GENERAL NOTES:

1. INSTALLATION: Construct guardrail in accordance with Specification 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 1/2 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 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. 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 967. Place washers under nuts.

6. MISCELLANEOUS ASPHALT PAVEMENT: Install Miscellaneous Asphalt Pavement where indicated with a tolerance of ± 1/2 inch in accordance with Specification 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 bolt(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 562.
   b. Use post bolts 20" 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.

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 Panels mounted flush per location, securing all panels with Button-Head Bolts threaded through aligned slots and holes. 2" Button-Head Bolts are permitted for panel splice locations.

9. 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.

For connecting guardrail to existing bridge Traffic Railings, see the layouts and details of Indexes 536-002, 521-404, and 423-405.

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 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).

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 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/trailing ends).
GENERAL GUARDRAIL
INSTALLED ELEVATION

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

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 22 (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 Three-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

GENERAL, TL-3 GUARDRAIL DETAILS

INDEX 536-001 2 of 22
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 Stn 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 Face, W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, and/or Rub Rail.
DESCRIPTION:

11/01/17

REVISED 4/1/19

GUARDRAIL

STANDARD PLANS

FY 2019-20

INDEX 536-001

SHEET 4 of 22

PANEL SUMMARY TABLE:

<table>
<thead>
<tr>
<th>Panel Type</th>
<th>Number of Spacing ¥</th>
<th>Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-3&quot; W-Beam</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>6'-8&quot; W-Beam</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>12'-6&quot; W-Beam</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>15'-7&quot; W-Beam</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>3'-15&quot; Thrie-Beam</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>6'-3&quot; Thrie-Beam</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>12'-8&quot; Thrie-Beam</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>25'-0&quot; Thrie-Beam</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

NOTES:

1. MATERIALS:
The corrugated steel panels in accordance with Specification 967 made from either Class A, 12 gauge steel or Class B, 10 gauge steel as specified in the Panel Summary Table above.

2. CABLE ANCHOR PLATE BOLT HOLES:
Include ¥ Ø Cable Anchor Plate Bolt Holes only where required for installation of the Cable Anchor Plate shown on Sheet 9, 10, & 11.

¥Ø ¥ Ø Cable Anchor Plate Bolt Holes (Where Required)

See Note 2
Notes:
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 Sheet 6.
2. Offset Bases: For each panel type, install the corresponding offset block type as shown. For General, 1'-10" Single Faced Approach Transitions only, use the 1'-6" Thrie-Beam Block (See Sheet 13).
3. Bolt Holes: 1\(\frac{1}{4}\)" Bolt Holes shown in posts within this index may be substituted with 1\(\frac{1}{2}\)" Bolt Holes.
4. Double Faced Guardrail: Orient Post Bolts with the Button-Head located on the side nearest the traffic lane. The bolts' threaded portion is not permitted to extend beyond 3\(\frac{1}{4}\)" from the face of the tightened nut. Trim the threaded portion as needed and galvanize in accordance with Specification 967.
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-Nail: Drive one nail per Standard Offset Block as shown to prevent Block rotation. Use steel 3\(\frac{1}{8}\)" nails with ASTM A523 hot-dip galvanization. For steel posts, drive the nail through the unused flange bolt hole and pound the nail so its head contacts the flange.
7. Materials: Use timber and steel posts and offset blocks in accordance with Specification 967. 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.

Post and Offset Block Details
GUARDRAIL TYPES - MOUNTING HEIGHTS & POST DEPTHS

GUARDRAIL SECTIONS - TYPICAL

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 Face)</td>
<td>3'-10&quot;</td>
<td>2'-0&quot;</td>
<td>6'-4&quot;</td>
</tr>
<tr>
<td>W-Beam (Double Face)</td>
<td>3'-10&quot;</td>
<td>2'-0&quot;</td>
<td>6'-4&quot;</td>
</tr>
<tr>
<td>Thrie-Beam</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'-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. "N" Use components per Sheets 4 & 5. Steel and timber post types are interchangeable unless otherwise defined. The 1:10 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 2" 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 offset either flush with the Face of Curb or 5" 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.
NOTES:
1. INSTALLATION: Locate Approach Terminals where called for in the plans, with the Post (1) placed at the Begin/End Guardrail Station indicated in the plans.

2. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2, including parallel and tapered segments.

3. APPROACH TERMINAL TEST LEVEL: Install either a Test Level 3 (TL-3) or Test Level 2 (TL-2) Approach Terminal as specified in the plans. TL-3 Approach Terminals may substitute for TL-2 Approach Terminals unless the substitution is specifically prohibited in the plans. TL-2 Approach Terminals may not substitute for TL-3 installations.

4. IMPACT HEAD END DELINERATOR: Apply Yellow Retroreflective Sheeting to the nose of the End Terminal in accordance with Specification 536.

5. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2, including parallel and tapered segments.


The Plan Views shown herein are schematic only, showing basic geometry for Approach Terminals listed on the APL. The predesigned length of Approach Treatment, 'LE', includes the proprietary portion of various Approach Terminals and provides for more consistent planning of assembly installations across the differing Approach Terminal types. Forward-anchoring style Approach Terminals may vary from the planned lengths shown by up to 3'-0".

Construct Approach Terminals as shown in the APL and in accordance with the manufacturer's unique drawing details, procedures, and specifications.

Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Shoulder Gutter conditions, extend the 2" Misc. Asphalt Pavement as shown in the corresponding 'Section at Post (1)' details below.

Special Posts on Sheet 21, including Special Steel Posts, Encased Posts, and Tranquility Juice-Outs, are not permitted within the Approach Terminal segment unless otherwise called for in the plans.

Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

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Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

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Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

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Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

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Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Shoulder Gutter conditions, extend the 2" Misc. Asphalt Pavement as shown in the corresponding 'Section at Post (1)' details below.

Special Posts on Sheet 21, including Special Steel Posts, Encased Posts, and Tranquility Juice-Outs, are not permitted within the Approach Terminal segment unless otherwise called for in the plans.

Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

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Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

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Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

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Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Shoulder Gutter conditions, extend the 2" Misc. Asphalt Pavement as shown in the corresponding 'Section at Post (1)' details below.

Special Posts on Sheet 21, including Special Steel Posts, Encased Posts, and Tranquility Juice-Outs, are not permitted within the Approach Terminal segment unless otherwise called for in the plans.

Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Shoulder Gutter conditions, extend the 2" Misc. Asphalt Pavement as shown in the corresponding 'Section at Post (1)' details below.

Special Posts on Sheet 21, including Special Steel Posts, Encased Posts, and Tranquility Juice-Outs, are not permitted within the Approach Terminal segment unless otherwise called for in the plans.

Install posts in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.

Install adjacent grading, gutters, and curb as shown herein, unless otherwise specified in the plans.

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.

Align panel lap splices in accordance with the manufacturer's drawings, regardless of the direction of traffic.
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" as close to the curb as the hardware allows, not to exceed 2'-6" from the face of curb.
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 3' 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 center line Sheet 6 End Treatment. The General Guardrail Height Taper is 1:10 (to Typical Front Slope Break). Where required, transition 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, "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.
Maintain the 1:10 maximum grading as shown in Section B-B throughout segment "LE". Where required, transition to differing adjacent slopes linearly, over a minimum longitudinal length of 25'-0".
6. IMPACT HEAD END DELINEATOR: Apply Yellow Retroreflective Sheeting to the nose of the End Terminal Assembly in accordance with Specification 539.
7. SINGLE FACED "PARALLEL" AND "FLARED" SEGMENTS: See Sheet 7.
NOTES:

1. COMPONENT DETAILS: For additional component details, see Sheet 10.

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 ASSHTO M180.

3. FOUNDATIONS: Install Steel Tubes by either of the following methods:
   a. Excavate, backfill, and compact material to provide full passive soil resistance to the surface of the Tube.
   b. Drive the Tube 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 2, 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 for this case).

6. END DELINERATOR: Mount retroreflective sheeting to the approach face of the End Unit in accordance with Specifications Sections 136 and 967.
NOTES:

1. INSTALLATION: Use components as shown on Sheets 9 & 11.

2. MATERIALS: Use steel plates, channels, and Cable Assemblies in accordance with Specification 967. Use Short Timber Breakaway Posts and Steel Tube Foundations in accordance with Specification 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 FNX24a and FWC24a, 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 3½" Type B nails with ASTM A53 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 plate holes are only permitted for this Cable Anchor Plate Assembly application.

5. SOIL PLATE BOLT HOLES: For Trailing Anchorages installations as shown on Sheet 9, the two bolt holes may be substituted with a single bolt hole located at the tube centerline.

END TREATMENT - COMPONENT DETAILS
Feed the Cable Stud through the Cable Stud Hole of the Transverse Cable Stud Mount as shown.

**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 12.
3. MATERIALS: Use steel End Shoes, Plates, Tubes, and pipes in accordance with Specifications 536.
4. PARTIAL CABLE ASSEMBLY: The Partial Cable Assembly is similar to the Cable Assembly defined on Sheet 10, except with a 9'-3" total length and the Swage Fitting and Cable Stud omitted from one end.
5. SPECIAL END SHOE MOUNT: Punch a 1 1/2" hole in the W-Beam Panel as needed to secure the Special End Shoe with the 1 1/2" Hex-Head Bolt. Galvanize hole per Specification 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 place.
   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 DELINEATOR: Mount retroreflective sheeting to the approach face of the Buffer End Unit in accordance with Specifications 536 and 967.

**PLAN**

**GUARDRAIL**

**INDEX**

**FY 2019-20 STANDARD PLANS**

**sheet 536-001 11 of 22**
**8 FOOT RADIUS CRT SYSTEM PLAN VIEW**

- **Standard Panel & Offset Block**
- **Min. Clear Area Limits**
  - Min. Clear Area Limits: L = 30'-0"
  - Min. Clear Area Limits: L = 50'-0"
- **Midspan Panel Splice (Typ.)**
- **Match Line**

**16 FOOT RADIUS CRT SYSTEM PLAN VIEW**

- **Standard Panel & Offset Block**
- **Min. Clear Area Limits**
  - Min. Clear Area Limits: L = 40'-0"
  - Min. Clear Area Limits: L = 60'-0"
- **Midspan Panel Splice (Typ.)**
- **Match Line**

**24 FOOT RADIUS CRT SYSTEM PLAN VIEW**

- **Standard Panel & Offset Block**
- **Min. Clear Area Limits**
  - Min. Clear Area Limits: L = 50'-0"
  - Min. Clear Area Limits: L = 70'-0"
- **Midspan Panel Splice (Typ.)**
- **Match Line**

**32 FOOT RADIUS CRT SYSTEM PLAN VIEW**

- **Standard Panel & Offset Block**
- **Min. Clear Area Limits**
  - Min. Clear Area Limits: L = 60'-0"
  - Min. Clear Area Limits: L = 80'-0"
- **Midspan Panel Splice (Typ.)**
- **Match Line**

### 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.²)</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>

### NOTES:

1. INSTALLATION: Construct the specified radius layout and Connecting 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 steep 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 967. Use steel panels and hardware in accordance with Specification 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 ½" 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 ½" Button-Head Bolt (8 reqd. per splice).
7. 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 POST ELEVATION (6"x8" Nom. Timber)

- **6" Nom. Hole**
- **1-½" Hole (Min.)**
- **3/8" Hole (Typ.)**
- **W-Beam Panel & ½" Ø x 10" Button-Head Bolt**

### CRT INSTALLED SECTION

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

**Last Revision:** 01/01/17

**Description:**

**FY 2019-20 STANDARD PLANS**

**GUARDRAIL**

**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. 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 Indexes 536-002, 521-404, and 521-405.

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 toe as shown. See Sheet 15 for details.

5. OFFSET BLOCKS: For Thrie-Beam post locations within the Length of Approach Transition segment, use the Timber Offset Blocks with 7'-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 7'-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 calculations 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

FDOT STANDARDS PLANS

FY 2019-20

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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 3.

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 where as shown. See Concrete Barrier, Index 521-001, and Traffic Railing, Indexes 521-420 thru 521-426, 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 'L'.

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.

APPENDIX TO RIGID BARRIER - LOW-SPEED, TL-2
SECTION H-H
BRIDGE ABUTMENT SLOPE GUARD
(Between Bridges)

NOTES:

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. For the case where this segment's offset differs from the Approach Transition offset, linearly taper the guardrail between the Begin/End Taper Stations and offsets as specified in the plans.

3. LENGTH OF APPROACH TRANSITION 'LE': 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 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 11B 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'-3", 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
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 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 runs of Rub Rail on their respective front face of the post and secure with the typical Button-Head bolt.

NOTES:
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 Terminal Assembly (LT), Approach Transition (LT), and Approach Transition (CT) 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.
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in post(s) located atop curvets, inlets, pier footings, or similar concrete structures, a Special Steel Post may be substituted for a Standard Post. Installs shown where shown in the plans and as needed, in accordance with Specification 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. 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 536. Use 3/4" Hex-Head Bolts for structures less than 9" deep as defined in the Specification.

4. PANEL MOUNT TO ADJUSTED POST: Punch additional 3/4" x 2" x 6"x 4-1/4" Anchor Bolts into 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 536.

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

SPECIAL STEEL POST FOR CONCRETE STRUCTURE MOUNT

NOTES:
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in post(s) conflicting with underground utilities or other underground obstructions, an Encased Post may be needed to mount the panel to a post in an adjusted location. Install where shown in the plans and as needed, in accordance with Specification 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 3'-0" for W-Beam Guardrail.

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

4. LIMIT: Encased Posts are not permitted for consecutive posts unless otherwise shown in the plans.

ENCASED POST FOR SHALLOW MOUNT

FRANGIBLE LEAVE-OUT FOR CONCRETE SURFACE MOUNT

NOTES:
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in post(s) placed within a concrete surface (typically a sidewalk), use a FRANGIBLE LEAVE-OUT around the post base as shown. Install where shown in the plans and as needed, in accordance with Specification 536.

2. MATERIALS: Use Non-Excavatable Flowable Fill in accordance with Specification 121, not to exceed 150 psi.

For the required 1'-6" x 1'-6" Leave-Out, smoothly cut the existing concrete surface or form-up the square shape when an application has new surrounding concrete. Ensure Flowable Fill surface is smooth and even with the adjacent concrete surface.
NOTES:

1. INSTALLATION: Install Barrier Delineators as shown in accordance with the plans, with Specifications 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 993.

3. COLOR: Use either white or yellow retroreflective sheeting to match the color of the nearest lane’s edgeline.

4. MOUNT LOCATIONS: Mount Barrier Delineators at 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'-0"**
- **S2 = 50'-0"**
- **S3 = 75'-0"**
- **S4 = 100'-0"**

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.

1. INSTALLATION: Install Barrier Delineators as shown in accordance with the plans, with Specifications 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 993.

3. COLOR: Use either white or yellow retroreflective sheeting to match the color of the nearest lane’s edgeline.

4. MOUNT LOCATIONS: Mount Barrier Delineators at 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'-0"**
- **S2 = 50'-0"**
- **S3 = 75'-0"**
- **S4 = 100'-0"**

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 shown for Begin/End Half Spacing and Begin/End Quarter Spacing.

   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 Sections. Panel Splices are required in General Segment. To show Midspan Splices in General segments, use one 3"-General panel length (9'-4½" or 10'-7½") or add an additional Transition spaced 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'-1½" spaces.

4. PANEL POST BOLT SLOTS:

   For Quarter Spacing configurations, punch additional 5/8" Post Bolt Slots in the panels only where required for mounting and in accordance with Specification 598.

---

**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>1/2&quot;</td>
<td>Full Length</td>
</tr>
<tr>
<td>Steel Post Mount - Single Faced Guardrail</td>
<td>10&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Timber Post Mount - Single Faced Guardrail</td>
<td>18&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 Connectors Splice</td>
<td>2½&quot;</td>
<td>Full Length</td>
</tr>
</tbody>
</table>

**NOTES:**

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

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**S/8" BUTTON-HEAD BOLT SYSTEM**

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**FY 2019-20 STANDARD PLANS**

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