PLAN OF RAILING ON BRIDGE DECK (WITHOUT SIDEWALK SHOWN, WITH SIDEWALK SIMILAR)  
(Reinforcing Steel Not Shown For Clarity)  

ELEVATION OF INSIDE FACE OF RAILING  
(BRIDGE DECK SHOWN, APPRAOH SLAB WITHOUT GUARDRAIL OR ADJACENT TO ROADWAY BARRIER SIMILAR)
PLAN OF RAILING WITH GUARDRAIL ON APPROACH SLAB WITHOUT SIDEWALK (APPROACH SLAB WITH ADJACENT SIDEWALK SIMILAR) (Reinforcing Steel Not Shown For Clarity)

30'-0" (min.) to 40'-0" Approach Slab (Measured Along Gutter Line)

** 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.

Begin or End Approach Slab

Bars 4S1 @ 1'-4" ; Bars 4V, 7P1 & 7P2 @ 8"

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

Field Cut Bar 6R1 and Field Bend as Necessary at Taper (Typ.)

Begin or End Approach Slab

3'-0" Taper

*** NOTE: For curb details and reinforcement of Typical End Section, Typical Interior Section and Posts with or without curbs see "Elevation of Inside Face of Railing" Sheet 1.

Top Bars

Guardrail Approach Transition Connection (When called for in the Plans)
**Bars 7P1**

1) End Post detailed above, Interior Post and Approach Slab End Section similar.
2) For decks to 8" thick 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" 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.

**Bars 5R2**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.

**Bars 4V1**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.

**Bars 6R1**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.

**Bars 6T**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.

**Bars 4S1**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.

**Bars 4S2**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.

**Bars 4S3**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.

**Bars 4V1**

1) Place Bars 7P1 and 7P2 and 4V with 6" embedment.
2) For decks 7P1 and 4V with the bottom mat of reinforcement as shown in Section A-A. For decks and slabs thicker than 8" 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.
CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS

BILL OF REINFORCING STEEL

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LENGTH</th>
<th>LB/BAR</th>
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<tbody>
<tr>
<td>P1</td>
<td>7</td>
<td>7'-7&quot;</td>
<td>15.00</td>
</tr>
<tr>
<td>P2</td>
<td>7</td>
<td>7'-3&quot;</td>
<td>14.82</td>
</tr>
<tr>
<td>P3</td>
<td>7</td>
<td>7'-2&quot;</td>
<td>14.65</td>
</tr>
<tr>
<td>P4</td>
<td>7</td>
<td>7'-3&quot;</td>
<td>14.82</td>
</tr>
<tr>
<td>P5</td>
<td>4</td>
<td>2'-11&quot;</td>
<td>1.94</td>
</tr>
<tr>
<td>R1</td>
<td>6</td>
<td>As Reqd.</td>
<td>1.5 (LB/LF)</td>
</tr>
<tr>
<td>R2</td>
<td>5</td>
<td>As Reqd.</td>
<td>1.04 (LB/LF)</td>
</tr>
<tr>
<td>R3</td>
<td>4</td>
<td>As Reqd.</td>
<td>0.67 (LB/LF)</td>
</tr>
<tr>
<td>S1</td>
<td>4</td>
<td>5'-0&quot;</td>
<td>3.34</td>
</tr>
<tr>
<td>S2</td>
<td>4</td>
<td>Varies 6'-2&quot; Min. 10'-3&quot; Max.</td>
<td>Varies 4.18 Min. 10.86 Max.</td>
</tr>
<tr>
<td>S3</td>
<td>4</td>
<td>17'-3&quot;</td>
<td>7.52</td>
</tr>
<tr>
<td>T</td>
<td>6</td>
<td>11'-4&quot;</td>
<td>17.02</td>
</tr>
<tr>
<td>U</td>
<td>5</td>
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<td>4.07</td>
</tr>
<tr>
<td>V1</td>
<td>4</td>
<td>3'-2&quot;</td>
<td>2.12</td>
</tr>
<tr>
<td>V2</td>
<td>4</td>
<td>3'-6&quot;</td>
<td>2.34</td>
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** Bars 4P5 and 4R3 are to be used with a curb only.
** Bend Bars 4S1, 4S2 & 4S3 around a #3 Stirrup Pin.
*** Bars 7P4 & 4V2 are to be used on C-I-P Concrete Retaining Walls.

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are cut 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 ØA = 90°, 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'-3" 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.

BAR 7P1
BAR 7P2
BAR 7P3 (Requires 3 Dimensional Bend)
BAR 7P4 ***

ROADWAY OR SIDEWALK CROSS-SLOPE

<table>
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<tr>
<th>HIGH SIDE</th>
<th>LOW SIDE</th>
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<tbody>
<tr>
<td>0% to 2%</td>
<td>80%</td>
</tr>
<tr>
<td>2% to 6%</td>
<td>93%</td>
</tr>
<tr>
<td>6% to 10%</td>
<td>96%</td>
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</table>

ØA shall be 90° if Contractor elects to place Railing Perpendicular to the Deck.

** Bars 4S1, 4S2 & 4S3 around a #3 Stirrup Pin.
*** Bars 7P4 & 4V2 are to be used on C-I-P Concrete Retaining Walls.

TRAFFIC RAILING - (CORRAL SHAPE)

REINFORCING STEEL NOTES:
1. All bar dimensions in the bending diagrams are cut 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 ØA = 90°, 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'-3" 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.

ESTIMATED TRAFFIC RAILING QUANTITIES

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CONCRETE QUANTITY (CY)</th>
<th>REBAR QUANTITY (LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical 10'-0&quot; Section w/Curb</td>
<td>1.13</td>
<td>451</td>
</tr>
<tr>
<td>Typical 10'-0&quot; Section w/o Curb</td>
<td>1.03</td>
<td>428</td>
</tr>
<tr>
<td>Approach Slab with Guardsrail End Section</td>
<td>0.14 (per LF)</td>
<td>0.29 (per LF)</td>
</tr>
</tbody>
</table>
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.

PARTIAL PLAN VIEW OF 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.

APPROACH SLAB WITH GUARDRAIL ATTACHED (NOT SHOWN):
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 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.

NOTES:
1) Alternating Bars 7P1 with Bars 7P2 and reverse direction of every other Bar 4V1 as detailed above to facilitate placement of concrete.
2) Shift deck transverse reinforcement minimally to allow placement of Bars 7P & 4V.

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.

PARTIAL PLAN VIEW OF 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.

APPROACH SLAB WITH GUARDRAIL ATTACHED (NOT SHOWN):
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 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.

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 OR LESS

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) Railing End Post and reinforcement detailed above. Railing Interior Post reinforcement similar.
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 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.

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) 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 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) Bar 7P1 shall be used in every other Bar 4V1 to facilitate placement of concrete. See detail above.
5) End Post - alternate Bars 7P1 with Bars 7P2 and reverse direction of every other Bar 4V1 to facilitate placement of concrete. See detail above.
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.