 4 & 5. Steel and timber post types are interchangeable unless otherwise indicated. The 1:10 Max. cross slope shown is the maximum slope permitted for proper guardrail function, but project-specific cross slope requirements are governed per the plans.
2. TYPICAL GRADING & PAVEMENT PLACEMENT DETAIL: Construct features as depicted except where superseded by specific Guardrail Sections or the plans. Place the Slope Break a Minimum of 2' behind the post. For Deep Posts, the slope break may be placed at the Post with the Miscellaneous Asphalt Pavement omitted.
3. SLOPE BREAK CONDITION: Install Deep Posts only where called for in the plans. Deep Posts are only permitted where post spacing is 6'-3" or less.
4. LATERAL OFFSETS: The Lateral Offsets shown are governed by the station and offset callouts for Face of Guardrail, as shown in the plans.
5. ADJACENT TO CURB: Place the Face of Guardrail consistently 3'-10" behind the Face of Curb, as indicated by the plans station and offset callouts. For offset changes, transition the Face of Guardrail as shown in the plans.

GUARDRAIL SECTIONS - SHOULders

FY 2018-19
STANDARD PLANS

GUARDRAIL

INDEX
536-001

6 of 22
NOTES:

1. GENERAL. See Notes 1 through 3 on Sheet 7.

2. CURBED SEGMENTS: Type E curb is required within the limits shown, when a different curb type is called for outside of the Type E curb limits, transition the curb shape linearly, over a nominal distance ranging 5'-0" to 10'-0".

3. TAPER LENGTH: For Curbed Segments, taper the guardrail away from the roadway where shown to place the inside edge of the Impact Head at 5' behind the face of the curb. Where additional lateral offset is required to fit the Approach Terminal Assembly hardware, such as a soil plate, place the Impact Head as close to the curb as the hardware allows, not to exceed 2'-6" from the face of curb.

4. GUARDRAIL HEIGHT TAPER: For Curbed Segments, the connecting General Guardrail Mounting Height, "H", is typically measured from the top of curb (See Sheet 6-1). Length of End Treatment, 'LE'. Posts and Offset Blocks in the adjoining General guardrail segment may be different from those inside of the "LE". A change in post type between timber and steel is permitted, immediately outside of the "LE" segment.

5. DOUBLE FACED SEGMENT: Connect to Double Faced General Guardrail, use consistent Posts and Offset Block types as specified in the APL drawings over the entire Length of End Treatment, 'LE'. Posts and Offset Blocks in the adjoining General Guardrail segment may be different from those inside of the "LE". A change in post type between timber and steel is permitted, immediately outside of the "LE" segment.

6. IMPACT HEAD END DELINEATOR: Apply Yellow Retroreflective Sheeting to the nose of the End Terminal Assembly (See Section A-A). Linearly taper the difference in Mounting Height over a minimum length of 12'-6", starting where indicated herein.

7. SINGLE FACED 'PARALLEL' AND 'FLARED' SEGMENTS: In conformity with Specification Section 536. Retroreflective Sheeting to the nose of the End Terminal Assembly in accordance with Specification Section 536.

CURVED AND DOUBLE FACED

END TREATMENT - APPROACH TERMINAL GEOMETRY

CURVED AND DOUBLE FACED

APPROACH TERMINAL ASSEMBLY

'CURVED' SEGMENT - PLAN VIEW

APPROACH TERMINAL ASSEMBLY

'DOUBLE FACED' SEGMENT - PLAN VIEW

'CURVED' SECTION A-A
(Height, 'H', Measured from Curb Transition to Misc. Asphalt Pavt.)

'DOUBLE FACED' SECTION B-B
(1:10 Slope or Flatter Reqd.)
1. COMPONENT DETAILS: For additional Type II component details, see Sheet 10. For Rectangular Button-Head Bolt details, see Sheet 22.

2. END UNITS: Use materials for end units as defined in Specifications Section 536. End Units are referred to as "End or Buffer Sections" in AASHTO M180. Lap the Flared End Unit behind the W-Beam; lap the Rounded and Buffered End Units over the face of the W-Beam. See note 5.

3. FOUNDATIONS: Install Steel Tubes with attached Soil Plate by either of the following methods:
   a. Excavate, backfill, and compact material to provide full passive soil resistance to all surfaces of the Tube and Soil Plate.
   b. Drive the Tube and Soil Plate as a single unit using a dummy timber post to prevent damage to the breakthrough post.

4. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2, including parapet and finished sections. Transitions, Low-Speed Guardrail, or Reduced Post spacing Guardrail segments may be substituted for the General Guardrail shown herein if indicated in the plans.

5. SIDEWALK REQUIREMENTS: When sidewalks are located adjacent to the End Treatment, install a Rounded End Unit (Flared End Unit not permitted for this case). When sidewalks or shared use paths are within 6'-0" from the backs of posts, use the Timber Post option shown (including the first post in the General Guardrail segment). Install the Pipe Rail for adjacent Sidewalk shown (including the first post in the General Guardrail segment). Install the Pipe Rail for adjacent Sidewalk shown (including the first post in the General Guardrail segment).

6. END DELINEATOR: Mount retroreflective sheeting to the approach face of the End Unit in accordance with Specification Sections 536 and 537.
1. INSTALLATION: Use components as shown on Sheets 9 & 11.

2. MATERIALS: Use steel Plates and Cable Assemblies in accordance with Specification Section 967. Use Short Timber Breakaway Posts and Steel Tube Foundations in accordance with Specification Section 536. Use Hex Nuts, Hex Jam Nuts, and Washers in accordance with the AASHTO-AGC-ARTBA Guide to Standardized Barrier Hardware with English unit equivalents of components FM24a and FM24b, respectively. Two Hex Nuts may be used for the Hex Jam Nut System.

3. PLATE STOP-NAILS: To prevent rotation of the Bearing Plate, drive steel 3⁄16" Type Bd nails with ASTM A153 hot-dip galvanization.

4. CABLE ANCHOR PLATE ASSEMBLY INSTALLATION: Mount to the pre-fabricated Cable Anchor Plate Bolt Holes in the W-Beam Panel, as shown on Sheet 4. These panel holes are only permitted for this Cable Anchor Plate Assembly application.

NOTES:
1. INSTALLATION: Use with CRT Systems as required on Sheet 12.

2. COMPONENT DETAILS: For additional component details, see Sheet 10 & 12. For the Rectangular Washer detail, see Sheet 22.

3. MATERIALS: Use steel End Shoe, Plates, Tubes, and pins in accordance with Specification Section 967.

4. PARTIAL CABLE ASSEMBLY: The Partial Cable Assembly is similar to the Cable Assembly defined on Sheet 10, except with a 9'-0" total length and the Swage Fitting and Cable Stud omitted from one end. Feed the Cable Stud through the Cable Stud Hole of the Transverse Cable Stud Mount as shown, and secure it with the Hex Jam Nut System as defined on Sheet 10.

5. SPECIAL END SHOE MOUNT: Punch a 1/4" Ø hole in the W-Beam Panel as needed to secure the Special End Shoe with the 1/4" Ø Hex-Head Bolt. Galvanize hole per Specification Section 562.

6. FOUNDATIONS: Install Steel Tubes with attached Soil Plates by either of the following methods:
   a. Excavate, backfill, and compact material to provide full passive soil resistance to all surfaces of the tube and soil plate.
   b. Drive the steel tube and soil plate as a single unit using a dummy timber post to prevent damage to the roadway post.

7. END DELINERATOR: Mount retroreflective sheeting to the approach face of the Buffer End Unit in accordance with Specification Sections 536 and 967.
MIN. CLEAR AREA LIMITS

1. INSTALLATION: Construct the specified radius layout and Connecting Detail option as shown in the plans.

2. APPROACH GRADING: Maintain grading on the roadway side of the guardrail face at a maximum slope of 1:10.

3. MID. CLEAR AREA: Keep the area behind the CRT free of fixed objects and aboveground hazards within the Min. Clear Area limits shown. Maintain a slope not steeper than 1:10 for a minimum 2' behind the posts, and maintain a slope not steeper than 1:2 beyond 2' from the posts.

4. APPROACH GRADING: Maintain grading on the roadway side of the guardrail face at a maximum slope of 1:10.

5. SHOP-BENT PANELS: Install Shop-Bent panel(s) where indicated using 12'-0" or 25'-0" W-Beam Panels. Splice at post locations within the CRT radius using the General configuration of Button-Head Bolt only at the location shown).

6. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2, including parallel and tapered segments. Approach Transitions, Low-Speed guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the General Guardrail shown herein if indicated in the plans.

CRT SYSTEM SUMMARY TABLE:

<table>
<thead>
<tr>
<th>Return Radius (FT.)</th>
<th>Length of Shop-Bent Panels (FT.)</th>
<th>Quantity of CRT Posts</th>
<th>Area Clear of Hazards L x W (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>12.5</td>
<td>5</td>
<td>25 x 15</td>
</tr>
<tr>
<td>16</td>
<td>25.0</td>
<td>6</td>
<td>30 x 15</td>
</tr>
<tr>
<td>24</td>
<td>37.5</td>
<td>8</td>
<td>40 x 20</td>
</tr>
<tr>
<td>32</td>
<td>50.0</td>
<td>10</td>
<td>50 x 20</td>
</tr>
</tbody>
</table>

CRT POST ELEVATION (6"x8" Nom. Timber)

CRT INSTALLED SECTION

LAYOUT FOR CONTROLLED RELEASE TERMINAL (CRT) SYSTEMS - SIDE ROADS AND DRIVEWAYS

INDEX 536-001

SHEET 12 of 22
NOTES:

1. INSTALLATION: Construct the Approach Transition segment where indicated in the plans. The required offset of the connecting adjacent guardrail is shown in the plans.

2. SECTION VIEWS & DETAILS: For cross sections and details including the barrier mounting hardware, curb transition, adjacent grading, and installation dimensions, see Sheet 15.

3. END TRANSITION OF CURB OPTION: The Plan and Elevation views depict an example Curb Transition to Shoulder Gutter from Section D-D to E-E, but this transition may require a different shape depending on the End Transition option indicated in the plans (Either a Shoulder Gutter Option, Raised Curb Option, or Flat No Curb Option). See Sheet 15 for curb shape details.

4. RIGID BARRIER END TRANSITION: Taper the Rigid Barrier as shown. See Concrete Barrier, Index 521-001, and Traffic Railing, Indexes 521-420 thru 521-429, for details.

5. OFFSET: The required offset difference between the Face of Guardrail and Rigid Barrier Shoulder Line is considered negligible and may not be shown in the guardrail offset callouts in the plans. A consistent guardrail offset deviation of up to 4 inches outside of the Rigid Barrier Shoulder Line is permitted over the length 'LA'.

6. LOW-SPEED GUARDRAIL: Low-Speed Guardrail typically includes Panels and Post Spacing as shown on Sheet 3, including parallel and tapered segments. Approach Terminals, General Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the Low-Speed Guardrail shown herein if indicated in the plans.
CURB TRANSITION ISOMETRIC VIEWS

NOTES:
2. END TRANSITION OF CURB OPTION: Install one of the three End Transition Types shown per Section E-E as indicated by the plans.
3. GRADING BEHIND POSTS: Place Slope Break a Min. 2'-0" behind the post, per Sheet 6.
4. MATERIALS & CONSTRUCTION: Construct the concrete Aligning Curb and Curb transition connectors in accordance with Specifications Section 967.

Approach Transition Connection - Details
NOTES:

1. INSTALLATION: Construct the Approach Transition segment where indicated in the plans. The required offset of the connecting adjacent guardrail is shown in the plans.

The layouts given on Sheet 18 provide basic schemes for connections to adjacent guardrail, where a taper to a differing guardrail offset may be required. If the adjacent guardrail has the same offset as the Approach Transition segment, then no taper is required.

2. THRIE-BEAM TERMINAL CONNECTOR: See Sheet 15 for Details. The installed bolt's threaded portion is not permitted to extend beyond 3/4 from the face of the nut; trim the threaded portion as needed and galvanize in accordance with Specification Section 562.

3. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2. Including Parallel and Tapered segments. End Treatments or Reduced Post Spacing. Guardrail segments may be substituted as needed. Transition segment where indicated in the plans.

APPENDIX TRANSITION CONNECTION TO RIGID BARRIER WITH DOUBLE FACED GUARDRAIL

SECTIONS:

SECTION F-F
SECTION G-G

TRIMMED STD. OFFSET BLOCKS
TRIMMED STD. OFFSET BLOCKS

TIMBER POST ALIGNMENT WIDTH
STEEL POST ALIGNMENT WIDTH
Shoulder Line

REVISION
LAST
11/01/17
11/6/2017

SECTION H-H
BRIDGE ABUTMENT
(Sheet 13 or 14)

Maintenance
End Block

1. INSTALLATION: The Plan Views shown are schematic only, showing example geometry for connecting guardrail segments including taper locations and Double Faced Guardrail requirements as applicable. Work this Sheet with the plans, where stationing and offsets for Begin/End Guardrail, Begin/End Rigid Barrier, and Begin/End Taper are specified. For existing bridge layouts, see Index 536-002, 521-404, and 521-405.

2. GENERAL (OR LOW-SPEED) GUARDRAIL SEGMENT: Construct this segment if shown in the plans. The system may also be lengthened to fit by installing two Rounded End Units as defined on Sheet 9. For either Option, meet the 1:10 adjacent grading requirements for Approach Terminals as shown on Sheet 8, and use the corresponding APL drawings for construction details.

3. LENGTH OF APPROACH TRANSITION 'LA': Install the Approach Transition as shown on Sheet 13 or 14, or 6'-3", as needed to correctly fit system between the Begin/End Taper Stas. and offset as specified in the plans.

4. LENGTH OF END TREATMENT 'LE': Install the Approach Terminal End Treatment as shown on Sheet 7 or 8, where called for in the plans. Use the corresponding APL drawings for construction details.

5. CROSSOVER GUARDRAIL (FOR TYPE B APPROACH): Install the Crossover Segment tapering linearly from the Begin Taper Sta. and offset to the End Taper Sta. and offset as specified in the plans.

6. LENGTH OF DOUBLE FACED GUARDRAIL PANELS, 'LD' (FOR TYPE B APPROACH): Terminate the Double Faced Guardrail panels as shown (based upon the 30° line measured from the hazard on the opposite side of the median). Extend the panel segment longer than the dimension 'LD' as needed for the Panel's end Bolt Slot to align with a post Bolt hole.

7. END TREATMENT OPTIONS (FOR TYPE B & C APPROACH): For Double faced applications, use either a Double Faced Approach Terminal Assembly per Sheet 8 or a Crash Cushion per Index 544-001. For either option, meet the 1:10 adjacent grading requirements for Approach Terminals as shown on Sheet 8.

8. SLOPE GUARD: Where indicated in the plans, install a Guardrail segment between bridge approaches and offset from the bridge abutment's Slope Break as shown. Install posts at the end bolt slots of the panel system. Use post spacing of either 3'-1" or 6", as needed to correctly fit system between barriers. The system may also be lengthened to fit by installing two Rounded End Units as defined on Sheet 9.

LAYOUT TO RIGID BARRIER - APPROACH ENDS
NOTES:
1. See the applicable Notes on Sheet 17.
2. See the applicable Notes on Sheet 17.
3. INSTALL TRAILING ANCHORAGE - Type II:
   a) Install the Trailing Anchorage - Type II as shown on Sheet 9, where called for in the plans.
   b) INSTALL THREE-BEAM TERMINAL CONNECTOR: Install connector and bolts as shown on Sheet 15.
4. RIGID BARRIER SINGLE SLOPE END FACE: See Concrete Barrier Wall, Index 521-001, and Traffic Railing, Indexes 521-422 and 521-423, for details.

TYPE C APPROACH TO RIGID BARRIER - DOUBLE FACED GUARDRAIL
PLAN VIEW - MEDIAN SHOULDERS ONLY
(Mirror Horiz. and Vert. for Opposite Direction and/or Side of Road)

TYPE D TRAILING CONNECTION FROM RIGID BARRIER
PLAN VIEW - MEDIAN OR OUTSIDE SHOULDER
(Mirror Horiz. and/or Vert. for Opposite Direction and/or Side of Road)

TRAILING END TRANSITION CONNECTION TO RIGID BARRIER - INSTALLED ELEVATION

LAYOUT TO RIGID BARRIER - TRAILING ENDS
1. GENERAL: Install Rub Rail where called for in the plans. Position as shown on Sheet 6 unless otherwise shown in the plans. Install the backs of Rub Rail panels flush against Standard Posts. Either of the Channel Section or Bent-Plate Panel Rub Rail options may be used (consistent type per project). Where Double Sided Rub Rail is called for, thread the Button-Head Bolt through the Post Bolt Hole(s) and the panels on either side, and tighten the nut against the face of the panel farthest from adjacent traffic lanes. Trim the bolt's threaded portion in accordance with Note 4 on Sheet 5.

2. MOUNTING HEIGHT: Mount to the Standard Post's Rub Rail Bolt Hole as defined on Sheet 5.

3. MATERIALS: Use steel components in accordance with Specification Section 967.

4. END RUB RAIL: For Single Sided Rub Rail, terminate the run of Rub Rail by bending the panel behind the post and securing in place (as shown). For Double Sided Rub Rail, terminate the ends of Rub Rail on their respective front face of the post and secure with the typical Button-Head Bolt.
1. **GENERAL**: Install General Pipe Rail where indicated in the plans or when existing sidewalks or shared use paths are located less than 4'-0" from the back of Steel Posts as shown on Sheet 6.

2. **PIPE RAIL END SEGMENTS**: Place End Segments on both ends of General Pipe Rail runs, with End Fixtures mounted to Terminal Posts located outside of Approach Terminals (LT), Approach Transition (LT), and Approach Transition (LT) segments.

3. **MATERIALS**: Use steel brackets, fixtures, and pipes in accordance with Specification 967.

4. **RAIL SPLICES**: Install Rail Splices to join pieces of 2" NPS Pipe Rail into a continuous system. Place splices as needed, at a spacing of 18'-0" or greater. Orient the head of bolt on the top of the pipe.

**NOTES:**

- **PIPE RAIL INSTALLATION**: Install General Pipe Rail in accordance with the description provided in the plans.

- **ELEVATION DETAIL**: Use the provided elevation detail to ensure proper installation of the pipe rail.

- **RAIL SPLICE DETAIL**: Refer to the rail splice detail for the proper installation of pipe rail splices.

**REFERENCES:**

- See "Mount Section Detail" for additional information on the mounting sections.

**DETAILS:**

- **Steel Post Flange**: Use steel post flanges for proper installation of brackets.

- **Hex-Head Bolt**: Use hex-head bolts for securing the pipe rail to the brackets.

- **Pipe Rail Gap**: The pipe rail gap should be at least 1'-0".

**SPECIFICATIONS:**

- **Steel Plate**: Use steel plates for additional support and stability.

**DIMENSIONS:**

- **1-1/2" Pipe Rail**: Use 1-1/2" pipe rails for the main body of the pipe rail.

- **1-1/2" Hex-Head Bolt**: Use 1-1/2" hex-head bolts for securing the pipe rail.

**INSTALLATION:**

- **Mount Bracket**: Use mount brackets to secure the pipe rail to the posts.

- **End Fixtures**: Use end fixtures to secure the pipe rail at the ends of the runs.

**REVISIONS:**

- **Revision Date**: 01/01/17
- **Last Revision Date**: 11/01/17

**INDEX:**

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NOTES:
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in posts located atop curvets, islands, piers, footings, or similar concrete structures, a Special Steel Post may be substituted for a Standard Post. Install where shown in the plans and/or as-needed, in accordance with Specification Section 536.

2. EDGE CONFLICT: When a required post location causes an Edge Conflict with the structure, where the Steel Base Plate is not located entirely on the structure at least 3" from the Edge of Concrete, the longitudinal post location may be altered up to 1'-6" (Quarter Span) from the original required spacing location to prevent the Edge Conflict. With the post location adjusted, use a Std. Post mounted in soil (Option 1) or a Special Steel Post with its Base Plate mounted entirely on the structure (Option 2). Maintain the original required spacing locations upstream and downstream of the structure.

3. BASE PLATE MOUNT: Install Special Steel Posts as shown using steel Adhesive-Bonded Anchor Bolts in accordance with Specification Section 536.

4. PANEL MOUNT TO ADJUSTED POST: Punch additional 3/16" x 2" Hexagonal Bolt Slots in the W-Beam or Thrie-Beam Panel only where needed to mount the panel to a post in an adjusted location. Meet Panel Post Bolt Slots requirements of Specification Section 536.

5. MATERIALS: Use steel base plates in accordance with Specification Section 536.
NOTES:

1. INSTALLATION: Install Barrier Delineators as shown in accordance with the plans, with Specifications Section 536 and 705, and with the manufacturer's design as approved on the APL.

2. MATERIALS: Use materials of the size and type defined for Barrier Delineators in Specifications Section 993.

3. COLOR: Use either white or yellow retroreflective sheeting to match the color of the nearest lane's edge line.

4. MOUNT LOCATIONS: Mount Barrier Delineators as shown, starting with Post (1) of Approach Terminals and incrementally increasing spacing towards the downstream direction. Install the Barrier Delineators at the following spacing:

   - S1 = 25'-0" Space
   - S2 = 50'-0" Space
   - S3 = 75'-0" Space
   - S4 = 100'-0" for the Remaining Run

   Additionally, place a Barrier Delineator on Post (2) of the Trailing Anchorage or on the post nearest the Rigid Barrier.

5. MEDIAN GUARDRAIL: Install retroreflective sheeting on both sides of the barrier delineator for Guardrail on medians.

STEEL POSTS

<table>
<thead>
<tr>
<th>Panel Splice</th>
<th>Begin/End Half Spacing Sta.</th>
<th>Reduced Post Spa. Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter</td>
<td>6'-3&quot; (General)</td>
<td></td>
</tr>
<tr>
<td>Midspan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TIMBER POSTS

<table>
<thead>
<tr>
<th>Panel Splice</th>
<th>Begin/End Half Spacing Sta.</th>
<th>Reduced Post Spa. Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter</td>
<td>6'-3&quot; (General)</td>
<td></td>
</tr>
<tr>
<td>Midspan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DETAIL 'S' - HALF SPACING ELEVATION (AS REQ'D. PER THE PLANS)

BUTTON-HEAD BOLT LENGTHS:

<table>
<thead>
<tr>
<th>Application(s):</th>
<th>Length 'L':</th>
<th>Min. Thread Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel Splice</td>
<td>1 1/2</td>
<td>Full Length</td>
</tr>
<tr>
<td>Timber Post Mount - Single Faced Guardrail</td>
<td>16&quot;</td>
<td>4</td>
</tr>
<tr>
<td>Steel Post Mount - Single Faced Guardrail</td>
<td>25&quot;</td>
<td>4</td>
</tr>
<tr>
<td>Modified Thrie-Beam Panel / Terminal Connector Splice</td>
<td>25&quot;</td>
<td>4</td>
</tr>
</tbody>
</table>

NOTES:

1. Use nuts, bolts, and washers in accordance with Specification Section 967.

2. For Steel Posts with Double Faced Guardrail, the single 25" length bolt (one bolt thru both post flanges) may be replaced with two 10" length bolts (one bolt per panel flange).

3. Use bolts listed in Table 2 in corresponding locations shown in this Index.

RIDGE GUARDRAIL

<table>
<thead>
<tr>
<th>Button-Head Bolt System</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8&quot; Button-Head Bolt System</td>
</tr>
</tbody>
</table>

FY 2018-19

STANDARD PLANS

GUARDRAIL

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