GENERAL NOTES:

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

   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 1/2" deep into the back face of the post.

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


4. BUTTON-HEAD BOLTS: Install Button-Head Bolts where indicated using bolts, nuts, and washers as defined 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 ± 1/2" depth 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.

   a. Use 15" post bolts with sleeve nuts and washers.
   b. Use 15" post bolts with sleeve nuts and washers.
   c. Use 15" post bolts with sleeve nuts and washers.

8. CONNECTION TO RIGID BARRIER: The connections to Rigid Barrier in this Index only apply to newly constructed bridge Traffic Railings and Concrete Barrier 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.

   a. When timber posts are used, one of the following safety treatments is required for the bolt(s) protruding from the back face of the posts:
   b. When bolt(s) protruding from the back face of the posts:
   c. When bolt(s) protruding from the back face of the posts:

9. 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 25'-0" to 31'-3". Provide an immediate transition to the required midspan splice using the available panel options on Sheet 4 (9'-4" or 15'-7") panel).

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

11. 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 1/2 of the panel’s post bolt slots at the approach/transition ends).

   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 1/2" deep into the back face of the post.
   c. Use 15" post bolts with sleeve nuts and washers.
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 25'-0" 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. MIDSPLAN 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 21 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, Multi-Fold Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

GENERAL, TL-3 GUARDRAIL DETAILS

INDEX NO. 400

SHEET NO. 2 of 22
LOW-SPEED GUARDRAIL

INSTALLED SECTION

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'-4½" 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.

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.


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 Face W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, and/or Rub Rail.

LOW-SPEED, TL-2 GUARDRAIL DETAILS
### POST AND OFFSET BLOCK DETAILS

#### TIMBER POST
(6"x8" Nominal)

#### STEEL POST
(W6x8.5 or W6X9)

#### TIMBER OFFSET BLOCK
(6"x8" Nominal)

#### MODIFIED THRIE-BEAM SYSTEM
(W6x8.5 or W6X9 Steel Post & W14X22 Steel Block)

### DESIGN STANDARDS

- **1. GENERAL**: Install Posts and Offset Blocks where indicated throughout this Index.
- **2. OFFSET BLOCKS**: For each Panel type, install the corresponding Offset Block type. For General, TL 3 (Single Panel Approach) Transitions only, use the 6' or Thrie-Beam Block (See Sheet 13).
- **3. 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 in Sheet 6.
- **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 1/2" from the face of the tightened nut. Drive the nail through the unused flange bolt hole and bend the nail so its head contacts the flange. Use Type 16d nails with ASTM A153 hot-dip galvanization. For steel posts, drive the nail through the unused flange bolt hole and bend the nail so its head contacts the flange. Use steel 3/8" Button-Head located on the side nearest the traffic lane.
- **5. MODIFIED THRIE-BEAM NESTED BACK-UP PLATE**: At each post connection, install a Nested Back-up Plate between the Three-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-NAIL**: Drive one nail per Standard Offset Block as shown to prevent Block rotation. Use steel 3/8" Button-Head Bolt with a Hex-Head Bolt & Nut (Opposite Corner) for Slope Break Conditions as shown on Sheet 6.
- **7. MATERIALS**: Use timber and steel posts and offset blocks in accordance with Specification Section 967. Composite offset blocks may be substituted as approved on the APL. Thrie-Beam Block (See Sheet 13)

### NOTES:

- Timber and Steel Posts may be substituted as approved on the APL.
- Thrie-Beam Block (See Sheet 13).
**GUARDRAIL TYPES - MOUNTING HEIGHTS & POST DEPTHS**

<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 &amp; Double Faced)</td>
<td>3'-10&quot;</td>
<td>2'-1&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>Thrie-Beam (Single &amp; 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'-11&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'-6&quot;</td>
<td>See Above</td>
<td>9'-0&quot;</td>
</tr>
</tbody>
</table>

**GUARDRAIL SECTIONS - TYPICAL**

**GUARDRAIL SECTIONS - CURB & GUTTER**

**GUARDRAIL SECTIONS - SHOULDERS**

**GUARDRAIL HEIGHT SUMMARY TABLE:**

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 at the corresponding height. 'H' Use components per Sheets 4 & 5. Steel and timber post types are interchangeable unless otherwise defined.

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 call outs for Face of Guardrail, as shown in the plans.

5. **ADJACENT TO CURB**: Place the Face of Guardrail consistently offset either flush with the Face of Curb or 5" behind the Face of Curb, as indicated by the plans station and offset call outs. For offset changes, Transition the Face of Guardrail as shown in the plans.

**NOTES:**

1. GUARDRAIL TYPES
2. GUARDRAIL SECTIONS
3. SLOPE BREAK CONDITION
4. LATERAL OFFSETS
5. ADJACENT TO CURB

**INDEX NO.** 400

**SHEET NO.** 6 of 22
NOTES:
1. GENERAL: See Notes 1 through 3 on Sheet 7.
2. CURVED 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 Curved 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'-0" from the face of curb.
4. GUARDRAIL HEIGHT TAPER: For Curved Segments, the connecting General Guardrail Mounting Height, 'H', is typically measured from the lip of gutter (See Sheet 6 General Guardrail Sections, Adjacent to Curb), while the End Terminal Assembly is measured from the Misc. Asphalt Pavt. (See Section A-A). Linearly taper the difference in Mounting Height over a minimum length of 12'-6", starting where indicated herein.
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, 10'. 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.
   Maintain the 1:10 maximum grading as shown in Section B-B (throughout segment 10'). Where required, transition to differing adjacent slopes linearly, over a minimum longitudinal length of 25'-0".
6. IMPACT HEAD END DEFINITE: Apply Yellow Reflective Sheeting to the nose of the End Terminal in accordance with Specification Section 536.

APPRAOCH TERMINAL GEOMETRY
CURVED AND DOUBLE FACED

END TREATMENT - APPROACH TERMINAL GEOMETRY CURVED AND DOUBLE FACED

CURVED SECTION A-A
(Height, 'H', Measured From Misc. Asphalt Pavt.)

DOUBLE FACED SECTION B-B
(1:10 Slope or Flatter Req'd.)

APPROACH TERMINAL ASSEMBLY
'CURVED' SEGMENT - PLAN VIEW

APPROACH TERMINAL ASSEMBLY
'DOUBLE FACED' SEGMENT - PLAN VIEW
NOTES:

1. COMPONENT DETAILS: For additional Type II component details, see Sheet 10. For Rectangular Washer details, see Sheet 22.

2. END UNITS: Use materials for end units as defined in Specifications Section 967. End Units are referred to as "end or buffer sections" in AASHTO M180.

3. 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 Tube and Soil Plate as a single unit using a dummy timber post to prevent damage to the breakaway post.

4. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 4, including parallel and tapered segments. 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).

When sidewalks or shared use paths are within 4'-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 Steel Posts if used, as shown on Sheet 20.

6. END DELINERATOR: Mount retroreflective sheeting to the approach face of the End Unit in accordance with Specification Sections 536 and 967.
NOTES:

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.

3. PLATE STOP-NAILS: To prevent rotation of the Bearing Plate, drive steel 3\(^{1/2}\)" Type B8 nails with ASTM A153 hot-dip galvanization.

4. CABLE ANCHOR PLATE ASSEMBLY INSTALLATION: Mount 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 Shoes, Plates, Tubes, and pipes in accordance with Specifications 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 ½" hole in the W-Beam Panel as needed to secure the Special End Shoe with the ½" 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 breakaway post.

7. END DELINERATOR: Mount reflective sheeting to the approach face of the Buffer End Unit in accordance with Specification Sections 536 and 967.

REV/CON/AV: 02/19/16

DESIGN STANDARDS

GUARDRAIL INDEX NO. 400 SHEET NO. 11 of 22
NOTES:

1. INSTALLATION: Construct the specified radius layout and Connect Detail Option as shown in the plans.

2. MIN. 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.

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

4. MATERIALS: For CRT Posts, use Timber Post material in accordance with Specification Section 967. Use steel panels and hardware in accordance with Specification Section 967.

5. BOLT OMISSION: For the 8 Foot Radius CRT System only, do not place a panel-to-post mount bolt at the center CRT Post (omit the 3/4" Button-Head Bolt only at the location shown).

6. SHOP-BENT PANELS: Install Shop-Bent panels where indicated using 12'-0" or 25'-0" W-Beam Panels. Splice at post locations within the CRT radius using the General configuration of 3/4" Button-Head Bolts (8 reqd. per splice).

7. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown in 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.
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 Layout given on Sheet 17 provides basic schemes for connections to adjacent guardrail, where a taper to a differing guardrail offset may be required. If the adjacent guardrail segment has the same offset as the Approach Transition segment, then no taper is required.

   For existing bridge connection options, see Index Nos. 402, 404, and 405.

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 to a Single Slope end section. See Concrete Barrier Wall, Index 410, and Traffic Railing, Indexes 420 thru 425, for details.

5. OFFSET BLOCKS: For Three-Beam panel locations within the length of Approach Transition segment, use the Timber Offset Blocks with 1'-6" height shown on Sheet 5. For the midspan of the Three-Beam Transition Panel and for all other W-Beam locations shown herein, use the W-Beam Offset Blocks with 1'-6" height.

6. 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'.

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

APPROACH TRANSITION CONNECTION
TO RIGID BARRIER - GENERAL, TL-3
**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 17 provide basic schemes for connections to adjacent guardrail, where a taper to a differing guardrail offset may be required. If the adjacent guardrail segment has the same offset as the Approach Transition segment, then no taper is required. For existing bridge connection options, see Index Nos. 400, 404, and 403.

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 to E, but this transition may require a different shape depending on the end transition option indicated in the plans. Either a 'Shoulder Gutter Option' or 'Flat No Curb Option' is shown (See Note 3).

4. **RIGID BARRIER END TRANSITION:** Taper the Rigid Barrier to a Single Slope end section. See Concrete Barrier Wall, Index 402, and Traffic Railing, Indexes 420 thru 425, 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 Terminal, General Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the Low-Speed Guardrail shown herein if indicated in the plans.

**APPROACH TRANSITION CONNECTION TO RIGID BARRIER - LOW-SPEED, TL-2**
ABILITY CURB OPTIONS

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. GRADE 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.

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. GRADE 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.
### TL-3 Double Faced Approach Transition

#### Installed Elevation

**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 18 for details. The installed bolt's threaded portion is not permitted to extend beyond 3/8 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 spacings as shown on Sheet 2, including parallel and tapered segments. End treatments or reduced post spacing may be substituted. A general reference to guardrail is shown herein and indicated in the plans.

#### Approach Transition Connection to Rigid Barrier with Double Faced Guardrail - Type F-F Section

- **Trimmed Std. Offset Block:** Timber Post Alignment Width
- **Steel Post Spacing:**
  - 4 Sp. @ 3'-1" for TL-3 Double Faced Approach Transition
  - 5 Sp. @ 1'-6" for TL-3 Double Faced Approach Transition

#### Approach Transition Connection to Rigid Barrier with Double Faced Guardrail - Type G-G Section

- **Trimmed Std. Offset Block:** Steel Post Alignment Width
  - 5 Sp. @ 1'-6" for TL-3 Double Faced Approach Transition
  - 4 Sp. @ 3'-1" for TL-3 Double Faced Approach Transition

### TL-3 Double Faced Approach Transition - Installed Plan

**DESIGN STANDARDS**

- **Asphalt Pavement:**
  - 2" Misc.
  - 2" Asphalt

- **Concrete Barrier Wall:**
  - Full Concrete
  - Rigid Barrier
  - Steel Post Alignment Width as Specified

- **Button Head Bolts:**
  - (Typ.)
  - 12 Gauge
  - 10 Gauge

- **Hex-Head Bolts:**
  - (Typ.)
  - 12 Gauge

- **W-Beam Panel:**
  - (Approach Side)
  - (Nested with 25'-0" Panel)
  - (12 Gauge) (Nested)

- **Post Spacing:**
  - 3 Sp. @ 1'-6"
  - 2 Sp. @ 1'-6"
  - 1 Sp. @ 1'-6"

- **Transition Segment:**
  - Where indicated in the plans.

- **Taper to Guardrail Offset:**
  - Per the plans

- **End Treatment:**
  - (Approach Side)
**TYPE A APPROACH TO RIGID BARRIER - PLAN VIEW**

**MEDIAN OR OUTSIDE SHOULDERS**

(Mirror Horiz. and/or Vert. for Opposite Direction and/or Side of Road)

**DESIGN STANDARDS**

**GUARDRAIL**

**LAYOUT TO RIGID BARRIER - APPROACH ENDS**

**INDEX NO.**

**SHEET NO.**

**FY 2017-18**

**DESCRIPTION:**

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 Nos. 402 thru 405.

2. GENERAL (OR LOW-SPEED) GUARDRAIL SEGMENT: Construct this segment if shown in the plans. For the shortest length case of a direct connection between the Begin Taper Sta. and offset to the End Taper Sta. and offset as specified in the plans.

3. LENGTH OF APPROACH TRANSITION "LA": Install the Approach Transition as shown per Sheet 13 or 14 as called for in the plans.

4. LENGTH OF END TREATMENT "LE": Install the Approach Terminal End Treatment as shown per 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 "3D" line measured from the hazard on the opposite side of the median). The system may also be lengthened to fit by installing two Rounded End Units as defined on Sheet 9. Install a Flared End Unit where shown, as defined on Sheet 9.

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 No. 430. For either Option, meet the 1:10 adjacent grading requirements for Approach Terminal 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 abutments Slope Break as shown. Install posts at the end bolt slots of the panel system. Use post spacing of either 7'-1", or 6'-7", 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.

**NOTES:**

SECTION H-H

BRIDGE ABUTMENT SLOPE GUARD (Between Bridges)
1. INSTALLATION: Install where indicated in the plans. Tighten the backs of Rub Rail panels snug against Standard Posts. Follow the Double Faced Guardrail Typical Section requirements of Sheet 6 unless otherwise specified by the plans. Either of the Channel Section or Bent-Plate Panel Rub Rail options may be used unless otherwise indicated in the Plans.

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 Faced Guardrail, terminate the run of Rub Rail by bending the panel behind the post and securing in place. For Double Faced Guardrail, terminate the run of guardrail on the front face of the post and secure it with the typical Button-Head bolt.

NOTES:

SECTION A-A (Panel Typical)

SECTION B-B (Panel Sleeve End)

SECTION C-C (Panel Typical)

DETAIL "A" (Sleeve Transition Elevation)

DETAIL "B" (Sleeve Transition Plan)

RUB RAIL TERMINATION - SCHEMATIC PLAN VIEW

RUB RAIL DETAILS

GUARDRAIL

FY 2017-18 DESIGN STANDARDS

INDEX NO. 400

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4/28/16

22000

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02/01/16
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 Timber Posts located outside of Approach Terminal Assembly ('LE'), Trailing Anchorage Assembly ('LT'), and Approach Transition ('LA') segments.

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

PEDESTRIAN SAFETY TREATMENT - PIPE RAIL
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in posts located atop culverts, inlets, pier footings, or similar concrete structures, a Special Steel Post may be substituted for a Standard Post. Special Steel Posts are not permitted within an Approach Terminal's Design Length as specified on the APL drawing. 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 by up to 1'-6" (Quarter Span) from the original required spacing location to prevent the Edge Conflict. Install where shown in the plans where an adjustment will be made in the longitudinal location to avoid the conflict. Install where shown in the plans and/or as needed in accordance with Specification Section 536.

3. BASE PLATE MOUNT: Install Special Steel Posts as shown using steel Adhesive-Bonded Anchor Bolts in accordance with Specifications Section 536. Use 3/8" Hex-base Bolts for structures less than 9" deep as defined in the Specification (See Note 2).

4. PANEL MOUNT TO ADJUSTED POST: Punch additional 7/16" Post 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 the Panel Post Bolt Slots requirements of Specification Section 536.

5. MATERIALS: Use non-reinforced Class NS Steel Post and Special Steel Posts as used where a 2'-0" depth will avoid the conflicts. Install where shown in the plans. Ensure Flowable Fill surface is smooth and even with the adjacent concrete surface.

NOTES:
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in posts located atop culverts, inlets, pier footings, or similar concrete structures, a Special Steel Post may be substituted for a Standard Post. Special Steel Posts are not permitted within an Approach Terminal's Design Length as specified on the APL drawing. Install where shown in the plans and/or as needed in accordance with Specification Section 536.

2. REDUCED-LENGTH STANDARD POST: Use a Standard Post with reduced length such that the Panel Height 'H' is maintained while the post bottom terminates 3" from the bottom of the Concrete Foundation. Typically, the Post Length 'L' is 4'-7" for W-Beam Guardrail.

3. FOUNDATION: Use non-reinforced Class NS Concrete material in accordance with Specification Section 347. After casting the concrete, ensure the surrounding soil material is completely backfilled and tamped to provide full passive resistance.

4. LIMIT: Encased Posts are not permitted for consecutive posts unless otherwise shown in the plans.
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 atop posts as shown, starting with Post (3) of Approach Terminals and incrementally increasing spacing towards the downstream direction. Install the Barrier Delineators at the following spacing:

   - S1 = 25' x 1 Space
   - S2 = 50' x 1 Space
   - S3 = 75' x 1 Space
   - S4 = 100' x 1 Space

   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.

BARRIER DELINEATORS

NOTES:

1. INSTALLATION: Work these details with the plans, where sheeting for Begin/End Quarter Spacing and Beginning Quarter Spacing are indicated if required.

   Where the Begin/End Stations indicated in the plans do not correspond exactly to post locations in construction, extend the Reduced Post Spacing segment to the nearest post(s) before the Begin Station and/or after the End Station called for.

2. PANEL SPLICES: Midspan Panel Splices are not required in Transition and Reduced Post Spacing segments, however they are required for General segments. To view Midspan Splices in General segments, use one of the following panel lengths (9'-4" or 10'-5") or add an additional Transition space post where required.

3. LOW-SPEED GUARDRAIL: For Reduced Post Spacing with Low-Speed Guardrail (12'-6" post spacing), the Reduced Spacing pattern requires a 6'-3" space between the 12'-6" and 3'-11½" spaces.

4. PANEL POST BOLT SLOTS: For Quarter Spacing configurations, punch additional 7/8" x 2" Post Bolt Slots in the panels only where required for mounting in accordance with Specification Section 536.

REduced POST SPACING FOR HAZARDS

DETAIL 'S' - QUARTER SPACING ELEVATION

AS REQ'D. PER THE PLANS

BUTTON-CHEAD BOLT SYSTEM

S3/8 BUTTON-CHEAD 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>18&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Steel Post Mount - Single Faced Guardrail</td>
<td>18&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Timber Post Mount - Single Faced Guardrail</td>
<td>14&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Steel or Timber Post Mount - Double Faced Guardrail</td>
<td>25&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Modified Three-Beam Panel / Terminal Connector Splice</td>
<td>25&quot;</td>
<td>Full Length</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 post flange).

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