<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Notes:</td>
</tr>
<tr>
<td></td>
<td>Index Contents</td>
</tr>
<tr>
<td>2</td>
<td>General, TL-3 Guardrail - Installed Plan and Elevation</td>
</tr>
<tr>
<td>3</td>
<td>Low-Speed, TL-2 Guardrail - Installed Plan and Elevation</td>
</tr>
<tr>
<td>4</td>
<td>W-Beam and Thrie-Beam Panel Details</td>
</tr>
<tr>
<td>5</td>
<td>Pedestrian Safety Treatment - Pipe Rail</td>
</tr>
<tr>
<td>6</td>
<td>Modified Mount - Special Steel Post for Concrete Structure Mount;</td>
</tr>
<tr>
<td>7</td>
<td>Modified Mount - Encased Post for Shallow Mount;</td>
</tr>
<tr>
<td>8</td>
<td>Barrier Delineators - Post Mounted;</td>
</tr>
<tr>
<td>9</td>
<td>Clear Space - Reduced Post Spacing for Hazards;</td>
</tr>
<tr>
<td>10</td>
<td>3/8 Button-Head Bolt System</td>
</tr>
</tbody>
</table>

**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. It 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 a 31" height at the top of the Panel (2'-1" mounting height at the top of the Panel and a midspan panel splice as shown on Sheet 2). Guardrail components included in the AASHTO-MGS-ARPA Joint Committee Task Force 13 Report: A Guide to Standardized Highway Barrier Hardware (http://www.aashtotf13.org/Barrier-Hardware.php).


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 ± 1/4" 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.

   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 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.

   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. **CONNECT TO RIGID BARRIER:** The connections to Rigid Barrier in this Index only apply to newly constructed bridge Traffic Railing and Concrete Barrier 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 Index Nos. 402, 404, and 405.

9. **CONNECT 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"-0". 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 top of the panel's post bolt slots at the approach/training ends).
GENERAL GUARDRAIL

INSTALLED ELEVATION

GENERAL GUARDRAIL
INSTALLED PLAN

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. 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 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, Modified 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
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.

4. **W-BEAM PANEL DETAILS:** See Sheet 4.

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 6 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.
**NOTES:**

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" 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 on Sheet 6.

4. **DOUBLE FACED GUARDRAIL:** Drive one Bolt with the Button-Head located on the side nearest the traffic lane. The bolt's threaded portion is not permitted to extend beyond ¾" 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 Three-Beam Panel and the post. The Nested Back-up Plate has a cross-section and material matching the Three-Beam Panel Section.

6. **BLOCK STOP-NAIL:** Drive one nail per Standard Offset Block as shown to prevent block rotation. Use steel 3½ 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.

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. Steel offset blocks are only permitted for Modified Three-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 &amp; Dbl)</td>
<td>3'-10&quot;</td>
<td>2'-0&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>Thrie-Beam (S &amp; D)</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 defined.

2. GUARDRAIL SECTIONS - PAVEMENT PLACEMENT DETAIL (See Note 2) 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 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.

GUARDRAIL SECTIONS
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 5'-0" from the face of curb.

4. GUARDRAIL HEIGHT TAPER: For Curbed 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 Approach Terminal 'H' 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. "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 DELINERATOR: Apply Yellow Retroreflective Sheeting to the nose of the End Terminal. Mounting Height, "H", is measured from the Misc. Asphalt Pavt. (See Section A-A). Linearly taper the difference in Mounting Height over a minimum length of 10'-0", maintaining the 1:10 maximum grading as shown in Section B-B (throughout segment "LE"). When required, transition to differing adjacent slopes linearly, over a minimum longitudinal length of 25'-0".

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 29. 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).
   a. When sidewalks or shared use paths are within 4'-0" from the back 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.
   b. END DELINERATOR: Mount retroreflective sheeting to the approach face of the End Unit in accordance with Specifications Sections 336 and 967.
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 3½" Type B8 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.
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 Post & Cap detail, see Sheet 22.

3. MATERIALS: Use steel End Shoes, Plates, Tubes, and pipes in accordance with Specifications Section 562.

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.

5. SPECIAL END SHOE MOUNT: Punch a 1/2" hole in the W-Beam Panel as needed to secure the Special End Shoe with the 1/2" x 1/2" Button-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 Delineator: Mount retroreflective sheeting to the approach face of the Buffer End Unit in accordance with Specification Sections 536 and 567.

NOTES:

- POST MOUNT CAP
- SPECIAL END SHOE
- FRIDGE CABLE STUD MOUNT
- END TREATMENT - CONTROLLED RELEASE TERMINAL (CRT) SYSTEM

DESIGN STANDARDS

GUARDRAIL
**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 Tree 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 OMISION:** For the 8 Foot Radius CRT System only, do not place a panel-to-post mount bolt at the center CRT Post (omit the Ø 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.
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. 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 13.

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 past 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 Terminals, Low Speed Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the General Guardrail shown herein if indicated in the plans.

APPREACH 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. 402, 404, and 405.

2. SECTION VIEWS & DETAILS: For cross sections and details including the barrier mounting hardware, 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 402, 404, and Traffic Railing, Indexes 420 thru 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 ‘L’. The required offset 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 60-degree 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.

APPRAOCH TRANSITION CONNECTION TO RIGID BARRIER - LOW-SPEED, TL-2
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. 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 may be substituted as indicated in the plans.

4. TRANSITION GENERAL GUARDRAIL: General Guardrail shown herein if indicated in the plans.

5. TRIMMED STD. OFFSET BLOCKS:
   - TIMBER POST ALIGNMENT WIDTH
   - STEEL POST ALIGNMENT WIDTH

6. APPROACH TRANSITION CONNECTION TO RIGID BARRIER WITH DOUBLE FACED GUARDRAIL
**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)

**TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW**

**CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY**

**DUAL BRIDGE APPROACH CONFIGURATION**

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

**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 Nos. 402 thru 405.

2. GENERAL FOR LOW-SPEED GUARDRAIL SEGMENT: Construct this segment if shown in the plans. The segment may be omitted as shown in the plans.

3. LENGTH OF APPROACH TRANSITION: Install the Approach transition as shown on Sheet 13 or 14 as called for in the plans.

4. LENGTH OF END TREATMENT: Install the Approach Terminal End Treatment as shown on Sheet 7 or 8, 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 8.

5. DOUBLE FACED GUARDRAIL: Provide Double Faced Guardrail panels as shown (based upon the 30° 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 8.

6. 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 430. For either option, meet the 1:10 adjacent grading requirements for Approach Terminals as shown on Sheet 8.

7. MEDIAN OR OUTSIDE SHOULDERS: 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 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 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 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 8.
NOTES:
1. See the applicable Notes on Sheet 17.
2. LENGTH OF TRAILING ANCHORAGE, ‘LT’: Install the Trailing Anchorage - Type II as shown on Sheet 9, where called for in the plans.
3. 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 410, and Traffic Railing, Indexes 420 thru 425, for details.

NOTES:
1. See the applicable Notes on Sheet 17.

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

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
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.
2" NPS Pipe Rail
(R=4" Min.)

Smooth Pipe Bend

2" NPS Pipe Rail
Mount Bracket
End Fixture
(Typ.)

Guardrail
Face of Elev. Detail

See "Mount Section Detail"

Offset Block
Steel Post

GENERAL PIPE RAIL SECTION

PIPE RAIL INSTALLED ELEVATION
(End Segment Shown)

Mount Bracket
2" NPS Pipe Rail

End Fixture

Steel Post

Tinier Post

PIPE RAIL INSTALLED PLAN
(End Segment Shown)

End Fixture

Steel Post

Pipe Rail
End Segment

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 Timber Posts located outside of Approach Terminal Assembly (‘LA’), 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.

PEDESTRIAN SAFETY TREATMENT - PIPE RAIL
NOTES:
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in posts located atop curbs, ledges, or other obstructions, an Encased Post may be placed at a reduced length to avoid the obstruction. Install where shown in the plans and/or as-needed in accordance with Specification Section 538.
2. ELEVATION: When the required post location is on the face of a Structure, use a Standard Post with reduced Length such that the Panel Height 'H' is maintained above the base plate to avoid the conflict. Install where shown in the plans and/or as-needed in accordance with Specification Section 538.
3. INSTALLATION: When the construction of Guardrail at the required post spacing results in posts located atop curbs, ledges, or other obstructions, an Encased Post may be placed at a reduced length to avoid the obstruction. Install where shown in the plans and/or as-needed in accordance with Specification Section 538.
4. PANEL MOUNT TO ADJUSTED POST: Punch additional 3/8" x 2" Bolt holes in the W-Beam or Tr-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 538.
5. MATERIALS: Use special steel base plates in accordance with Specification Section 538.

SPECIAL STEEL POST FOR CONCRETE STRUCTURE MOUNT

NOTES:
1. INSTALLATION: When the construction of Guardrail at the required post spacing results in posts located atop curbs, ledges, or other obstructions, an Encased Post may be substituted for a Standard Post. Special Steel Posts are not permitted when the plans and/or as-needed in accordance with Specification Section 538.
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 adjustment, 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.

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 posts 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/or as-needed in accordance with Specification Section 538.
2. MATERIALS: Use Non-Excavatable Flowable Fill in accordance with Specification Section 121, not to exceed 150 psi.
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 (3) of Approach Terminals and incrementally increasing spacing towards the downstream direction. Install the Barrier Delineators at the following spacing:

   - S1 = 25'-0" 1 Space
   - S2 = 50'-0" 1 Space
   - S3 = 75'-0" 1 Space
   - S4 = 100'-0" 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.

6. MOUNT LOCATION - ISOMETRIC VIEWS

    STEEL POSTS
    TIMBER POSTS

    MOUNT LOCATION - PLAN VIEW

BARRIER DELINEATORS

NOTES:

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

2. PANEL SPICES: Midspan Panel Splices are not required in Transition and Reduced Post Spacing segments. They are required for General Spacing only. To draw Midspan panel splice in General segments, use the non-General panel length (9'-40" or 10'-7") 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 0'-3" space between the 12'-6" and 3'-1" spaces.

4. PANEL POST BOLT SLOTS: For Quarter Spacing configurations, punch additional 3/4" x 3/4" Post Bolt Slots in the panels only where required for mounting and in accordance with Specifications Section 936.

REDUCED POST SPACING FOR HAZARDS

NOTES:

1. INSTALLATION: Locate Splices in Construction, extend stationing for Guardrail on both sides of the barrier delineator for Guardrail on medians.

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

3. LOW-SPEED GUARDRAIL: For Reduced Post Spacing with Low-Speed Guardrail (12'-6" post spacing), the Reduced Spacing pattern requires a 0'-3" space between the 12'-6" and 3'-1" spaces.

4. PANEL POST BOLT SLOTS: For Quarter Spacing configurations, punch additional 3/4" x 3/4" Post Bolt Slots in the panels only where required for mounting and in accordance with Specifications Section 936.

GRAY'S BUTTON-HEAD BOLT SYSTEM
GUARDRAIL TRANSITIONS AND CONNECTIONS FOR EXISTING BRIDGES

SPECIAL STEEL POST FOR ROADWAY THRIE-BEAM TRANSITIONS TO BRIDGE TRAFFIC RAILING RETROFITS

1. This index provides guardrail transition and connection details for approach end guardrail on existing bridges, and anchorage details for trailing end traffic railing retrofits and safety shapes on existing bridges. Sheets 1 through 23 apply to bridges with retrofitted traffic railings. (Sheet 23 shows the trandition and guardrail connections). Sheet 24 applies to bridges with safety shaped traffic railing. Construct the guardrail transitions and connections where shown in the plans.

2. The schemes identified by Arabic numerals in this index are complementary to the bridge traffic railing barrier retrofit schemes with like roman numerals. The schemes in this index identified by roman numerals are complementary to bridge safety shaped traffic railing barrier where determined to be in accordance with applications of criteria specified in the instructions for design standards (IDS-470 & IDS-480).

3. For trailing end guardrail connections for existing bridges with either vertical face retrofits or safety shape traffic railing, see the trailing end transition to rigid barrier detail shown in Index No. 400. Likewise, for miscellaneous guardrail construction details that are not provided in this index, refer to Index No. 400.

DESIGN NOTES FOR GUARDRAIL TRANSITIONS CONNECTING TO TRAFFIC RAILING RETROFITS ON EXISTING BRIDGES

1. The transition detail shown on this sheet shows all the standard post spacings within the typical thrie-beam approach transitions connecting to existing bridges with retrofitted traffic railings, and (b) depict the typical alignments of the approach transitions.

2. The curb and gutter flare shown on this sheet is typical of flares that are to be constructed when approaching curbs extend to the beginning of the slab, and where other treatment to curb blunt ends are not in place.

3. The special steel post for roadway thrie-beam transitions detailed on this sheet is specific to all transition applications on this index that require one or more steel posts. The special steel post and base plate assembly shall be fabricated in accordance with Specification Section 967.

4. Anchor studs shall be fully threaded rods in accordance with ASTM F1554 Grade 36 or ASTM A493 Grade B7. All nuts shall be heavy hex in accordance with ASTM A563 or ASTM A491.

5. Anchor studs and nuts shall be hot-dip zinc coated in accordance with the specifications. After the nuts have been snug tightened, the anchor stud threads shall be single pitch distanced immediately above the top nuts to prevent loosening of the nuts. Distanced threads shall be coated with a galvanizing compound in accordance with the specifications.

6. Adhesive bonding material systems for anchors shall comply with Specification Section 377 and shall be installed in accordance with Specification Section 416.4. Nested beam extensions and plates for terminal connector attachments will vary for traffic railing barrier vertical face retrofits. The plan views for the vertical face retrofit barriers show the primary configurations for each particular scheme. The associated pictorial views show the variations.

7. For installing thrie-beam terminal connector to traffic railing vertical face retrofits, see notes on Sheets 32 through 15 and the Flag notation on Sheet 23.

8. Payment for connections to traffic railing vertical face retrofits are to be made under the contract unit price for Bridge Anchorage Assembly, EA., and shall be full compensation for bolt hole construction, terminal connector, terminal connector plate and bolts, nuts and washers.

DESIGN NOTES FOR GUARDRAIL TRANSITIONS CONNECTING TO TRAFFIC RAILING RETROFITS ON EXISTING BRIDGES

1. For selection of an appropriate transition scheme, see the instructions for Design Standards (IDS-470 & IDS-480) for instructions to the Structures and Roadway engineers.

GENERAL NOTES
When End Terminal Cannot Be Located Outside Of Opposing Roadway Clear Zone

Approach Guardrail Treatments For Bridges With Concrete Traffic Railing

Extending Less Than Full Approach Slab Length in Wide Medians With Flush Shoulders

GUARDRAIL LENGTHS

<table>
<thead>
<tr>
<th>Median Width (Ft.)</th>
<th>6' Bridge Shoulder</th>
<th>10' Bridge Shoulder</th>
<th>6' Bridge Shoulder</th>
<th>10' Bridge Shoulder</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Panels (No.)</td>
<td>Length (Ft.)</td>
<td>Panels (No.)</td>
<td>Length (Ft.)</td>
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<td>11.5</td>
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<td>16.5</td>
<td>22</td>
<td>20.5</td>
<td>30.5</td>
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The lengths shown on this table are typical for roadways with standard widths and shoulders and a related connection to the existing wing post. Length requirements shall be determined on a site specific basis for both standard width and narrow bridge shoulders and for end anchorage or end shielding use.

When End Terminal Cannot Be Located Outside Of Opposing Roadway Clear Zone

Approach Guardrail Treatments For Bridges With Concrete Traffic Railing

Extending Less Than Full Approach Slab Length in Wide Medians With Flush Shoulders

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Approach Guardrail Treatments For Bridges With Concrete Traffic Railing

Exte...
**MEDIAN SIZING CRASH CUSHIONS LOCATED ON OPPOSING ROADWAY SHOULDERS**

**GUARDRAIL LENGTHS**

<table>
<thead>
<tr>
<th>MEDIAN WIDTH (Ft.)</th>
<th>6' BRIDGE SHOULDERS</th>
<th>10' BRIDGE SHOULDERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>110 TAPER RATE</td>
<td>115 TAPER RATE</td>
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</table>

The lengths shown in this table are based on standard widths for roadway and bridge median shoulders. Length requirements for both standard width and narrow bridge shoulders and end anchorage or end shielding requirements shall be determined on a site specific basis. When crash cushions are required on approach roadway shoulders, their sizes may be determined by the residual speeds (S') along the runouts from the approach roadway; however, when calculated speeds (S') are less than 30 mph crash cushions shall be no less in size than for 30 mph, see speed diagram below. The number of panels may be reduced when installing a crash cushion more than 2.5' in width, see * below.

*Number shown is the minimum number of panels plus a W-Thrie beam transition panel; single faced guardrail must have a length of five (5) or more panels.

**APPROACH GUARDRAIL TREATMENTS FOR BRIDGES WITH CONCRETE TRAFFIC RAILING**

**EXTENDING LESS THAN FULL APPROACH SLAB LENGTH IN NARROW MEDIAN S WITH FLUSH SHOULDERS**

**REVISION**

**INDEX NO.** 402

**SHEET NO.** 1C of 24
DESCRIPTION:

SEE INDEX NO. 471 - SCHEME 1

SEE INDEX NO. 471 - SCHEME 2

SEE INDEX NO. 471 - SCHEME 3

PARTIAL PLAN VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS
FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)
PARTIAL PLAN VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS
FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)
PARTIAL PLAN VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)
PARTIAL PLAN VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS
FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)

SEE INDEX NOS. 473 & 476 - SCHEMES 5 & 6
PARTIAL PLAN VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)

SEE INDEX NO. 474 - SCHEME 1

SEE INDEX NO. 474 - SCHEME 2

SEE INDEX NO. 474 - SCHEME 3

DESIGN STANDARDS

GUARDRAIL TRANSITIONS AND CONNECTIONS FOR EXISTING BRIDGES

INDEX NO. 402

7 of 24
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)

SEE INDEX NO. 471 - SCHEME 1

SEE INDEX NO. 471 - SCHEME 2

SEE INDEX NO. 471 - SCHEME 3
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (THRIE-BEAM RETROFIT)
PARTIAL PLAN VIEWS OF TRAFFIC RAILING (VERTICAL FACE RETROFIT)

Note:
*21\times 12\times \frac{9}{16}\text{ Thrie-Beam Terminal Connector Plate (Back-Up Plate), And} \ 1\frac{2}{8}\times 12\text{ Long H5 Hex Bolts And Nuts (5 Req'd) With 2\frac{1}{2}\text{ OD Plain Round Washers Under Heads And Nuts}
PARTIAL PLAN VIEWS OF TRAFFIC RAILING (VERTICAL FACE RETROFIT)
(INDEX 482 SHOWN, INDEX 405 SIMILAR)

Note:
- *21" x 12" x 1/2" Thrie-Beam Terminal Connector Plate (Back-Up Plate); And ¼" x 12" Long
  NS Hex Bolts And Nuts (5 Req'd) With 2½" OD Plain Round Washers Under Heads And Nuts
See Index Nos. 405 or 482 - Scheme 1

See Index Nos. 405 or 482 - Scheme 4

See Index Nos. 405 or 482 - Scheme 5

Partial Plan Views of Traffic Railing (Vertical Face Retrofit)

(Index 482 shown, Index 405 similar)

Note:
* 21" x 12" x 3/4" Thrie-Beam Terminal Connector Plate (Back-Up Plate), And 3/8" x 12" Long
  HS Hex Bolts And Nuts (5 Req'd.) With 21/2" OD Plain Round Washers Under Heads And Nuts
PARTIAL PLAN VIEWS OF TRAFFIC RAILING (VERTICAL FACE RETROFIT)

Note:
* 21" x 12" x 1/8" Thrie-Beam Terminal Connector Plate (Wedge-Plate), And 5/8" MS Hex Bolts And Nuts (12" Long For
  Scheme 1 And Length To Fit For Schemes 2 And 3/15 Req'd) With 27/32" OD Plain Round Washers Under Heads And Nuts

SEE INDEX NO. 483 - SCHEME 1

SEE INDEX NO. 483 - SCHEME 2

SEE INDEX NO. 483 - SCHEME 3
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (VERTICAL FACE RETROFIT)

* Post Bolts At First Standard (3'-1") Post Hole Location On Bridge (7" Min. From End Of Bridge). Use 5/8" HS Hex Bolts And Nuts With 2½" OD Plain Round Washers Under Heads And Nuts.
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (VERTICAL FACE RETROFIT)

PICTORIAL VIEW

SEE INDEX NO. 481 - SCHEME 3

PICTORIAL VIEW

SEE INDEX NO. 481 - SCHEME 3

PICTORIAL VIEW

SEE INDEX NO. 481 - SCHEME 3

* Post Bolts At First Standard (3'-1") Post Hole Location On Bridge (7" Min. From End Of Bridge), Use 1/4" NS Hex Bolts And Nuts With 1/2" OD Plain Round Washers Under Heads And Nuts.
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS
FOR BRIDGE TRAFFIC RAILING (VERTICAL FACE RETROFIT)
(INDEX 482 SHOWN, INDEX 405 SIMILAR)

* Post Bolts At First Standard (7'-1") Post Hole Location On Bridge
7" Min. From End Of Bridge. Use 1/8" HS Hex Bolts And Nuts
With 2½" DD Plain Round Washers Under Heads And Nuts
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS

FOR BRIDGE TRAFFIC RAILING (VERTICAL FACE RETROFIT)

(INDEX 482 SHOWN, INDEX 405 SIMILAR)

* Post Bolts At First Standard (7'-1½") Post Hole Location On Bridge (7' Min. From End Of Bridge). Use ¾" HD Hex Bolts And Nuts With 2½" OD Plain Round Washers Under Heads And Nuts.
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (VERTICAL FACE RETROFIT)

(INDEX 482 SHOWN, INDEX 405 SIMILAR)
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING (VERTICAL FACE RETROFIT)

- Post Bolt As First Standard (7'-1½") Post Hole Location On Bridge (7" Min. From End Of Bridge), Use Ig B HS Hex Bolts And Nuts With 2½" OD Plain Round Washers Under Heads And Nuts.

* Post Bolt As First Standard (7'-1½") Post Hole Location On Bridge (7" Min. From End Of Bridge), Use Ig B HS Hex Bolts And Nuts With 2½" OD Plain Round Washers Under Heads And Nuts.
PICTORIAL VIEWS OF GUARDRAIL APPROACH TRANSITIONS
AND CONNECTIONS FOR BRIDGE TRAFFIC RAILING
(VERTICAL FACE RETROFIT)
TRAILING END GUARDRAIL AND ANCHORAGE FOR BRIDGE TRAFFIC RAILING (THRIE BEAM RETROFITS)
GUARDRAIL TRANSITIONS AND CONNECTIONS FOR EXISTING FLAT SLAB, PRESTRESSED BEAM AND GIRDER BRIDGES

NOTE FOR GUARDRAIL TRANSITIONS TO SAFETY SHAPE TRAFFIC RAILINGS ON EXISTING BRIDGES

1. When the guardrail attachment overlies the Bridge Number, Bridge Name or Date on the traffic railing, provide an aluminum sign panel with the obscured information. Attach the sign panel to the face of the traffic railing adjacent to the Three-Beam Terminal Connector with 1/8 x 1" long concrete screws or expansion anchors at each corner, as approved by the Engineer. The sign panel shall be a minimum 1/8" thick and meet the requirements of Specification Section 700 with a white background and 3" tall black letters and sized appropriately to contain the information required. The cost of the sign panel shall be included in the cost of the Guardrail Bridge Anchorage Assembly.

2. When retrofitting three-beam guardrail to existing wing posts or existing bridge safety shape traffic railing, attachment construction to be paid for under the contract unit price for Guardrail Bridge Anchorage Assembly, EA, and shall be full compensation for bolt hole construction, terminal connector, terminal connector plate(s) and bolts, nuts and washers.

GUARDRAIL APPROACH TRANSITIONS AND CONNECTIONS FOR EXISTING FLAT SLAB, PRESTRESSED BEAM AND GIRDER BRIDGES WITH SAFETY SHAPE TRAFFIC RAILING EXTENDING LESS THAN FULL APPROACH SLAB LENGTH
GENERAL NOTES

CONCRETE: Concrete for the Traffic Railing (Vertical Face Retrofit) shall be Class IV. Concrete for Curb Transition Blocks shall be Class I (Bridge Deck).

ADHESIVE-BONDED DOWELS: Adhesive Bonding Material Systems for Dowels shall comply with Specification Section 937 and be installed in accordance with Specification Section 416. The field testing proof loads required by Specification Section 416 shall be 23,800 lbs. for Dowel Bars 6D on the inside face (traffic side) of the railing (1'-0" embedment) and 18,500 lbs for Dowel Bars 6D along the outside face of the traffic railing (5'-0" embedment).

BRIDGES ON CURVED ALIGNMENTS: The details presented in this Standard are shown for bridges on tangent alignments. Details for bridges on horizontally curved alignments are similar.

BARRIER DELINEATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing along the entire length of the bridge 2' from the face on the traffic side at the spacing shown in the table below. Barrier Delineator color (white or yellow) shall match the color of the near edgeline.

GUARDRAIL: See Index 400 for guardrail component details, geometric layouts and associated notes not fully detailed herein.

BRIDGE BARE PLATE: If a portion of the existing Traffic Railing is to be removed that carries the bridge name, number and date, or if the installation of the Traffic Railing (Thrie Beam Retrofit) will obscure the bridge name, number and date, then replace the information that has been removed or obscured, with 3' tall black lettering on white nonreflective sheeting applied to the top of the adjacent guardrail. The information must be clearly visible from the right side of the approaching travel lane. The sheeting and adhesive backing shall comply with Specification Section 994 and may comprise individual decals of letters and numbers.

PAYMENT: Guardrail Bridge Anchorage Assembly (each) includes all barrier delineators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.

BARRED NOTE

- DOWEL DETAIL

- Hole Diameter to meet Manufacturer’s Requirements

- Note: Shift dowel holes to clear if the existing reinforcement is encountered.

<table>
<thead>
<tr>
<th>BARRIER DELINERATOR SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from Edge of Travel Lane to Face of Railing</td>
</tr>
<tr>
<td>&lt; 4'</td>
</tr>
<tr>
<td>4' to 8'</td>
</tr>
<tr>
<td>&gt; than 8'</td>
</tr>
</tbody>
</table>

Dowel Bar 6D

Adhesive Bonding Material System

Existing Concrete

Emplacement Length

Varies

Varies

 condemning to Face of Railing

Note: Shift dowel holes to clear if the existing reinforcement is encountered.

Paymant: Guardrail Bridge Anchorage Assembly (each) includes all barrier delineators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.
**VERTICAL FACE RETROFIT RAILING DETAILS - POST & BEAM RAILING WITH NARROW CURB**

**SCHEME 1 - APPROACH ENDS OF BRIDGES WITH BEAM OR GIRDER SUPERSTRUCTURE**

- **Bars 6D** spacing at Railing Ends (Typ)
- **Bars 5S** (Typ)
- **Bars 6D1**
- **Bars 6D2**

**SCHEME 2 - APPROACH ENDS OF BRIDGES WITH FLAT SLAB SUPERSTRUCTURE & PARALLEL WINGWALLS (SHOWN)**

- **Beam Railing**
- **Existing Post & Beam Railing**
- **Dowel Bars 6D** (Typ)

**ESTIMATED TRAFFIC RAILING QUANTITIES**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>CY/FT</td>
<td>0.076</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LB/FT</td>
<td>14.71</td>
</tr>
</tbody>
</table>

**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAM**

- **Bars 6D1**
- **Bars 6D2**
- **Bars 5S**

**BILL OF REINFORCING STEEL**

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>6</td>
<td>3'-1&quot;</td>
</tr>
<tr>
<td>D2</td>
<td>6</td>
<td>3'-10&quot;</td>
</tr>
<tr>
<td>S</td>
<td>5</td>
<td>AS REQD</td>
</tr>
</tbody>
</table>

**REINFORCING STEEL NOTES:**

1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement for the railing on a retaining wall shall be the same as detailed for a bridge deck.
3. All reinforcing steel in the Vertical Face Retrofit Railing shall have a 2" minimum cover.
GUARDRAIL TRANSITIONS-EXISTING POST & BEAM BRIDGE RAILINGS (NARROW & RECESSED CURBS)

**PARTIAL PLAN - APPROACH TRANSITION**

- **Existing Bridge Coping**
- **Existing Post & Beam Railing**
- **Gutter Line**
- **Begin or End Bridge**
- **Existing Bridge Deck**
- **Transition Block (if shown in Plans)**

**PARTIAL ELEVATION - APPROACH TRANSITION**

- **SCHEMES 1 & 3**
  - Narrow Curb Shown, Recessed Curb Similar

- **SCHEMES 2 & 4**
  - Narrow Curb Shown, Recessed Curb Similar, Flat Slab Superstructure Shown, Beam or Girder Superstructure Similar

* See Limits of Removal of Existing Structure, Sheets 2 of 8 and 4 of 8.
GUARDRAIL TRANSITIONS-EXISTING POST & BEAM BRIDGE RAILINGS (NARROW & RECESSED CURBS)

DESCRIPTION:

PLAN VIEW OF TRANSITION BLOCK
(GUARDRAIL NOT SHOWN FOR CLARITY)

ELEVATION OF TRANSITION BLOCK
(GUARDRAIL AND POSTS NOT SHOWN FOR CLARITY)

ESTIMATED QUANTITIES PER TRANSITION BLOCK

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Class II (Bridge Deck)</td>
<td>CT</td>
<td>0.4</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>lb</td>
<td>61</td>
</tr>
</tbody>
</table>

NOTES:

ANCHOR RODS: Steel Anchor Rods shall be ASTM A36, ASTM A709 Grade 36 or ASTM A615 Grade 60 hot-dip galvanized in accordance with Specification Section 962.

ADHESIVE-BONDED DOWELS: Adhesive Bonded Dowels are shown installed in an existing curb or sidewalk integrally reinforced with Approach Slab, Wingwall or Bridge Deck. For installations in existing detached curbs or sidewalks, install dowels in available sound concrete.

Shift bars (as needed) to install six dowels into existing bridge or approach slab mounted curb.
GENERAL NOTES

CONCRETE: Concrete for the Traffic Railing (Vertical Face Retrofit) and replacement curb sections shall be Class IV. Concrete for Curb Transition Blocks shall be Class II (Bridge Deck).

REINFORCING STEEL: Reinforcing steel shall be ASTM A615, Grade 60, except Expansion Dowel Bar B which shall be ASTM A36 smooth round bar hot-dip galvanized in accordance with the Specifications.

EXPANSION SLEEVE ASSEMBLY: Pipe sleeve shall be ASTM D2241 PVC pipe, SDR13.5. End Cap shall be ASTM D2666 PVC socket fitting, Schedule 40. End of Sleeve assembly at railing open joint shall be sealed with silicone to prevent concrete intrusion during railing casting. A compressible polyurethane plug is required in the opposite end of the assembly for correct dowel positioning during railing casting. Correct dowel positioning is required in order to provide for thermal movement of the deck.

ADHESIVE BONDED ANCHORS AND DOWELS: Adhesive Bonding Material Systems for Anchors and Dowels shall comply with Specification Section 937 and be installed in accordance with Specification Section 416. The field testing proof loads required by Specification Section 416 shall be 23,800 lbs. for Dowel Bars 6D on the inside face (traffic side) of the railing (1'-0" embedment) and 18,500 lbs. for Dowel Bars 6D along the outside face of the traffic railing (5" min. embedment).

BRIDGES ON CURVED ALIGNMENTS: The details presented in these Standards are shown for bridges on tangent alignments. Details for bridges on horizontally curved alignments are similar.

BARRIER DELINERATORS: Barrier Delinicators shall meet Specification Section 993. Install barrier delinicators on top of the Traffic Railing along the entire length of bridge 2" from the face on the traffic side at the spacing shown in the table below. Barrier Delinicator color (white or yellow) shall match the color of the near edgeline.

PAYMENT: Concrete Traffic Railing- Bridge Retrofit- Post & Beam Railing (each) includes all materials and labor required to demolish a portion of the existing structure where required and to construct the concrete portion of the retrofit railings. Guardrail Bridge Anchorage Assembly (each) includes all barrier delinicators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.

PAYMENT:

Concrete Traffic Railing- Bridge Retrofit- Post & Beam Railing (each) includes all materials and labor required to demolish a portion of the existing structure where required and to construct the concrete portion of the retrofit railings.

Guardrail Bridge Anchorage Assembly (each) includes all barrier delinicators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.

PARTIAL ELEVATION OF RAILING SHOWING FINGER/SLIDING PLATE JOINT AT BEGIN OR END BRIDGE - SCHEMES 2 THRU 5

(Guardrail Transition not shown for clarity)

* Place 1" thick polystyrene blockout over limits of bridge deck expansion joint full width to the end of the Traffic Railing to allow for thermal movement. Seal Forms to prevent mortar leakage into the expansion joint.

PARTIAL ELEVATION OF RAILING SHOWING FINGER/SLIDING PLATE JOINT AT BEGIN OR END BRIDGE - SCHEME 1

(Guardrail Transition not shown for clarity)

**Place 1" thick polystyrene blockout over limits of bridge deck expansion joint full width to the end of the Traffic Railing to allow for thermal movement. Seal Forms to prevent mortar leakage into the expansion joint.**

**PAYMENT:**

Concrete Traffic Railing- Bridge Retrofit- Post & Beam Railing (each) includes all materials and labor required to demolish a portion of the existing structure where required and to construct the concrete portion of the retrofit railings.

Guardrail Bridge Anchorage Assembly (each) includes all barrier delinicators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.

PAYMENT:

Concrete Traffic Railing- Bridge Retrofit- Post & Beam Railing (each) includes all materials and labor required to demolish a portion of the existing structure where required and to construct the concrete portion of the retrofit railings.

Guardrail Bridge Anchorage Assembly (each) includes all barrier delinicators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.

PAYMENT:

Concrete Traffic Railing- Bridge Retrofit- Post & Beam Railing (each) includes all materials and labor required to demolish a portion of the existing structure where required and to construct the concrete portion of the retrofit railings.

Guardrail Bridge Anchorage Assembly (each) includes all barrier delinicators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.

PAYMENT:

Concrete Traffic Railing- Bridge Retrofit- Post & Beam Railing (each) includes all materials and labor required to demolish a portion of the existing structure where required and to construct the concrete portion of the retrofit railings.

Guardrail Bridge Anchorage Assembly (each) includes all barrier delinicators for the entire bridge length, transition blocks, and necessary hardware to complete the Guardrail transitions shown.
**NOTES:**

1. On approach end provide a Roadway Guardrail Transition, Index No. 402 (as shown) or other site specific treatment. See Roadway Plans for limiting station of roadway Guardrail Transition or other site specific treatment. If limiting station of roadway Guardrail Transition is on the bridge, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of roadway Guardrail Transition is along the wing wall, see schemes 2, 3, 4 or 5.

2. Field cut bars 5S and Dowel Bars 6D to maintain clearance within vertical face retrofit railing. On skewed bridges, if the skew along the deck joint extends across the width of the railing, the 2'-6" minimum dimension shall apply to both the front and back face of the railing. For treatment of trailing end see roadway plans.

3. Where existing structure has been removed and not encased in new concrete; match adjoining areas and finish by grouting or grinding as required. Exposed existing reinforcing steel not encased in new concrete shall be burnished off 1" below existing concrete and grouted over.

**DESIGN STANDARDS**

**PARTIAL PLAN OF RAILING**

- Varies 1st to 3rd or 4th Existing Post - Contractor to establish and construct
- Minimum possible length using criteria shown above in partial plan of railing

**PARTIAL ELEVATION OF INSIDE FACE OF RAILING**

(Expansion Dowel Assemblies & Bars 4C not shown for clarity)

**TYPICAL TREATMENT OF RAILING ALONG BRIDGE**

1. On approach end provide a roadway guardrail transition, Index No. 402 (as shown) or other site specific treatment. See roadway plans for limiting station of roadway guardrail transition or other site specific treatment. If limiting station of roadway guardrail transition is on the bridge, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of roadway guardrail transition is along the wing wall, see schemes 2, 3, 4 or 5.

2. Field cut bars 5S and dowel bars 6D to maintain clearance within vertical face retrofit railing.

3. Where existing structure has been removed and not encased in new concrete; match adjoining areas and finish by grouting or grinding as required. Exposed existing reinforcing steel not encased in new concrete shall be burnished off 1" below existing concrete and grouted over.

**TYPICAL SECTION THRU RAILING ALONG APPROACH SLAB**

**SECITION A-A**

**TYPICAL SECTION THRU RAILING ON BRIDGE DECK**

**SECTION B-B**

**SECTION C-C**

**TYPICAL SECTION THRU RAILING ALONG APPROACH SLAB (SCHEMES 2 AND 3 ONLY)**
PARTIAL PLAN OF RAILING

SCHEME 1
RAILING END TREATMENT FOR PERPENDICULAR OR ANGLED WING WALLS

1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

3. If a Special Steel Guardrail Post is required for attachment to the top of a sloping Wing Wall, saw cut and remove a wedge shaped portion of the sloping Wing Wall as required to provide a level surface for post installation.

SCHEME 2
RAILING END TREATMENT FOR PARALLEL CURBS

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 3 of 6. On skewed bridges, if the skew along the deck joint extends across the width of the railing, the 2'-6" minimum dimension shall apply to both the front and back face of the railing.

2. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend beyond end of existing End Bent Wing Wall, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

3. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

PARTIAL ELEVATION OF INSIDE FACE OF GUARDRAIL

SCHEME 1 NOTES:

1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

3. If a Special Steel Guardrail Post is required for attachment to the top of a sloping Wing Wall, saw cut and remove a wedge shaped portion of the sloping Wing Wall as required to provide a level surface for post installation.

SCHEME 2 NOTES:

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 3 of 6. On skewed bridges, if the skew along the deck joint extends across the width of the railing, the 2'-6" minimum dimension shall apply to both the front and back face of the railing.

2. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend beyond end of existing End Bent Wing Wall, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

3. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
**SCHEME 3 NOTES:**

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 3 of 6.

2. Dowel Bars 4N may be installed on a maximum angle of 45° to the cut edge of the Approach Slab as shown to facilitate drilling of holes and installation of bars.

3. At the Contractor's option, along the length of the Approach Slab curb that is to be replaced, Dowel Bars 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes in the new section of curb using an Adhesive Bonding Material System with a 1'-0" minimum embedment.
SCHEME 5 NOTES:

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guide rail Transition is on the bridge, see Sheet 3 of 6.

2. Dowel Bars 4N may be installed on a maximum angle of 45° to the cut edge of the Approach Slab as shown to facilitate drilling of holes and installation of bars.

3. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend beyond end of existing End Bent Wing Wall, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

4. Field bend Dowel Bars 4N within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

5. At the Contractor's option, along the length of the Approach Slab curb that is to be replaced, Dowel Bars 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes in the new section of curb using an Adhesive Bonding Material System with a 1'-0" minimum embedment.
### STANDARD BARRIER WALL SECTIONS

**DETAIL I**

**BARRIER DELINEATOR SPACING FOR CONCRETE BARRIER WALLS**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4</td>
<td>40'</td>
</tr>
<tr>
<td>4 to 8</td>
<td>80'</td>
</tr>
<tr>
<td>&gt; 8</td>
<td>100'</td>
</tr>
</tbody>
</table>

1. Install barrier delineators for use on Concrete Barrier Walls in accordance with Specification Section 595.

2. Retroreflective sheeting shall be yellow or white and conform to the color of the near Edge of Travel Way, Lane Line.

**END VIEW**

**CONCRETE BARRIER WALL TERMINAL**

**DETAIL II**

**ELEVATION**

**CONCRETE BARRIER WALL TERMINAL FOR NARROW MEDIANS**

**DETAIL III**

**GENERAL NOTES**

1. Class II concrete shall be used for the construction of Concrete Barrier Walls, except, in moderately and extremely aggressive environments, Class IV concrete shall be used. All non-designated size reinforcing steel shall be No. 5 bars. Exposed concrete surfaces shall have a Class 3 surface finish in accordance with Specification Section 521 or as required in the plans.

2. Longitudinal reinforcement to be continuous or spliced No. 5 Bars. Lap splices a minimum of 2'-0".

3. Consonant barrier wall terminals for design speeds = 50 mph.
   - a. Terminated outside clear zone of the approach traffic, use DETAIL II end treatment.
   - b. Terminated within a shielded location.
   - c. Terminal protection by the use of a crash cushion system.
   - d. Terminated in conjunction with a suitably designed barrier to another barrier.

4. Expansion joints are required at bridge ends and/or at locations where the wall is an integral part of an existing or proposed concrete slab. Construct required joints to match existing or proposed expansion joints.

5. When the barrier is installed adjacent to the pavement, compact the top 12" of the subgrade to at least 98% of the proposed concrete slab. Construct required joints to match existing or proposed expansion joints.

6. Where standard F-Shape walls abut existing New Jersey (NJ) Shape walls, face transitions of not less than 5' in length shall be constructed at the adjoining end of the F-Shape wall.

7. Shoulder concrete barrier wall has been structurally evaluated to be equivalent or greater in strength to other safety shapes which have been crash tested to NCHRP Report 350, TL-4 requirements.

8. For wall segments constructed with the slip form method, score 3/8" deep crack control V-grooves while the concrete is still plastic and mold them when walls are constructed with the stationary form method. V-Grooves shall be spaced at 20' intervals, the end of the face grooves shall be in line with the ends of the top face groove and the long dimension of all grooves shall align at 90 degrees to the longitudinal axis of the wall. When wall segments are less than 40' in length, space the V-Groove equally between open joints. Dowel transverse construction joints for abutting segments less than 40' (See DETAIL B).

9. Minimum length of cast-in-place or precast segments is 20 feet.

10. Precast construction is allowed as an alternate to cast-in-place construction.
   - a. Wall segments < 40' in length shall be jointed by a transverse joint in accordance with DETAIL C. The minimum segment length is 20'.
   - b. Bedding of the precast sections shall be facilitated by the use of sand-cement grout or equal method to assure uniform bearing.
   - c. Reinforcement may be required for handling stresses.

11. On roadways designated for reverse laning, all downstream ends that are not shielded or outside the clear zone shall be marked with Type 3 Object Markers.

12. For BARRIER WALL INLET details see Index 218 and Index 219. For MEDIAN BARRIER INLETS see Index 217.

13. Concrete barrier wall with NJ Safety Shape may not be substituted for the Standard F Shape Barrier.

### CONCRETE BARRIER WALL TERMINALS

**CONCRETE BARRIER WALL WALL**

**INDEX NO.**

**SHEET NO.**

1 of 25
SHOULDER TREATMENT WHEN CRASH CUSHIONS SHIELD CONCRETE BARRIER WALL ENDS LOCATED INSIDE APPROACH CLEAR ZONE OR LATERAL OFFSET

DETAIL A

DOVELED TRANSVERSE CONSTRUCTION JOINT WHERE ABUTTING SEGMENT(S) LESS THAN 40' IN LENGTH (Required on abutting ends of Segments < 40' long)

DETAIL B

PRECAST TONGUE AND GROOVE TRANSVERSE JOINT (Required on abutting ends of Precast Segments ≥ 40' long)

DETAIL C

FREE END REINFORCEMENT

NOTE:
1. Free end reinforcement required for nonreinforced walls at the following locations: All exposed ends; abutting ends of precast segments ≥ 40'; ends with guardrail connections; ends with redirective crash cushion connections; and, ends connecting to bridge traffic rails or other rigid barriers.
**NOTES:**

1. Reduce the vertical steel spacing to 4 inches O.C. a distance of 4 feet for each side of all cold or expansion joints.

2. Unless otherwise noted, Minimum Segment Wall Length is 20 LF.

3. All walls may be made up of segments 20 or more in length provided the segments are joined by a transverse joint in accordance with the CONCRETE BARRIER WALL SPECIAL DETAILS, DETAIL B.

4. Quantities shown are for information only. Barrier wall inlets (Index 218) shall be isolated from the barrier wall stem and footing by 1" expansion material.

5. All longitudinal reinforcement to be continuous or spliced No. 5 bars. Lap splices a minimum of 2'-0".

6. For additional information on Bars 5A, 5B, 5C and 5D, see BAR BENDING DIAGRAMS.

**QUANTITIES:**

- Concrete 0.26 CY/LF
- Reinforcing Steel 44 LBS/LF

**SHOULDER WALL (TYPICAL)**

- Expanded Shoulder Varies (2 Min.)
- Shoulder Pavement R 1 1/2" (Typ.)
- Bar SA @ 8" O.C. No. 5 Bars @ 8" O.C. (Typ.)
- Gutter Line R 1"" (Typ.)
- Construction Joint Permitted
- No. 5 Bars @ 8" O.C. (Typ.)
- 3" Min.
- 2" 3 Space
- 4 Space
- 3'-3" 3" Min.
- 3'-3" 4" 4" 4 Space
- 3'-3" 4" 4" 4 Space

**QUANTITIES:**

- Concrete 0.26 CY/LF
- Reinforcing Steel 52 LBS/LF

- Should be Used In Lieu of Bar SC In Areas Where Obstructions Require Localized Omission Of Toe

- NOTE: With Reinforcing Steel (Bar SC) 55 LBS/LF; Concrete 0.27 CY/LF
- With Reinforcing Steel (Bar SD) 52 LBS/LF; Concrete 0.23 CY/LF

**SHOULDER WALL (MODIFIED)**

- Expanded Shoulder Varies (2 Min.)
- Shoulder Pavement R 1 1/2" (Typ.)
- Bar SA @ 8" O.C. No. 5 Bars @ 8" O.C. (Typ.)
- Gutter Line R 3/4" (Typ.)
- Construction Joint Permitted
- No. 5 Bars @ 8" O.C. (Typ.)
- 3" Min.
- 2" 3 Space
- 4 Space
- 3'-3" 3" Min.
- 3'-3" 4" 4" 4 Space
- 3'-3" 4" 4" 4 Space

**SHOULDER WALL (RETAINING)**

- Expanded Shoulder Varies (1:2 Max.)
- Shoulder Pavement R 3/4" (Typ.)
- Bar SA @ 8" O.C. No. 5 Bars @ 8" O.C. (Typ.)
- Gutter Line R 3/4" (Typ.)
- Construction Joint Permitted
- No. 5 Bars @ 8" O.C. (Typ.)
- 3" Min.
- 2" 3 Space
- 4 Space
- 3'-3" 3" Min.
- 3'-3" 4" 4" 4 Space
- 3'-3" 4" 4" 4 Space

**PLAN VIEW**

- Reinforcing Steel 52 LBS/LF
- Concrete 0.30 CY/LF

**REINFORCED CONCRETE SHOULDER WALL**

**TRANSITION AT INLETS**

- Head Of Footing
- Back Of Barrier
- 1" Expansion Material
- Front Face Barrier Wall
- Toe Of Footing
- Top Of Barrier
- Inlet Per Index 218

**FY 2016-17 DESIGN STANDARDS**

**INDEX NO.**

**PAGE NO.**

**DESCRIPTION:**

- CONCRETE BARRIER WALL

**LAST REVISION:**

- 07/01/15

**INDEX NO.:**

- 410

**SHEET NO.:**

- 3 of 25
**F-SHAPE MEDIAN BARRIER**

**WHEN Y IS LESS THAN OR EQUAL TO 6 INCHES**

---

**CANTILEVER WALL**

**SUPERELEVATED SECTION**

---

**L-WALL**

**SUPERELEVATED SECTION**

---

**MEDIAN BARRIER WALL FOR SUPERELEVATED SECTIONS WITH VARIABLE ROADWAY PROFILE GRADE LINES**

---

**NOTES:**

1. Unless the plans stipulate a specific wall type, either the Cantilever Wall or the L-Wall may be constructed at the Contractor's option.

2. Reduce the vertical steel spacing to 4 inches O.C. a distance of 4 feet for each side of all cold or expansion joints.

3. All longitudinal reinforcement to be continuous or spliced No. 5 bars. Lap splices a minimum of 2'-0".

4. For additional information on Bars 5E, 5F, 5G, 5H and 5J, see BAR BENDING DIAGRAMS.

5. No. 4 dowel may be extended to provide steel stake. Omit dowel bars when construction joint is not used.
LARGE SIGN MEDIAN BARRIER MOUNTED SIGN SUPPORT TRANSITION (OPTION 1)

- **32" F-Shape Median Barrier**: Transition from 32" to 54" Barrier Height
- **54" High Vertical Face Barrier**: Transition from 32" to 54" Barrier Height

**ELEVATION**

- **4'-6"**
- **2'-8"**
- **2'-0"**
- **1'-6"**
- **6"**

**SPACING OF #5 STIRRUP BARS**

- **Min.**
- **Typ.**

**CONSOLIDATION**

- **Foundation (Drilled Shaft shown. Spread footing similar)**
- **#5 Bars (Typ.)**
- **#5 Stirrup Bars @ 1'-0" Spacing**
- **Max. Shift To Clear Project Specific Sign Support Foundation**

* See Plans For Additional Project Specific Reinforcement For Sign Support Foundation.

**SECTION A-A**

- **2" Cover (Min.)**
- **#5 Stirrup Bars**

**SECTION B-B**

- **2" Cover (Min.)**
- **#5 Stirrup Bars**

**SECTION C-C**

- **2'-0"**
- **1'-0"**
- **2'-0"**

**SECTION D-D**

- **6"**
- **0" Setback Distance (Min.)**

**OVERHEAD SIGN SUPPORT**

- **(Project Specific Design)**
Design Standards Index 410

52" F-Shape Median Barrier

Varies (15'-0" Min.)

* Transition from 32" to 54" Barrier Height

54" High Vertical

Face Barrier

* Transition from 32" to 54" Barrier Height

Design Standards Index 410

32" F-Shape Median Barrier

6 ~ #5 Bars (Typ.)

Min.

2'-0"

2'-0"

2'-8"

2'-8"

1'-6"

Min.

1'-0"

2' -0"

4'-6"

LARGE SIGN MEDIAN BARRIER MOUNTED SIGN SUPPORT TRANSITION (OPTION 2)
LARGE SIGN MEDIAN BARRIER MOUNTED SIGN SUPPORT TRANSITION (OPTION 3)
**Notes:**

1. Embedded junction boxes are to be fabricated from steel conforming to ASTM A36 and be hot-dip galvanized after fabrication. All seams shall be continuously welded and ground smooth. A neoprene gasket shall be attached to the box to provide a watertight cover. The cover screws shall be fully galvanized.

2. Remove excess concrete while green and hand form chamfers.

3. Embedded junction box complete and conduit risers are incidental to the construction and cost of the barrier wall; there is to be no separate compensation for the box, risers or installation unless specifically called for in the plans.
NOTES:
1. Transition Segments Shall Be Doweled Into The End Of The Barrier Wall In The Following Manner: Four 1" diameter holes 6" deep on 6" centers shall be drilled in the end of the barrier and No. 6 bars 15" long set in an Adhesive Bonded Material System per Standard Specification Section 416. The ends of the dowels extending into the transition segment shall be wrapped with one layer of ASTM D226, Type I (15 lb.) asphalt-saturated organic felt with the ends cramped.

2. When Construction joints are utilized for transition segment construction the stem shall be doweled to the footing in the following manner: Five No. 5 bars 19" long shall be embedded 7" into the footing. The dowels shall be spaced 15" on centers with the first dowel located 12" from the barrier wall. Dowels may be placed within or adjacent to the keyway.

3. The detail BRIDGE WITH BIKE LANE can be superimposed over the details: WITH UTILITY STRIPS AND WITHOUT BIKE LANE and WITHOUT UTILITY STRIPS AND WITH BIKE LANE. The detail BRIDGE WITHOUT BIKE LANE can be superimposed over the details: WITHOUT UTILITY STRIPS AND WITHOUT BIKE LANE and WITHOUT UTILITY STRIPS AND WITHOUT BIKE LANE.

4. For SECTION DD, see CURB AND GUTTER WITHOUT ADJACENT BICYCLE LANE. For SECTION EE, see CURB AND GUTTER WITH ADJACENT BICYCLE LANE.
NOTES:
1. For X=Length of advancement in feet for near and opposing lanes and for sectional details see CURB AND GUTTER WITHOUT ADJACENT BICYCLE LANE.
2. The 1'-6" and 2'-6" offsets to toe of barrier wall cannot be reduced to accommodate hazards; however, hazards located in the stem of the wall may be accommodated by the details on HAZARD PENETRATION INTO STEM OF RIGID CONCRETE BARRIER WALLS; AND SHOULDER BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND THE DESIGN SPEED ≤ 45 MPH.
3. The detail BRIDGE WITH BIKE LANE can be superimposed over the details: WITH UTILITY STRIPS AND WITH BIKE LANE and WITHOUT UTILITY STRIPS AND WITHOUT BIKE LANE. The detail BRIDGE WITHOUT BIKE LANE can be superimposed over the details: WITH UTILITY STRIPS AND WITHOUT BIKE LANE and WITHOUT UTILITY STRIPS AND WITHOUT BIKE LANE.
4. For SECTION EE, see ONE-WAY CURB AND GUTTER DEPARTURES.
5. For SECTION QQ, see CURB AND GUTTER WITHOUT ADJACENT BICYCLE LANE. 
   For Section TT, see CURB AND GUTTER WITH ADJACENT BICYCLE LANE.

**SECTION FF**

### BRIDGE WITHOUT BIKE LANE

- End Barrier Wall (Rigid) (Curb & Gutter)
- Sidewalk Alignment Varies To Suit Conditions Around Hazard
- Utility Strip (Varies)
- Type F Curb & Gutter (2')

### BRIDGE WITH BIKE LANE

- End Barrier Wall (Rigid) (Curb & Gutter)
- Sidewalk Alignment Varies To Suit Conditions Around Hazard
- Utility Strip (Varies)
- Type F Curb & Gutter (2')

**WITH UTILITY STRIP AND WITHOUT BIKE LANE**

- End Barrier Wall (Rigid) (Curb & Gutter)
- Sidewalk Alignment Varies To Suit Conditions Around Hazard
- Utility Strip (Varies)
- Type F Curb & Gutter (2')

**WITHOUT UTILITY STRIP AND WITHOUT BIKE LANE**

- End Barrier Wall (Rigid) (Curb & Gutter)
- Sidewalk Alignment Varies To Suit Conditions Around Hazard
- Type F Curb & Gutter (2')

**TWO-WAY CURB AND GUTTER TRAFFIC DEPARTURE**

- HAZARD 4' OR LESS FROM FACE OF CURB
END OF BRIDGE RAIL OR OTHER HAZARD THAT REQUIRES SHIELDING

BEGIN CONCRETE BARRIER WALL (Rigid) (Curb & Gutter)

OFFSET CONTROL POINT

EDGE OF TRAVEL WAY

FACE OF BARRIER WALL

TOE OF BARRIER WALL

LEFT SIDE APPROACH SHOWN - LEFT SIDE OPPOSITE HAND

NEAR LANE APPROACH

RIGHT SIDE APPROACH SHOWN - LEFT SIDE OPPOSITE HAND

OPPOSING LANE APPROACH

WITH OR WITHOUT UTILITY STRIP - UTILITY STRIP SHOWN

For Applications, see CURB AND GUTTER (WITH AND WITHOUT) UTILITY STRIP AND WITHOUT ADJACENT BIKE LANE

LENGTH OF ADVANCEMENT

CURB AND GUTTER WITHOUT ADJACENT BIKE LANE

EQUATION VARIABLES:

\[ d = \text{Distance in feet from near edge of the near approach traffic lane to back of hazard or clear zone width whichever is lesser. For left side hazards and clear zones on two-way undivided facilities } D \text{ is measured from the inside edge of the near approach traffic lane.} \]

\[ D = \text{Distance in feet from near edge of the near approach traffic lane to the face of barrier (at offset control point). For left side hazards on two-way undivided facilities } D \text{ is measured from the inside edge of the nearest opposing traffic lane.} \]

LENGTH OF ADVANCEMENT

CURB AND GUTTER WITHOUT ADJACENT BIKE LANE

QUANTITIES:

Concrete: 0.24 CY/LF; Reinforcing Steel: 26 LBS/LF

INSERT A

Transition Concrete Barrier Wall (Index 410) to Mate With Back Side of F Shape Bridge Traffic Railing (Index 420/425).

For Opposing Lane Approach (Near Lane Approach Opposite Hands)

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<th>INDEX</th>
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</table>

SECTION QQ (FOR HIGH SIDE)

SECTION QQ (FOR LOW SIDE)

QUANTITIES:

Concrete: 0.24 CY/LF; Reinforcing Steel: 26 LBS/LF

NOTES:

1. Reduce the vertical steel spacing to 4 inches O.C. a distance of 4 feet for each side of cold or expansion joints.
2. All longitudinal reinforcement to be continuous or spliced No. 5 bars. Lap splices a minimum of 2'-0".
3. Transverse expansion joints are to be constructed at the juncture of wall transitions and curb and gutter, and at intervals so that spacing will not exceed 100'.
4. For Concrete Barrier Wall Inlet details with Rigid Curb and Gutter applications, see Index No. 219.
5. Minimum Segment Wall Length = 20 LF.
6. For additional information on Bar 5K, see BAR BENDING DIAGRAM.
**Design Standards FY 2017-18**

**Concrete Barrier Wall**

**Description:**

1. **Reduce the vertical steel spacing to 4 inches O.C. a distance of 4 feet for each side of all cold or expansion joints.**

2. **All longitudinal reinforcement to be continuous or spliced No. 5 bars. Lap splices a minimum of 2'-0".**

3. **Transverse expansion joints are to be constructed at the juncture of wall transitions and curb and gutter, and at intervals so that spacing will not exceed 100'.**

4. **For Concrete Barrier Wall Inlet details with Rigid Curb and Gutter applications, see Index No. 219.**

5. **Minimum Segment Wall Length = 20 LF.**

6. **For additional information on Bar 5K, see BAR BENDING DIAGRAM.**

7. **Drainage slots shall be located at all low points along the sidewalk and unless otherwise shown in the plans, slots shall be spaced at intervals not exceeding 50' in fill sections and 20' cut sections. Slots shall be located such that only two bars are cut away or deleted in front and back lines of vertical reinforcement.**

**Notes:**

- Provide 2" concrete cover.
- Drainage slots, vertical and horizontal bars shall be placed to locate in front and back lines if vertical reinforcement. On each side of wall transitions and curb and gutter, and at intervals so that spacing will not exceed 100'.
- Drainage slots shall be located at all low points along the sidewalk and unless otherwise shown in the plans, slots shall be spaced at intervals not exceeding 50' in fill sections and 20' cut sections. Slots shall be located such that only two bars are cut away or deleted in front and back lines of vertical reinforcement. On each side of drainage slots, vertical and horizontal bars shall be placed to provide 2" concrete cover.
GUARDRAIL CONNECTING PANELS AND POST SPACING

NOTES:
1. For additional connection details for guardrail to barrier wall, work with Sheet 18 and Index 411.
2. For component details including Standard Posts and Panels, see Index 400.
3. For connecting General Guardrail and Approach Terminal details, see Index 400.

GUARDRAIL APPROACH TRANSITION TO CURVED SHOULDER BARRIER WALL
### Description:

**CONCRETE BARRIER WALL**

**INDEX NO. 410**

**SHEET NO. 18 of 25**

**DESIGN STANDARDS**

**FY 2017-18**

**FIELD TRIMMED**

**STANDARD THRIE-BEAM OFFSET BLOCK**

**FIELD TRIMMED, SEE DETAIL, RIGHT**

**FOR USE WITH EITHER**

1: 10 OR 1: 15

**GUARDRAIL TRANSITIONS**

**PLAN FOR DESIGN SPEED ≤ 45 MPH**

**PLAN FOR DESIGN SPEED ≥ 50 MPH**

### Notes:

1. The affected segments between bent supports or pier columns shall be constructed in accordance with the details for REINFORCED CONCRETE SHOULDER WALL, Section QQ, or Section TT. In cases where the barrier wall and slope pavement or other structure would occupy the same location, the wall and structure are to be modified as detailed in the plans.

2. The barrier wall radial segments are intended for use on approach and trailing ends of both one-way and two-way facilities. The guardrail connections shown on this sheet apply to one-way approaches and to the approaches and trailing ends of two-lane two-way facilities. For details on trailing ends of two-way multilane and one-way facilities, the trailing connection in Index 400 may be used.

For walls with normal offsets from hazards and their guardrail connections, see GUARDRAIL CONNECTION TO CONCRETE BARRIER WALL APPROACH ENDS.

3. Refer to Index No. 400 for additional guardrail information.

4. Attach thrie-beam terminal connector to shoulder barrier wall with a 21"x12"x½" thrie beam terminal connector plate and 5-½x12" long HS hex bolts and nuts with ½" plain round washers under heads and nuts.

5. 1½"x17½" galvanized steel back-up plate with ½" post bolts (either 14" or 18" long) and nuts with ½" plain round washers under nuts.

6. For details at Rigid Hazard, see HAZARD PENETRATION INTO STEM OF RIGID CONCRETE BARRIER WALLS.

7. For additional information on PLAN FOR DESIGN SPEED ≤ 45 MPH, see SHOULD BARRIER WHEN OFFSET FROM ABOVE GROUND HAZARD < 3' AND THE DESIGN SPEED < 45 MPH.

8. For additional information on PLAN FOR DESIGN SPEED ≥ 50 MPH, see SHOULD BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND THE DESIGN SPEED = 50 MPH.

9. See APPROACH TRANSITION TO CURVED SHOULDER BARRIER WALL on Sheet 17 for Guardrail Panel and Post Spacing information.

### Standard Thrie-Beam Offset Block

### Formula

\[ y = \frac{5}{2} x \]

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</table>

**Note:**

Wall may be constructed in chords having lengths ≤ 4 feet.
PIER AT BACK OF CONCRETE BARRIER WALL

NOTES:
1. These treatments are not applicable to hazards that cannot provide lateral support to resist the LRFD lateral equivalent static force. See the plans for limits of wall sections and other associated wall treatments.

2. For Low Speed SECTIONS MM, NN and OO, see SHOULDER BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND THE DESIGN SPEED ≤ 45 MPH.

3. For High Speed SECTIONS MM and NN, see SHOULDER BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND THE DESIGN SPEED ≥ 50 MPH.

4. The details on this sheet are treatments to the V-shape concrete barrier walls, where the conditions impose reduced clearances between above ground hazards and the walls. Bridge bent supports and piers are shown.

5. When thru drainage is required, a 3" x 12" Drain Slot shall be provided at one of the following locations:
   a. 4' upstream of pier edge for a declining approach.
   b. 4' downstream of pier edge for an inclining approach.

PIER PENETRATION INTO TOP OF CONCRETE BARRIER WALL

PIER AT FACE OF CONCRETE BARRIER WALL

RIGID HAZARD PENETRATION INTO STEM OF CONCRETE BARRIER WALL

...
SHOULDER BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND THE DESIGN SPEED ≤ 45 MPH

NOTES:
1. Reduce the vertical steel spacing to 4 inches O.C. a distance of 4 feet for each side of all cold or expansion joints.
2. All longitudinal reinforcement to be continuous or spliced No. 5 bars. Lap splices a minimum of 2'-0".
3. For additional information on Bars 5A and 5L, see BAR BENDING DIAGRAMS.
4. ½" Min. Expansion Joint or at the contractor's option: Back face of barrier wall may be cast against Pier with ½" Expansion Material.
NOTES:
1. Reduce the vertical steel spacing to 4 inches O.C. a distance of 4 feet each side of all cold joints.
2. All longitudinal reinforcement to be continuous or spliced No. 5 bars. Lap splices a minimum of 2'-0".
3. For additional information on Bars 5A, 5B, 5M, 5N and 5P, see BAR BENDING DIAGRAMS.
4. For Section OO, see SHOULDER BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND THE DESIGN SPEED ≤ 45 MPH.
5. Where the 42" SHOULDER WALL does not abut the pier, use the TYPICAL or MODIFIED sections.
6. ½" Min. Expansion Joint or at the contractor's option: Back face of barrier wall may be cast against Pier with ½" Expansion Material.

SHOULDER BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND DESIGN SPEED ≥ 50 MPH
ONE-WAY TRAFFIC
(LEFT SIDE OPPOSITE HAND)

TWO-LANE TWO-WAY TRAFFIC

SHOULDER BARRIER WALL WHEN OFFSET FROM ABOVE GROUND HAZARD < 1'-6" AND DESIGN SPEED ≥ 50 MPH
END TRANSITION DETAILS - 42" SHOULDER WALL WITH GUARDRAIL OR SHOULDER WALL CONTINUATION FOR DESIGN SPEED ≥ 50 MPH

ELEVATION VIEW
42" SHOULDER WALL END TRANSITION

NOTES:
For additional information on Bars 5A, 5M and 5N see BAR BENDING DIAGRAMS.
CONCRETE MEDIAN BARRIER WALL TRANSITIONS AT BRIDGE PIERS FOR DESIGN SPEEDS ≥ 50 MPH

Standard Barrier Wall

End Measurement for Median Barrier Transition

L (Total Transition) = 100'-0" (Symmetrical At Pier Approaches)

42" Median Wall
15'-0"
Varies
15'-0"
42" Half Wall

\[ M = \left( \frac{P+1}{12} - 1 \right) \times 10; \text{ where } M \text{ is in feet and } P \text{ is in inches.} \]

Varies = L - 30 - M; when Varies, L and M are in feet.

Plan

SECTION AA (42" BARRIER)

SECTION BB (42" BARRIER)

Notes:

1. Reduce the vertical steel spacing to 4 inches O.C. a distance of 4 feet for each side of all cold or expansion joints.
2. All longitudinal reinforcement to be continuous or spliced No. 5 bars. Lap splices a minimum of 2'-0".
4. For additional information on Bars 5A, 5M, 5N and 5R, see BAR BENDING DIAGRAMS.

Concrete Median Barrier Wall Transitions at Bridge Piers for Design Speeds ≥ 50 MPH

Concrete Barrier Wall

FY 2017-18

Design Standards

Index No.

Sheets

24 of 25
Notes:
1. For Additional Information on “STANDARD BAR BENDING DETAILS,” See Index 21300.
2. For Bar 5G, Bar 5J, and Dimensions (W, W1 and Y), see CANTILEVER WALL DIMENSIONS TABLE.
This Pier Protection Barrier has been structurally evaluated to be equivalent or greater in strength to other safety shape traffic barriers which have been crash tested to NCHRP Report 350 TL-5 criteria. This barrier meets the requirements of the AASHTO LRFD Bridge Design Specifications for a barrier used for bridge pier protection.

GENERAL NOTES

1. Concrete shall be Class III or IV unless otherwise called for in the plans.
2. Construct Pier Protection Barrier continuous without transverse contraction or expansion joints. Transverse construction joints may be used at a spacing greater than or equal to 40'. Provide longitudinal reinforcing steel continuous across construction joints.
3. When the Pier Protection Barrier is installed adjacent to Roadway or Shoulder pavement, compact the top 12" of the subgrade to at least 98% of the maximum density determined by FM 1-T 180, Method D.
4. (Instantiate Barrier Wall Inters. Index 21B, from Pier Protection Barriers and Footings with 1" expansion material.)
5. On roadways designated for reverse lane, mark all downstream barrier ends that are not shielded or outside the clear zone with Type 3 Object Markers. Include the cost of the Object Marker in the cost of the Pier Protection Barrier.
6. Payment: Pier Protection Barrier and Crash Wall to be paid for under the contract unit price for Shoulder Concrete Barrier Wall (Rigid-Shoulder 42"), LF or Shoulder Concrete Barrier Wall (Rigid-Shoulder 54"), LF.
7. Provide 3/8" deep crack control V-grooves at 15' to 30' spacing. Locate V-grooves above any joint or discontinuity in the barrier footing. Align V-Grooves perpendicular to the longitudinal axis of the Pier Protection Barrier and make continuous across the top surface and both side faces. For slip formed barriers, score 3/8" V-Grooves while the concrete is still plastic, otherwise pre-form the joints when stationary forms are utilized.

Concrete shall be Class III or IV unless otherwise called for in the plans.
Length of Advancement determined from the diagrams and equations shown establishes the location of the upstream beginning length of need for a Pier Protection Barrier. However, the Length of Advancement for the combination of Pier Protection Barrier and required guardrail can be no less than that required by other details of Index 400.

Equation Variables:

\[ D = \text{Distance in feet from the near edge of the near approach traffic lane to the pier protection barrier gutter line at its intersection with the departure line or the face of guardrail at its intersection with the departure line.} \]

\[ d = \text{Distance in feet from the near edge of the near approach traffic lane to the back of pier.} \]

Equation:

\[ D = 30'(L) - (d) \]

\[ D = 16'(L) - (d) \]

\[ D = 13'(L) - (d) \]

\[ \text{Design Speed} \geq 50 \text{ mph} \]

\[ \text{Design Speed} \leq 45 \text{ mph} \]

\[ \text{Design Speed} \geq 50 \text{ mph} \]

\[ \text{Design Speed} \leq 45 \text{ mph} \]

\[ \text{Design Speed} = 16(D-d) \]

\[ \text{Design Speed} = 13(D-d) \]

\[ \text{Design Speed} = 16(D-d) \]

NOTE:

See Index 400 for Clear Zone and Horizontal Clearance Length of Advancement Diagrams.

PPB = Pier Protection Barrier
**LEFT SIDE OPPOSITE HAND**

**ONE-WAY TRAFFIC**

**TWO-LANE TWO-WAY TRAFFIC**

**NOTES:**
See Index 400 for Clear Zone and Horizontal Clearance Length of Advancement Diagrams.
PPB = Pier Protection Barrier

See Notes on Sheet 2.
Setback Limit
Back of Pier or Bent

Type 3 Object Marker when required (see Index 400, General Note No. 23)

Pier or Bent Inside Setback Distance

Pier Protection Barrier or 54" Pier Protection Barrier

Guardrail Transition, see Index 410, Sheet 24

Hazard Free, Traverseable Slopes

PPB Approach Departure Line

Point of Departure

.beginning of length of need (LA)

PPB Departure Line (LA)

PPB Departure Line (RA)

.end of length of need (RA)

Hazard Free, Traverseable Slopes

PPB Departure Line (LA)

Thick Line

1.76' - Design Speed ≥ 50 mph

2.49' - Design Speed ≤ 45 mph

LEFT APPROACH (LA)

RIGHT APPROACH (RA)

42" or 54" Pier Protection Barrier with Crash Walls - 50 Min.

TWO-LANE TWO-WAY TRAFFIC

LENGTH OF ADVANCEMENT DIAGRAMS - PIER PROTECTION BARRIER WITH CRASH WALL AND GUARDRAIL CONTINUATION

See Notes on Sheet 2.

PPB = Pier Protection Barrier

See Index 400 for Clear Zone and Horizontal Clearance Length of Advancement Diagrams.
### Plan for Design Speed ≤ 45 MPH

**Plan for Design Speed ≥ 50 MPH**

**Flared End Treatment - Pier Protection Barrier with Guardrail Continuation**

**Standard Thrее-Beam Offset Block (Field Trimmed)**

**Notes**

1. The Pier Protection Barrier radial segments are intended for use on approach and trailing ends of both one-way and two-way facilities. The guardrail connections shown on this sheet apply to one-way approaches and to the approaching and trailing ends of two-lane two-way facilities. On trailing ends of two-way multilane and one-way facilities, the trailing connection in Index 400 may be used.

For guardrail connections, see Index 410, Sheet 18.

2. Refer to Index No. 400 for additional guardrail information.

**Drawings and Details**

- **Sheet 17** for panels and post spacing
- **Index 410** for panels and post spacing
- **Index 400** for guardrail connections

**Dimensions**

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**Note:**

- Barrier may be constructed in chords having lengths ≤ 4 feet.
- Guardrail connections shown on this sheet apply to one-way approaches and to the approaching and trailing ends of two-lane two-way facilities.
- On trailing ends of two-way multilane and one-way facilities, the trailing connection in Index 400 may be used.

---

**End Treatment - Pier Protection Barrier with Concrete Barrier Wall Continuation**

**Elevation**

- **Pier Protection Barrier**
- **Concrete Barrier Wall**
- **Approach Transition**

---

**Design Standards**

- **FDOT**
- **FY 2017-18**
- **Index No. 411**
- **Sheet No. 6 of 10**
END TRANSITION AND TAPERED TOE DETAILS - PIER PROTECTION BARRIER WITH GUARDRAIL CONTINUATION

NOTES:
1. See Sheet 9 for Footing Details.
2. See Sheet 8 for Cross Sections.

ESTIMATED 42" PPB QUANTITIES

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ESTIMATED 54" PPB QUANTITIES

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PARTIAL ELEVATION - 54" PPB DETAIL

END TRANSITION DETAILS - PIER PROTECTION BARRIER WITH GUARDRAIL OR CONCRETE BARRIER WALL CONTINUATION

NOTES:
1. See Sheet 9 for Footing Details.
2. See Sheet 8 for Cross Sections.
**BILLY OF REINFORCING STEEL**

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**REINFORCING STEEL NOTES:**
1. All bar dimensions in the bending diagrams are cut to size.
2. Bars 8S may be continuous or spliced at the construction joints. Lap splice for Bars 8S shall be a minimum of 4'-0".
3. The Contractor may utilize Welded Wire Reinforcement when approved by the Engineer. Welded Wire Reinforcement must consist of Deformed wire meeting the requirements of Specification Section 931.

**Notes:**
- See Sheet 9 for Footing Details.
- See Sheet 7 for bar spacings and details within End Transitions.

**REVISION**
**INDEX NO.**

**DESCRIPTION:**

**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

- **BARS 8S**
- **BARS 8S** (within Flared End Treatments)
- **TRANSITION BARS 8T1 & 8T2**

**TRANSITION STIRRUP BARS 8P**
To Be Field Cut (10 of each required per Railing End Transition)

**NUMBER OF BARS 8S**

- **STIRRUP BAR 8P**
- **STIRRUP BAR 8R**
- **STIRRUP BAR 5P**
- **STIRRUP BAR 5V**
- **END STIRRUP BAR 5V**
  (Two required per Barrier End Transition w/ Tapered Toe)

**BILL OF REINFORCING STEEL**

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**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

- **BARS 8S**
- **BARS 8S** (within Flared End Treatments)
- **TRANSITION BARS 8T1 & 8T2**

**TRANSITION STIRRUP BARS 8P**
To Be Field Cut (10 of each required per Railing End Transition)

**NUMBER OF BARS 8S**

- **STIRRUP BAR 8P**
- **STIRRUP BAR 8R**
- **STIRRUP BAR 5P**
- **STIRRUP BAR 5V**
- **END STIRRUP BAR 5V**
  (Two required per Barrier End Transition w/ Tapered Toe)

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**NOTES:**
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**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

- **BARS 8S**
- **BARS 8S** (within Flared End Treatments)
- **TRANSITION BARS 8T1 & 8T2**

**TRANSITION STIRRUP BARS 8P**
To Be Field Cut (10 of each required per Railing End Transition)

**NUMBER OF BARS 8S**

- **STIRRUP BAR 8P**
- **STIRRUP BAR 8R**
- **STIRRUP BAR 5P**
- **STIRRUP BAR 5V**
- **END STIRRUP BAR 5V**
  (Two required per Barrier End Transition w/ Tapered Toe)

**BILL OF REINFORCING STEEL**

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**NOTES:**
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- See Sheet 7 for bar spacings and details within End Transitions.

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**NOTES:**
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**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

- **BARS 8S**
- **BARS 8S** (within Flared End Treatments)
- **TRANSITION BARS 8T1 & 8T2**

**TRANSITION STIRRUP BARS 8P**
To Be Field Cut (10 of each required per Railing End Transition)

**NUMBER OF BARS 8S**

- **STIRRUP BAR 8P**
- **STIRRUP BAR 8R**
- **STIRRUP BAR 5P**
- **STIRRUP BAR 5V**
- **END STIRRUP BAR 5V**
  (Two required per Barrier End Transition w/ Tapered Toe)
**BARRIER FOOTING DETAILS**

**PIER PROTECTION BARRIER**

**BILL OF REINFORCING STEEL**

**REINFORCING STEEL NOTES:**
1. All bar dimensions in the bending diagrams are cut to out.
2. Lap splices for Bars 5B shall be a minimum of 2'-2".
3. The Contractor may use Welded Wire Reinforcement when approved by the Engineer. Welded Wire Reinforcement must consist of Deformed wire meeting the requirements of Specification Section 931.

**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

**BARS 5A & 5B**

**BARS 5B** (within Flared End Treatments)

**ESTIMATED BARRIER FOOTING QUANTITIES**

**NOTES:**
1. Provide 3" lip when optional construction joint is used. Omit 3" lip adjacent to Barrier Wall Inlets and as required to provide 2" min. clear between Cantilever Footing and adjacent Pier Footing or Column.
2. See Sheets 7 & 8 for Barrier Details.
FIELD BEND BARS 5B in Crash Wall to extend 2'-0" min into PPB (Typ.)

FIELD BEND BARS 5C, 5E in Footings as shown (Typ.)

FIELD CUT, ROTATE AND SHIFT BARS 5A & 5U in Footings as shown (Typ.)

FIELD BEND AND SHIFT BARS 5B in Crash Wall Footing to lap 2'-0" min. with Bars 5B in Barrier Footing (Typ.)

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are out to out.
2. Lap splices for Bars 5B shall be a minimum of 2'-2".
3. The Contractor may use Welded Wire Reinforcement when approved by the Engineer. Welded Wire Reinforcement must consist of Deformed wire meeting the requirements of Specification Section 931.

PLAN VIEW
(Concrete Barrier Wall Continuation shown, Guardrail Continuation similar)

VIEW G-G
* Match height of adjacent Pier Protection Barrier

VIEW H-H
* Match Cross Slope of Shoulder

REINFORCING STEEL NOTES:
1. Provide 3" lip when optional construction joint is used.
2. See Sheet 8 for Barrier Details and Sheet 9 for Barrier Footing details.
3. Bars 5B placed 2'-8" min. into PPB (Typ.)

SECTION H-H
CRASH WALL & FOOTING DETAILS

BILL OF REINFORCING STEEL

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NOTES:
1. Provide 3" lip when optional construction joint is used.
2. See Sheet 8 for Barrier Details and Sheet 9 for Barrier Footing details.

CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS

FACTORs:
- Bars 5B (Typ.)
- Bars 5U @ 6" sp.
- Bars 5C @ 1'-0" sp.
- Bars 5E placed locally as required
- Field trim Bars 5B and bend Bars 5B locally as required to maintain cover (Typ.)

5 Sp @ 1'-0"
**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

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<tr>
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<td>5</td>
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**ESTIMATED CRASH WALL & FOOTING QUANTITIES**

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<td>Reinforcing Steel (54&quot; Crash Wall)</td>
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**NOTES:**
1. All bar dimensions in the bending diagrams are out to out.
2. Lap splices for Bars SB shall be a minimum of 2'-2".
3. The Contractor may use Welded Wire Reinforcement when approved by the Engineer. Welded Wire Reinforcement must consist of Deformed wire meeting the requirements of Specification Section 931.

**PLAN VIEW**

(Concrete Barrier Wall Continuation shown, Guardrail Continuation similar)

**VIEW G-G**

*Match height of adjacent Pier Protection Barrier

**SECTION H-H**

**CRASH WALL & FOOTING DETAILS**

**NOTE:**
PPB = Pier Protection Barrier
GENERAL NOTES

1. Pursuant to 35 United States Code, Chapter 18, also known as the Bayh Dole Act of 1980, the low profile barrier was developed through federal funding. The Portable Temporary Low Profile Barrier for Roadside Safety is a licensed design by the University of Florida. Any infringement on the rights of the designer shall be the sole responsibility of the user.

2. This standard drawing (Index No. 412) is provided by the Florida Department of Transportation solely for use by the Department and its assignees. The purpose for this standard drawing is to indicate the approval of use of the barrier on the State Highway System; to provide sufficient pictorials for identifying the barrier unit; and, to provide general installation geometry for the barrier.

3. This legally mandated relationship is unique to federally funded university parents that Department contractors use on contracts. Pursuant to federal law, the University may pursue royalties for a valid patent. Only those barrier units cast by producers licensed by the University Of Florida will be allowed for installation on the State Highway System in Florida. Barrier wall units shall conform to Section 521 of the Standard Specification and shall be produced in Department-approved plants with quality control plans for prestressing concrete barrier walls. Each barrier wall unit shall be permanently marked with an identification that is traceable to the manufacturer, the producing precast concrete plant and the date of production. This permanent identification mark will serve as certification that the unit has been manufactured in accordance with University of Florida drawings and specifications, and the approved quality control program.

4. The low profile barrier is to be installed only with hardware and accessories furnished by the licensed barrier producer. Units shall be used for no purpose other than as interconnected segments in a run of barrier. Low profile barrier wall units shall maintain firm contact with adjoining units. Nuts on tensioning rods shall be installed snug tight.

5. The low profile barrier is applicable for work zone speeds of 45 mph or less.

6. If the plans specify Low Profile Barrier then substitution with other barrier types is not permitted.

7. Tubular markers shall be orange in color and installed along the run of barrier at the ends and at 50 feet on tangents and 25 feet centers on radii. The markers shall be fixed to the top of the barrier by an adhesive or other method approved by the engineer. Approach end units shall be marked with a Type I object marker. The cost of the tubular markers and Type I object marker shall be included in the cost of the low profile barrier.

8. Information regarding licensing, shop drawings, specifications, quality control and certification of compliance can be obtained from the University Of Florida: Office of Technology Licensing, P.O. Box 115500, Gainesville, Florida, 32611-5500. Telephone: 352-392-8929, Fax: 352-392-6600. Reference UF#11052.

9. The Portable Temporary Low Profile Barrier for Roadside Safety shall be paid for under the contract unit price for Barrier Wall (Temporary) Low Profile Concrete, LF, and will be full compensation for furnishing, installing, maintaining and removing barrier wall.

10. Deflection space shall be kept clear of any grass, construction debris, stockpiled materials, equipment, and objects.

BACKSIDE AND END PICTORIAL VIEWS

PORTABLE TEMPORARY LOW PROFILE BARRIER FOR ROADSIDE SAFETY
GENERAL NOTES

1. Pursuant to 35 United States Code, Chapter 18, also known as the Bayh Dole Act of 1980, the non-mountable curb was developed through federal funding. The 'Portable Temporary Low Profile Barrier For Roadside Safety' is a licensed design by the University Of Florida. Any infringement on the rights of the designer shall be the sole responsibility of the user.

2. This standard drawing (Index No. 412) is provided by the Florida Department Of Transportation solely for use by the Department and its assignees. The purpose for this standard drawing is to indicate the approval of use of the barrier on the State Highway System; to provide sufficient pictorials for identifying the barrier unit; and, to provide general installation geometry for the barrier.

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4. The low profile barrier is to be installed only with hardware and accessories furnished by the licensed barrier producer. Units shall be used for no purpose other than as interconnected segments in a run of barrier. Low profile barrier wall units shall maintain firm contact with adjoining units. Nuts on tensioning rods shall be installed snug tight.

5. The low profile barrier is applicable for work zone speeds of 45 mph or less.

6. If the plans specify Low Profile Barrier then substitution with other barrier types is not permitted.

7. Tubular markers shall be orange in color and installed along the run of barrier at the ends and at 50 centimeters on tangents and 25 centimeters on radii. The markers shall be fixed to the top of the barrier by an adhesive or other method approved by the engineer. Approach end units shall be marked with a Type I object marker. The cost of the tubular markers and Type I object marker shall be included in the cost of the low profile barrier.

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BACKSIDE AND END PICTORIAL VIEWS

PORTABLE TEMPORARY LOW PROFILE BARRIER FOR ROADSIDE SAFETY
PORTABLE TEMPORARY LOW PROFILE BARRIER FOR ROADSIDE SAFETY

Notes:

LIMITATION OF USE: This installation technique can only be used on flexible or rigid pavement.

ASPHALT PAD: Where existing pavement is not present, construct 2" Asphalt Pad using miscellaneous asphalt pavement in accordance with Specification Section 339 with the exception that the use of a pre-emergent herbicide is not required. Payment for Asphalt pad will be included in the cost of the barrier.

DEFLECTION SPACE AT DROPFFS

PLAN VIEW OF APPROACH END OFFSET
PORTABLE TEMPORARY LOW PROFILE BARRIER FOR ROADSIDE SAFETY

MAXIMUM CURVATURE ● MINIMUM RADIUS

CONVEX CURVATURE

TRAFFIC SIDE

Inset A

CONCAVE CURVATURE

TRAFFIC SIDE

Inset B

See Inset A

See Inset B
Flare Falls Within The Clear Zone Of Opposing Traffic
Type I Object Marker To Be Installed When Trailing End Located Outside The Clear Zone Of Opposing Traffic

* Trailing End Flares Are Not Required When Barrier Located Outside The Clear Zone Of Opposing Traffic
Type I Object Marker To Be Installed When Trailing End Flare Falls Within The Clear Zone Of Opposing Traffic

**LEGEND**

| Type  I Object Marker |

**PORTABLE TEMPORARY LOW PROFILE BARRIER FOR ROADSIDE SAFETY**
Flare Falls Within The Clear Zone Of Opposing Traffic
Type I Object Marker To Be Installed When Trailing End Located Outside The Clear Zone Of Opposing Traffic

*  Trailing End Flares Are Not Required When Barrier Located Outside The Clear Zone Of Opposing Traffic
Type I Object Marker To Be Installed When Trailing End Flare Falls Within The Clear Zone Of Opposing Traffic

### BARRIER OPENINGS AT DRIVEWAYS

**PORTABLE TEMPORARY LOW PROFILE BARRIER FOR ROADSIDE SAFETY**
The Type K Temporary Concrete Barrier System has been crash tested to NCHRP Report 350 TL-3 criteria or structurally evaluated to meet the requirements of NCHRP Report 350 TL-3 criteria for the installation configurations as shown utilizing the types, sizes, lengths, shapes, strengths and grades of the fabrication and installation materials as shown.

In order to maintain crashworthiness of the system, do not substitute different grades, sizes, shapes or types of reinforcing steel for those shown for constructing Type K Barrier Units. Also, do not substitute different type, size, length or material grade anchor bolts, nuts, washers, adhesives, connector pins, stakes, keeper pins, or guardrail components for installing Type K Barrier Units.

FABRICATION NOTES:

FABRICATOR PREQUALIFICATION: The Barrier Units shall be made in a prestressed concrete plant that meets the requirements of Specification Section 450 or in a precast plant meeting the requirements of Specification Section 250.

CONCRETE: Concrete shall be Class IV in accordance with Specification Section 346. Specification Sections 346-10.2 through 346-10.4 are not applicable. Barrier Units represented by concrete acceptance strength tests which fall below 5000 psi will be rejected.

REINFORCING STEEL: All reinforcing steel shall be ASTM A 615, Grade 60 except for Bars 6D1, 6D2 and 6D3. Bars 6D1, 6D2 and 6D3 shall be ASTM A 706 except that a 3/4" diameter pin must be used for the 180 degree bend test. After fabrication, all or part of Bars 6D shall be hot dip galvanized in accordance with Specification Section 962 or coated with a cold galvanizing compound in accordance with Specification Section 562. The minimum limit of galvanizing or coating is shown in the Bending Diagrams. At the Fabricator's option, the entire length of Bars 6D may be galvanized or coated. Install Bars 6D within 3/8" of the plan dimensions. Correct placement of Bars 6D is critical for proper fit up and performance of individual Barrier Units.

At the option of the Fabricator, Deformed Welded Wire Fabric in accordance with Specification Section 931 and the details shown on Sheet 2 may be utilized in lieu of Bars 4A and 5B.

All dimensions in the Bending Diagrams are out to out. All reinforcing steel shall have a 2" minimum cover except as noted.

LIFTING SLEEVE ASSEMBLY: Inclusion of the Lifting Sleeve Assemblies is optional. Steel for Pipe Sleeve shall be in accordance with ASTM A 53. Hot-dip galvanize the Lifting Sleeve Assemblies after their fabrication in accordance with the Specifications.

SURFACE FINISH: Construct Barrier Units in accordance with Specification Sections 400 and 521. Finish the top and sides of the Barrier Units with a General Surface Finish. Finish the bottom of the Barrier Units to a dense uniform surface by floating in lieu of the General Surface Finish. Use stationary metal forms or stationary timber forms with a form liner.

MARKING: Permanently mark the top left end of each Barrier Unit by the use of an embedded and anchored metallic plate with letters and figures a minimum of 0.5" tall. Ink stamps are not allowed. Permanently mark with the following information:
- Type K
- Fabricator's name or symbol
- Date of manufacture (day, month and year)

HANDLING: At no time shall the Barrier Units be lifted or moved by use of Bars 6D that extend from the ends of the units. Approximate weight of one unit equals 2.7 tons.

Alternate Designs: Manufacturers/vendors seeking approval of proprietary Temporary Barrier Systems for inclusion on the Approved Products List (APL) as alternative designs shall submit a Product Application package. The application package shall include manufacturer's product drawings, specifications, installation manual, National Cooperative Highway Research Program (NCHRP) Report 350 or Manual for Assessing Safety Hardware (MASH) Test Level 3 (TL-3) crash test documentation and the FHWA "Letter of Acceptance."

The posted APL drawings will need to include the following:
1. Anchorage, bolting, and staking details for connections to asphalt and concrete pavement.
2. Sections and tables showing required deflection space and minimum offsets to above ground hazards or drop-offs.
3. Alignment and length of need details.
4. Transition and overlap details.
5. End treatment details.
ANCHO Blockout Detail

SECTION D-D
(Reinforcement not shown for clarity)

* Measured from end of Barrier Unit to outside edge of Bars 6D.

PLAN VIEW

ELEVATION VIEW

SECTION THRU LIFT/DRAIN SLOT

CONCRETE BARRIER QUANTITIES

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</table>

The above quantities are for one Barrier Unit.

Cross References:
For Section A-A, Section B-B and Section C-C see Sheet 3.
D 19.7 spacing shall match spacings for Bars 4A shown in Elevation View, Reinforcement cage as shown.

Place 2 ~ No. 5 Bars (12'-3" long) tied to D 19.7 inside of bottom Welded Wire Reinforcement cage by 2".

**NOTES:**
- Place 2 ~ No. 5 Bars (12'-3" long) in bottom of Welded Wire Reinforcement cage as shown.
- D 19.7 spacing shall match spacings for Bars 4A shown in Elevation View, Reinforcement cage as shown.
- Place 2 ~ No. 5 Bars (12'-3" long) tied to D 19.7 inside of bottom Welded Wire Reinforcement cage by 2".
NOTES FOR ALL INSTALLATIONS:

1. LIMITATION OF USE: This Temporary Concrete Barrier System is intended for work zone traffic control and other temporary applications. It shall not be used for permanent traffic railing construction unless specifically permitted by the Plans. Except as shown for the Back Filled Roadway Installations, the Barrier Units must be installed on a flexible pavement (asphalt) or rigid pavement (concrete) surface as shown with a cross slope of 1:10 or flatter. Except as shown for transition installations, Type K Barrier Units are not intended to be bolted down or skewed down in locations where they can be impacted from the back side.

2. HANDLING: At no time shall the Barrier Units be lifted or moved by use of Bars 60 that extend from the ends of the units. Approximate weight of one unit equals 2.7 tons.

3. ASPHALT PAD: Where existing flexible pavement is not present, construct a minimum 2" thick temporary Asphalt Pad using Miscellaneous Asphalt Pavement in accordance with Specification Section 339 with the exception that the use of a pre-emergent herbicide is not required. No separate payment will be made for the Asphalt Pad.

4. SURFACE PREPARATION: Except as shown for the Back Filled Roadway Installations, remove all grass, debris, loose dirt and sand from the pavement, bridge deck or Asphalt Pad surface within the barrier footprints just prior to placement of the Barrier Units.

5. OFFSET TO TRAVELWAY: Offset shall meet requirements as shown on sheet 1 of Index 415.

6. CONNECTION PIN ASSEMBLY: Steel for Connection Pin and Top Plate assemblies shall be in accordance with ASTM A36 or ASTM A709 Grade 36. Nondestructive testing of welds shall not be required. At the Contractor’s option, a 3/8" diameter hole may be provided at the bottom of the Connection Pin, as shown, for the installation of a vandal resistance bolt.

7. CONNECTION PIN INSTALLATION: Initially set Barrier Units by using a 3/8" wooden block between ends of adjacent units. Install Connection Pin between adjacent Barrier Units as shown, then pull newly placed Barrier Unit away from adjacent Barrier Unit to remove slack between Connection Pin and Bars 60 (except as shown on Sheet 3). Barrier Units shall not be used unconnected.

8. DELINEATION: Mount Barrier Delineators on top of Barrier Units that are used as traffic barriers along travel ways in work zones. Space the Barrier Delineators at 50 centers in alignment transitions, 100 centers on horizontal curves and 200 centers on tangent alignments.

9. MAINTENANCE: Deflection space shall be kept clear of any grass, construction debris, stockpiled materials, equipment, and objects.

10. REUSE OF CONNECTION PINS: Connection pins may be reused if they have the structural integrity of new pins.

11. INSTALLATIONS ON CURVED ALIGNMENTS: The details presented in these Standards are shown for installations on tangent alignments. Details for horizontally curved alignments are similar.

12. TRANSITIONS: Transitions are required between freestanding, bolted down, staked down and back filled Type K Barrier installations, see Sheet 8 for transition requirements and details. Transitions are also required between installations of Type K Barrier and other types of temporary barrier, see Index No. 415 for transition requirements and details. Splices and transitions are required between installations of Type K Barrier and permanent Bridge or Roadway Traffic Railings, see Sheets 9 through 13 for transition requirements and details. Transitions are required between installations of Type K Barrier and Proprietary (APL) Barrier Systems, see Sheets 14 and 15 for transition requirements and details.

13. PAYMENT: Barrier Units for work zone traffic control and other temporary applications shall be paid for under the contract unit price for Barrier (Temporary) (Type K), LF. The Contractor shall furnish Barrier Units except when the Plans stipulate the availability of Department owned units. Regardless of unit source the Contractor shall furnish all hardware and shall be responsible for all handling including loading, transport, unloading, stockpiling, installation, removal and return. Unless otherwise noted on the Plans, the Barrier Units shall become the property of the Contractor and shall be removed from the site prior to acceptance of the completed project.

NOTES FOR THRIE BEAM GUARDRAIL SPLICE INSTALLATIONS:

1. THRIE-BEAM GUARDRAIL: Provide Thrie-Beam Guardrail for splices in accordance with AASHTO M 180, Type II (Zinc coated) and as follows: Two panels per splice (one panel per side) of Class B (10 Gauge) or Class A (12 Gauge) Guardrail panel length shall be 12'-6". Provide and install all other associated metallic guardrail components (Terminal Connectors, Shoulder Bolts, Hex Bolts and Nuts, Filler Plates, etc.) in accordance with Index No. 400. Install five Guardrail Anchor Bolts at each end of each splice in any of the standard seven anchor bolt holes in the Thrie-Beam Terminal Connector, if reinforcing steel is encountered through drilling or cutting of Thrie-Beam Units, shift Thrie-Beam Terminal Connector so as to clear reinforcing steel within the given tolerances or select a different bolt hole to use. Do not drill or cut through reinforcing steel within Type K Barrier Units. Drilling or cutting through reinforcing steel within permanent concrete traffic railings is permitted. Do not drill or cut through utilities or conduits within permanent concrete traffic railings.

2. GUARDRAIL OFFSET BLOCKS: Provide and install timber Offset Blocks meeting the material requirements of Index No. 400. Field trim Offset Blocks as required for proper fit. Utilize Offset Blocks as shown and required in order to prevent bending or kinking of Thrie-Beam Guardrail panels.

3. CONCRETE FOR FILLING TAPERED TRAFFIC RAILING TIES: Provide concrete for filling tapered toes of Traffic Railings as shown meeting the material requirements of Specification Section 346, any Class, or a commercially available pre-packed concrete mix (3000 psi minimum compressive strength). Sampling, testing, evaluation and certification of the concrete in accordance with Specification Section 348 is not required. Pour grade with water the surfaces upon and against which the concrete fill will be placed prior to placing concrete. Place and finish concrete fill using forms or by hand methods to the general configurations shown so as to provide a smooth shape transition between Type K Barrier and the adjacent traffic railing. A low slump is desirable if placing and finishing concrete by hand methods. Cure the concrete fill by application of a curing compound, or by covering with a wet tarp or burlap for a minimum of 24 hours. Completely remove the concrete fill upon relocation or removal of the Type K Temporary Concrete Barrier.

CONNECTION PIN DETAIL

NOTE: Contractor shall furnish all hardware and shall be responsible for all handling including loading, transport, unloading, stockpiling, installation, removal and return.
BOLTED DOWN BRIDGE, APPROACH SLAB, ROADWAY AND TRANSITION INSTALLATIONS

NOTES FOR BOLTED DOWN BRIDGE, APPROACH SLAB, ROADWAY AND TRANSITION INSTALLATIONS:

LIMITATION OF USE: This installation technique can only be used on rigid pavement and concrete bridge decks as shown. Barrier Units shall not be bolted down on bridge superstructures that contain post-tensioned tendons within the concrete deck (top flange of concrete box girders) or on bridge superstructures consisting of longitudinally prestressed, transversely post-tensioned, solid or voided concrete slab units. Anchor Bolts must not be installed on both sides of the Barrier Units. Do not bolt down Barrier Units across bridge finger or modular expansion joints.

ANCHOR BOLTS, NUTS AND WASHERS: Adhesive-Bonded Anchor Bolts shall be fully threaded rods in accordance with ASTM F 1554 Grade 36. Anchor Bolts for through bolting shall be in accordance with ASTM A 36 or ASTM A 709 Grade 36. Nuts shall be in accordance with ASTM A 563 or ASTM A 194. Flat Washers shall be in accordance with ASTM F 436 and Plate Washers shall be in accordance with ASTM A 36 or ASTM A 709 Grade 36.

Install three (3) Anchor Bolts per Barrier Unit on the traffic side of the Barrier Units as shown, except for Transition Installations. For the number and positions of Anchor Bolts required in Transition Installations see Sheets A-8 and A-9 and Index No. 415. Drilling through deck reinforcing steel to install Anchor Bolts is permitted. Unless otherwise shown in the Plans, at the Contractor's option Barrier Units may be installed by through bolting (where geometrically possible) or by the use of Adhesive-Bonded Anchor Bolts. Do not drill into or otherwise damage the tops of supporting beams or girders, bridge deck expansion joints or drains. Install Anchor Bolts and Nuts so that the maximum extension beyond the face of the Barrier Units is 1/8". Snug tighten the Nuts on the Anchor Bolts. For through bolted installations, snug tighten the double Nuts on the underside of the deck against each other to minimize the potential for loosening.

Omit one (1) Anchor Bolt within a single Barrier Unit if a conflict exists between the Anchor Bolt location and a bridge deck expansion joint or drain. The adjacent Barrier Units must each be installed with the standard three (3) Anchor Bolts.

Omit one (1) Anchor Bolt within a single Barrier Unit as shown in the Transition at Bridge Deck Expansion Joint Schematic if the Barrier Unit straddles a bridge deck expansion joint. The adjacent Barrier Units must each be installed with the standard three (3) Anchor Bolts.

ADHESIVE-BONDING MATERIAL SYSTEMS: Adhesive Bonding Material Systems for Anchor Bolts shall be Type HSHV in accordance with Specification Section 937 and shall be installed in accordance with Specification Section 416. Prior to installation of the Barrier Units in the Plan location(s), install a demonstration Barrier Unit using the proposed production installation method, at a location approved by the Engineer. In lieu of the production test requirements of Specification Section 416-6, install six (6) Adhesive-Bonded Anchor Bolts in the demonstration Barrier Unit and test each Anchor Bolt with a 29,800 pound tensile proof load. Install and test additional demonstration Anchor Bolts when requested by the Engineer. Remove the demonstration Barrier Unit prior to testing the Anchor Bolts. Remove the test Anchor Bolts after testing as directed by the Engineer.

REMOVAL OF ANCHOR BOLTS: Upon removal or relocation of Barrier Units, remove all Anchor Bolts and completely fill the remaining holes in bridge decks, approach slabs and roadway rigid pavements that are to remain with Magnesium Ammonium Phosphate Concrete in accordance with Specification Section 930 or with an Epoxy Resin Compound, Type F or G, in accordance with Specification Section 926. If a flexible pavement overlay is present and is to remain, completely fill the remaining holes in the flexible pavement with hot or cold patch asphalt material.

TREATMENT AT BRIDGE DECK EXPANSION JOINT SCHEMATIC

* To accommodate movement at Expansion Joint, set Barrier Units with 3/8" gap at locations shown.
**NOTES FOR STAKED DOWN ROADWAY AND TRANSITION INSTALLATIONS:**

LIMITATION OF USE: This installation technique can only be used on a flexible pavement or an Asphalt Pad as shown. Stakes must not be installed on both sides of the Barrier Units.

**STAKES:** Provide steel for Stake assemblies in accordance with ASTM A 36 or ASTM A 709 Grade 36. All welding shall be in accordance with the American Welding Society Structural Welding Code (Steel) AWS/D1.1 (current edition). Weld metal shall be E60XX or E70XX. Nondestructive testing of welds is not required.

Install three (3) Stakes on the traffic side of the Barrier Units as shown, except for Transition Installations. For the number and positions of stakes required in Transition Installations see Sheets 4, 5 and 6 and Index No. 415. Install Stakes so that the Stop Plate is snug against the bottom of the Anchor Blockout.

**BURIED UTILITIES:** Prior to installation of Stakes verify locations of all adjacent buried utilities, drainage structures, pipes, etc. If conflicts between Stake locations and buried elements exist, a maximum of two (2) Stakes within a single Barrier Unit may be omitted if the adjacent Barrier Units are installed with the standard three (3) Stakes.

**REMOVAL OF STAKES:** Upon removal or relocation of Barrier Units, completely remove all Stakes and completely fill the remaining holes in flexible pavement that is to remain with hot or cold patch asphalt material.

**REUSE OF STAKES:** Stakes may be reused if they have the structural integrity of new stakes.

**TYPICAL SECTION (BRIDGE DECK SHOWN, APPROACH SLAB SIMILAR):**

- **STAKE DETAIL:**
  - **STOP PLATE DETAIL:**
  - **PLAIN STAKE HEAD DETAIL:**

**NOTES FOR FREE STANDING BRIDGE OR APPROACH SLAB INSTALLATIONS:**

**KEEPER PINS:** Keeper Pins shall be \( \frac{1}{8}\)" diameter, smooth steel bar in accordance with ASTM A 36 or ASTM A 709 Grade 36. As directed by the Engineer in order to limit vibration induced translation of the Barrier Units, install one (1) Keeper Pin per Barrier Unit on the traffic side of the Barrier Units as shown. Do not drill into or otherwise damage bridge deck expansion joints or drains.

**REMOVAL OF KEEPER PINS:** Upon removal or relocation of Barrier Units, remove all Keeper Pins and completely fill the remaining holes in bridge decks and approach slabs that are to remain with Magnesium Ammonium Phosphate Concrete in accordance with Specification Section 930 or with an Epoxy Resin Compound, Type F or Q, in accordance with Specification Section 926. If a flexible pavement overlay is present and is to remain, completely fill the remaining holes in the flexible pavement with hot or cold patch asphalt material.

**FREESTANDING BRIDGE OR APPROACH SLAB INSTALLATIONS:**

**FREESTANDING ROADWAY INSTALLATION:**

**NOTES FOR FREE STANDING ROADWAY INSTALLATION:**

LIMITATION OF USE: This installation technique can only be used on a flexible or rigid pavement or on an Asphalt Pad as shown.
NOTES FOR FREESTANDING MEDIAN INSTALLATION:

KEEPR PINS: Required for Bridge Decks only. Keeper Pins shall be 1/2" diameter, smooth steel bar in accordance with ASTM A 36 or ASTM A 709 Grade 36. As directed by the Engineer in order to limit vibration induced translation of the Barrier Units, install one (1) Keeper Pin per Barrier Unit as shown. Alternate Keeper Pin locations from side to side of Barrier Units along the length of the installation. Do not drill into or otherwise damage bridge deck expansion joints or drains. Upon removal or relocation of Barrier Units, remove all Keeper Pins and completely fill the remaining holes in bridge decks and approach slabs that are to remain with Magnesium Ammonium Phosphate Concrete in accordance with Specification Section 930 or with an Epoxy Resin Compound, Type F or Q, in accordance with Specification Section 926. If a flexible pavement overlay is present and is to remain, completely fill the remaining holes in the flexible pavement with hot or cold patch asphalt material.

NOTES FOR SOIL BACK FILLED ROADWAY INSTALLATIONS:

SOIL BACK FILL MATERIAL: Provide Back Fill Material consisting of any available clean soil. Compact Back Fill Material until the soil mass is firm and unyielding. Provide erosion control as specified in the Plans. If none is specified in the Plans, provide erosion control as required to maintain the integrity of the Back Fill embankment.

GEOTEXTILE FABRIC: Provide Type D-5 Geotextile Fabric in accordance with Specification Section 926 to contain Back Fill Material behind Barrier Units. Geotextile Fabric may be continuous over the length and height of the installation or may be individual pieces as required to cover the Lift / Drain Slots and open vertical joints between Barrier Units.
APPRAOCH TRANSITION FROM FREESTANDING TO BOLTED OR STAKED DOWN TYPE K TEMPORARY CONCRETE BARRIERS

* NOTE: Where Barrier is located within Clear Zone of opposing traffic, Approach Transition is required.

LEGEND:
- Freestanding Units
- Back Filled Units
- Bolted or Staked Units
- Transition Units (4 Units)
- Freestanding Units (13 Units Min.)
- Bolted - 1½" Nominal Staked - 1'-0" Min.
- Drop-off or Hazard
- See Sheet 6 for dimensions

TRAILING END TRANSITION FROM BOLTED OR STAKED DOWN TO FREESTANDING TYPE K TEMPORARY CONCRETE BARRIERS

TRAILING END TRANSITION FROM BACK FILLED TO FREESTANDING TYPE K TEMPORARY CONCRETE BARRIERS
TRANSITION FROM FREESTANDING TYPE K TEMPORARY CONCRETE BARRIERS TO BRIDGE MEDIAN TRAFFIC RAILING OR ROADWAY MEDIAN CONCRETE BARRIER WALL

* NOTE:
Where barrier is located within clear zone of opposing traffic, approach transition is required.

LEGEND:

- Freestanding Units (13 Units Min.)
- Transition Units (4 Units)
- Bridge Traffic Railing or Roadway Concrete Barrier Wall
- Bolted or Staked Units

See Sheet 7 for dimensions

See Approach Transition Splice Details Sheets 10, 12 & 13

Type K Barrier Units (Typ.)

Drop-off or Hazard

Bolted - 1½" Nominal
Staked - 1'-0" Min.

See Sheet 6 for dimensions

See Approach Transition Splice Details Sheets 10, 12 & 13

TRANSITION FROM FREESTANDING TYPE K TEMPORARY CONCRETE BARRIERS TO BRIDGE TRAFFIC RAILING OR ROADWAY CONCRETE BARRIER WALL

TRANSITION FROM BOLTED OR STAKED DOWN TYPE K TEMPORARY CONCRETE BARRIERS TO BRIDGE TRAFFIC RAILING OR ROADWAY CONCRETE BARRIER WALL

LEGEND:

Dot indicates number and position of Bolts or Stakes
PARTIAL PLAN VIEW AT MEDIAN TRAFFIC RAILING

32" F Shape Traffic Railing (shown);
32" New Jersey Shape and 42" F Shape
Traffic Railings and 8' or 14' Traffic Railing / Noise Walls (similar)

* Thrie-Beam Guardrail Splice

Align Top of Type K Barrier Unit with Traffic Railing at its end

Cross References:
See Sheet 13 for Section A-A, Section B-B and Section C-C.

PARTIAL PLAN VIEW AT SHOULDER TRAFFIC RAILING

32" F Shape Traffic Railing (shown);
32" New Jersey Shape and 42" F Shape
Traffic Railings and 8' or 14' Traffic Railing / Noise Walls (similar)

* Thrie-Beam Guardrail Splice

Bolted or Staked Down Type K Barrier Units

PARTIAL ELEVATION VIEW - FLORIDA CORRAL TRAFFIC RAILING

32" Florida Corral Traffic Railing (shown).
32' & 42' Vertical Shape Traffic Railings (similar)

* Thrie-Beam Guardrail Splice

Offset Block
Bolted to guardrail

Bolted or Staked Down Type K Barrier Units

PARTIAL ELEVATION VIEW - VERTICAL SHAPE TRAFFIC RAILINGS

42' Vertical Shape Traffic Railing (shown).
32' Vertical Shape Traffic Railing (similar)

* Thrie-Beam Guardrail Splice

Raised Sidewalk

Bolted or Staked Down Type K Barrier Units

PARTIAL ELEVATION VIEW - APPROACH TRANSITION SPLICE DETAIL

FOR F AND NEW JERSEY SHAPE TRAFFIC RAILINGS AND 8' & 14'
TRAFFIC RAILING / NOISE WALLS (CONCRETE BARRIER WALL SIMILAR)

Filled tapered toe if present (shown hatched) with concrete, see Notes on Sheet 4.

Filled tapered toe if present (shown hatched) with concrete, see Notes on Sheet 4.
32" F Shape Traffic Railing (shown);
32" New Jersey Shape and 42" F Shape
Traffic Railings and 8' or 14' Traffic
Railing / Noise Walls (similar)

32" Florida Corral Traffic Railing (shown);
32" & 42" Vertical Shape Traffic Railing (similar)

Freestanding Type K Barrier Units shown: Bolted or
Staked Units similar. See Plans for specific requirements.

\[ 1'-0" \times \]

Offset Block
Guardrail

* Thrie-Beam Guardrail Splice

Align Top of Type K Barrier Unit
with Traffic Railing at its end

Fill tapered toe if present (shown hatched)
with concrete, see note on Sheet 4

PARTIAL PLAN VIEW

PARTIAL ELEVATION VIEW

Cross References:
See Sheet 13 for Section A-A,
Section B-B and Section C-C.

TRAILING END SPLICE DETAIL

FOR F AND NEW JERSEY SHAPE TRAFFIC RAILINGS
AND 8' & 14' TRAFFIC RAILING / NOISE WALLS

FOR FLORIDA CORRAL AND VERTICAL
SHAPE TRAFFIC RAILINGS
SECTION A-A
32" F Shape Median Traffic Railing (shown), Median Concrete Barrier Wall (similar)

SECTION A-A
32" F Shape Traffic Railing (shown), 42" Traffic Railing and 8' & 14' Traffic Railing / Noise Walls (similar)

SECTION A-A
32" New Jersey Shape Concrete Barrier Wall (shown), 32" New Jersey Shape Traffic Railing & other Narrow Traffic Railings (similar)

SECTION A-A
32" & 42" Vertical Shape Traffic Railing (shown), Florida Corral Traffic Railing (similar)

SECTION B-B
Adjacent to Shoulder Traffic Railings

SECTION C-C
Adjacent to 32" F or New Jersey Shape Median Traffic Railing or Median Concrete Barrier Wall

SECTION C-C
32" F or New Jersey Shape Traffic Railing, Railing Transition & End Post

SECTION D-D

SECTION E-E
32" New Jersey Shape Traffic Railing (shown), 32" F Shape Traffic Railing (similar)
APPROACH TRANSITION FROM FREESTANDING PROPRIETARY TEMPORARY BARRIERS TO BOLTED OR STAKED DOWN TYPE K TEMPORARY CONCRETE BARRIERS

LEGEND:

- Dot indicates number and position of Bolts or Stakes

TRAILING END TRANSITION FROM BOLTED OR STAKED DOWN TYPE K TEMPORARY CONCRETE BARRIERS TO FREESTANDING PROPRIETARY TEMPORARY BARRIERS

APPROACH AND TRAILING END TRANSITIONS FROM FREESTANDING TYPE K TEMPORARY CONCRETE BARRIERS TO FREESTANDING PROPRIETARY TEMPORARY BARRIERS

TYPE K-PROPRIETARY TEMPORARY CONCRETE BARRIER TRANSITIONS
NOTE: Where Barrier is located within Clear Zone of opposing traffic, Approach Transition is required.

APPROACH TRANSITION FROM FREESTANDING PROPRIETARY TEMPORARY BARRIERS TO BACK FILLED TYPE K TEMPORARY CONCRETE BARRIERS

LEGEND:

- Dot indicates number and position of Bolts or Stakes

TRAILING END TRANSITION FROM BACK FILLED TYPE K TEMPORARY CONCRETE BARRIERS TO FREESTANDING PROPRIETARY BARRIERS

MEDIAN APPROACH AND TRAILING END TRANSITIONS FROM FREESTANDING TYPE K TEMPORARY CONCRETE BARRIERS TO FREESTANDING PROPRIETARY TEMPORARY BARRIERS

TYPE K-PROPRIETARY TEMPORARY CONCRETE BARRIER TRANSITIONS
GENERAL NOTES

1. Temporary concrete barrier systems on roadways may be any of the following:
   a. The FDOT Type K Temporary Concrete Barrier system (Design Standard Index 414). F-Shape Units. For
      temporary concrete barrier systems on bridges see Design Standard Index No. 414.
   b. Proprietary temporary concrete barrier systems meeting NCHRP Report 350 Test Level 3 criteria which
      are included on the Approved Products List.

2. Barrier units of dissimilar types may be interconnected within a single line barriers using transition units.

3. Alignment, length of need, anchorage and end treatment shall be in accordance with this Index.

4. Temporary concrete barrier units shown herein shall not be used for permanent barrier construction
   regardless of unit length.

5. If the plans specify Barrier (Temporary) (Type K), substitution with other barrier types is not permitted.

6. If the plans specify temporary concrete barrier system, substitution with water filled barriers is not
   permitted.

7. Where existing flexible pavement is not present, construct a minimum 2" thick temporary asphalt pad using
   miscellaneous asphalt pavement in accordance with Specification Section 359 with the exception that the use
   of a pre-emergent herbicide is not required. No separate payment will be made for the Asphalt Pad.

8. Barrier delineators meeting the requirements of Specifications Section 993 are to be mounted on top of
   temporary concrete barriers that are used as barriers along traveled ways in work zones. The barrier
   delineators are to be spaced at 50 centers in alignment transitions and 100' at all other locations. Color
   must match adjacent longitudinal pavement marking.

9. Barrier units used for work zone traffic control and other temporary applications shall be paid for under
   the contract unit price for Barrier (Temporary), LF.

10. Deflection space shall be clear of any grass, construction debris, stockpiled materials, equipment, and
    objects.

11. Placing alternate temporary barrier systems with heights greater than 32 inches within the work zone may
    obstruct the clear sight distance at intersections and driveways. Prior to placing these barrier systems, the
    contractor shall submit a Certification Statement that the clear sight distance meets the requirements of
    Index 546, signed and sealed by a Florida Professional Engineer.

12. Minimum temporary concrete barriers installed per run shall be 16 units.

### Offset and Deflection Space Requirements

<table>
<thead>
<tr>
<th>Installation</th>
<th>Shielding</th>
<th>Work Zone Speed</th>
<th>Offset to Travelway</th>
<th>Deflection Space</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Above Ground Hazards</td>
<td>45 mph or Less</td>
<td>1' min., 2' preferred</td>
<td>2' min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 mph and Greater</td>
<td>2' min., 4' preferred</td>
<td>4' min.</td>
</tr>
<tr>
<td></td>
<td>Drop-off Hazards</td>
<td>45 mph or Less</td>
<td>1' min., 2' preferred</td>
<td>2' min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 mph and Greater</td>
<td>a. Drop-offs 4' or Less and No traffic below</td>
<td>2' min., 4' preferred</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>b. All drop-off conditions other than 'a'</td>
<td>2' min., 4' preferred</td>
</tr>
<tr>
<td></td>
<td>Separating Traffic</td>
<td>45 mph or Less</td>
<td>1' min., 2' preferred</td>
<td>2' min.</td>
</tr>
<tr>
<td></td>
<td>Opposing Traffic</td>
<td>50 mph and Greater</td>
<td>2' min., 4' preferred</td>
<td>4' preferred</td>
</tr>
</tbody>
</table>

### MEDIAN INSTALLATION

- Barrier delineators are required on top of temporary concrete barriers.
- F-Shape units are included on the Approved Products List.
- Proprietary temporary concrete barrier systems meeting NCHRP Report 350 Test Level 3 criteria which
  are included on the Approved Products List.
- Temporary concrete barrier systems on bridges see Design Standard Index No. 414.
- Flexible or rigid pavement or asphalt pad as required.

### ROADWAY INSTALLATION

- Barrier delineators are required on top of temporary concrete barriers.
- Flexible or rigid pavement or asphalt pad as required.
- Slope 1:10 or flatter.

### REVISION

- LAST REVISION: 01/01/16
- DESCRIPTION: FY 2017-18 DESIGN STANDARDS
- INDEX NO.: 415
- SHEET NO.: 1 of 7
The approach departure line location is determined by the line intersect with the back of the hazard or the area to be shielded, however the intersect offset distance is not to be beyond the clear zone limit. The trailing departure line is determined by the line intersect with the front of the downstream end of the hazard or the area to be shielded.

The length of barrier needed is the distance from the approach departure line intersect with the upstream toe of the temporary concrete barrier to the trailing departure line intersect with the downstream toe of the temporary concrete barrier.

Temporary concrete barrier end units shall be located at or outside the clear zone or shielded by other barriers, earth embedment or a crash cushion.

Proprietary redirective crash cushions designed for use with temporary concrete barriers have the beginning length of need and departure line intersect point indicated on the respective APL drawing for each proprietary crash cushion. Where redirective crash cushions are located on the departure line by their length of need reference point, the upstream end unit must be aligned with the crash cushion, and the temporary concrete barrier's end unit secured with bolts or stakes. See Sheets 3 through 6 for configurations requiring end unit anchorage.

The offset of the temporary concrete barriers from the near traffic lane, flare rate and flare length are to be as determined by the Engineer, and, unless other flare rates are approved by the Engineer the flare rates to be applied are 1:16 for speeds ≥ 50 mph and 1:13 for speeds ≤ 45 mph; see Index No. 642 for other flare rates on freeway facilities.

The surface cross slope approaching the barrier and continuing across the required deflection space shall not exceed a rate of 1 vertical: 10 horizontal.
CLEAR ZONE WIDTHS FOR WORK ZONES

The term 'clear zone' describes the unobstructed relatively flat area, impacted by construction, extending outward from the edge of the traffic lane. The table below gives clear zone widths in work zones for medians and roadside conditions other than for roadside canals; where roadside canals are present, clear zone widths are to conform with the distances to canals as described in the PPM, Volume 1, Chapter 4.

<table>
<thead>
<tr>
<th>WORK ZONE SPEED (MPH)</th>
<th>TRAVEL LANES &amp; MULTILANE RAMPS (feet)</th>
<th>AUXILIARY LANES &amp; SINGLE LANE RAMPS (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-70</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>55</td>
<td>24</td>
<td>14</td>
</tr>
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<td>45-50</td>
<td>18</td>
<td>10</td>
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<tr>
<td>30-40</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>ALL SPEEDS</td>
<td>4 BEHIND FACE OF CURB</td>
<td>4 BEHIND FACE OF CURB</td>
</tr>
</tbody>
</table>

Equation Variables:

\[ L = \text{Length of Need} \]

\[ X = \text{Length of Advancement} \]

\[ X = (\text{Length of advancement}) = \text{The distance a longitudinal barrier must be extended in advance of an area of concern in order to adequately shield the hazard.} \]

\[ (D \text{RA}), (D \text{LA}) = \text{Distance in feet from the near edge of the travel way to the back of the hazard or the clear zone limit, whichever is less} \]

\[ (X \text{RA}), (X \text{LA}) = \text{Distance in feet from the near edge of the travel way to the back of the hazard or clear zone.} \]

Departure line = A line extending from the Point of Departure to the back of a hazard or clear zone.

The point at which a barrier intersects the departure line establishes the beginning of both the Length of Need and the Length of Advancement.

STRAIGHT ALIGNMENT AND LENGTH OF NEED

LEGEND

\( \text{LA} \): Left Approach

\( \text{RA} \): Right Approach

\( \text{L} \): Departure Rates

1:16 For Speeds ≤ 45 mph

1:13 For Speeds ≥ 50 mph

Area Shielded When Work Zone Hazards Or The Work Area Extend To Or Beyond Clear Zone Limit

\( \text{D} \): Clear Zone Limit

\( \text{X} \): Hazard Free, traversable slopes

\text{Stakes}:

\text{Dot indicates number and position of bolts or stakes.}
MEDIAN HAZARDS WITHIN CLEAR ZONES BOTH ROADWAYS

MEDIAN HAZARDS EXTENDS TO OR BEYOND CLEAR ZONES BOTH ROADWAYS

LEGEND

BARRIER END UNIT ANCHORAGE
DESCRIPTION:

TEMPORARY CONCRETE BARRIER

FREE STANDING BARRIER TYPE K

6 UNITS

2' CLEAR

1:18.75

3 UNITS

OVERLAP REFERENCE LINE

MECHANICAL INSTALLATION

LEGEND

Dot Indicates Number And Position Of Bolts Or Stakes

CONTINUATION OF BARRIER • FROM OTHER TYPE BARRIERS TO BARRIER TYPE K

APPROACH SHOULDER BARRIER ON UNDIVIDED FACILITIES

50 MPH OR GREATER

APPROACH SHOULDER BARRIER ON DIVIDED FACILITIES

50 MPH OR GREATER

INTERIOR MEDIAN BARRIER

OVERLAP REFERENCE LINE
DEPARTURE (TRAILING) SHOULDER BARRIER ON UNDIVIDED FACILITIES

CONTINUATION OF BARRIER - FROM BARRIER TYPE K TO OTHER TYPE BARRIERS

BARRIER TYPE K ON BRIDGES AND APPROACH SLABS
1. Redirective crash cushions are the principal (standard) device to be used for shielding approach ends of temporary concrete barriers. The contractor has the option to construct any of the redirective crash cushions listed on the Approved Products List at "102 Temporary Crash Cushion", subject to the uses and limitations described on their respective drawings. The last four Temporary Concrete Barrier units abutting crash cushions must be anchored to a paved surface in accordance with Design Standards Index 414.

2. Temporary redirective crash cushions shall be installed in accordance with the manufacturer's specifications and recommendations. Temporary crash cushions can be either new or functionally sound used devices. Performance of intended function is the only condition for acceptance, whether the crash cushion is new, used, refurbished, purchased, leased, rented, or loaned, shared between projects, or made up of mixed new and used components.

3. Temporary Crash Cushions shall not be bolted down on bridge superstructures that contain post-tensioned tendons within the concrete deck (top flange of concrete box girders) or on bridge superstructures consisting of longitudinally prestressed, transversely post-tensioned, solid or voided concrete slab units. Gating crash cushions shall be used where bolting is not allowed.

4. Assemble and install Crash Cushions according to the limitations noted on the Approved Products List (APL) webpage, the manufacturer's specifications, and the applicable crash cushion drawings posted on the APL.

5. Optional temporary redirective crash cushions are to be paid for per locations under the contract unit price for Crash Cushion (Redirective Option) (Temporary), LD.

6. A yellow Type I Object Marker shall be centered 3' in front of the crash cushion nose. Mounting hardware shall be in conformance with Section 993 of the Standard Specifications for Road and Bridge Construction.

As an option, the contractor may install reflective sheeting on the nose of the crash cushion. The sheeting to be applied to the nose of the crash cushion shall be a minimum of 360 square inches with a minimum height of 15 inches.

7. Equipment, stockpile material, etc., shall not be placed behind the crash cushion.

8. When subjected to reverse direction hits, construct Transition Panels from Temporary Concrete Barrier to Crash Cushions. For additional details refer to the applicable crash cushion drawings on the APL.

9. Galvanize metallic components to meet the requirements for Steel Guardrail, Section 967 of the Standard Specifications for Road and Bridge Construction.

### SHIELING ENDS WITH REDIRECTIVE CRASH CUSHIONS (REDIRECTIVE OPTION)

**LEGEND**

- Dot Indicates Number and Position Of Bolts Or Stakes

**TEMPORARY CONCRETE BARRIER**

**INDEX NO.** 415

**SHEET NO.** 7 of 7
TRAFFIC RAILING NOTES

This railing has been structurally evaluated to be equivalent or greater in strength to other safety shape railings which have been crash tested to NCHRP Report 350 TL-4 Criteria.

CONCRETE AND REINFORCING STEEL: See Structures Plans General Notes.

GUARDRAIL FOR GUARDRAIL CONNECTION DETAILS SEE INDEX 400.

SUPERELEVATED BRIDGES: At the option of the Contractor, the Traffic Railing on super-elevated bridges may be constructed perpendicular to the roadway surface. If an adjoining railing is constructed plumb, the transition of the Traffic Railing from perpendicular to plumb over a minimum distance of 20'-0". The cost of all modifications will be at the Contractor's expense.

PEDESTRIAN AND BICYCLE RAILING: See Index 821 and 822 for Notes, Details and post spacings for Traffic Railings with Aluminum Pedestrian/Bicycle Bullet Railings.

V-GROOVED: Construct % V-Grooves plumb. Space V-Grooves equally between % Open Joints and/or Deck joints and at V-Groove locations on Retaining Wall footings.

TRAFFIC RAILING - (32' F SHAPE)

ELEVATION OF INSIDE FACE OF RAILING
(Reinforcing Steel not shown for clarity)

(Railing on Bridge Deck and Approach Slab shown, Railing on Retaining Wall similar)

PLAN
(Reinforcing Steel not shown for clarity)

For Railing End Transition see Detail "A" (Typical except as noted below).

Approach Slab

Edge of Approach Slab (Coping) &

Bridge Deck

Joint (see Notes) - Coping (Typ.)

Intermediate Open Joint (see Notes) - See Detail "B" for Pre-cured Silicone Sealant

% V-Groove in both faces and top of Traffic Railing

% V-Groove in both faces and top of Traffic Railing

% V-Groove in both faces and top of Traffic Railing

32'-0" Maximum

-spacing % V-Grooves (see Notes)

Deck Joint (see Notes)

Deck Joint (see Notes)

Approach Slab (Flexible Pavement Approach Slab Shown, Rigid Pavement Approach Slab Similar)

Guardrail Approach Transition Connection (When called for in Plans)

Approach Slab (Flexible Pavement Approach Slab Shown, Rigid Pavement Approach Slab Similar, Typ.)

Bridge Deck

Front Face of Backwall &

Begin or End Bridge

Begin or End Approach Slab or Begin or End Railing on Retaining Wall

NOTE OR DATE

BRIDGE NUMBER

NAME OR DATE

BRIDGE NUMBER

The Name and Bridge Number shall be placed on the Traffic Railing so as to be seen on the driver's right side when approaching the bridge. The Date shall be placed on the driver's left side when approaching the bridge. The Name shall be as shown in the General Notes in the Structures Plans. The Date shall be the year the bridge is completed. For a widening when the existing railing is removed, use both the existing date and the year of the widening. Black plastic letters and figures 3" in height may be used, as approved by the Engineer, in lieu of the letters and figures formed by % V-Grooves. V-Grooves shall be formed by preformed letters and figures.

BARRIER DELINERATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing 2'-0" from the face on the traffic side at the spacing shown in the table above. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railing.

JOINTS: See Plans, Superstructure, Approach Slab and Retaining Walls Sheets for actual dimensions and joint orientation. Provide open jointing at Deck Expansion Joint locations matching the dimensions of the Deck Joint. For treatment of Railings on skewed bridges see Sheet No. 3.

Provide % Intermediate Open Joints at:

(1) Superstructure supports where slab is continuous.

(2) End of approach slabs when adjacent to retaining walls and at expansion joints on retaining wall junction slabs.
**DESCRIPTION:**

Section A-A

TYPICAL SECTION THRU TRAFFIC RAILING

(Section thru Bridge Deck shown, Section thru Approach Slab and Retaining Walls similar)

**PLAN - Railing End Transition (Showing Bars 5V and 5S)**

- Bars 5P @ 8" sp.
- Bars 5V @ 8" sp.
- Bars 5S (Typ.)
- Bars 5S (Bottom)
- Approach Slab - Field Cut End Bar 5V - Field Bend to maintain cover

**PLAN - Railing End Transition (Showing Bars 5P and 5S)**

- Bars 5P @ 8" sp. (Max.)
- Bars 5S (Typ.)
- Approach Slab - Bars 5V as shown

**DETAIL "A"**

(Railing on Approach Slab shown, Railing on Retaining Wall similar)

**NOTES:**

- Omit Railing End Transition and Guardrail if Index 410 Concrete Barrier Wall is used beyond the Approach Slab or Retaining Wall.

- See Structures Plans, Plan and Elevation Sheet and Roadway Plans. If Railing End Transition is omitted, extend Typical Section to end of the Approach Slab or limiting station on Retaining Wall, and space Bars 5P and 5V at 8" (Typ.)

**VIEW B-B**

(Section thru Approach Slab shown, Section thru Retaining Walls similar)

**NOTES:**

- Rotate Bars 5V in Railing End Transition to maintain cover. Begin placing Railing Bars 5P and 5V on Approach Slab at the barrier end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 5P and 5V shall be made immediately adjacent to Begin or End Bridge.

**CROSS REFERENCE:**

For locations of Section A-A and View B-B see Sheet 1.

**NOTE:**

- Omit Railing End Transition and Guardrail if Index 410 Concrete Barrier Wall is used beyond the Approach Slab or Retaining Wall.

**REVISIO N NO.**

INDEX NO.

**DESCRIPTION:**

TRAFFIC RAILING - (32' F SHAPE)

FY 2017-18

DESIGN STANDARDS

INDEX NO.

420

SHEET NO.

2 of 4

* Where railings of adjacent bridges are to be built back to back, the outside vertical plane of the railing and deck/approach slab may coincide along a plane centered 1'-6" from each gutter line. A bond breaker will be required. See Structures Plans, Superstructure Sheets for Details.

**REVISIO N**

LAST REVISION 01/01/16

11/01/16

* Future Asphalt Overlay

**CONST. JOINT REQUIRED**

* Bridge Deck

* Thrie-Beam Terminal Connector & Guardrail Bolts

* Thrie-Beam Terminal Connector Bolts

* Thrie-Beam Terminal Connector & Guardrail Bolts

* Thrie-Beam Terminal Connector Bolts
NOTES:
1) Concrete Parapet reinforcement is not affected by skew angle, see Index No. 820 for details.
2) Parapet expansion joint shall match the deck expansion joint which shall be turned perpendicular or radial to the gutter line. See Structures Plans, Superstructure Sheets for details.
3) Traffic Railing reinforcement vertical Bars 5V & 5P may be shifted up to 1" (Max) and rotated up to 10 degrees as required to allow proper placement. Bars 5V adjacent to expansion joints shall be field adjusted to maintain clearance and spacing, extra Bars 5V will be required. Bars 5V bottom horizontal portion shall be cut so as to maintain maximum bottom horizontal length of bar to each vertical leg being placed, the remainder of bar shall be discarded. Cut Bars 5V may be rotated to maintain clearance.
4) Railing ends at deck expansion joints shall follow the deck joint with allowance for joint movement. Expansion joint at the inside face of parapet shall be turned perpendicular or radial to this line. See Structures Plans, Superstructure and Approach Slab Sheets for details.
5) ½" Intermediate Open Joints and V-Grooves in railing and parapet shall be placed perpendicular or radial to the gutter line or inside face of parapet line. See Structures Plans, Superstructure Sheets for locations.
6) At begin or end approach slab extend slab at the railing ends 3" (gutter side or back face of railing as required) as shown to provide a base for casting of the railing.
7) Begin placing Railing Bars 5P and 5V on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 5P and 5V shall be made immediately adjacent to Begin or End Bridge.

GENERAL NOTES:
1) Work this Sheet with Traffic Railing, Pedestrian/Bicycle Railing, and Approach Slab Indexes as applicable.
2) Deck Expansion Joint at begin or end bridge shown. Deck Expansion Joints at ½ Pier or Intermediate Bents are similar.
3) Partial Plan Views shown are intended as guides only. See Structures Plans, Superstructure and Approach Slab Sheets for skew angles, joint orientation, dimensions and details.
4) Railings on Raised Sidewalks shall be treated similar to the Partial Plan View of Bridge Deck with Traffic Railing.
5) If Welded Wire Reinforcement is used in lieu of conventional reinforcement, placement of the WWR vertical elements shall be similar to those shown above. Clipping of horizontal elements to facilitate placement shall be minimized where possible. When clipping is required, supplement horizontal elements by lap splicing with deformed bars having an equivalent area of steel.
1. All bar dimensions in the bending diagrams are out to out.
2. The P and the 2'-4" vertical dimensions shown for Bar 5V are based on a bridge deck without a raised sidewalk. If a raised sidewalk is to be provided, increase these dimensions to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 8" deck with ØA = ØB = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

Pre-cured Silicone Sealant (4" wide)

DETAIL "B" - SECTION AT INTERMEDIATE OPEN JOINT

PREWIRED WIRE REINFORCEMENT NOTES:
1. At the option of the Contractor Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5P, 5S and 5V. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.
2. WWR at Railing End Transition shall be field bent inward as required (Pieces 1 & 2) to maintain cover. The vertical wires (D30.7) in Piece 1 shall be cut as shown and the gutter side portion bent inward as required to allow placement.

INTERMEDIATE JOINT SEAL NOTES:
1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 931.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

STIRRUP BAR 5P

STIRRUP BAR 5V

END STIRRUP BAR 5V

(One Required per Railing End Transition)

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are out to out.
2. The P and the 2'-4" vertical dimensions shown for Bar 5V are based on a bridge deck without a raised sidewalk. If a raised sidewalk is to be provided, increase these dimensions to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 8" deck with ØA = ØB = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

Pre-cured Silicone Sealant (4" wide)

DETAIL "B" - SECTION AT INTERMEDIATE OPEN JOINT

PREWIRED WIRE REINFORCEMENT NOTES:
1. At the option of the Contractor Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5P, 5S and 5V. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.
2. WWR at Railing End Transition shall be field bent inward as required (Pieces 1 & 2) to maintain cover. The vertical wires (D30.7) in Piece 1 shall be cut as shown and the gutter side portion bent inward as required to allow placement.

INTERMEDIATE JOINT SEAL NOTES:
1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 931.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

STIRRUP BAR 5P

STIRRUP BAR 5V

END STIRRUP BAR 5V

(One Required per Railing End Transition)

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are out to out.
2. The P and the 2'-4" vertical dimensions shown for Bar 5V are based on a bridge deck without a raised sidewalk. If a raised sidewalk is to be provided, increase these dimensions to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 8" deck with ØA = ØB = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

Pre-cured Silicone Sealant (4" wide)

DETAIL "B" - SECTION AT INTERMEDIATE OPEN JOINT

PREWIRED WIRE REINFORCEMENT NOTES:
1. At the option of the Contractor Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5P, 5S and 5V. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.
2. WWR at Railing End Transition shall be field bent inward as required (Pieces 1 & 2) to maintain cover. The vertical wires (D30.7) in Piece 1 shall be cut as shown and the gutter side portion bent inward as required to allow placement.

INTERMEDIATE JOINT SEAL NOTES:
1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 931.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

STIRRUP BAR 5P

STIRRUP BAR 5V

END STIRRUP BAR 5V

(One Required per Railing End Transition)

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are out to out.
2. The P and the 2'-4" vertical dimensions shown for Bar 5V are based on a bridge deck without a raised sidewalk. If a raised sidewalk is to be provided, increase these dimensions to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 8" deck with ØA = ØB = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

Pre-cured Silicone Sealant (4" wide)

DETAIL "B" - SECTION AT INTERMEDIATE OPEN JOINT

PREWIRED WIRE REINFORCEMENT NOTES:
1. At the option of the Contractor Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5P, 5S and 5V. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.
2. WWR at Railing End Transition shall be field bent inward as required (Pieces 1 & 2) to maintain cover. The vertical wires (D30.7) in Piece 1 shall be cut as shown and the gutter side portion bent inward as required to allow placement.

INTERMEDIATE JOINT SEAL NOTES:
1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 931.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

STIRRUP BAR 5P

STIRRUP BAR 5V

END STIRRUP BAR 5V

(One Required per Railing End Transition)

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are out to out.
2. The P and the 2'-4" vertical dimensions shown for Bar 5V are based on a bridge deck without a raised sidewalk. If a raised sidewalk is to be provided, increase these dimensions to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 8" deck with ØA = ØB = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

Pre-cured Silicone Sealant (4" wide)

DETAIL "B" - SECTION AT INTERMEDIATE OPEN JOINT

PREWIRED WIRE REINFORCEMENT NOTES:
1. At the option of the Contractor Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5P, 5S and 5V. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.
2. WWR at Railing End Transition shall be field bent inward as required (Pieces 1 & 2) to maintain cover. The vertical wires (D30.7) in Piece 1 shall be cut as shown and the gutter side portion bent inward as required to allow placement.

INTERMEDIATE JOINT SEAL NOTES:
1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 931.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

STIRRUP BAR 5P

STIRRUP BAR 5V

END STIRRUP BAR 5V

(One Required per Railing End Transition)

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are out to out.
2. The P and the 2'-4" vertical dimensions shown for Bar 5V are based on a bridge deck without a raised sidewalk. If a raised sidewalk is to be provided, increase these dimensions to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 8" deck with ØA = ØB = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

Pre-cured Silicone Sealant (4" wide)

DETAIL "B" - SECTION AT INTERMEDIATE OPEN JOINT

PREWIRED WIRE REINFORCEMENT NOTES:
1. At the option of the Contractor Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5P, 5S and 5V. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.
2. WWR at Railing End Transition shall be field bent inward as required (Pieces 1 & 2) to maintain cover. The vertical wires (D30.7) in Piece 1 shall be cut as shown and the gutter side portion bent inward as required to allow placement.

INTERMEDIATE JOINT SEAL NOTES:
1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 931.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

STIRRUP BAR 5P

STIRRUP BAR 5V

END STIRRUP BAR 5V

(One Required per Railing End Transition)

REINFORCING STEEL NOTES:
This railing has been structurally evaluated to be equivalent or greater in strength to other safety shape railings which have been crash tested to NCHRP Report 350 TL-4 criteria.

CONCRETE AND REINFORCING STEEL: See Structures Plans, General Notes.

GUARDRAIL: For Guardrail connection details see Index 400.

SUPERELEVATED BRIDGES: At the option of the Contractor the Traffic Railing on superelevated bridges may be constructed perpendicular to the roadway surface. The cost of all modifications will be at the Contractor's expense.

BARRIER DELINEATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing along the centerline at the spacing shown in the table above. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railing.

JOINTS: See Plans, Superstructure, Approach Slab and Retaining Walls Sheets for actual dimensions and joint orientation. Provide open Railing joints at Deck Expansion joint locations matching the dimensions of the Deck Joint. For treatment of Railings on skewed bridges see Sheet 3.

Provide 3/4" Intermediate Open joints at:

(1) Superstructure supports where slab is continuous.

Approach Slab (Flexible Pavement Approach Slab Shown, Rigid Pavement Approach Slab Similar)
NOTE:
Begin placing Railing Bars 5R and 5W on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 5R and 5W shall be made immediately adjacent to Begin or End Bridge. Shift and rotate Bars 5R and 5W as required to maintain cover in Railing End Transition.

Omit Railing End Transition and Guardrail if Index 410 Concrete Barrier Wall is used beyond the Approach Slab. See Structures Plans, Plan and Elevation Sheet and Roadway Plans. If Railing End Transition is omitted, extend Typical Section to the end of Approach Slab and space Bars 5R and 5W at 1'-0" (Typ.)
PARTIAL PLAN VIEW OF BRIDGE DECK AND APPROACH SLAB WITH MEDIAN TRAFFIC RAILING

NOTES:
1) Median Traffic Railing reinforcement vertical Bars SW may be shifted up to 1" (Max.) and rotated up to 10 degrees as required to allow proper placement.

2) Transition Stirrup Bars SW shall be used as required at railing ends adjacent to expansion joints to facilitate placement of bars in acute corners. Place Transition Bars SW in a fan pattern to maintain spacing. Rotate bars in 10° (Max.) increments as required.

3) Median Traffic Railing ends at deck expansion joints shall follow the deck joint with allowance for joint movement. See Structures Plans, Superstructure and Approach Slab Sheets for Details.

4) ½" Intermediate Open Joints in railing shall be placed perpendicular or radial to the axis of the median railing. See Structures Plans, Superstructure and Approach Slab Sheets for locations.

5) At begin or end approach slab extend slab at the median railing ends 3' (open side) as shown to provide a base for casting of the railing.

6) Work this Sheet with Approach Slab Indexes as applicable.

7) Deck Expansion Joint at begin or end bridge shown. Deck Expansion Joints at Intermediate Piers or Bents are similar.

8) Partial Plan Views shown are intended as guides only. See Structures Plans, Superstructure and Approach Slab Sheets for skew angles, joint orientation, dimensions and details.

9) If Welded Wire Reinforcement is used in lieu of conventional reinforcement, placement of the WWR vertical elements shall be similar to those shown above. Clipping of horizontal elements to facilitate placement shall be minimized where possible. Where clipping is required, supplement horizontal elements by lap splicing deformed bars with an equivalent area of steel.
**ALTERNATE REINFORCING STEEL (WELDED WIRE REINFORCEMENT) DETAILS**

**SPlice DETAIL**
(Between WWR Sections)

**WELDed WIRE REINFORCEMENT NOTES:**

1. At the option of the Contractor Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5R, 5S and 5W. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.

2. WWR at Railing End Transition shall be field bent inward as required (Pieces 1 & 2) to maintain cover. The top of Piece 1 shall be cut to allow overlap.

3. Place WWR panels so as to minimize the end overhang of longitudinal wires at Railing Ends and Open Joints. Overhangs greater than 6" are not permitted.

**INTERMEDIATE JOINT SEAL NOTES:**

1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 932.

2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.

3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

---

**ESTIMATED TRAFFIC RAILING QUANTITIES**

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(The above quantities are based on a crowned roadway, with a 2% cross slope)

**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

**STIRRUP BAR 5R**

**STIRRUP BAR 5W**

To Be Field Cut and Bent (10 required per Railing End Transition)

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**BILL OF REINFORCING STEEL**

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<td>6'-7&quot;</td>
</tr>
<tr>
<td>S</td>
<td>5</td>
<td>As Req'd</td>
</tr>
<tr>
<td>Ø</td>
<td>5</td>
<td>5'-3&quot;</td>
</tr>
</tbody>
</table>

---

**CONVENTIONAL REINFORCING STEEL CROSS-SLOPE**

<table>
<thead>
<tr>
<th>ROADWAY CROSS-SLOPE</th>
<th>DN SLOPE AT CROWN</th>
</tr>
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<tbody>
<tr>
<td>0% to 1%</td>
<td>R</td>
</tr>
<tr>
<td>1% to 2%</td>
<td>R</td>
</tr>
<tr>
<td>2% to 6%</td>
<td>R</td>
</tr>
<tr>
<td>6% to 10%</td>
<td>R</td>
</tr>
<tr>
<td>10% to 20%</td>
<td>R</td>
</tr>
<tr>
<td>20% to 60%</td>
<td>R</td>
</tr>
</tbody>
</table>

---

**REINFORCING STEEL NOTES:**

1. All bar dimensions in the bending diagrams are out to out.

2. All reinforcing steel at the open joints shall have a 2" minimum cover.

3. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

4. At the Contractor’s option, Bars 5W may be fabricated as a two piece bar with a 1'-2" lap splice of the bottom legs.
This railing has been structurally evaluated to be equivalent or greater in strength to other safety shape railings which have been crash tested to NCHRP Report 350 TL-4 Criteria.

CONCRETE AND REINFORCING STEEL: See Structures Plans, General Notes.

GUARDRAIL: For Guardrail connection details, see Index 400.

RAILINGS ON RETAINING WALLS: If the Traffic Railing is to be provided on a retaining wall, the railing section will be the same as shown on Index 422, Sheet 2. All other details such as the guardrail transition attachment, the maximum spacing of the 3/8" open joints and 1/2" V-Groove shall apply.

BARRIER DELINEATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table above. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railings.

V-GROOVES: Construct 1/2" V-Grooves plumb and provide at 30'-0" maximum intervals as shown. Space V-Grooves equally between Open Joints and/or Deck Joints and at V-Groove locations on Retaining Wall footings.

NAME, DATE, AND BRIDGE NUMBER: The Name and Bridge Number shall be placed on the Traffic Railing so as to be seen on the driver's right side when approaching the bridge. The Date shall be placed on the driver's left side when approaching the bridge. The Name shall be as shown in the General Notes in the Structures Plans. The Date shall be the year the bridge is completed. For a widening when the existing railing is removed, use both the existing date and the year of the widening. Black plastic letters and figures 3" in height may be used, as approved by the Engineer, in lieu of the letters and figures formed by 1/8" V-Grooves. V-Grooves shall be formed by preformed letters and figures.

JOINTS: See Plans, Superstructure, Approach Slab and Retaining Walls Sheets for actual dimensions and joint orientation. Provide open Railing Joints at Deck Expansion Joint locations matching the dimensions of the Deck Joint. For treatment of Railings on skewed bridges see Index 420.

Provide 3/8" Intermediate Open Joints at:
1. Superstructure supports where slab is continuous.
2. Ends of approach slabs when adjacent to retaining walls and at expansion joints on retaining wall junction slabs.

This REVISION
LAST REVISION: 01/01/16
FOOT: FY 2017-18
DESIGN STANDARDS
INDEX NO. 422
SHEET NO. 1 of 3

TRAFFIC RAILING - (42" VERTICAL SHAPE)
Begin placing Railing Bars 5T and 5X on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 5T and 5X shall be made immediately adjacent to Begin or End Bridge. Shift and rotate Bars 5T and 5X as required to maintain cover in Railing End Transition.

Omit Railing Taper, End Transition and Guardrail if Concrete Barrier Wall is used beyond the Approach Slab or Retaining Wall. See Structures Plans, Plan and Elevation Sheet and Roadway Plans. If Taper and Railing End Transition is omitted, extend Typical Section to end of the Approach Slab or limiting station on Retaining Wall, and space Bars 5T and 5X at 1'-0" (Typ.)

NOTES:

- Transition Bars 5X (Field Cut and Lap Splice for Railing End Transition, Shift and Rotate as Required to Maintain Cover)
- Transition Bars 5T (Field Cut and Lap Splice for Railing End Transition, Shift and Rotate as Required to Maintain Cover)
- Transition Bars 5T (Field Cut and Lap Splice for Railing End Transition, Shift and Rotate as Required to Maintain Cover)
- Transition Bars 5T (Field Cut and Lap Splice for Railing End Transition, Shift and Rotate as Required to Maintain Cover)

CROSS REFERENCE:
For location of Section A-A, View B-B and View C-C, see Sheet 1.

VIEW C-C
RAILING END TRANSITION
Guardrail Not Shown For Clarity

SECTION A-A
TYPICAL SECTION THRU TRAFFIC RAILING
SECTION THRU BRIDGE DECK SHOWN

11/01/16

VIEW B-B
(End View of Traffic Railing, Approach Slab shown, Retaining Wall Junction Slab similar)

TRAFFIC RAILING - (42" VERTICAL SHAPE)
CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS

BILL OF REINFORCING STEEL

<table>
<thead>
<tr>
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<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>5</td>
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<tr>
<td>T</td>
<td>5</td>
<td>10'-8&quot;</td>
</tr>
<tr>
<td>X</td>
<td>5</td>
<td>6'-9&quot;</td>
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ROADWAY CROSS-SLOPE

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<tr>
<th>LOW GUTTER</th>
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<tr>
<td>0% to 2%</td>
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<td>2% to 6%</td>
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<tr>
<td>6% to 10%</td>
<td>84°</td>
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REINFORCING STEEL NOTES:

1. All bar dimensions in the bending diagrams are out to out.
2. The 4'-6" vertical dimension shown for Bars 5T and 5X is based on a bridge deck with a 6" thick x 6' wide raised sidewalk at low side of deck, 2% deck cross slope and a counter 2% raised sidewalk cross slope. If the raised sidewalk thickness, width or cross slope vary from the above amounts, adjust this dimension accordingly to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above with ØA = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars SS may be continuous or spliced at the construction joints. Bar splices for Bars SS shall be a minimum of 2'-2".
6. The Contractor may utilize Welded Wire Reinforcement (WWR) when approved by the Engineer. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.

TRAFFIC RAILING - (42" VERTICAL SHAPE)

INTERMEDIATE JOINT SEAL NOTES:

1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 932.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

DETAIL "A" - SECTION AT INTERMEDIATE OPEN JOINT

SECTON THRU RECESSED "V" GROOVE TO FORM INSCRIBED LETTERS AND FIGURES

ESTIMATED TRAFFIC RAILING QUANTITIES

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(The above quantities are based on a 6" thick x 6' wide raised sidewalk at low side of deck, 2% deck cross slope and counter 2% sidewalk cross slope)
This railing has been structurally evaluated to be equivalent or greater in strength to other safety shape railings which have been crash tested to NCHRP Report 350 TL-4 Criteria.

**TRAFFIC RAILING NOTES**

**RAILINGS ON RETAINING WALLS:** If the Traffic Railing is to be provided on a retaining wall, the railing section will be the same as shown on Sheet 2. All other details such as the guardrail transition attachment, the maximum spacing of the 3/8 intermediate open joints and 3/8 V-Groove shall apply.

**NAME, DATE, AND BRIDGE NUMBER:** The Name and Bridge Number shall be placed on the Traffic Railing so as to be seen on the driver's right side when approaching the bridge. The Date shall be placed on the driver's left side when approaching the bridge. The Date shall be as shown in the General Notes of the Structures Plans. The Date shall be the year the bridge is completed. For a widening when the existing railing is removed, use both the existing date and the year of the widening. Black plastic letters and figures 3" in height may be used, as approved by the Engineer, in lieu of the letters and figures formed by 3/8" V-Grooves. V-Grooves shall be formed by preformed letters and figures.

**OPEN JOINTS:** See Structures Plans, Superstructure, Approach Slab Sheets and Retaining Walls for actual dimensions and joint orientation. Provide open Traffic Railing Joints at Deck Expansion Joint locations matching the dimensions of the Deck Joint. For treatment of railings on skewed bridges see Index 420.

**CROSS REFERENCE:**
- For Section A-A and View B-B, see Sheet 2.
- For Detail "A" see Sheet 3.

**CONCRETE AND REINFORCING STEEL:** See Structures Plans, General Notes.

**GUARDRAIL:** For guardrail connection details, see Index 400.

**PEDESTRIAN/BICYCLE RAILING AND SPECIAL HEIGHT BICYCLE RAILING DETAILS:** See Index 822 for Post, Rail and Rail Splice/Expansion Assembly Fabrication and Installation Details and Notes. V-GROOVES: Construct 1/2" V-Grooves plumb. Space V-Grooves equally between 3/8 Open Joints and/or Deck Joints and at V-Groove locations on Retaining Wall footings.

**BARRIER DELINEATORS:** Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table above. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railing.

<table>
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<th>Distance</th>
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<tr>
<td>&gt; than 8'</td>
<td>80'</td>
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**TRAFFIC RAILING - (32" VERTICAL SHAPE):**

**INDEX NO.** 423
**SHEET NO.** 1 of 3

**DESIGN STANDARDS**

**FY 2017-18**

**REV 0016**

**DESCRIPTION:**

**PLAN**

(Rails, Posts and Reinforcing Steel not shown for clarity)

**ELEVATION OF INSIDE FACE OF RAILING**

(Reinforcing Steel not shown for clarity)
Notes:

- Omit Railing End Taper and Guardrail if Concrete Barrier Wall is used beyond the Approach Slab. See Structures Plans, Plan and Elevation Sheet, and Roadway Plans. If Railing End Taper is omitted, extend Typical Section to the end of the Approach Slab. Begin placing Railing Bars ST and SX on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars ST and SX shall be made immediately adjacent to Begin or End Bridge. Shift and rotate Bars ST and SX on Approach Slab in end taper section as required to maintain cover.

Cross Reference:

For location of Section A-A and View B-B, see Sheet 1.

NOTE: For Post "B", Post "C", and Rail Details, see Index No. 822.
**Details of Traffic Railing**

**Table of Reinforcing Steel**

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<th>Length</th>
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</thead>
<tbody>
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<td>5</td>
<td>5</td>
<td>As Req'd</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>5'-10&quot;</td>
</tr>
</tbody>
</table>

**Conventional Reinforcing Steel Bending Diagrams**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Length</th>
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</thead>
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<td>5</td>
<td>5</td>
<td>As Req'd</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>5'-10&quot;</td>
</tr>
</tbody>
</table>

**Roadway Cross-Slope Low Gutter**

- 0% to 2%: 90°
- 2% to 6%: 87°
- 6% to 10%: 84°

**Roadway Cross-Slope High Gutter**

- 0% to 2%: 90°
- 2% to 6%: 93°

**Intermediate Joint Seal Notes:**

1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 932.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

**Reinforcing Steel Notes:**

1. All bar dimensions in the bending diagrams are cut to cut.
2. The 3'-8" vertical dimensions shown for Bars 5T and 5X are based on a bridge deck with a 6" thick x 6' wide raised sidewalk at low side of deck, 2% deck cross slope and a counter 2% raised sidewalk cross slope. If the raised sidewalk thickness, width or cross slopes vary from the above amounts, adjust these vertical dimensions accordingly to achieve a 6" minimum embedment into the bridge deck.
3. The reinforcement for the railing on a Retaining Wall shall be the same as detailed with ØA = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".
6. The Contractor may utilize Welded Wire Reinforcement (WWR) when approved by the Engineer. WWR must consist of Deformed wire meeting the requirements of Specification Section 933.

**Paint Recessed Surfaces Black**

**Pre-cured Silicone Sealant (4" wide)**

**Section Thru Recessed "V" Groove to Form Inscribed Letters and Figures**

**Estimated Traffic Railing Quantities**

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<tr>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>CY/LF</td>
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</tr>
<tr>
<td>Reinforcing Steel</td>
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<td>25.90</td>
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(The above quantities are based on a 6" thick x 6' wide raised sidewalk at low side of deck, 2% deck cross slope and counter 2% sidewalk cross slope.)
PLAN OF RAILING WITH GUARDRAIL ON APPROACH SLAB WITHOUT SIDEWALK (APPROACH SLAB WITH ADJACENT SIDEWALK SIMILAR) (Reinforcing Steel Not Shown For Clarity)

**Begin placing Railing Bars 7P1 or 7P2 and 4V on Approach Slab at the barrier end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 7P1 or 7P2 and 4V shall be made immediately adjacent to Begin or End Bridge.**

**NOTES:**
- **(NF)** means Near Face.
- **(FF)** means Far Face.

**CROSS REFERENCES:**
- For Sections see Sheets 3 and 4.
- For Quantities and Quantity Breakdown see Sheet 5.

**ELEVATION OF INSIDE FACE OF RAILING WITH GUARDRAIL ON APPROACH SLABS GREATER THAN 40'-0" ALONG GUTTER (WITHOUT CURB SHOWN, WITH CURB SIMILAR)**

**SECTION THRU RECESSED V-GROOVE TO FORM INSCRIBED LETTERS AND FIGURES**

**NOTES:**
- **(NF)** means Near Face.
- **(FF)** means Far Face.

**CROSS REFERENCES:**
- For Sections see Sheets 3 and 4.
- For Quantities and Quantity Breakdown see Sheet 5.
TYPICAL SECTIONS THRU RAILING ON BRIDGE DECK WITH SIDEWALK (SHOWN)
(RAILING ON APPROACH SLAB SIMILAR)

1) End Post detailed above, Interior Post and Approach Slab End Section similar.
2) For decks to 8'-0" place Bars 7P1 and 7P2 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8'-0" place Bars 7P1 and 7P2 and 4V with 6" embedment.
3) Alternate Bars 7P1 and 7P2 at each post. At End Posts 3 each (Min.) required, at Intermediate Post 6 each required.
4) Reverse direction of every other Bar 4V1 to match direction of Bars 7P1 or 7P2.
5) Shift deck and approach slab transverse reinforcement minimally to allow placement of Bars 7P & 4V.

RAILING ADJACENT TO SIDEWALK NOTES:

- Bars 7P1 and 7P2 at each post. At End Posts 3 each (Min.) required, at Intermediate Post 6 each required.
- Reverse direction of every other Bar 4V1 to match direction of Bars 7P1 or 7P2.
- Shift deck and approach slab transverse reinforcement minimally to allow placement of Bars 7P & 4V.
REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement for the railing on a C-I-P Concrete Retaining Wall shall be the same as detailed above for a 8" deck with \( \theta_A = 90^\circ \), where applicable. If bottom horizontal legs of Bars 7P1, 7P3 and 4V1 prohibit placement, Bars 7P4 and 4V2 may be substituted for Bars 7P1, 7P3 and 4V1 as shown.
3. All reinforcing steel at the open joints shall have a 2" minimum cover unless otherwise noted.
4. At Construction Joints, Bars 6R1, 5R2 and 4R3 may be continuous or spliced. Where bars are spliced provide a 2'-7" Min. lap length for Bar 6R1, a 2'-2" Min. lap length for Bars 5R2 and a 1'-8" Min. lap length for Bars 4R3.
5. The skew angle for Bars 7P3 may vary from joint to joint and side to side, see Structures Plans, Superstructure Sheets for details.

**Bars 4S1, 4S2 & 4S3 are to be used with a curb only.**

**Bars 7P1, 7P2 & 7P3 are to be used with a curb only.**

***Bars 7P4 & 4V2 are to be used on C-I-P Concrete Retaining Walls.***

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**REVISION NO.**

**SHEET NO.**

**INDEX NO.**

**DESCRIPTION:**

FY 2017-18 DESIGN STANDARDS

TRAFFIC RAILING - (CORRAL SHAPE)
NOTES:
1) Railing expansion joint shall match the deck expansion joint which shall be turned perpendicular or radial to the gutter line. See Structures Plans, Superstructure and Approach Slab Sheets for details.
2) Bars 4S1 (not shown) shall be placed perpendicular or radial to the gutter.

BRIDGE DECK AND APPROACH SLAB WITHOUT GUARDRAIL ATTACHED (SHOWN):
3) End Post & Approach Slab End Section - Place Bars 7P1 & 4V1 in acute corners of intersection of deck joint and gutter line. Place Bars 7P3 & 4V1 in acute corners of intersection of deck joint and gutter line as required. Interior Post - use Bars 7P1 and 4V1 placed with bottom mat of reinforcement. Shift deck or slab reinforcement minimally to allow proper placement of Bars 7P and 4V and to facilitate placement of concrete.
4) Place Bars 7P1 & 4V1 in acute corners of intersection of deck joint and gutter line as required. Shift deck or slab reinforcement minimally to allow proper placement of Bars 7P & 4V and to facilitate placement of concrete.
5) Begin placing Railing Bars 7P1 & 4V1 on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 7P & 4V shall be made immediately adjacent to Begin or End Bridge.

APPROACH SLAB WITH GUARDRAIL ATTACHED (NOT SHOWN):
6) Bars 7P at end of the railing shall be field cut and shifted to maintain clearance, see Railing End Taper Detail Sheet 2 for similar details.

GENERAL NOTES:
1) Deck Expansion Joint at begin or end bridge shown. Deck Expansion Joints at Pier or Intermediate Bents are similar.
2) Partial Plan Views shown are intended as guides only. See Structures Plans, Superstructure and Approach Slab Sheets for skew angles, joint orientation, dimensions and details.
PARTIAL PLAN VIEW OF BRIDGE DECK AND APPROACH SLAB WITH SIDEWALK

- SKEW ANGLE GREATER THAN 15 DEGREES

NOTES:
1) Railing ends at deck expansion joints shall follow the deck joint with allowance for joint movement. Expansion joint at the inside face of parapet shall be turned perpendicular or radial to this line. See Structures Plans, Superstructure and Approach Slab Sheets for details.
2) Bars 4S1 (not shown) shall be placed perpendicular or radial to the gutter.
3) Deck transverse reinforcement may be shifted minimally as required to allow proper placement of Bars 7P & 4V and to facilitate placement of concrete. Bars 7P1 & 4V1 or 7P2 & 4V1 shall be used on opposing sides of the joint depending on the direction of the skew, see detail above. Approach Slab reinforcement may be shifted if conflicts occur.
4) End Post - alternate Bars 7P1 with Bars 7P2 and reverse direction of every other Bar 4V1 to facilitate placement of concrete. Bars 7P & 4V shall be placed perpendicular or radial to the gutter (Typ. with or without Guardrail attached).
5) End Post - alternate Bars 7P1 with Bars 7P2 and reverse direction of Bars 4V1 (as detailed) where possible. Approach Slab reinforcement may be shifted if conflicts occur.
6) Use Bars 7P2 and reverse direction of Bars 4V1 where skew restricts use of Bars 7P1 & 4P1.
7) Begin placing Railing Bars 7P & 4V on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 7P & 4V shall be made immediately adjacent to Begin or End Bridge.

PARTIAL PLAN VIEW AT BEGIN OR END APPROACH SLAB WITH SIDEWALK AND RAILING WITH GUARDRAIL ATTACHED

- SKEW ANGLE GREATER THAN 15 DEGREES SHOWN, 15 DEGREES OR LESS SIMILAR

NOTES:
1) Railing ends at deck expansion joints shall follow the deck joint with allowance for joint movement. Expansion joint at the inside face of parapet shall be turned perpendicular or radial to this line. See Structures Plans, Superstructure and Approach Slab Sheets for details.
2) Bars 4S1 (not shown) shall be placed perpendicular or radial to the gutter.
3) Edge of Approach Slab adjacent to the roadway shall follow end of railing. Bars 7P at end of the railing shall be field cut and shifted to maintain clearance, see detail bottom left this sheet for similar details.
4) Alternate Bars 7P1 with Bars 7P2 and reverse direction of every other Bar 4V1 to facilitate placement of concrete.
5) Bars 7P & 4V shall be rotated to match bridge deck reinforcement. Shift deck transverse reinforcement minimally to allow placement of Bars 7P & 4V.
6) Railing End Post and reinforcement detailed above. Railing Interior Post reinforcement similar.
7) Begin placing Railing Bars 7P & 4V on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 7P & 4V shall be made immediately adjacent to Begin or End Bridge.

TRAFFIC RAILING - (CORRAL SHAPE)
This railing has been structurally evaluated to be equivalent or greater in strength to other safety shape railings which have been crash tested to NCHRP Report 350 TL-5 Criteria.

CONCRETE AND REINFORCING STEEL: See Structures Plans, General Notes.

SUPERELEVATED BRIDGES: At the option of the Contractor the Traffic Railing on superelevated bridges may be constructed perpendicular to the roadway surface. If an adjoining railing is constructed plumb, transition the end of the Traffic Railing from perpendicular to plumb over a minimum distance of 20'-0". The cost of all modifications will be at the Contractor's expense.

GUARDRAIL: For Guardrail connection details, see Index 400.

RAILINGS ON RETAINING WALLS: If the Traffic Railing is to be provided on a retaining wall, the railing section will be the same as shown on Sheet 2. All other details such as the guardrail transition attachment, the maximum spacing of the ½" open joints and ⅝" V-groove shall apply.

V-GROOVES: Construct ⅝" V-grooves plumb. Space V-grooves equally between ½" Open Joints and/or Deck Joints and at V-groove locations on Retaining Wall footings.

Provide ½ Intermediate Open Joints shall be provided at:
1) Superstructure supports where slab is continuous.
2) Ends of approach slabs when adjacent to retaining walls and at expansion joints on retaining wall junction slabs.

BARRIER DELINEATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing 2' from the face on the traffic side at the spacing shown in the table above. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railing.
PLAN - Railing End Transition  
(Showing Bars 5V, 8S1, 5S2 and 8T2)  

NOTE:  
Begin placing Railing Bars 5P and 5V on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes.  
If required, adjustments to the bar spacing for Bars 5P and 5V shall be made immediately adjacent to Begin or End Bridge.  
Shift and rotate Bars 5P and 5V (see Detail "A") as required to maintain cover in Railing End Transition.  

---

NOTE:  
Field bend bars as required.  

*** Rotate Bars 5V as shown to maintain clearance. 

---

VIEW B-B  
(Section thru Approach Slab shown, Section thru Retaining Walls similar)  

*** Bars 5V @ 8" sp. (Max.) 

---

SECTION A-A  
(TYPICAL SECTION THRU TRAFFIC RAILING (SECTION THRU BRIDGE DECK SHOWN - SECTION THRU APPROACH SLAB SIMILAR))

---

ELEVATION - RAILING END TRANSITION  
(Guidrail and back leg of Stirrups not shown for clarity)  

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INDEX  

SHEET NO. 2 of 3
### CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS

#### BILL OF REINFORCING STEEL

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#### ROADWAY CROSS-SLOPE

<table>
<thead>
<tr>
<th>LOW GUTTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA B B</td>
</tr>
<tr>
<td>0% to 2% 90°</td>
</tr>
<tr>
<td>2% to 6% 93°</td>
</tr>
<tr>
<td>6% to 10% 96°</td>
</tr>
</tbody>
</table>

**BA and BB shall be 90° if Contractor elects to place Railing perpendicular to the Deck.**

---

**BARS 851 & 552**

- **TRANSITION BARS 8T1 & 8T2**
  - (2 of each required per Railing End Transition)

- **STIRRUP BAR 5P**
  - **TRANSITION STIRRUP BARS 5P**
    - To Be Field Cut (30 of each required per Railing End Transition)

- **STIRRUP BAR 5V**
  - **END STIRRUP BAR 5V**
    - To Be Field Cut (One required per Railing End Transition)

**REINFORCING STEEL NOTES:**

1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 10" deck with BA = BB = 90°.
3. All reinforcing steel at the open joints shall have a 2" minimum cover.
4. Bars 851 may be continuous or spliced at the construction joints. Lap splices for Bars 851 and 552 shall be a minimum of 2'-5" and 2'-2", respectively.
5. The Contractor may utilize Welded Wire Reinforcement (WWR) when approved by the Engineer. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.

---

### ESTIMATED TRAFFIC RAILING QUANTITIES

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>CY/LF</td>
<td>0.134</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LB/LF</td>
<td>44.71</td>
</tr>
</tbody>
</table>

**Note:** The estimated railing quantities are based on a 2% deck cross slope; railing on low side of deck.

---

**INTERMEDIATE JOINT SEAL NOTES:**

1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 937.
2. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Traffic Railing.

---

**SECTION THRU RECESSED "V" GROOVE TO FORM INSCRIBED LETTERS AND FIGURES**

**DETAIL "B" - SECTION AT INTERMEDIATE OPEN JOINT**

**TRAFFIC RAILING - (42" F SHAPE)**

- **Pre-cured Silicone Sealant (4" wide)**
- **Paint Recessed Surfaces Black**

---

**DEL. DATE:** 11/01/16

**REV:** 3 of 3

**DESIGN STANDARDS**

**FY 2017-18**

**INDEX NO.** 425

**LAST REVISION DATE:** 01/01/16

**DESCRIPTION:** TRAFFIC RAILING - (42" F SHAPE)
This railing has been structurally evaluated to be equivalent or greater in strength to other single-slope railings which have been crash tested to MASH TL-4 criteria.

**CONCRETE AND REINFORCING STEEL:** See Structures Plans, General Notes.

**GUARDRAIL:** For Guardrail connection details see Index 400.

**SUPERELEVATED BRIDGES:** At the option of the Contractor the Traffic Railing on super-elevated bridges may be constructed perpendicular to the roadway surface. If an adjoining railing is constructed plumb, transition the end of the Traffic Railing from perpendicular to plumb over a minimum distance of 20'-0". The cost of all modifications will be at the Contractor’s expense.

**BARRIER DELINERATORS:** Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing along the centerline at the spacing shown in the table above. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railing.

**TRAFFIC RAILING NOTES:**

**V-GROOVES:** Construct \( \frac{3}{8} \)" V-Grooves plumb. Space V-Grooves equally between \( \frac{3}{8} \)" open joints and/or Deck Joints.

**JOINTS:** See Plans, Superstructure, Approach Slab and Retaining Walls Sheets for actual dimensions and joint orientation. Provide open Railing Joints at Deck Expansion Joint locations matching the dimensions of the Deck Joint. For treatment of Railings on skewed bridges see Sheet No. 3. Provide \( \frac{3}{8} \)" Intermediate Open Joints at:

1. - Superstructure supports where slab is continuous.

**END TRANSITION:** When guardrail approaches are shown in the Plans, provide the tapered end transition as shown. When a Concrete Traffic Railing or Median Barrier Wall is shown on the approaches see the Structures Plans for the End Transition Details.

**BARRIER DELINEATOR SPACING:**

<table>
<thead>
<tr>
<th>Distance - Edge of Travel Lane to Face of Railing</th>
<th>Spacing (Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4</td>
<td>40'</td>
</tr>
<tr>
<td>4' to 8'</td>
<td>80'</td>
</tr>
<tr>
<td>&gt; than 8'</td>
<td>None Required</td>
</tr>
</tbody>
</table>

**CROSS REFERENCE:**

For Section A-A, View B-B and Detail "A" see Sheet 2.

For Detail "B" see Sheet 4.
SECTION A-A
TYPICAL SECTION THRU TRAFFIC RAILING
(SECTION THRU BRIDGE DECK SHOWN - SECTION THRU APPROACH SLAB SIMILAR)

NOTE:
Begin placing Railing Bars 5R and 5W on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 5R and 5W shall be made immediately adjacent to Begin or End Bridge. Shift and rotate Bars 5R and 5W as required to maintain cover in Railing End Transition.

See the Structures Plans for Special End Transition details, if Index 410 Concrete Barrier Wall is used beyond the Approach Slab. See Structures Plans, Plan and Elevation Sheet and Roadway Plans.
NOTES:

1) Median Traffic Railing reinforcement vertical Bars 5W may be shifted up to 1" (Max.) and rotated up to 10 degrees as required to allow proper placement.

2) Transition Stirrup Bars 5W shall be used as required at railing ends adjacent to expansion joints to facilitate placement of bars in acute corners. Place Transition Bars 5W in a fan pattern to maintain spacing. Rotate bars in 10° (Max.) increments as required.

3) Median Traffic Railing ends at deck expansion joints shall follow the deck joint with allowance for joint movement. See Structures Plans, Superstructure and Approach Slab Sheets for Details.

4) 3" Intermediate Open Joints and V-Grooves in railing shall be placed perpendicular or radial to the C of the median railing. See Structures Plans, Superstructure and Approach Slab Sheets for locations.

5) At begin or end approach slab extend slab at the median railing ends 3' (open side) as shown to provide a base for casting of the railing.

6) Work this Sheet with Approach Slab Indexes as applicable.

7) Deck Expansion Joint at begin or end bridge shown. Deck Expansion Joints at C Pier or Intermediate Bents are similar.

8) Partial Plan Views shown are intended as guides only. See Structures Plans, Superstructure and Approach Slab Sheets for skew angles, joint orientation, dimensions and details.

9) If Welded Wire Reinforcement is used in lieu of conventional reinforcement, placement of the WWR vertical elements shall be similar to those shown above. Clipping of horizontal elements to facilitate placement shall be minimized where possible. Where clipping is required, supplement horizontal elements by lap splicing with deformed bars having an equivalent area of steel.
The above quantities are based on a crowned roadway, with a 2% cross slope.

Reinforcing Steel

Concrete

CY/LF

LB/LF

Optional Splice

(see Note 4)

Length as Required

ITEM

UNIT

QUANTITY

Concrete

CY/LF

0.159

Reinforcing Steel

LB/F

23.99

(The above quantities are based on a crowned roadway, with a 2% cross slope)

WELDED WIRE REINFORCEMENT NOTES:

1. At the option of the Contractor deformed Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5R, 5S and 5W. WWR must meet the requirements of Specification Section 931.

2. WWR at Railing End Transition shall be field bent (welded as required) to maintain cover. The bottom of Piece 1 shall be cut to allow overlap.

3. Place WWR panels so as to minimize the end overhang of longitudinal wires at Railing Ends and Open Joints. Overhangs greater than 6" are not permitted.

TRANSITION STIRRUP BAR 5W

To Be Field Cut

(10 required per Railing End Transition)

STIRRUP BAR 5R

(5 required per Railing End Transition)

Field Cut & Discard

Field Bend as required to maintain cover

Field Cut & Rouse

Optional Splice (see Note 4)

REINFORCING STEEL NOTES:

1. All bar dimensions in the bending diagrams are out to out.

2. All reinforcing steel at the open joints shall have a 2" minimum cover.

3. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

4. At the Contractor's option, Bars 5W may be fabricated as a two piece bar with a 1'-2" lap splice of the bottom legs.

WREIGNED WIRE REINFORCEMENT (WWR) DETAILS

1. At the option of the Contractor deformed Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5R, 5S and 5W. WWR must meet the requirements of Specification Section 931.

2. WWR at Railing End Transition shall be field bent (welded as required) to maintain cover. The bottom of Piece 1 shall be cut to allow overlap.

3. Place WWR panels so as to minimize the end overhang of longitudinal wires at Railing Ends and Open Joints. Overhangs greater than 6" are not permitted.

TRANSITION STIRRUP BAR 5W

To Be Field Cut

(10 required per Railing End Transition)

STIRRUP BAR 5R

(5 required per Railing End Transition)

Field Cut & Discard

Field Bend as required to maintain cover

Field Cut & Rouse

Optional Splice (see Note 4)

REINFORCING STEEL NOTES:

1. All bar dimensions in the bending diagrams are out to out.

2. All reinforcing steel at the open joints shall have a 2" minimum cover.

3. Bars 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".

4. At the Contractor's option, Bars 5W may be fabricated as a two piece bar with a 1'-2" lap splice of the bottom legs.

WELDED WIRE REINFORCEMENT NOTES:

1. At the option of the Contractor deformed Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 5R, 5S and 5W. WWR must meet the requirements of Specification Section 931.

2. WWR at Railing End Transition shall be field bent (welded as required) to maintain cover. The bottom of Piece 1 shall be cut to allow overlap.

3. Place WWR panels so as to minimize the end overhang of longitudinal wires at Railing Ends and Open Joints. Overhangs greater than 6" are not permitted.
This railing has been structurally evaluated to be equivalent or greater in strength to other single-slope railings which have been crash tested to MASH TL-4 Criteria.

CONCRETE AND REINFORCING STEEL: See Structures Plans General Notes.

GUARDRAIL: For Guardrail connection details see Index 400.

SUPERELEVATED BRIDGES: At the option of the Contractor the Traffic Railing on super-elevated bridges may be constructed perpendicular to the roadway surface. If an adjoining railing is constructed plumb, transition the end of the Traffic Railing from perpendicular to plumb over a minimum distance of 20'-0". The cost of all modifications will be at the Contractor's expense.

PEDESTRIAN AND BICYCLE RAILING: See Index 821 and 822 for Notes, Details and post spacings for Traffic Railings with Aluminum Pedestrian/Bicycle Bullet Railings.

V-GROOVES: Construct \( \frac{3}{8} \) V-Grooves plumb. Space V-Grooves equally between \( \frac{1}{2} \) Open Joints and/or Deck joints at \( \frac{3}{8} \) V-Groove locations on Retaining Wall footings.

END TRANSITION: When guardrail approaches are shown in the Plans, provide the Tapered End Transition as shown. When a concrete traffic railing or barrier wall is shown on the approaches, see the Structures Plans for the end transition details.

NAME, DATE AND BRIDGE NUMBER: The Name and Bridge Number shall be placed on the Traffic Railing so as to be seen on the driver's right side when approaching the bridge. The Date shall be placed on the driver's left side when approaching the bridge. The Name shall be as shown in the General Notes in the Structures Plans. The Date shall be the year the bridge is completed. For a widening when the existing railing is removed, use both the existing date and the year of the widening. Black plastic letters and figures 3" in height may be used, as approved by the Engineer, in lieu of the letters and figures formed by \( \frac{1}{8} \) V-Grooves. V-Grooves shall be formed by preformed letters and figures.

BARRIER DELINERATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing 2'-0" from the face on the traffic side at the spacing shown in the table above. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railing.

JOINTS: See Plans, Superstructure, Approach Slab and Retaining Walls Sheets for actual dimensions and joint orientation. Provide open deck joints at Deck Expansion Joint locations matching the dimensions of the Deck Joint. For Treatment of Railings on skewed bridges see Sheet No. 3.

Provide \( \frac{1}{2} \) Intermediate Open Joints at:

1. Superstructure supports where slab is continuous.
2. Ends of approach slabs where adjacent to retaining walls and at expansion joints on retaining wall junction slabs.
For locations of Section A-A and View B-B see Sheet 1.

Where railings of adjacent bridges are to be built back to back, the outside vertical plane of the railing and deck/approach slab may coincide along a plane centered 1'-4" from each gutter line. A bond breaker will be required. See Structures Plans, Superstructure Sheets for Details.

* Where railings of adjacent bridges are to be built back to back, the outside vertical plane of the railing and deck/approach slab may coincide along a plane centered 1'-4" from each gutter line. A bond breaker will be required. See Structures Plans, Superstructure Sheets for Details.

SECTION A-A

**TYPICAL SECTION THRU TRAFFIC RAILING**

(Section thru Bridge Deck shown, Section thru Approach Slab and Retaining Walls similar)

**VIEW B-B**

(Section thru Approach Slab shown, Section thru Retaining Walls similar)

NOTE: See Structure Plans for Special End Transition details if Index 410 Concrete Barrier Wall is used beyond the Approach Slab or Retaining Wall.

See Structures Plans, Plan and Elevation Sheet and Roadway Plans. If Railing End Transition is omitted, extend Typical Section to end of the Approach Slab or limiting station on Retaining Wall, and space Bars 4P and 4V at 6" (Typ.)

**DETAIL "A"**
PARTIAL PLAN VIEW OF SKEWED BRIDGE DECK AND APPROACH SLAB WITH SIDEWALK, SINGLE SLOPE TRAFFIC RAILING AND PEDESTRIAN/BICYCLE RAILING INDEX NO. 820, 825 or 826, OTHER TRAFFIC RAILINGS SIMILAR

NOTES:
1) Concrete Parapet reinforcement is not affected by skew angle, see Index No. 820 for details.
2) Parapet expansion joint shall match the deck expansion joint which shall be turned perpendicular or radial to the gutter line. See Structures Plans, Superstructure Sheets for details.
3) Traffic Railing reinforcement vertical Bars 4V & 4P may be shifted up to 1" (Max.) and rotated up to 10 degrees as required to allow proper placement. Bars 4V adjacent to expansion joints shall be field adjusted to maintain clearance and spacing, extra Bars 4V may be required.
4) Railing ends at deck expansion joints shall follow the deck joint with allowance for joint movement. Expansion Joint at the inside face of parapet shall be turned perpendicular or radial to this line. See Structures Plans, Superstructure and Approach Slab Sheets for details.
5) $\frac{3}{4}$ Intermediate Open Joints and V Grooves in railing and parapet shall be placed perpendicular or radial to the gutter line or inside face of parapet line. See Structures Plans, Superstructure Sheets for locations.
6) At begin or end approach slab extend slab at the railing ends 3' (gutter side or back face of railing as required) as shown to provide a base for casting of the railing. Field trim toe of Bars 4V by 1 inch as required to maintain concrete cover at edge of deck.
7) Begin placing Railing Bars 4P and 4V on Approach Slab at the railing end and proceed toward Begin or End Bridge to ensure placement of guardrail bolt holes. If required, adjustments to the bar spacing for Bars 4P and 4V shall be made immediately adjacent to Begin or End Bridge.

GENERAL NOTES:
1) Work this Sheet with Traffic Railing, Pedestrian/Bicycle Railing, and Approach Slab Indexes as applicable.
2) Deck Expansion Joint at begin or end bridge shown. Deck Expansion Joints at $\frac{3}{4}$ Pier or Intermediate Bents are similar.
3) Partial Plan Views shown are intended as guides only. See Structures Plans, Superstructure and Approach Slab Sheets for skew angles, joint orientation, dimensions and details.
4) Railings on Raised Sidewalks shall be treated similar to the Partial Plan View of Bridge Deck with Traffic Railing.
5) If Welded Wire Reinforcement is used in lieu of conventional reinforcement, placement of the WWR vertical elements shall be similar to those shown above. Clipping of horizontal elements to facilitate placement shall be minimized where possible. When clipping is required, supplement horizontal elements by lap splicing with deformed bars having an equivalent area of steel.
The above quantities are based on a 2% deck cross slope; railing on low side of deck.

**WELDED WIRE REINFORCEMENT NOTES:**

1. At the option of the Contractor deformed Welded Wire Reinforcement (WWR) may be utilized in lieu of all Bars 4P, 4S and 4V. WWR must consist of Deformed wire meeting the requirements of Specification Section 931.
2. WWR at Railing End Transition shall be field bent inward as required (Piece 2) to maintain cover. The bottom of the vertical wire (D20) in Piece 2 shall be cut a maximum of 4 inches and the gutter side portion bent inward as required to allow placement.

**INTERMEDIATE JOINT SEAL NOTES:**

1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 932.
2. Apply sealant to all Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
3. Include the cost of the Pre-cured Silicone Sealant in the Contract Unit Price for the Traffic Railing.

**REINFORCING STEEL NOTES:**

1. All bar dimensions in the bending diagrams are out to out.
2. The 1'-6" vertical dimensions shown for Bar 4V is based on a bridge deck without a raised sidewalk. If a raised sidewalk is to be provided, increase this dimension to achieve a 6" minimum embedment into the bridge deck. See Structures Plans, Superstructure and Approach Slab Sheets.
3. The reinforcement for the railing on a retaining wall shall be the same as detailed above for an 8" deck with ØB = 90°.
4. All reinforcing steel at the open joints shall have a 2" minimum cover.
5. Bars 4S may be continuous or spliced at the construction joints. Bar splices for Bars 4S shall be a minimum of 2'-0".

**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

- **ROADWAY CROSS-SLOPE**
  - Low Gutter: 90°
  - High Gutter: 90°

- **BILL OF REINFORCING STEEL**
  - Mark: P
  - Size: 4
  - Length: As Required

**ALTERNATE REINFORCING STEEL (WWR) DETAILS**

WWR Piece No. 1

- D20 (Extend or Lap Splice each longitudinal wire)
- ØB shall be 90° if Contractor elects to place railing perpendicular to the deck and approach slabs.

WWR Piece No. 2

- ØB = 90°
- Bar* or Wire

**CONTRACT UNIT PRICE FOR THE TRAFFIC RAILING**

- Concrete: 0.107
- Reinforcing Steel: 22.82

**ESTIMATED TRAFFIC RAILING QUANTITIES**

- **Item**
  - ALTERNATE REINFORCING STEEL (WWR) DETAILS

- **Unit**
  - LF

- **Quantity**
  - 0.107

- **Reinforcing Steel**
  - 22.82
This railing has been structurally evaluated to be equivalent or greater in strength to other single slope railings which have been crash tested to MASH TL-5.

CONCRETE AND REINFORCING STEEL: See Structures Plans, General Notes.

SUPERELEVATED BRIDGES: At the option of the Contractor the Traffic Railing on superelevated bridges may be constructed perpendicular to the roadway surface. If an adjoining railing is constructed plumb, inclination on the end of the Traffic Railing with respect to plumb shall be less than 20°-0'. The cost of all modifications will be at the Contractor's expense.

GUARDRAIL: For Guardrail connection details, Index 400.

TRAFFIC RAILING NOTES

This railing has been structurally evaluated to be equivalent or greater in strength to other single slope railings which have been crash tested to MASH TL-5.

CONCRETE AND REINFORCING STEEL: See Structures Plans, General Notes.

SUPERELEVATED BRIDGES: At the option of the Contractor the Traffic Railing on superelevated bridges may be constructed perpendicular to the roadway surface. If an adjoining railing is constructed plumb, inclination on the end of the Traffic Railing with respect to plumb shall be less than 20°-0'. The cost of all modifications will be at the Contractor's expense.

GUARDRAIL: For Guardrail connection details, Index 400.

RAILINGS ON RETAINING WALLS: If the Traffic Railing is to be provided on a retaining wall, the railing section will be the same as shown on Sheet 2. All other details such as the guardrail transition attachment, the maximum spacing of the 1/2 open joints and 1/2 V-groove shall apply.


END TRANSITION: When guardrail approaches are shown in the Plans, provide the tapered end transition as shown. When a concrete traffic railing or barrier wall is shown on the approaches, see the Structures Plans for the End Transition Details.

NAME, DATE, AND BRIDGE NUMBER: The Name and Bridge Number shall be placed on the Traffic Railing so as to be seen on the driver's right side when approaching the bridge. The Date shall be placed on the driver's left side when approaching the bridge. The Name shall be as shown in the General Notes in the Structures Plans. The Date shall be the year the bridge is completed. For a widening when the existing railing is removed, use both the existing date and the year of the widening. Black plastic letters and figures 3" in height may be used, as approved by the Engineer, in lieu of the letters and figures formed by 1/2 "V-Grooves. V-Grooves shall be formed by preformed letters and figures.


Provide 1/2 Intermediate Open Joints shall be provided at:

1) Superstructure supports where slab is continuous.

2) Ends of Approach slabs when adjacent to retaining walls and at expansion joints on retaining wall junction slabs.

BARRIER DELINEATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing 2' from the face on the traffic side at the spacing shown in Table 1. Barrier Delineator color (white or yellow) shall match the color of the near edgeline. The cost of the Barrier Delineators shall be included in the Contract Unit Price for the Traffic Railing.
PLAN - Railing End Transition (Showing Transition Bars 5P and Bars 6S1, 6T1 & 6T2)

SECTION A-A

ELEVATION - RAILING END TRANSITION
(Guardrail not shown for clarity)

SECTION B-B

ELEVATION - RAILING END TRANSITION
(Showing Bars 5V, 6S1, 6T2)

NOTE:
- Transition Bars SP Field Cut (Typ. Unless Otherwise Noted)
- Bars 5S2 (Bottom) as required
- Connector Bolts
- Thrie-Beam Terminal
- 3-Pairs of Bars 5V
- ** Field Bend Bars 5V in Toe Transition to maintain clearance.

** See joint orientation note on Sheet 1.
*** Field Bend Bars 5V in Toe Transition to maintain clearance.

NOTE:
- See Structures Plans for Special End Transition details if Index 410 Concrete Barrier Wall is used beyond the Approach Slab or Retaining Wall. See Structures Plan and Elevation Sheet and Roadway Plans. If Railing End Transition is omitted, extend Typical Section to end of Approach Slab or limiting station on Retaining Wall, and space Bars 5P and 5V at 6" (Typ.).

** Where railings of adjacent bridges are to be built back to back, the outside vertical plane of the railing and deck may coincide along a plane centered 1'-6" from each outer line. A bond breaker will be required. See Structures Plans, Superstructure Sheets for Details.

NOTE:
- See Structures Plans for Special End Transition details if Index 410 Concrete Barrier Wall is used beyond the Approach Slab or Retaining Wall. See Structures Plan and Elevation Sheet and Roadway Plans. If Railing End Transition is omitted, extend Typical Section to end of Approach Slab or limiting station on Retaining Wall, and space Bars 5P and 5V at 6" (Typ.).
The estimated railing quantities are based on a 2% deck cross-slope, railing on low side of deck.

**REINFORCING STEEL NOTES:**
1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement for the railing on a retaining wall shall be the same as detailed above for a 10' deck with \( \phi_A = \phi_B = 90\)°.
3. All reinforcing steel at the open joints shall have a 2" minimum cover.
4. Bars 6S1 may be continuous or spliced at the construction joints. Lap splices for Bars 6S1 and 5S2 shall be a minimum of 2'-0" and 2'-2", respectively.
5. The Contractor may utilize deformed WWR when approved by the Engineer. WWR must meet the requirements of Specification Section 931.

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**ITEMS AND QUANTITIES**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Unit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>CY/LF</td>
<td>0.143</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LB/LF</td>
<td>43.01</td>
</tr>
</tbody>
</table>

Note: The estimated railing quantities are based on a 2% deck cross-slope, railing on low side of deck.
GENERAL NOTES

1. Index 430 is applicable for permanent crash cushion installations that shield the ends of Concrete Barrier Wall or Guardrail, only.

2. Design Length is based on a given design speed and the shortest Crash Cushion available on the Approved Products List (APL). When a Length Restriction is not applicable (N/A), then the Contractor has the option to select valid Crash Cushions from the APL, which have design lengths greater than or equal to the Design Length identified in the plans. When a Length Restriction is applicable, then the Contractor has the option to select valid Crash Cushions from the APL, which have design lengths less than or equal to the Design Length in the plans and that are less than or equal to the Length Restriction identified in the plans.

3. For High Speed Facilities with a Design Speed greater than 60 mph, use a TL-3 Crash Cushion.

4. Assemble and install Crash Cushions according to the limitations noted on the Approved Products List (APL) webpage, the manufacturer’s specifications, and the applicable crash cushion drawings posted on the APL.

5. When subjected to reverse direction hits, construct Transition Panels from Concrete Barrier Walls to Crash Cushions; for additional details refer to the applicable crash cushion drawings on the APL.

6. Galvanize metallic components to meet the requirements in the Specification, Section 967.

7. For Guardrail Applications, construct the Manufacturer’s Transition between the Permanent Crash Cushion and the Standard Guardrail Transition; refer to all Standard Guardrail Transition details of this Index.

8. For additional information on the End Measurement for Guardrail Payment, refer to the Standard Specifications for Road and Bridge Construction, Section 536.

9. Provide delineation in accordance with Specification, Section 544.

10. The EOR shall provide the station of the Length of Need (LON) location in the plans. Provide delineation in accordance with Specification, Secton 544. For additional information on the End Measurement for Guardrail Payment, refer to the Standard of this Index.
CRASH CUSHION DETAILS

**PLANN VIEW**

- **Location Station**
- **Lap In Direction Of Adjacent Traffic**
- **Nested for Bi-Directional Traffic**
- **Guards Rail Post (Typ)**
- **Offset Block (Typ)**

**ELEVATION VIEW**

- **Location Station**
- **4 Spaces @ 1'-6¾" CC**
- **5 Spaces @ 3'-1½" CC**
- **6'-3" to Next Post**
- **Standard W-Beam Blockout**

**DESIGN STANDARDS FY 2017-18**

- **CRASH CUSHION**
- **Design Length**
- **12'-6" Thrie-Beam Panel (Nested For Bi-Directional Traffic)**
- **6'-3" W-Thrie Beam Transition Panel**
- **18'-9" Standard Guardrail Transition**
- **End Measurement For Gradrail Payment**

**STANDARD GUARDRAIL TRANSITION**

Note:
Post Numbers 8, 9 and 10 will have Standard 6"x8"x18" Wooden W-beam Blockouts.
For Additional Information on Standard Guardrail Transitions see Design Standard, Index 400.
**GENERAL NOTES**

1. The opaque visual barrier is intended to function as a visual screen, and is not intended to resist vehicle impact loads nor to restrain, contain or restrict vehicles or cargo. The barrier is designed to withstand zone wind loading and strikes by light debris, and, designed to yield to exceptional strikes by vehicles or cargo, and to contain ruptured segments of the screen when yielding to such strikes.

2. When the opaque visual barrier is constructed on an existing barrier wall, dowels shall be 7'-8" in length, embedded 6" into the barrier wall and set with an approved non-shrink grout. Embedment holes shall be 1 1/8" diameter, drilled to a depth 1 1/4" below the tip of the dowel unless greater depth is required to accept manufactured grout capsules.

   When the opaque visual barrier is constructed in conjunction with project concrete barrier walls, dowels may be set as described above, in either the drilled or preformed holes; or, placed when the barrier wall is cast. For dowels that are placed when the wall is cast, the dowel shall be 2'-2" in length and embedded to a depth of 12".

   When longitudinal reinforcing bars are encountered in the stem of existing barrier, shift the dowels to clear, maintaining the 11#2" Cover Minimum to the face of the Opaque Visual Barrier.

3. For both double and single faced concrete barrier walls the opaque visual barrier is to be located in the center of the top of the wall.

   For single faced barrier walls that are constructed around other vertical structures, the opaque visual barrier shall follow the alignments of only one of the walls and be centered along that wall.

   For dual median barrier walls that follow differential profiles, the opaque visual barrier shall be constructed atop the wall with the higher elevation, unless conditions dictate otherwise. Lateral transitions or end overlaps for opaque visual barriers that alternate between dual walls shall be detailed in the plans.

   For median barrier walls that are divided when connecting to separated bridges, the opaque visual barrier shall be constructed atop the approach side barrier wall, unless differential profiles dictate locating the opaque visual barrier on the departure side barrier wall.

   Opaque visual barriers to be located on capped fills between dual barrier walls shall be detailed in the plans.

4. In lieu of the reinforcement shown, the Contractor may substitute welded wire fabric equal to or better than that shown, when approved by the Engineer. Details shall be submitted with requests for substitution.

5. The Contractor may construct contiguous precast concrete panels in lieu of the cast-in-place opaque screen when approved by the Engineer - Panel design and method for anchorage to the barrier wall shall be detailed by shop drawings when requesting the Engineer's approval.

   The Contractor may construct the opaque screen monolithically with the barrier wall; however, the screen design shall not be modified so as to cause the wall to be dynamically active from strikes on the screen; see design considerations in Note No. 1 above.

6. Exposed concrete surfaces shall have a Class 3 surface finish in accordance with Section 521 of the Standard Specification, unless another finish is called for in the plans.

7. Payment for opaque visual barrier shall be full compensation for concrete, reinforcement, dowels, casting, placement, drilling, grouting, tooling, finishing and work incidental thereto, and shall be paid for under the contract unit price for Opaque Visual Barrier (Concrete) (2'-3" Height), LF.
This Traffic Railing Retrofit has been structurally evaluated to be equivalent or greater in strength to a design which has been successfully crash tested in accordance with NCHRP Report 350 T-4 criteria.

CONCRETE: Concrete for Transition Blocks and Curbs shall be Class II (Bridge Deck).

REINFORCING STEEL: Reinforcing steel shall be ASTM A615, Grade 60.

THRIE-BEAM GUARDRAIL: Steel Thrie-Beam Elements shall meet the requirements for Class B (10 Gauge) Guardrail of AASHTO M 180, Type II (Zinc coated). The minimum panel length for Thrie-Beam Elements shall be 12'-6". Field drilled holes for Post connections shall be 3⁄8" by 2½" slotted holes.

GUARDRAIL BOLTS: Guardrail bolts, nuts and washers shall be in accordance with AASHTO M180.

GUARDRAIL POSTS AND BASE PLATES: Posts and Base Plates shall be in accordance with ASTM A36 or ASTM A709 Grade 36.

ANCHOR BOLTS, NUTS AND WASHERS: Adhesive-Bonded Anchors and Anchor Bolts shall be fully threaded rods in accordance with ASTM F1554 Grade 105 or ASTM A193 Grade B7. At the Contractor's option, Anchor Bolts for through bolting may be in accordance with ASTM A449. All Nuts shall be single self-locking hex nuts and in accordance with ASTM A563 or ASTM A194. Flat Washers shall be in accordance with ASTM A36 and Plate Washers (for long slotted holes only) shall be in accordance with ASTM A36 or ASTM A709 Grade 36. After the nuts have been snug tightened, the anchor bolt threads shall be disturbed to prevent removal of the nuts. Distorted threads and the exposed trimmed ends of anchors shall be capped with a galvanizing compound in accordance with the Specifications.

COATINGS: All Nuts, Bolts, Anchors, Washers, Guardrail Posts, Anchor Plates, and Base Plates shall be hot-dip galvanized in accordance with the Specifications. Guardrail Post Assemblies shall be hot-dip galvanized after fabrication.

ADHESIVE-BONDED ANCHORS AND DOWELS: Adhesive Bonding Material Systems for Anchors and Dowels shall comply with Specification Section 937 and be installed in accordance with Specification Section 416. The field testing proof loads required by Specification Section 416 shall be 15,000 lbs. for 3⁄8" of anchor bolts; 22,000 lbs. for the 5⁄16" anchor bolts with 13" embedment; and 30,500 lbs. for the 5⁄8" anchor bolts with 9" embedment.

BRIDGES ON CURVED ALIGNMENTS: The details presented in these Standards are shown for bridges on tangent alignments. Details for bridges on horizontally curved alignments are similar.

ANCHOR BOLTS, NUTS AND WASHERS: Adhesive-Bonded Anchors and Anchor Bolts shall be fully threaded rods in accordance with ASTM F1554 Grade 105 or ASTM A193 Grade B7. At the Contractor's option, Anchor Bolts for through bolting may be in accordance with ASTM A449. All Nuts shall be single self-locking hex nuts and in accordance with ASTM A563 or ASTM A194. Flat Washers shall be in accordance with ASTM A36 and Plate Washers (for long slotted holes only) shall be in accordance with ASTM A36 or ASTM A709 Grade 36. After the nuts have been snug tightened, the anchor bolt threads shall be disturbed to prevent removal of the nuts. Distorted threads and the exposed trimmed ends of anchors shall be capped with a galvanizing compound in accordance with the Specifications.
NOTES:

1. On approach end provide Index No. 402 (as shown) or other site specific treatment, see Roadway Plans. For treatment of trailing end see Roadway Plans.

2. Actual joint dimension and orientation vary. For Intermediate Deck Joints use the Modified Post Spacing at Intermediate Deck Joints Detail, Index No. 470, Sheet 2, as required.

3. Areas where existing structure has been removed shall match adjoining areas and shall be finished flat by grouting or grinding as required. Exposed existing reinforcing steel shall be burned off 1" below existing concrete and grouted over.

CROSS REFERENCES:
For Section A-A see Sheet 2.
For Traffic Railing Notes and Details see Index No. 470.
SECTION A-A
TYPICAL SECTION THRU RAILING ON BRIDGE DECK

BILL OF REINFORCING STEEL

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BAR BENDING DIAGRAMS

- DOWEL BAR 4D (Standard 180° Hook)
- DOWEL BAR 4L

NOTES:
1. All bar dimensions are out to out.
2. The 1'-2" vertical dimension shown for Bar 4D is based on a curb height of 9". If curb height is less or more than 9", decrease or increase this dimension by an amount equal to the difference in curb height.

SECTION B-B
TYPICAL SECTION THRU RAILING ALONG APPROACH SLAB
(SCHEM 2 SHOWN, SCHEME 3 SIMILAR)

Asphalt Overlay when present (Varies)

Existing Approach Slab

Varies

See Detail "A"

Final Riding Surface

Asphalt Overlay when present (Varies)

Final Riding Surface

Existing Bridge Deck

1 - Anchor Plate with
2 - Plate Washers
(See Index No. 470)

Depth of Plumb (Max.)

Exsiting Curb

1 1/4" ± 1" Out

Thrie-Beam Guardrail

Existing Wing Wall

Embed. 5" Min.

Existing Traffic Railing

Thrie-Beam Guardrail

Guardrail Post Assembly "A", "B" or "C" (See Roadway Plans)

2 - 1 1/8" Ø x 1 1/2" Post Bolts
and Recessed Nuts

2 - 1 1/8" Ø x 8" Adhesive-Bonded Anchors with Heavy Hex Nuts and Washers set in drilled holes (5/8" Max. Depth)

2 - 1 1/8" Ø x 8" Adhesive-Bonded Anchors with Heavy Hex Nuts and Washers set in drilled holes (5 1/8" Max. Depth)

2 - 1" Ø x 10" x 5/8" Thick Neoprene Pad

Asphalt Overlay when present (Varies)

Exsisting Wing Wall

5" Min.

1'-2"x 10"x 1 8" Thick Neoprene Pad

Guardrail Post Assembly "A", "B" or "C" (See Roadway Plans)

1/8" ± 1/2" Out

Thrie-Beam Guardrail

Control Line

Top of Curb

DETAIL "A"

TYPICAL SECTION THRU EXISTING TRAFFIC RAILING SHOWING LIMITS OF REMOVAL
(BRIDGE DECK SHOWN, WING WALL SIMILAR)

CROSS REFERENCES:
For location of Section A-A see Sheets 1, 3 & 4.
For location of Section B-B see Sheets 3 & 4.
For application of Dim. A see Post Dimension Table on Index 470, Sheet 3.

NOTES:
1. All bar dimensions are out to out.
2. The 1'-2" vertical dimension shown for Bar 4D is based on a curb height of 9". If curb height is less or more than 9", decrease or increase this dimension by an amount equal to the difference in curb height.

* Shim with washers around Anchors as required to maintain tolerance.
** Offset may vary ± 1" for Adhesive-Bonded Anchors to clear existing curb reinforcing and provide minimum edge clearance. Offset shall be consistent along length of bridge.
SCHEME 1 NOTES:
1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.
2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

SCHEME 2 NOTES:
1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.
2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
**SCHEME 3 NOTES:**

1. Provide Cast-In-Place Curb as shown. Shape and height of Transition Block and Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field cut and bend Bars 4A and rotate Dowel Bars 4B within Curb and Transition Block as required to maintain 2” top and side clearance and 3” bottom clearance.

3. A single ½” Ø x 8” Adhesive-Bonded Anchor may be omitted as shown when 2” clear cover cannot be provided.
NOTES:
1. On approach end provide Index No. 402 (as shown) or other site specific treatment, see Roadway Plans. For treatment of trailing end see Roadway Plans.
2. Actual joint dimension and orientation vary. For Intermediate Deck Joints use the Modified Post Spacing at Intermediate Deck Joints Detail, Index No. 470, Sheet 2, as required.
3. Areas where existing structure has been removed shall match adjoining areas and shall be finished flat by grouting or grinding as required. Exposed existing reinforcing steel shall be burned off 1" below existing concrete and grouted over.

CROSS REFERENCES:
For Section A-A see Sheet 2.
For Traffic Railing Notes and Details see Index No. 470.

Existing Bridge Deck
Existing Bridge Coping
Gutter Line

Front Face of Three-Beam Guardrail
Direction of Traffic

PARTIAL PLAN OF RAILING

@ Post Bolts and Match Line (Approach End) (See Sheets 3 and 4)
6'-3" spacing (Typ. except as noted along Bridge, see Note 2)

@ Post Bolts
1'-6" Min. for non skewed joints. For treatment of skewed Intermediate Deck Joints see Skew Detail Index No. 470, Sheet 2 (Typ.)

PARTIAL ELEVATION OF INSIDE FACE OF RAILING
(Existing Traffic Railing not shown for clarity)

TYPICAL TREATMENT OF RAILING ALONG BRIDGE
**SECTION A-A**

**TYPICAL SECTION THRU RAILING ON BRIDGE DECK**

- **Dowel Bar 4D**
- **Dowel Bar 4L**
- **Dowel Bar 4M**

**BAR BENDING DIAGRAMS**

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**NOTE:** All bar dimensions are out to out.

**BILL OF REINFORCING STEEL**

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**SECTION B-B**

**TYPICAL SECTION THRU RAILING ALONG APPROACH SLAB**

(SCHMES 5 AND 6 SHOWN, SCHEMES 3 AND 4 SIMILAR)

**NOTE:** All bar dimensions are out to out.

**BAR BENDING DIAGRAMS**

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**NOTE:** All bar dimensions are out to out.

**VIEW C-C**

- **Existing Wing Post**
- **Existing Curb Overhang**
- **Existing Bridge Deck**
- **Existing Traffic Railing**
- **Guardrail Post Assembly**
- **Adhesive-Bonded Anchors**
- **Heavy Hex Nuts and Washers**

**CROSS REFERENCES:**

- For location of Section A-A see Sheets 1, 3 & 4.
- For location of Section B-B see Sheet 4.
- For location of View C-C see Sheet 3.
- For application of Dim. A see Post Dimension Table on Index 470, Sheet 3.
1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4D within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

SCHEME 1 NOTES:

1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4D within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

SCHEME 2 NOTES:

1. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend to end of Approach Slab. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4D and Bars 4M within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
NOTES:
1. On approach end provide Index No. 402 (as shown) or other site specific treatment, see Roadway Plans. For treatment of trailing end see Roadway Plans.
2. Actual joint dimension and orientation vary. For Intermediate Deck Joints use the Modified Post Spacing at Intermediate Deck Joints Detail, Index No. 470, Sheet 2, as required.
3. Areas where existing structure has been removed shall match adjoining areas and shall be finished flat by grouting or grinding as required. Exposed existing reinforcing steel shall be burned off 1" below existing concrete and grouted over.

Cross References:
For Section A-A see Sheet 2.
For Traffic Railing Notes and Details see Index No. 470.

Typical Treatment of Railing Along Bridge

Partial Plan of Railing

Partial Elevation of Inside Face of Railing (Existing Traffic Railing not shown for clarity)
SECTION A-A
TYPICAL SECTION THRU RAILING ON BRIDGE DECK

SECTION B-B
TYPICAL SECTION THRU RAILING ALONG APPROACH SLAB
(SCHEMES 5 AND 6 SHOWN, SCHEMES 3 AND 4 SIMILAR)

BILL OF REINFORCING STEEL

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BAR BENDING DIAGRAMS

Dowel Bar 4D
2'-8" x 2'-8"

Dowel Bar 4L
2'-8" x 2'-8"

BAR 4M
3'-7"

NOTE: All bar dimensions are out to out.

* Shim with washers around Anchor Bolts and Anchors as required to maintain tolerance.

** Offset may vary ± 1" for Adhesive-Bonded Anchors and Anchor Bolts to clear existing curb reinforcing and provide minimum edge clearance. Offset shall be consistent along length of bridge.

VIEW C-C

DETAIL "A"

CROSS REFERENCES:
For location of Section A-A see Sheet 1, 3 and 4.
For location of Section B-B see Sheet 4.
For location of View C-C see Sheet 4.
For Trafficing Notes and Details see Index No. 470.
For application of Dim. A see Post Dimension Table on Index 470, Sheet 3.
TRAFFIC RAILING - (THRIE-BEAM RETROFIT)  
WIDE STRONG CURB TYPE 2

SCHEME 1  
RAILING END TREATMENT FOR PERPENDICULAR OR ANGLED WING WALLS

1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

SCHEME 2  
RAILING END TREATMENT FOR PARALLEL OR FLARED CURBS WITH DETACHED SIDEWALKS OR INTEGRAL SIDEWALK LESS THAN 6" THICK

1. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend to end of Approach Slab. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend or tilt Dowel Bars 4D and Bars 4M within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

DESIGN STANDARDS  
FY 2017-18
PARTIAL PLAN OF RAILING

Varies (6'-3" Max, 3'-11/2" Min)  
(Typ. along Approach Slab)  
Post Spacing Scheme 3 as  
measured to Post Bolts  
(Typ. along Approach Slab)  
Post Spacing Scheme 4 as  
measured to Key Post  

Asphalt Overlay when present (Varies)  
Guardrail Post Assembly (Typ.)  

PARTIAL ELEVATION OF INSIDE FACE OF RAILING  
(Existing Wing Post and Traffic Railing not shown for clarity)

SCHEMES 3 AND 4

RAILING END TREATMENT FOR FLARED INTEGRAL CURBS

SCHEMES 5 AND 6

RAILING END TREATMENT FOR PARALLEL INTEGRAL CURBS

NOTES:
1. Provide Transition Block (as shown) or Curb if existing Approach Slab fits do not extend to end of Approach Slab. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
Guardrail Post Assembly with Offset Block (Typ.)

Intermediate Deck Joint (See Note 2)

Existing Curb

Existing Bridge Curb

Existing Bridge Deck

Front Face of Thrie-Beam Guardrail

Direction of Traffic

PARTIAL PLAN OF RAILING

\( \frac{1}{8} \) Post Bolts and Match Line (Approach End) (See Sheets 3 and 4)

\( \frac{1}{8} \) Post Bolts and Match Line (Trailing End) (See Sheets 3 and 4)

6'-3" spacing (Typ. except as noted along Bridge, see Note 2)

1'-6" Min. for non skewed joints. For treatment of skewed Intermediate Deck Joints see Skew Detail Index No. 470, Sheet 2 (Typ.)

Intermediate Deck Joint (See Note 2)

1\( \frac{1}{8} \) Post

Asphalt Overlay when present

Thrie-Beam Guardrail

Final Riding Surface

Existing Bridge Deck

PARTIAL ELEVATION OF INSIDE FACE OF RAILING

TYPICAL TREATMENT OF RAILING ALONG BRIDGE

NOTES:
1. On approach end provide Index No. 402 (as shown) or other site specific treatment, see Roadway Plans. For treatment of trailing end see Roadway Plans.
2. Actual joint dimension and orientation vary. For Intermediate Deck Joints use the Modified Post Spacing at Intermediate Deck Joints Detail, Index No. 470, Sheet 2, as required.
3. Areas where existing structure has been removed shall match adjoining areas and shall be finished flat by grouting or grinding as required. Exposed existing reinforcing steel shall be burned off 1" below existing concrete and grouted over.

CROSS REFERENCES:
For Match Line see Sheets 3 & 4.
For Section A-A see Sheet 2.
For Traffic Railing Notes and Details see Index No. 470.
**SECTION A-A**

**TYPICAL SECTION THRU RAILING ON BRIDGE DECK**

**BILL OF REINFORCING STEEL**

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**BAR BENDING DIAGRAM**

3'-8" DOWEL BAR 4L

**NOTE:** All bar dimensions are out to out.

**TYPICAL SECTION THRU EXISTING TRAFFIC RAILING SHOWING LIMITS OF REMOVAL (BRIDGE DECK SHOWN, WING WALL SIMILAR)**

**SECTION B-B (SCHEME 2)**

**TYPICAL SECTION THRU RAILING ALONG APPROACH SLAB**

* Shin with washers around Anchor Bolts and Anchors as required to maintain tolerance.

**Offset may vary ± ½" for Adhesive-Bonded Anchors to clear existing curb reinforcing and provide minimum edge clearance. Offset shall be consistent along length of bridge.

**CROSS REFERENCES:**

For location of Section A-A see Sheet 1 and 3.
For location of Section B-B see Sheet 3.
For application of Dim. A see Post Dimension Table on Index 470, Sheet 3.

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**FY 2017-18 DESIGN STANDARDS**

**TRAFFIC RAILING - (THRIE-BEAM RETROFIT) INTERMEDIATE CURB**

**INDEX NO.**

474

**SHEET NO.**

2 of 4
**SCHEME 1 NOTES:**

1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

**SCHEME 2 NOTES:**

1. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend to end of Approach Slab. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
SCHEME 3
RAILING END TREATMENT FOR FLARED WING WALLS

PARTIAL ELEVATION OF INSIDE FACE OF RAILING

PARTIAL PLAN OF RAILING

SCHEME 3 NOTE:
1. A single \( \frac{3}{8} \) \( \times \) 8" Adhesive-Bonded Anchor may be omitted as shown when 2" clear cover cannot be provided (see Section C-C).

CROSS REFERENCE:
For application of Dim. A see Post Dimension Table on Index 470, Sheet 3.
NOTES:

1. On approach end provide Index No. 402 (as shown) or other site specific treatment, see Roadway Plans. For treatment of trailing end see Roadway Plans.

2. Actual joint dimension and orientation vary. For Intermediate Deck Joints use the Modified Post Spacing at Intermediate Deck Joints Detail, Index No. 470, Sheet 2, as required.

3. Areas where existing structure has been removed shall match adjoining areas and shall be finished flat by grouting or grinding as required. Exposed existing reinforcing steel shall be burned off 1" below existing concrete and grouted over.

CROSS REFERENCES:
For Section A-A see Sheet 2.
For Traffic Railing Notes and Details see Index No. 470.

TYPICAL TREATMENT OF RAILING ALONG BRIDGE

PARTIAL PLAN OF RAILING

PARTIAL ELEVATION OF INSIDE FACE OF RAILING (Existing Traffic Railing not shown for clarity)

TYPICAL TREATMENT OF RAILING ALONG BRIDGE
1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4D and Bars 4M within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

SCHEME 2 NOTES:

1. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend to end of Approach Slab. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic and on bridges with flared Approach Slab Curb.

2. Field bend Dowel Bars 4D and Bars 4M within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
SCHEMES 3 AND 4

RAILING END TREATMENT FOR FLARED INTEGRAL CURBS

PARTIAL ELEVATION OF INSIDE FACE OF RAILING
(Existing Wing Post and Traffic Railing not shown for clarity)

SCHEMES 5 AND 6

RAILING END TREATMENT FOR PARALLEL INTEGRAL CURBS

1. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend to end of Approach Slab. Shape and height of existing Block or Curb shall match existing edge curb. Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
NOTES:
1. On approach end provide Index No. 402 (as shown) or other site specific treatment, see Roadway Plans.
   For treatment of trailing end see Roadway Plans.
2. Actual joint dimension and orientation vary. For Intermediate Deck Joints use the Modified Post Spacing
   at Intermediate Deck Joints Detail, Index No. 470, Sheet 2, as required.
3. Areas where existing structure has been removed shall match adjoining areas and shall be finished flat by
   grouting or grinding as required. Exposed existing reinforcing steel shall be burned off 1’ below existing
   concrete and grouted over.

CROSS REFERENCES:
For Section A-A see Sheet 2.
For Traffic Railing Notes and Details see Index No. 470.
**SECTION A-A**

**TYPICAL SECTION THRU RAILING ON BRIDGE DECK**

**BILL OF REINFORCING STEEL**

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<td>4</td>
<td>3'-7&quot;</td>
</tr>
<tr>
<td>L</td>
<td>4</td>
<td>8'-1&quot;</td>
</tr>
<tr>
<td>M</td>
<td>4</td>
<td>2'-8&quot;</td>
</tr>
</tbody>
</table>

**BAR BENDING DIAGRAMS**

- **DOWEL BAR 4D**
- **DOWEL BAR 4L**
- **BAR 4M**

**NOTE:** All bar dimensions are out to out.

**SECTION B-B**

**TYPICAL SECTION THRU RAILING ALONG APPROACH SLAB**

(SCHEMES 5 AND 6 SHOWN, SCHEMES 3 AND 4 SIMILAR)

- **Thrie-Beam Guardrail**
- **Guardrail Post Assembly "A", "B" or "C"**
- **Asphalt Overlay when present**
- **Existing Curb Overhang**
- **Existing Wing Post**
- **Existing Wing Wall**

**CROSS REFERENCES:**

- For location of Section A-A see Sheet 1, 3 & 4.
- For location of Section B-B see Sheet 4.
- For location of Section C-C see Sheet 3.
- For application of Dim. A see Post Dimension Table on Index 470, Sheet 3.
PARTIAL PLAN OF RAILING
(See Note 1, Sheet 1)

PARTIAL ELEVATION OF INSIDE FACE OF RAILING
(Existing Wing Post and Traffic Railing not shown for clarity)

SCHEME 1
RAILING END TREATMENT FOR PERPENDICULAR OR ANGLED WING WALLS

SCHEME 1 NOTES:
1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic.
2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

SCHEME 2
RAILING END TREATMENT FOR PARALLEL OR FLARED CURBS WITH DETACHED SIDEWALKS OR INTEGRAL SIDEWALK LESS THAN 6" THICK

SCHEME 2 NOTES:
1. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend to end of Approach Slab. Shape and height of Transition Block or Curb shall match existing bridge curb. Transition Block may be omitted on trailing ends with no opposing traffic. On approaches with flared Approach Slab Curb, Transition Block may be omitted on trailing ends with no opposing traffic.
2. Field bend or tilt Dowel Bars 4D and Bars 4M within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
NOTES:

1. Dimensions and elevations for existing guardrails to be verified by the Contractor before beginning construction.

2. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend to end of Approach Slab. Shape and height of the traffic face of Transition Block or Curb shall match existing bridge curb. See Sheet 4 for Transition Block details. Block may be omitted on trailing ends with no opposing traffic.

3. Do not bolt nested rails to the blocks and posts at posts (a), (c) & (e).

4. Limits of Payment for Thrie-Beam Panel Retrofit

Traffic Railing (Thrie-Beam Panel Retrofit) - Class B (10 Gauge) Panels

Guardrail Approach Transition

PARTIAL ELEVATION - APPROACH TRANSITION

Guardrail Post (Typ.)

PARTIAL PLAN - APPROACH TRANSITION

W-Beam Guardrail - See Index 400

Transit Section

Direction of Adjacent Traffic

Wingwall mounted railing section (if present; length varies)

Wingwall mounted railing section (if present; length varies)

Guardrail Trailing End Transition

Traffic Railing (Thrie-Beam Panel Retrofit) - Class B (10 Gauge) Panels

PARTIAL ELEVATION - TRAILING END TRANSITION

Elevations for existing guardrails to be verified by the Contractor before beginning construction.
Traffic Railing

Existing Concrete

1" Joint

Open Joint (Varies)

Wingwall mounted railing section

(At present, length varies)

Begin or End Bridge

Existing Curb

Existing Bridge Deck

Existing Concrete Traffic Railing

5\(\frac{1}{2}\) x 10\(\frac{1}{2}\) x 2" Wood Block (Typ.)

ELEVATION VIEW A-A

(At Double Posts)

(View at Intermediate Double Posts shown;
View at Expansion Joints similar)

Existing Curb

Existing Bridge Deck

ELEVATION VIEW A-A

(At Single Post)

5\(\frac{1}{2}\) x 10\(\frac{1}{2}\) x 2" Wood Block (Typ.)

Existing Curb

Existing Bridge Deck

ELEVATION VIEW A-A

(At End Post)

8\(\frac{1}{2}\) x Post Bolt, Nut, Round Washer & Plate Washer (Typ.)

8\(\frac{1}{2}\) x Post Bolt, Nut, Round Washer & Plate Washer (Typ.)

8\(\frac{1}{2}\) x Post Bolt, Nut, Round Washer & Plate Washer (Typ.)

8\(\frac{1}{2}\) x Post Bolt, Nut, Round Washer & Plate Washer (Typ.)

8\(\frac{1}{2}\) x Post Bolt, Nut, Round Washer & Plate Washer (Typ.)

Existing Reinforcement

Asphalt Overlay

(W/present)

(Thickness varies)

Existing Curb

Existing Bridge Deck

(Thickness varies)

Existing Concrete Traffic Railing

5\(\frac{1}{2}\) x 10\(\frac{1}{2}\) x 2" Wood Block (Typ.)

Wedge Shaped Wood Block**

(when required)

Wedge Shaped Wood Block**

Wood Block (Typ.)

Wedge Shaped Wood Block**

Wood Block (Typ.)

Wood Block (Typ.)

Wood Block (Typ.)

Wedge Shaped Wood Block**

ELEVATION VIEW A-A

(At Single Post)

* Measured from edge of existing Post. Bolts may be installed at either side of any Post.

NOTES:

1. Post Bolts shall be 5\(\frac{1}{2}\) ø x 14' long set in 7\(\frac{1}{2}\) ø core drilled holes, see Sheet No. 1.

2. Shift Post Bolt holes minimally inward toward center of posts if existing reinforcement is encountered during drilling of holes. If reinforcement is still encountered, notify the Engineer before proceeding with drilling.

3. Post Bolt spacing not to exceed 8'-0" (± 1').

For End Posts with an existing wedge shaped wood block, remove existing wood block and replace with new Wedge Shaped Wood Block (See Sheet 1 for notes and details).
PLAN VIEW OF TRANSITION BLOCK
(GUARDRAIL NOT SHOWN FOR CLARITY)

ELEVATION OF TRANSITION BLOCK
(GUARDRAIL AND POSTS NOT SHOWN FOR CLARITY)

ESTIMATED QUANTITIES PER TRANSITION BLOCK

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Class II (Bridge Deck)</td>
<td>CF</td>
<td>0.4</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LB</td>
<td>61</td>
</tr>
<tr>
<td>Guardrail (Reset)</td>
<td>LF</td>
<td>12.5</td>
</tr>
</tbody>
</table>

NOTES:

ANCHOR RODS: Steel Anchor Rods shall be ASTM A36, ASTM A709 Grade 36 or ASTM A615 Grade 60 hot-dip galvanized in accordance with Specification Section 962.

ADHESIVE-BONDED DOWELS: Adhesive Bonding Material Systems for Dowels shall comply with Specification Section 937 (Type HV) and be installed in accordance with Specification Section 416.

Adhesive Bonded Dowels are shown installed in an existing curb or sidewalk integrally reinforced with Approach Slab, Wingwall or Bridge Deck. For installations in existing detached curbs or sidewalks, install dowels in available sound concrete.

Shift bars (as needed) to install six dowels into existing bridge or approach slab mounted curb.
This Traffic Railing Retrofit has been structurally evaluated to be equivalent or greater in strength to a design which has been successfully crash tested previously and approved for a NCHRP Report 350 Test Level 4 rating, except for the Tapered End Transition on Index No. 484.

CONCRETE: Concrete for the Traffic Railing (Vertical Face Retrofit), Spread Footing Approaches and replacement curb sections shall be Class IV. Concrete for Curb Transition Blocks shall be Class II (Bridge Deck).

REINFORCING STEEL: Reinforcing steel shall be ASTM A615, Grade 60, except Expansion Dowel Bar B which shall be ASTM A36 smooth round bar hot-dip galvanized in accordance with the Specifications.

EXPANSION SLEEVE ASSEMBLY: Pipe sleeve shall be ASTM D2241 PVC pipe, SDR13.5. End Cap shall be ASTM D2466 PVC socket fitting, Schedule 40. End of Sleeve assembly at railing open joint shall be sealed with silicone to prevent concrete intrusion during railing casting. A compressible expanded polystyrene plug is required in the opposite end of the assembly for correct dowel positioning during railing casting. Correct dowel positioning is required in order to provide for thermal movement of the deck.

ADHESIVE-BONDED ANCHORS AND DOWELS: Adhesive Bonding Material Systems for Anchors and Dowels shall comply with Specification Section 937 and be installed in accordance with Specification Section 416. The field testing proof loads required by Specification Section 416 shall be 23,800 lbs for Dowel Bars 6D on the inside face (traffic side) of the railing (1'-0" embedment) and 18,500 lbs for Dowel Bars 6D along the outside face of the traffic railing (5' min. embedment).

BRIDGES ON CURVED ALIGNMENTS: The details presented in these Standards are shown for bridges on tangent alignments. Details for bridges on horizontally curved alignments are similar.

NAME, DATE AND BRIDGE NUMBER: The Name and Bridge Number shall be placed on the Traffic Railing so as to be seen on the driver's right side when approaching the bridge. The Date shall be placed on the driver's left side when approaching the bridge. The Date shall be the year the bridge was constructed. Letters and figures may be 3" tall black plastic as approved by the Engineer or V-Grooves. V-Grooves shall be formed by preformed letters and figures.

ELEVATION MARKERS: Elevation Markers need not be replaced when portions of the existing traffic railing carrying existing elevation markers are removed.

BARRIER DELINERATORS: Barrier Delineators shall meet Specification Section 993. Install Barrier Delineators on top of the Traffic Railing 2' from the edge of the traffic side at the spacing shown in the table below. Barrier Delineator color (white or yellow) shall match the color of the near edgeline.

PAYMENT: Payment under Traffic Railing (Vertical Face Retrofit) includes all materials and labor required to construct the railing and incidental work as required for transition blocks, curbs, spread footing approaches, and Barrier Delineators.

CONCRETE: Concrete for the Traffic Railing (Vertical Face Retrofit), Spread Footing Approaches and replacement curb sections shall be

ITEM | UNIT | QUANTITY | 9" CURB | INCREMENT
--- | --- | --- | --- | ---
Concrete | CY/FT | 0.064 | 0.003 per in. height
Reinforcing Steel | LB/FT | 13.27 | 0.10 per in. length

(Quantities are based on a 9" curb, no curb cross slope and 1'-0" embedment length of Bars 6D. If the curb height or embedment length differs from that shown, increase or decrease quantity by the given per inch increment.) See Index No. 484, Sheet 4 for Spread Footing Approach Quantities.
1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement in the Vertical Face Retrofit Railing shall have a 2" minimum cover.
3. Expansion Dowel Bars B shall be ASTM A36 smooth round bar and hot-dip galvanized in accordance with the Manufacturer's Requirements.
4.XR 5S may be continuous or spliced at the construction joints. Bar splices for Bars 5S shall be a minimum of 2'-2".
5. Expansion Dowel Bars B shall be ASTM A36 smooth round bar and hot-dip galvanized in accordance with the Specifications.
SCHEME 1 NOTES:

1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Rail End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

SCHEME 2 NOTES:

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is on the bridge, see Index No. 481, Sheet 1. On skewed bridges, if the skew along the deck joint extends across the width of the railing, the 2'-6" minimum dimension shall apply to both the front and back face of the railing.

2. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Rail End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

3. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
SCHEME 3 NOTE:

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1.
**TYPICAL TREATMENT OF RAILING ALONG BRIDGE**

1. On approach end provide a Roadway Guardrail Transition, Index No. 402 (as shown) or other site specific treatment. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is on the bridge, attach Thrie-Beam Connector to railing as shown above. Bar's 4C not shown for clarity.

2. Field cut Bars 5S and Dowel Bars 6D to maintain clearance within Vertical Face Retrofit Railing.

3. Where existing structure has been removed and not encased in new concrete; match adjoining areas and finish flat by grading or grading as required. Exposed existing reinforcing steel not encased in new concrete shall be burned off 1" below existing concrete and ground over.

**NOTES:**

1. On approach end provide a Roadway Guardrail Transition, Index No. 402 (as shown) or other site specific treatment. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is on the bridge, attach Thrie-Beam Connector to railing as shown above. Bar's 4C not shown for clarity.

2. Field cut Bars 5S and Dowel Bars 6D to maintain clearance within Vertical Face Retrofit Railing.

3. Where existing structure has been removed and not encased in new concrete; match adjoining areas and finish flat by grading or grading as required. Exposed existing reinforcing steel not encased in new concrete shall be burned off 1" below existing concrete and ground over.

**TYPICAL SECTION THRU EXISTING APPROACH SLAB AND END BENT WING WALL SHOWING LIMITS OF REMOVAL (SCHEMES 4 AND 5 ONLY)**

**CROSS REFERENCE:**

For General Notes, Estimated Quantities, Dowel Detail, Expansion Dowel Detail, Reinforcing Steel Notes & Bending Diagrams see Index No. 480.
Dowel Bars 4L (10" Embedment) (Place 3 Bars Min. Top and 1 Bar Min. Bottom)

Existing Approach Slab

Place first post 2" clear of Wing Wall

PARTIAL ELEVATION OF INSIDE FACE OF GUARDRAIL
(Existing Wing Post not shown for clarity)

SCHEME 1
RAILING END TREATMENT FOR PERPENDICULAR OR ANGLED WING WALLS

SCHEME 1 NOTES:
1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.

3. If a Special Steel Guardrail Post is required for attachment to the top of a sloping Wing Wall, saw cut and remove a wedge shaped portion of the sloping Wing Wall as required to provide a level surface for post installation.

SCHEME 2
RAILING END TREATMENT FOR PARALLEL CURBS

SCHEME 2 NOTES:
1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrive-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1. On skewed bridges, if the skew along the deck joint extends across the width of the railing, the 2'-6" minimum dimension shall apply to both the front and back face of the railing.

2. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend beyond end of existing End Bent Wing Wall, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.

3. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
Existing Approach Slab

<table>
<thead>
<tr>
<th>PARTIAL PLAN OF RAILING</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAILING END TREATMENT FOR FLARED CURBS</td>
</tr>
<tr>
<td>SCHEME 3</td>
</tr>
</tbody>
</table>

SCHEME 3 NOTES:

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is on the bridge, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1.

2. Dowel Bars 4N may be installed on a maximum angle of 45° to the cut edge of the Approach Slab as shown above. Dowel Bar 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes using an Adhesive Bonding Material System with a 1'-0" minimum embedment.

3. At the Contractor's option, along the length of the Approach Slab curb that is to be replaced, Dowel Bars 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes in the new section of curb using an Adhesive Bonding Material System with a 1'-0" minimum embedment.

Existing Curb

PARTIAL ELEVATION OF INSIDE FACE OF RAILING

Organic Felt bond breaker along joint

TRAFFIC RAILING - (VERTICAL FACE RETROFIT) WIDE CURB

SCHEME 4 NOTES:

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is on the bridge, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1.

2. Dowel Bars 4N may be installed on a maximum angle of 45° to the cut edge of the Approach Slab as shown above. Dowel Bar 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes using an Adhesive Bonding Material System with a 1'-0" minimum embedment.

3. At the Contractor's option, along the length of the Approach Slab curb that is to be replaced, Dowel Bars 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes in the new section of curb using an Adhesive Bonding Material System with a 1'-0" minimum embedment.

Existing Approach Slab

PARTIAL ELEVATION OF INSIDE FACE OF RAILING

(SCHEME 3)

(SCHEME 4)

Existing Wing Post, Railing Reinforcing and Expansion Dowel Assemblies not shown for clarity

Existing Curb

Dowel Bars 6D @ 1'-3" Spacing Max. (Front Face only)

Bars 5S (Field Bend) (Typ.)

Dowel Bars 6D @ 1'-3" Spacing Max. (Back Face only)

Bars 6D @ 1'-3" Spacing Max. (Front Face only)

Bars 4C (Typ.)

Asphalt Overlay when present (Varies)

Final Riding Surface

Varies (Match Length of Existing Flared Curbs)

Asphalt Overlay when present (Varies)

Final Riding Surface

Varies (Match Length of Existing Flared Curbs)

Front Face of Backwall, Begin or End Bridge & Match Line (See Sheet 1)

Parallel Portion of Vertical Face Retrofit Railing if present (See Note 1)

Limiting Station of Transition (See Note 1 Below & Note 1, Sheet 1)

Roadway Guardrail Transition (See Note 1 Below & Note 1, Sheet 1)

(Existing Wing Post, Railing Reinforcing and Expansion Dowel Assemblies not shown for clarity)
### SCHEME 5

**RAILING END TREATMENT FOR PARALLEL CURBS**

1. **PARTIAL PLAN OF RAILING**
   - Existing Wing Post (Type Varies)
   -有机硅紧固件连接处
2. **PARTIAL ELEVATION OF INSIDE FACE OF RAILING**
   - 有机硅紧固件连接处

### Notes:
1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1.
2. Dowel Bars 6D may be cast in with new section of curb as shown to facilitate drilling of holes and installation of bars.
3. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend beyond end of existing End Bent Wing Wall, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.
4. Field bend Dowel Bars 4M within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
5. At the Contractor's option, along the length of the Approach Slab curb that is to be replaced, Dowel Bars 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes in the new section of curb using an Adhesive Bonding Material System with a 1'-0" minimum embedment.

### Traffic Railing - (Vertical Face Retrofit)

**Wide Curb**

| Varies (3 Preferred, |
| 2'-0" Min., constant for Full length of Retrofit) |
| 8" | 31" |

**SCHEME 5 NOTES:**

1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1.
2. Dowel Bars 4M may be installed on a maximum angle of 45° to the cut edge of the Approach Slab as shown to facilitate drilling of holes and installation of bars.
3. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend beyond end of existing End Bent Wing Wall, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on trailing ends with no opposing traffic.
4. Field bend Dowel Bars 4M within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
5. At the Contractor's option, along the length of the Approach Slab curb that is to be replaced, Dowel Bars 6D may be cast in with the new section of curb as shown or they may be installed in drilled holes in the new section of curb using an Adhesive Bonding Material System with a 1'-0" minimum embedment.
**Coping Distance**

Existing Approach Slab

1. On approach end provide a **Roadway Guardrail Transition**, Index No. 402 (as shown) or other site specific treatment. See **Roadway Plans** for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is on the bridge, attach **Thrie-Beam Terminal Connector** to railing as shown above. If limiting station of Roadway Guardrail Transition is along the Wing Wall, see Schemes 2 or 3, Sheets 2 & 3. On skewed bridges, if the skew along the deck joint extends across the width of the railing, the 2'-6" minimum dimension shall apply to both the front and back face of the railing. For treatment of trailing end see **Roadway Plans**. If vertical face retrofit extends beyond bridge and approach slab ends, see Index No. 484 for treatment and Details.

2. Field cut Bars 5S and Dowel Bars 6D to maintain clearance within Vertical Face Retrofit Railing.

3. Where existing structure has been removed and not encased in new concrete; match adjoining areas and finish flat by grouting or grinding as required. Exposed existing reinforcing steel not encased in new concrete shall be burned off 1" below existing concrete and grouted over.

**Expansion Dowel & Bars 4C not required at end of railing for Scheme 1, except where traffic railing retrofit extends beyond ends of bridge, see Index No. 484.**

**Provide 1/2 Intermediate Open Joints at:**

1) **Superstructure supports** where slab is continuous.

2) Curb heights vary from 5" Min. to 1'-2" Max.

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.

**Provide 1" Intermediate Open Joints at:**

1) Superstructure supports where slab is continuous.

2) Curb heights vary from 5" Min. to 1'-2" Max.

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.

**Curb heights vary from 5" Min. to 1'-2" Max.**

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.

**Provide bond breaker at:**

1) Existing Approach Slab

2) Expansion Dowel & Bars 4C not required

3) Superstructure supports where slab is continuous.
SCHEME 1 NOTES:
1. Provide Transition Block (as shown) or Curb if existing Approach Slab does not have a curb, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on truss ends with no opposing traffic.
2. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
3. If a Special Steel Guardrail Post is required for attachment to the top of a sloping Wing Wall, saw cut and remove a wedge shaped portion of the sloping Wing Wall as required to provide a level surface for post installation.

SCHEME 2 NOTES:
1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1. On skewed bridges, if the skew along the deck joint extends across the width of the railing, the 2'-6" minimum dimension shall apply to both the front and back face of the railing.
2. Provide Transition Block (as shown) or Curb if existing Approach Slab Curb does not extend beyond end of existing End Bent Wing Wall, see Roadway Plans. Shape and height of Transition Block or Curb shall match existing bridge curb. Railing End Transition and Transition Block may be omitted on truss ends with no opposing traffic.
3. Field bend Dowel Bars 4L within Transition Block as required to maintain 2" top and side clearance and 3" bottom clearance.
EXISTING END BENT WING WALL

EXISTING APPROACH SLAB

EXISTING CURB

FINAL RIDING SURFACE

ASPHALT OVERLAY WHEN PRESENT (VARIES)

LIMITING STATION OF TRANSITION

VARES (1'-0" MIN.)

SCHEME 3 NOTE:
1. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment. If limiting station of Roadway Guardrail Transition is along the Wing Wall, attach Thrie-Beam Terminal Connector to railing as shown above. If limiting station of Roadway Guardrail Transition is on the bridge, see Sheet 1.

PARTIAL PLAN OF RAILING

Dowel Bars 6D @ 1'-3" Spacing Max (Front and Back row of bars only)

Bars 5S (Field Bend)

PULLS (1'-0" MIN.)

BEGIN FlARED PORTION OF VERTICAL FACE RETROFIT RAILING

ROADWAY GUARDRAIL TRANSITION

(See Note 1, This Sheet & Note 1, Sheet 1)

EXISTING CURB

EXISTING END BENT WING WALL

PARTIAL ELEVATION OF INSIDE FACE OF RAILING

(Railing Reinforcing and Expansion Dowel Assemblies not shown for clarity)

SCHEME 3

RAILING END TREATMENT FOR FLARED WING WALLS
**Design Notes:**

1. The minimum length of advancement for both near lane and opposing lane approaches is 20'.
2. For Design Speeds greater than 40 mph the Tapered End Transition is not permitted. See Index No. 400 for length of Advancement of guardrail or other project-specific end treatments.

**Design Speed** (mph) | **Length of Advancement, Ft. (X)**
--- | ---
≤ 40 | = 16 (D-d)

Notes:
- The minimum length of advancement for both near lane and opposing lane approaches is 20'.
- For Design Speeds greater than 40 mph the Tapered End Transition is not permitted. See Index No. 400 for length of Advancement of guardrail or other project-specific end treatments.

D = Distance in feet from near edge of near approach traffic lane to either:
- the back of hazard, when the hazard is located inside the clear zone or horizontal clearance;
- the clear zone or horizontal clearance outer limits, when hazard extends to, or goes beyond the clear zone or horizontal clearance limits.

For left side hazards on two-way undivided facilities, "D" is measured from the inside edge of the near approach traffic lane as shown above.

D = Distance in feet from near edge of near approach traffic lane to face of traffic railing (at offset control point). For left side hazards on two-way undivided facilities, "D" is measured from the inside edge of the nearest opposing traffic lane as shown above.

≤ 40

**Design Notes:**

- The Tapered End Transition should only be used when space is limited which precludes the use of a guardrail end treatment or crash cushion.

- D = Distance in feet from near edge of near approach traffic lane to either:
  - the back of hazard, when the hazard is located inside the clear zone or horizontal clearance;
  - the clear zone or horizontal clearance outer limits, when hazard extends to, or goes beyond the clear zone or horizontal clearance limits.

- For left side hazards on two-way undivided facilities, "D" is measured from the inside edge of the near approach traffic lane as shown above.

- d = Distance in feet from near edge of near approach traffic lane to face of traffic railing (at offset control point). For left side hazards on two-way undivided facilities, "D" is measured from the inside edge of the nearest opposing traffic lane as shown above.
NOTES:
1. On approach end provide a Roadway Guardrail Transition, Index No. 402 (Sheet 16 - Scheme 1) or other site specific treatment. See Roadway Plans for limiting station of Roadway Guardrail Transition or other site specific treatment.
2. Provide Railing & Curb Base Transitions (as shown) if curb does not extend beyond end of Spread Footing Approach, see Roadway Plans. Railing End Transition & Railing & Curb Base Transitions may be omitted on trailing ends with no opposing traffic.

CROSS REFERENCES:
For Section A-A, C-C and X-X see Sheet 4.
SECTION X-X (TYPICAL CURB, TYPE VARIES, TYPE F SHOWN) (See Index No. 300 and Plans for Details)

- Match Cross Slope of high side and low side at begin or end bridge or approach slab.

SECTION C-C (GUARDRAIL END TRANSITION)

Varies (3' Max., 1' Min. match bridge offset constant for Retrofit to begin Curb & Railing Transition)

CROSS REFERENCES:
For location of Sections A-A, B-B and X-X see Sheet 2.
For location of Section C-C see Sheet 3.

TRAFFIC RAILING - (VERTICAL FACE RETROFIT) SPREAD FOOTING APPROACH

INDEX NO. 484 4 of 10
SCHEME 1 – MODIFICATION FOR INDEX NO. 481, 482 AND 483 - SCHEME 1

RAILING END TREATMENT FOR PERPENDICULAR OR ANGLED WINGS WITH NARROW CURBS (SHOWN), WIDE CURBS AND INTERMEDIATE CURBS (SIMILAR)

PARTIAL ELEVATION OF INSIDE FACE OF RAILING
(Expansion Dowel Assemblies and Bars 4C not shown for clarity)

CROSS REFERENCE:
For Section A-A see Sheet 4
For Expansion Dowel Assembly and placement of Dowel Bars 6D Details see Index 480.
**DESCRIPTION:**

REVISION NO.

INDEX SHEET NO.

**REVISION OF DESIGN STANDARDS FY 2017-18**

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**NOTES:**

1. Remove existing concrete along saw cut joints. Existing reinforcing steel may be cut at joint or extended into new concrete. Exposed existing reinforcing not encased in new concrete shall be removed 1" below existing concrete surface and grouted over.

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**CROSS REFERENCES:**

For Section A-A see Sheet 4.
For Section D-D see Sheet 5.
For Expansion Dowel Assembly and placement of Dowel Bars 6D Details see Index 480.

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**SCHEME 2 ~ MODIFICATION FOR INDEX NO. 481 - SCHEME 2**

**RAILING END TREATMENT FOR PARALLEL WING WALLS WITH NARROW CURBS**

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**PARTIAL ELEVATION OF INSIDE FACE OF RAILING**

(Expansion Dowel Assemblies and Bars 4C not shown for clarity)

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**SECTION THRU EXISTING CURB AND APPROACH SLAB TO BE REMOVED**

(Free Standing Curb Similar)
SCHEME 3 - MODIFICATION FOR INDEX NO. 481 SCHEME 3
RAILING END TREATMENT FOR FLARED WING WALLS WITH NARROW CURBS

PARTIAL ELEVATION OF INSIDE FACE OF RAILING
(Expansion Dowel Assemblies and Bars 4C not shown for clarity)

EXISTING APPROACH SLAB

PARTIAL PLAN OF RAILING

FRONT FACE OF BACKWALL, BEGIN OR END BRIDGE & MATCH LINE (SEE INDEX NO. 481, SHEET 3)
**SCHEME 5 ~ MODIFICATION FOR INDEX NO. 482 SCHEME 3 AND 4**

**RAILING END TREATMENT FOR PARALLEL CURBS AND FLARED WING WALLS WITH WIDE CURBS**

**PARTIAL ELEVATION OF INSIDE FACE OF RAILING**

(Existing Wing Post, Expansion Dowel Assemblies and Bars 4C not shown for clarity)

**SCHEME 4 ~ MODIFICATION FOR INDEX NO. 482 SCHEME 2**

**RAILING END TREATMENT FOR PARALLEL CURBS AND WING WALLS WITH WIDE CURBS**

**PARTIAL PLAN OF RAILING**

Bars 5F @ 8" spacing Max. (Typ.) Clip bars as reqd. to maintain Cover

Bar SE @ 8" spacing Max. (Typ.) Clip bars as reqd. to maintain Cover

Bar 5F @ 8" spacing Max. (Typ.) Tied to Bar 5F

Bar 4G (Typ.)

Top of Curb

Asphalt Overlay when present (Varies)

Final Riding Surface

Existing End Bent Wing Wall

Existing Approach Slab

**CROSS REFERENCES:**

For Section A-A see Sheet 4.
For Section D-D see Sheet 3.
For Section G-G see Sheet 7.
For Expansion Dowel Assemblies Details see Index 480.
SCHEME 6 – MODIFICATION FOR INDEX NO. 483 SCHEME 2
RAILING END TREATMENT FOR PARALLEL CURBS AND WING WALLS WITH INTERMEDIATE CURBS

Provide 1/2 Preformed Joint Filler on top of existing curb (shown hatched).

Bars 4C (Typ.)

Expansion Dowel Sleeve Assembly

Dowel Bars 6D

Bars 4G (Typ.)

Bars 5F @ 8" spacing Max. (Typ.) Clip bars as reqd. to maintain Cover

Bars 5E @ 8" spacing Max. (Typ.) tied to Bars 5F

Dowel Bars 6D

2' @ 1'-3" Max. Spacing

Final Riding Surface

Asphalt Overlay when present

Existing Curb

Existing Approach Slab

Bars 4G

Existing End Bent Wing Wall

Bars 5S (Typ.)

2" Cover

Dowel Bars 6D

SECTION H-H

Note:
* Match curb height at adjoining existing end bent wing.

PARTIAL ELEVATION OF INSIDE FACE OF RAILING
(Expansion Dowel Assemblies and Bars 4C not shown for clarity)

Varyes (3" Max., 1" Min. match bridge offset constant for Retrofit to begin transition)

CROSS REFERENCES:
For Section A-A see Sheet 4
For Section D-D see Sheet 5
For Expansion Dowel Assembly and placement of Dowel Bars 6D
Details see Index 480

TRAFFIC RAILING - (VERTICAL FACE RETROFIT)
SPREAD FOOTING APPROACH

INDEX
484
NO.

FY 2017-18
DESIGN STANDARDS

LAST
07/01/09
REVISION

DESCRIPTION:
**SCHEME 7 - MODIFICATION FOR INDEX NO. 483 SCHEME 3**

**RAILING END TREATMENT FOR PARALLEL CURBS AND FLARED WING WALLS WITH INTERMEDIATE CURBS**

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**PARTIAL PLAN OF RAILING**

- Front Face of Backwall, Begin or End Bridge & Match Line (See Index No. 483, Sheet 3).
- Portion of existing curb to remain (shown shaded), provide 1½" Preformed Joint Filler bond breaker on top of existing curb.
- Expansion Dowel Sleeve Assemblies.
- Bars 4C (Typ).
- Bars 5S @ 8" spacing Max. (Typ.) tied to Bars 5F (hit bars minimally as required).
- Bars 5E @ 8" spacing Max. (Typ.) Clip bars as reqd. to maintain Cover.
- Edge of Existing Approach Slab.

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**PARTIAL ELEVATION OF INSIDE FACE OF RAILING**

(Expansion Dowel Assemblies and Bars 4C not shown for clarity)

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**SECTION 1-1**

- Varies (3½ Max., 1½ Min.) match bridge offset constant for Retrofit to begin transition.
- 2" Cover.
- Bars 5E @ 8" Sp.
- Bars 5S (Typ.)
- Top of Curb.
- Bars 5S (Typ.)
- Organic Felt bond breaker.

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**CROSS REFERENCES:**

- For Section A-A see Sheet 4.
- For Section D-D see Sheet 5.
- For Section H-H see Sheet 9.
- For Expansion Dowel Assemblies and placement of Dowel Bars 6D Details see Index 480.

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**Note:**

- **Match curb height at adjoining existing end bent wing.**

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**TRAFFIC RAILING - (VERTICAL FACE RETROFIT)**

**SPREAD FOOTING APPROACH**