Barriers
# Barriers

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-100</td>
<td>10-15-19</td>
<td>44&quot; Concrete Median Barrier (Full Section)</td>
</tr>
<tr>
<td>BA-101</td>
<td>10-21-14</td>
<td>44&quot; Concrete Median Barrier Width Transition</td>
</tr>
<tr>
<td>BA-102</td>
<td>10-21-14</td>
<td>44&quot; Concrete Barrier (Half Section)</td>
</tr>
<tr>
<td>BA-103</td>
<td>10-15-19</td>
<td>34&quot; Concrete Barrier (Half Section)</td>
</tr>
<tr>
<td>BA-104</td>
<td>10-15-19</td>
<td>34&quot; Concrete Barrier for use with Reinforced Paved Shoulder</td>
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<tr>
<td>BA-105</td>
<td>10-15-19</td>
<td>34&quot; to 44&quot; Concrete Barrier Transition Section</td>
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<tr>
<td>BA-106</td>
<td>10-21-14</td>
<td>Reinforced Paved Shoulder for Concrete Barrier</td>
</tr>
<tr>
<td>BA-107</td>
<td>10-15-19</td>
<td>Concrete Barrier End Section</td>
</tr>
<tr>
<td>BA-108</td>
<td>10-17-17</td>
<td>Concrete Barrier Tapered End Section</td>
</tr>
<tr>
<td>BA-150</td>
<td>10-15-19</td>
<td>Side Obstacle Protection with Concrete Barrier and Guardrail</td>
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## Concrete Barriers

## Steel Beam Guardrail

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>BA-200</td>
<td>04-16-19</td>
<td>Steel Beam Guardrail Components</td>
</tr>
<tr>
<td>BA-201</td>
<td>04-18-17</td>
<td>Steel Beam Guardrail Barrier Transition Section (MASH TL-3)</td>
</tr>
<tr>
<td>BA-202</td>
<td>10-20-15</td>
<td>Steel Beam Guardrail Bolted End Anchor</td>
</tr>
<tr>
<td>BA-203</td>
<td>10-15-19</td>
<td>Steel Beam Guardrail W-Beam End Anchor</td>
</tr>
<tr>
<td>BA-204</td>
<td>10-15-19</td>
<td>Steel Beam Guardrail Thrie-Beam End Anchor</td>
</tr>
<tr>
<td>BA-205</td>
<td>04-19-16</td>
<td>Steel Beam Guardrail Tangent End Terminal (MASH TL-3)</td>
</tr>
<tr>
<td>BA-206</td>
<td>10-15-19</td>
<td>Steel Beam Guardrail Flared End Terminal For Cable Connection</td>
</tr>
<tr>
<td>BA-210</td>
<td>04-19-16</td>
<td>Guardrail Post Adaptor Unit</td>
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<tr>
<td>BA-211</td>
<td>10-21-14</td>
<td>Steel Beam Guardrail Long - Span System for Post Conflicts</td>
</tr>
<tr>
<td>BA-221</td>
<td>04-18-17</td>
<td>Steel Beam Guardrail Barrier Transition Section (MASH TL-2)</td>
</tr>
<tr>
<td>BA-225</td>
<td>10-17-17</td>
<td>Steel Beam Guardrail Tangent End Terminal (MASH TL-2)</td>
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<td>BA-250</td>
<td>10-18-16</td>
<td>Steel Beam Guardrail Installation at Concrete Barrier or Bridge End Post (MASH TL-3)</td>
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<tr>
<td>BA-251</td>
<td>04-19-16</td>
<td>Steel Beam Guardrail Installation at Side Obstacle (Two-Way Protection)</td>
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<tr>
<td>BA-252</td>
<td>04-19-16</td>
<td>Steel Beam Guardrail Installation at Side Obstacle (One-Way Protection)</td>
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<td>BA-253</td>
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<td>Steel Beam Guardrail Installation at Railroad Signal</td>
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<tr>
<td>BA-260</td>
<td>10-18-16</td>
<td>Steel Beam Guardrail Installation at Concrete Barrier or Bridge End Post (MASH TL-2)</td>
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## Barriers

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<thead>
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<tr>
<td>BA-351</td>
<td>10-15-19</td>
<td>Cable Guardrail</td>
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<td></td>
<td>High Tension Cable Guardrail</td>
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<td>BA-401</td>
<td>10-15-19</td>
<td>Temporary Barrier Rails</td>
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<tr>
<td></td>
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<td>Temporary Barrier Rail (Precast Concrete)</td>
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<tr>
<td>BA-500</td>
<td>04-19-16</td>
<td>Crash Cushions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temporary Crash Cushions Sand Barrel</td>
</tr>
</tbody>
</table>
Concrete Barrier, BA-100 and Footing

Possible Contract Item:

4"
Per Foot

Concrete Quantities

<table>
<thead>
<tr>
<th>Size</th>
<th>Number of Bars</th>
<th>WT (lbs)</th>
<th>Max. Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>7&quot;</td>
<td>14</td>
<td>7'-4&quot;</td>
<td>107</td>
</tr>
<tr>
<td>1'-6&quot;</td>
<td>5</td>
<td>19'-6&quot;</td>
<td>141</td>
</tr>
</tbody>
</table>

Use epoxy-coated Grade 60 reinforcing bars. Provide 2 inches minimum cover. Anchor barrier reinforcement to prevent movement. Secure each section at the front, back, and at 3 ft minimum intervals using a method approved by the Engineer.

Expansion joints are necessary only where specifically required by project plans. Conform expansion material to the shape of the barrier. No sealer is required.

Saw contraction joints as indicated. Where abutting sections are placed as separate pours, a butt joint may be used. Extend longitudinal reinforcement into the abutting section a minimum of 1'-6".

For barrier dowelled to pavement, match pavement joints. For free-standing barrier with integral footings, use 17 foot maximum, 15 foot minimum joint spacing.

Use 1 inch diameter deformed dowel bars of sufficient length to ensure 6 inch minimum embedment in barrier and supporting surface. Install dowels either in supporting surface when placed, or in drilled holes using polymer grout complying with Materials I.M. 491.11 or hydraulic cement grout complying with Materials I.M. 491.13.

Sawed contraction joint

Special Shaping for Barrier over Intake

Possible Tabulation:

Concrete Barriers, BA-100 and Footing

Possible Contract Item:

44" Concrete Median Barrier

(FULL SECTION)
Use epoxy-coated grade 60 reinforcing bars. Provide 2 inches minimum cover. Anchor barrier reinforcement to prevent movement. Secure each section at the front, back, and at 3'-6" minimum intervals using a method approved by the Engineer.

1. Use 1 inch diameter deformed dowel bars of sufficient length to ensure 6 inch minimum embedment in barrier and supporting surface. Install bars either in supporting surface when placed or in drilled holes using polymer grout complying with Materials I.M. 491.11 or hydraulic cement grout complying with Materials I.M. 491.13.

2. Fillet all exposed corners with a 3/8 inch dressed and beveled strip.

3. Provide 18 inch overlap of reinforcing steel between sections.

REINFORCING BARS LIST

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length (in)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>7</td>
<td>68'</td>
<td>42</td>
</tr>
<tr>
<td>g2</td>
<td>5</td>
<td>1</td>
<td>87'</td>
<td>8</td>
</tr>
<tr>
<td>g3</td>
<td>5</td>
<td>1</td>
<td>87'</td>
<td>8</td>
</tr>
<tr>
<td>g4</td>
<td>5</td>
<td>1</td>
<td>92'</td>
<td>8</td>
</tr>
<tr>
<td>g5</td>
<td>5</td>
<td>1</td>
<td>94'</td>
<td>8</td>
</tr>
</tbody>
</table>

CONCRETE QUANTITIES

Per Section

1.3 cu
**REINFORCING BAR LIST**

**Per Section (Approx. 20 feet)**

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Weight (lbs.)</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>14</td>
<td>7'-3&quot;</td>
<td>106</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>h</td>
<td>5</td>
<td>2</td>
<td>19'-6&quot;</td>
<td>141</td>
<td>---</td>
</tr>
</tbody>
</table>

**Use Grade 60 epoxy-coated reinforcing bars. Provide 2 inches minimum cover. Anchor all reinforcement to prevent movement. Secure each section at the front, back, and at 3-6" intervals using a method approved by the Engineer.**

**Expansion joints are necessary only where specifically required by project plans. Conform expansion material to the shape of the barrier. No sealer is required.**

**Where abutting sections are placed as separate pours, a butt joint may be used. Extend longitudinal reinforcement into the abutting section a minimum of 1'-6".**

**For barrier dowelled to pavement, match pavement joints. For free-standing barrier with integral footings, use 17 foot maximum, 15 foot minimum joint spacing.**

**Use 1 inch diameter deformed dowel bars of sufficient length to ensure 6 inch minimum embedment in barrier and supporting surface. Install dowels either in supporting surface when placed, or in drilled holes using polymer grout complying with Materials I.M. 491.11 or hydraulic cement grout complying with Materials I.M. 491.13.**

**Possible Contract Item:** Concrete Barrier, BA-102 or Concrete Barrier, BA-102 and Footing

**Possible Tabulation:** Concrete Barrier, BA-102 and Footing

**Concrete Quantities**

<table>
<thead>
<tr>
<th>Per foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.11 cy</td>
</tr>
</tbody>
</table>

**INTERIM STANDARD ROAD PLAN**

**BA-102**

**44" CONCRETE BARRIER**

(HALF SECTION)
SAWED CONTRACTION JOINT
Saw cut top and front face. Saw cut back if exposed.

DETAIL 'A'
Special Shaping for Barrier over Intake

CONCRETE QUANTITIES
Per foot
0.10 cy

REINFORCING BAR LIST
Per Section (Approx. 20 feet)

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Weight (lbs)</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>14</td>
<td>5'-6&quot;</td>
<td>83</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>f1</td>
<td>5</td>
<td>5</td>
<td>19'-6&quot;</td>
<td>94</td>
<td></td>
</tr>
</tbody>
</table>

INTERIM
STANDARD ROAD PLAN
BA-103
(SHEET 1 of 1)

REVISIONS:
Modified circle note 3.
APPROVED BY DESIGN METHODS ENGINEER

ELEVATION
Use Grade 60 epoxy-coated reinforcing bars. Provide 2 inches minimum cover. Anchor all reinforcement to prevent movement. Secure each section at the front, back, and at 3'-6" intervals using a method approved by the Engineer.

Expansion joints are necessary only where specifically required by project plans. Conform expansion joint to the shape of the barrier. No sealer is required.

Where abutting sections are placed as separate pours, a butt joint may be used. Extend longitudinal reinforcement into the abutting section a minimum of 1'-6".

For barrier dowelled to pavement, match pavement joints. For free-standing barrier with integral footings, use 17 foot maximum, 15 foot minimum joint spacing.

When connecting to BA-105 or BA-107, include 4 additional #5 bars embedded a minimum of 3 feet into the BA-103 barrier.

Use 1 inch diameter deformed dowel bars of sufficient length to ensure 6 inch minimum embedment in barrier and supporting surface. Install dowels either in supporting surface when placed, or in drilled holes using polymer grout complying with Materials I.M. 491.11 or hydraulic cement grout complying with Materials I.M. 491.13.

Fillet all exposed corners with a 1/2 inch dressed and beveled strip.

Construct concrete footing when barrier is not placed on concrete slab. Apply Article 2403.3 of the Standard Specifications, but the use of forms is optional. If forms are used, place backfill around the completed footing.

Place barrier markers at 100 foot increments in areas with non-continuous lighting, or 250 foot increments in areas with continuous lighting. Marker color to be the same as adjacent edge lines.

Possible Contract Item:
Concrete Barrier, BA-103 or
Concrete Barrier, BA-103 and Footing

Possible Tabulation:
Concrete Barrier, BA-103 and Footing

CONSTRUCTION HEADER or
Contract Akron Joint

CONCRETE BARRIER
1'-6" typ. Length

SECTION A-A

2'-15" wide x 1" deep saw cut. No sealing required.

See Detail 'A'

BARRIER FACE

BENT BAR

ELEVATION

1'-6" Lap min.

Detail 'A'
See or End of Barrier

Possible Expansion Joint or End of Barrier

Concrete Barrier, BA-103 and Footing

CONCRETE BARRIER, BA-103 or
Concrete Barrier, BA-103 and Footing

Concrete Barrier, BA-103 or
Concrete Barrier, BA-103 and Footing

Concrete Barrier, BA-103 or
Concrete Barrier, BA-103 and Footing

Concrete Barrier, BA-103 or
Concrete Barrier, BA-103 and Footing

Concrete Barrier, BA-103 or
Concrete Barrier, BA-103 and Footing
**Possible Contract Item:** Concrete Barrier, BA-104

**Possible Tabulation:** 108-18B

**Use Grade 60 epoxy-coated reinforcing bars. Provide 2 inches minimum cover. Anchor all reinforcement to prevent movement. Secure each section at the front, back, and at 3'-6" intervals using a method approved by the Engineer.**

1. Expansion joints are necessary only where specifically required by project plans. Conform expansion material to the shape of the barrier. No sealer is required.

2. Where abutting sections are placed as separate pours, a butt joint may be used. Extend longitudinal reinforcement into the abutting section a minimum of 1'-6". Contraction joint locations shall match pavement joint locations.

3. Fillet all exposed corners with a 1/2 inch dressed and beveled strip.

4. Place barrier markers at 100 foot increments in areas with non-continuous lighting, or 250 foot increments in areas with continuous lighting. Marker color to be the same as adjacent edge line.

5. Refer to BA-106 for details of 5g2 bars, 5g3 bars, and reinforced paved shoulder.

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**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Bar</th>
<th>Number of Bar</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5g1</td>
<td>15</td>
<td>3'-6&quot;</td>
<td>1'-4&quot;</td>
</tr>
<tr>
<td>6f1</td>
<td>9</td>
<td>19'-4&quot;</td>
<td>—</td>
</tr>
</tbody>
</table>

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**SAWED CONTRACTION JOINT**

Saw cut top and front face. Saw cut back if exposed.
Use Grade 60 epoxy-coated reinforcing bars. Provide 2 inches minimum cover. Anchor all reinforcement to prevent movement. Secure each section at the front, back, and at 3'-6" intervals using a method approved by the Engineer.

1. Where abutting sections are placed as separate pours, a butt joint may be used. Extend longitudinal reinforcement into the abutting section a minimum of 1'-6".

2. Use 1 inch diameter deformed dowel bars of sufficient length to ensure 6 inch minimum embedment in barrier and supporting surface. Install dowels either in supporting surface when placed, or in drilled holes using polymer grout complying with Materials I.M. 491.11 or hydraulic cement grout complying with Materials I.M. 491.13.

3. Filet all exposed corners with a 1/2 inch dressed and beveled strip.

4. Construct concrete footing when barrier is not placed on concrete slab. Apply Article 2403.03 of the Standard Specifications, but the use of forms is optional. If forms are used, place backfill around the completed footing.

5. Place barrier markers at 100 foot increments in areas with non-continuous lighting, or 250 foot increments in areas with continuous lighting. Marker color to be the same as adjacent edge line.

CONCRETE QUANTITIES
for one Transition Section
1.2 cy

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Weight (lb.)</th>
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</thead>
<tbody>
<tr>
<td>g1</td>
<td>S</td>
<td>8</td>
<td>*</td>
<td>53.5</td>
</tr>
<tr>
<td>f1</td>
<td>S</td>
<td>7</td>
<td>10'-2&quot;</td>
<td>73.5</td>
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<tr>
<td>g2</td>
<td>S</td>
<td>2</td>
<td>3'-8&quot;</td>
<td>11.6</td>
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* Varies from 5'-7" to 7'-3"
REINFORCING BAR LIST
Per Shoulder Panel (Approximately 20 Linear Feet)

<table>
<thead>
<tr>
<th>Bar</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Spacing</th>
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<tbody>
<tr>
<td>4''</td>
<td>6x1 18</td>
<td>5'-'</td>
<td>12''</td>
</tr>
<tr>
<td>6''</td>
<td>6x1 18</td>
<td>5'-'</td>
<td>12''</td>
</tr>
<tr>
<td>6''</td>
<td>5x2 18</td>
<td>6'-'</td>
<td>12''</td>
</tr>
<tr>
<td>8''</td>
<td>6x1 18</td>
<td>9'-'</td>
<td>12''</td>
</tr>
<tr>
<td>8''</td>
<td>5x2 8</td>
<td>9'-'</td>
<td>12''</td>
</tr>
<tr>
<td>10''</td>
<td>6x1 18</td>
<td>11'-'</td>
<td>12''</td>
</tr>
<tr>
<td>12''</td>
<td>5x2 12</td>
<td>16'-'</td>
<td>12''</td>
</tr>
</tbody>
</table>

Applicable to all Shoulder Widths:

- 5g2 3
- 5g3 3

Variations:

- Match spacing of vertical bars in concrete barrier.
- Increase these dimensions by one inch for every inch of paved shoulder thickness greater than 6 inches.

ESTIMATED SHOULDER QUANTITIES
Per Linear Foot

<table>
<thead>
<tr>
<th>Concrete Sq. Yds.</th>
<th>4'</th>
<th>6'</th>
<th>8'</th>
<th>10'</th>
<th>12'</th>
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<tbody>
<tr>
<td>0.84</td>
<td>0.62</td>
<td>1.06</td>
<td>1.29</td>
<td>1.51</td>
<td></td>
</tr>
</tbody>
</table>

BENT BAR DETAILS

Length = 5'-1''
Length = 3'-4''

Possible Contract Item:
Reinforced Paved Shoulder for Concrete Barrier

Possible Tabulation:
108-18B

REVISION
10-21-14
SHEET 1 of 1

STANDARD ROAD PLAN
BA-106

APPROVED BY DESIGN METHODS ENGINEER

CONTRACT DOCUMENT
REVISION 4
REVISION 6
10-15-14
SHEET 1 of 1

REINFORCED PAVED SHOULDER
FOR CONCRETE BARRIER

Place keys at 2'-8'' centers.
Use 2 x 8 lumber 8'' long to make keys.
1. Expansion joints are necessary only where specifically required by project plans. Conform expansion materials to the shape of the barrier. No sealer is required.

2. Where abutting sections are placed as separate pours, a butt joint may be used. Extend longitudinal reinforcement into the abutting section a minimum of 1'-6".

3. Fillet all exposed corners with a \( \frac{1}{2} \) inch dressed and beveled strip.

4. Form holes using 1 inch diameter plastic conduit.

5. See BA-106 for details of 5c3 bars, 5c1 bars, and reinforced paved shoulder.

Use Grade 63 epoxy-coated reinforcing bars. Provide 2 inches minimum cover. Anchor all reinforcement to prevent movement. Secure each section at the front, back, and at 3'-6" intervals using a method approved by the engineer.

Expansion joints are necessary only where specifically required by project plans. Conform expansion materials to the shape of the barrier. No sealer is required.
Normal Pavement Jointing

Elevation

Offset for Rounded Barrier Top

Possible Sidewalk - exact shape and dimensions determined by the Engineer to comply with individual project requirements.

Elevations

Possible Intake - 'E' Joint

30' Concrete Approach Barrier

Possible Contract Item: Concrete Barrier, Tapered End, BA-108

Possible tuberculosis:

Concrete Approach Barrier

Normal Edge of Through Pavement

Possible Sidewalk - exact shape and dimensions determined by the Engineer to comply with individual project requirements.

Full Barrier Rail Section

Install a 'C' joint in concrete approach barrier to match the location of each joint in both roadway and bridge approach pavement.

1. Typical joint spacing and location. Follow specific project requirements as directed by the Engineer.

2. Match boxout width to existing curb and gutter joint. Use 2 foot wide boxout where curb and gutter are not constructed.

3. #8 x 8 inch deformed bars or 1 inch diameter smooth.

4. For joint detail, see PV-101.

5. Bottom width of barrier is maintained at 17 inches.

6. Bottom width of barrier transitions from 8 to 17 inches.

7. Required sidewalk will be measured and paid for separately.

8. Additional concrete quantity required for extended roadway pavement will be included in roadway paving quantity.

9. Place no delineator or object marker in front of, or on, the barrier.

10. Approximately 2.0 cubic yards of concrete are required to construct barrier as shown. Amount may vary depending on individual site requirements.

20' Normal Pavement Jointing

Bridge Approach Pavement

Tapered End Section

Concrete Approach Barrier

Normal Edge of Through Pavement

Possible Intake - 'E' Joint

30' Concrete Approach Barrier

Possible Contract Item: Concrete Barrier, Tapered End, BA-108

Possible Tabulation:

Concrete Approach Barrier

Normal Edge of Through Pavement

Possible Intake - 'E' Joint

30' Concrete Approach Barrier

Possible Contract Item: Concrete Barrier, Tapered End, BA-108

Possible Tabulation:
Possible Contract Items:
Concrete Barrier Items
Steel Beam Guardrail Items
PCC Paved Shoulder
Reinforced Paved Shoulder

Possible Tabulations:
108-18B
112-9

LEGEND

- PCC Paved Shoulder
- Reinforced PCC Paved Shoulder

PLAN

ELEVATION

SECTION A-A

1. "L-2" or "KT-2" joint. When roadway pavement is existing, use "BT-3" joint. See PV-101.
2. Refer to BA-250.
4. Refer to project typicals.
5. Refer to BA-106.

Refer to project typicals.
Refer to BA-106.
W-BEAM INSTALLATION

ELEVATION

Rail Elements

SECTION

SECTION WITH CURB

W-BEAM INSTALLATION

Possible Contract Item:
Steel Beam Guardrail

At Bridge End Drains, cut Scour Protection (Transition Mat and Tuff Reinforcement Mat) or remove rock as required to place posts such that Bridge End Drains abut post(s).

1. When specified by the contract documents, install posts at 3'-11" spacing.

2. 6'-0" Wood Post (optional)

3. 6'-0" Steel Post (typ.)

When specified by the contract documents, install posts at 3'-11" spacing.

6' maximum for 6' Standard or 6' Sloped curbs and for non-standard curbs.

Wood or composite only. Steel blockouts will not be allowed.

16d Nail (typ.)
STEEL POST AND BLOCKOUT DETAILS

WOOD POST AND BLOCKOUT DETAILS

BOLT DETAILS

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<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>T</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splice Bolt</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>Bolt for Steel Post with 6&quot; Blockout</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>Bolt for Steel Post with 12&quot; Blockout</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>Bolt for Wood Post with 6&quot; Blockout</td>
<td>3/4</td>
<td>3/4</td>
</tr>
<tr>
<td>Bolt for Wood Post with 12&quot; Blockout</td>
<td>3/4</td>
<td>3/4</td>
</tr>
</tbody>
</table>

\( T = \) Min. Thread Length  \( L = \) Bolt Length

---

Wood or composite only. Steel blockouts will not be allowed.
Installation information applies to both wood and steel posts.

1. Wood or composite only. Steel blockouts will not be allowed.
2. Post extends to bottom of hole in all cases. Trim top of post as required and treat with preservative according to Section 4161 of the Standard Specifications.
3. Use a 12 inch bit with two drills or a 15 inch bit with one drill. If placing post before paving, provide required leave-out area. If placing post after paving, drill or cut required area. Leave-out may be round or square.
4. Use a 12 inch bit with three drills or a 24 inch bit with one drill.

Post Embedment

### Post Installed in Bedrock

<table>
<thead>
<tr>
<th>Case</th>
<th>Depth to Bedrock</th>
<th>Minimum Depth to Drill into Bedrock</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>S = 0&quot; to 16&quot;</td>
<td>R = 0&quot;</td>
</tr>
<tr>
<td>B</td>
<td>S = 16&quot; to 52&quot;</td>
<td>R = Post Length - Mounting Height - S</td>
</tr>
</tbody>
</table>

### Post Installed in Pavement

#### Plan - Pavement Thickness <= 8"

Either approach is acceptable.

#### Plan - Pavement Thickness > 8"

Wood or composite only. Steel blockouts will not be allowed.

Post extends to bottom of hole in all cases. Trim top of post as required and treat with preservative according to Section 4161 of the Standard Specifications.

Use a 12 inch bit with one drill. If placing post before paving, provide required leave-out area. If placing post after paving, drill or cut leave-out area. Leave-out may be round or square.
At Bridge End Drains, cut Scour Protection (Transition Mat and Turf Reinforcement Mat) or remove rock as required to place post(s) such that Bridge End Drains abut post(s).

1. Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.
2. Possible 4 inch sloped curb. See project plans.
3. Depending on end anchor type, BTS Post #15 may be eliminated or modified. See BA-202.

Possible Contract Item:
Steel Beam Guardrail Barrier Transition Section, BA-201

Materials included in the Contract Item:
Steel Post Option:
(9) 6" x 6" x 6'-5" posts
(6) 6" x 8" x 8'-9" posts
(12) 6" x 12" x 19" blockouts
(3) 6" x 12" x 14" blockouts
Wood Post Option:
(9) 6" x 6" x 6'-5" posts
(6) 6" x 8" x 7'-0" posts
(12) 6" x 12" x 19" blockouts
(3) 6" x 12" x 14" blockouts

1. Asymmetrical Transition Section
2. 12'-6" Thrie-Beam rail sections*
3. 6'-3" Thrie-Beam rail section*

(*) One 18'-9" Thrie-Beam rail section may be substituted for one of the 12'-6" sections and the 6'-3" section as shown

Approved bolts, nuts, and washers
Refer to BA-200 for guardrail components

* One 18'-9" Thrie-Beam rail section may be substituted for one of the 12'-6" sections and the 6'-3" section as shown
Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.

Possible 4 inch sloped curb. See project plans.

Depending on end anchor type, BTS Post #15 may be eliminated or modified. See BA-202.

Wood or composite only. Steel blockouts will not be allowed.

Place bolt in top hole only.
BARRIER TRANSITION SECTION

WOOD BTS POSTS #1-3

1. Guarand height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.
2. Possible 4 inch sloped curb. See project plans.
3. Depending on end anchor type, BTS Post #15 may be eliminated or modified. See BA-202.
4. Wood or composite only. Steel blockouts will not be allowed.
5. Place bolt in top hole only.
6. 16d nail to prevent blockout rotation.

WOOD BTS POST #4

STANDARD ROAD PLAN

STEEL BEAM GUARDRAIL

WOOD BTS POSTS #5-9

WOOD BTS POSTS #10-15
Materials included in the Contract Item:
Steel Beam Guardrail End Anchor, Bolted

Possible Contract Item:
3 - Thrie-Beam Terminal Connector
5 - BOLT PATTERN
Thrie-Beam Terminal Connector

Installation Line

1" Hole (typ.)

32" Mounting Height

See Detail 'A'

See Detail 'B'

1" dia. Hole (typ.)

ELEVATION

PLAN

SECTION A-A

REVISIONS - Changed BTS post numbers to match changes in BA-201.
32" Mounting Height

BTS Post #14

(7) - 1" dia. Holes

Thrie-Beam Terminal Connector

ELEVATION

PLAN

Possible Curb

Type B

See BA-201.

INSTALLATION LINE

Curb

See Detail 'B'

32" Mounting Height

7 - BOLT PATTERN

Four - Beam Terminal Connector

See Detail 'A'

1" dia. Hole

SECTION B-B
Thrie-Beam Terminal Connector

32" Mounting Height

Possible Curb

1" dia. Hole
(by others)

Installation Line

See Detail 'A'

32" Mounting Height

SECTION C-C

1. See BA-201.

2. Use treated spacer boards (1 in. x 6 in. or 2 in. x 6 in.) to produce a tight fit between the wedge blockout and endpost. A nominal 1 inch gap is acceptable. Spacer boards are incidental to bolt end anchor.

3. See Detail 'C'

4. See Detail 'B'

7 - BOLT PATTERN

Thrie-Beam Terminal Connector

(7) - 1" dia. Holes

Wedge Blockout at BTS Post #15
See Detail 'C'

BTS Post #15

Skip BTS Post #15

30°

Wedge Blockout

Wedge Blockout

Countersink Guardrail

Bolt so bolt does not protrude past outside edge of Wedge Blockout.

Wedge Blockout

SECTION 'C'

See Detail 'A'

Possible Curb

7 - BOLT PATTERN

Thrie - Beam Terminal Connector

Wedge Blockout at BTS Post #15
See Detail 'C'

BTS Post #15

Skip BTS Post #15

30°

Wedge Blockout

Wedge Blockout

Countersink Guardrail

Bolt so bolt does not protrude past outside edge of Wedge Blockout.
1. Slotted holes 8 x 1 1/2" long.
2. Refer to BA-200.
3. Cover entire face of end section with alternating black and yellow striped adhesive sheeting. Stripes shall be approximately 3 inches in width and shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the end anchor. Yellow stripes shall meet the retroreflectivity requirements for Type III or Type IV reflective sheeting.

Possible Contract Item:
Steel Beam Guardrail End Anchor, Thrie-Beam

Materials included in the Contract Item:
(1) 12'-6" Thrie-Beam rail section
(1) Asymmetrical Transition Section
(2) Thrie-Beam posts (wood or steel - match remainder of Installation)
(1) W-Beam post (wood or steel - match remainder of Installation)
(1) Thrie-Beam blockouts
(1) BCT Wood Post
(1) Rounded Thrie-Beam End Section
(1) Anchor Bracket Assembly
(1) Pipe Sleeve
(1) Cable Assembly
(1) Foundation Tube Assembly with Soil Plate
(1) Approved bolts, nuts, and washers.

Revisions:
- New logo.
- APPROVED BY DESIGN METHODS ENGINEER

Soil Plate

Plan

Elevation

Foundation Tube

BCT Wood Post

Rounded Thrie-Beam End Section
Refer to Materials I.M. 455.02 for a list of approved sources.

Use materials meeting the respective manufacturer's specifications. Install end terminals according to the manufacturer's recommendations.

Note: At the Contractor's option, and at no cost to the Contracting Authority, alternate post designs developed by the manufacturer and accepted by the FHWA for use within the end terminal may be substituted for the post design shown. When such a substitution is made, provide the Engineer with three copies of the most current installation and maintenance manual for the alternate design.

1. Cover entire face of impact head with alternating black and yellow striped adhesive sheeting meeting the following requirements:
   - Stripes are approximately 3 inches wide and slope down at a 45 degree angle toward the side on which traffic is to pass the end terminal.
   - Stripes are approximately 3 inches wide and slope down at a 45 degree angle toward the side on which traffic is to pass the end terminal.
   - Yellow stripes meet the retroreflectivity requirements for Type III or Type IV reflective sheeting.

2. Refer to BA-200.

Possible Contract Item:
Steel Beam Guardrail Tangent End Terminal, BA-205

Possible Tabulations:
108-8A
108-8B
108-8C
108-8D
Refer to Materials I.M. 455.02 for a list of approved sources. If no MASH compliant steel beam guardrail flared end terminals are available, furnish a steel beam guardrail flared end terminal from the list of approved sources for Local Systems.

Use materials meeting the respective manufacturer's specifications. Install end terminals according to the manufacturer's recommendations.

Note: at the Contractor's option, and at no additional cost to the Contracting Authority, alternate post designs developed by the manufacturer and accepted by the FHWA for use within the end terminal may be substituted for the post design shown. When such a substitution is made, provide the Engineer with three copies of the most current installation and maintenance manual for the alternate design.

1. Cover entire face of impact head or buffered end section with alternating black and yellow striped adhesive sheeting meeting the following requirements:
   - Stripes are approximately 3 inches wide and slope down at a 45 degree angle toward the side on which traffic is to pass the end terminal.
   - Yellow stripes meet the retroreflectivity requirements for Type III or Type IV reflective sheeting.

2. Refer to BA-200.

Possible Contract Item:
Steel Beam Guardrail Flared End Terminal, BA-206

Possible Tabulations:
108-8A
108-8B
108-8C

Refer to Materials I.M.

Designation: Post 1
- 31'' (6 spaces @ 6'-3'')
- 45° offset to end of rail
- Impact Head or Buffered End Section

Designation: Post 2
- 48'' offset to end of rail

Designation: Post 3
- W-Beam Post and Bracket

Designation: Post 4
- Ground Line

Designation: Post 5

Designation: Post 6

Designation: Post 7

Designation: Steel Beam Guardrail Flared End Terminal (40'-7"

Designation: Plan

Designation: Elevation

Designation: Lapping Procedure

Designation: Nearest Traffic

Designation: Standard Road Plan

Designation: Standard Road Plan

Designation: Steel Beam Guardrail

Designation: Flared End Terminal

Designation: For Cable Connection

Designation: 108-8A

Designation: 108-8B

Designation: 108-8C

Designation: Possible Tabulations

Designation: Possible Contract Item

Designation: Steel Beam Guardrail Flared End Terminal, BA-206

Designation: Refer to BA-200.

Designation: Note: at the Contractor's option, and at no additional cost to the Contracting Authority, alternate post designs developed by the manufacturer and accepted by the FHWA for use within the end terminal may be substituted for the post design shown. When such a substitution is made, provide the Engineer with three copies of the most current installation and maintenance manual for the alternate design.

Designation: Cover entire face of impact head or buffered end section with alternating black and yellow striped adhesive sheeting meeting the following requirements:
   - Stripes are approximately 3 inches wide and slope down at a 45 degree angle toward the side on which traffic is to pass the end terminal.
   - Yellow stripes meet the retroreflectivity requirements for Type III or Type IV reflective sheeting.

Designation: Refer to BA-200.
Install post adapter unit on top of box culverts or similar situations when standard post embedments are not possible. Not intended for use on inlets.

Contractor may elect to fabricate posts using a 6-foot post and adjusting in the field as follows:

A. Saw off top end to proper length and drill new holes.

B. Treat the sawed end and drilled holes with two coats of organic zinc rich paint containing at least 94% zinc dust. Ensure the surfaces to be treated are free of oil residues due to sawing or drilling.

The price bid for "Steel Beam Guardrail, Post Adapter Unit, BA-210" is full compensation for furnishing, assembling, and installing the adapter unit as shown. Quantity shown in the contract documents.

A. Saw off top end to proper length and drill new holes.

B. Treat the sawed end and drilled holes with two coats of organic zinc rich paint containing at least 94% zinc dust. Ensure the surfaces to be treated are free of oil residues due to sawing or drilling.

The price bid for "Steel Beam Guardrail, Post Adapter Unit, BA-210" is full compensation for furnishing, assembling, and installing the adapter unit as shown. Quantity shown in the contract documents.

- Bolt length equals slab thickness plus 2 inches.
- Provide W6x9 or W6x8.5 steel guardrail post. Supply incidental to steel guardrail:
  - 4 - 1" ASTM A307 Hex Head bolts with one nut and two washers per bolt
  - 1 - 11" x 8" ASTM A36 Steel Plate
  - 1 - 12" x 8" ASTM A36 Steel Plate

Incidental to Adapter Unit:
- 1 - 12" x 6 1/2 x 1/2 ASTM A36 Steel Plate
- 1 - 11" x 6 1/2 x 1/2 ASTM A36 Steel Plate
- 4 - 1" ASTM A307 Hex Head bolts with one nut and two washers per bolt

Incidental to Steel Beam Guardrail:
- W6 x 9 or W6 x 8.5 Steel Guardrail Post (variable length)
  - 6" x 12" x 14" Blockout

Possible Tabulations:
- 108-SA
- 108-BS
- 108-SC
This sheet is intended to show the method of installing w-beam guardrail at locations where normal post placements are not possible due to conflicts with underground structures.

### Installation Type | Minimum Guardrail Length
---|---
1 | 37'-6"
2 | 43'-9"
3 | 50'-9"

### Notes:
1. A minimum length of w-beam guardrail must be installed both upstream and downstream of the outermost CRT posts. Refer to the Minimum Guardrail Length table. This length includes the length of any end terminals, end anchors, and transition sections.
2. A minimum of 62'-6" of w-beam guardrail must be installed between the outermost CRT post and the beginning of any Variable Flare (VF) section.
3. 6" maximum for guardrail placed behind 6" Standard Curbs, 6" Sloped Curbs, and non-standard curbs.

Possible Contract Item:
Steel Beam Guardrail

Materials included in the Contract Item:
(6) 6" x 8" x 6'-0" CRT posts
(6) 6" x 12" x 14\(\text{\frac{1}{2}}\)" blockouts
Approved bolts, nuts, and washers

Possible Tabulations:
108-58
108-8C

---

**TYPICAL SECTION AT CRT POST**
- Level Ground
- Behind Curb
- 6'-0"

**TYPICAL SECTION AT CRT POST**
- Behind Curb
- 28"

**TYPICAL SECTION AT BOX CULVERT**
- Level Ground
- Ground Elevation
- 12" Blockout
- 31" Mouting Height
- 10.1 Slope (max.)
- 31" Mouting Height
- Ground Elevation
- Face of Culvert Headwall
- 0" preferred
- 2" max.

**TYPICAL SECTION AT CRT POST**
- Behind Curb
- 12" Blockout
- 31" Mouting Height
- Ground Elevation
- 12" Blockout
- 31" Mouting Height
- 10.1 Slope (max.)
- Ground Elevation

---

**LAPPING PROCEDURE**
- as shown in contract documents
- 12" Blockout
- 31" Mounding Height
- Ground Elevation
- 10.1 Slope (max.)
- 31" Mounding Height
- Ground Elevation
- Face of Culvert Headwall
- 0" preferred
- 2" max.

---

**ELEVATION - TYPE 1**
- (1 post omitted)
- 12'-6" max. obstruction width
- 12' min.
- 10.1 Slope (max.)

**ELEVATION - TYPE 2**
- (2 posts omitted)
- 18'-9"
- 12'-6" max. obstruction width
- 12' min.

**ELEVATION - TYPE 3**
- (3 posts omitted)
- 25'-0"
- 22'-6" max. obstruction width
- 12' min.

---

**Location Station**
- 12'-6"
- (3 CRT posts @ 6'-3" spacing)
- 12'-6"
- (3 CRT posts @ 6'-3" spacing)
- 12'-6"
- (3 CRT posts @ 6'-3" spacing)
At Bridge End Drains, out Scour Protection (Transition Mat and Tuff Reinforcement Mat) or remove rock as required to place post(s) such that Bridge End Drains abut post(s).

1. Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.

2. Possible 4 inch sloped curb. See project plans.

Possible Contract Item:
Steel Beam Guardrail Barrier Transition Section, BA-221

Materials included in the Contract Item:
- Steel Post Option:
  - (5) 6" x 8" x 6'-0" posts
  - (2) 6" x 12" x 18" blockouts
  - (3) 6" x 12" x 14" blockouts
- Wood Post Option:
  - (5) 6" x 8" x 6'-0" posts
  - (2) 6" x 12" x 18" blockouts
  - (3) 6" x 12" x 14" blockouts

1) Asymmetrical Transition Section
2) Thrie-Beam rail sections
3) 12'-6" W-Beam rail sections
4) Approved bolts, nuts, and washers

Refer to BA-200 for guardrail components.
1. Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.

2. Possible 4 inch sloped curb. See project plans.

3. Wood or composite only. Steel blockouts will not be allowed.

4. Place bolt in top hole only.

STEEL BTS POSTS #1-3

STEEL BTS POST #4

STEEL BTS POST #5
WOOD BTS POSTS #1-3

- Wood Post 6'' x 8''
- Installation

WOOD BTS POST #4

- Wood Post 6'' x 8''
- Installation

WOOD BTS POST #5

- Wood Post 6'' x 8''
- Installation

1. Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.
2. Possible 4 inch sloped curb. See project plans.
3. Wood or composite only. Steel blockouts will not be allowed.
4. Place bolt in top hole only.
5. 16d nail to prevent blockout rotation.

REVISIONS:
- Wood BTS Post #4 view on page 2 and on page 3.
- Removed bottom bolts on Steel BTS Post #4 view on page 2.

APPROVED BY DESIGN METHODS ENGINEER

STANDARD ROAD PLAN

STEEL BEAM GUARDRAIL
BARRIER TRANSITION SECTION (MASH TL-2)
Use materials meeting the respective manufacturer’s specifications. Install end terminals according to the manufacturer’s recommendations.

Note: at the Contractor’s option, and at no cost to the Contracting Authority, alternate post designs developed by the manufacturer and accepted by the FHWA for use within the terminal may be substituted for the post design shown. When such a substitution is made, provide the Engineer with three copies of the most current installation and maintenance manual for the alternate design.

1. Cover entire face of impact head with alternating black and yellow striped adhesive sheeting meeting the following requirements:
   - Stripes are approximately 3 inches wide and slope down at a 45 degree angle toward the side on which traffic is to pass the end terminal.
   - Yellow stripes meet the retroreflectivity requirements for Type III or Type IV reflective sheeting.

2. Refer to BA-200.

Possible Contract Item:
Steel Beam Guardrail Tangent End Terminal, BA-225

Possible Tabulation:
108-8A
Install delineators and object markers according to SI-211.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

1. See BA-201.
2. See BA-202 for connections to concrete barriers and bridge rail end sections.
3. See BA-205.
4. See BA-206.

Minimum VT1 of 49'-7" if no VF is used. Minimum VT1 of 53'-1" if VF is used.

Possible Contract Items:
Steel Beam Guardrail
Steel Beam Guardrail Barrier Transition Section, BA-201
Steel Beam Guardrail End Anchor, Bolted
Steel Beam Guardrail Tangent End Terminal, BA-205
Steel Beam Guardrail Flared End Terminal, BA-206

Possible Tabulation:
108-8A
Install delineators and object markers according to SI-211.

For grading requirements, see EW-301.

For general guardrail details, see BA-206.

1. See BA-205.
2. See BA-206.

Possible Contract Items:
- Steel Beam Guardrail
- Steel Beam Guardrail Tangent End Terminal, BA-205
- Steel Beam Guardrail Flared End Terminal, BA-206

Possible Tabulation:
108-88
LAPPING PROCEDURE

VARIABLE FLARE

APPROACH TRAFFIC

Edge of Traveled Way

End Terminal
(47'-8" for Tangent, 37'-6" for Flared)

Installation Line

Face of Guardrail

Steel Beam Guardrail Tangent End Terminal
(50'-9"")
or
Steel Beam Guardrail Flared End Terminal
for Cable Connection
(49'-7"")

Rail Splice

Variable Tangent
(Multiple of 6.25')

Variable Flare
(Multiple of 6.25')

Variable Tangent
(Multiple of 6.25'
Min. 12.5')

Variable Tangent
(Multiple of 6.25'
Min. 12.5')

End Anchor
(9'-6")

LOCATION STATION
A1: POST

Rail Splice

install delineators and object markers according to SI-211.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

1. See BA-203.

2. See BA-205.

3. See BA-206.

Possible Contract Items:

Steel Beam Guardrail
Steel Beam Guardrail End Anchor, W-Beam
Steel Beam Guardrail Flared End Terminal, BA-206
Steel Beam Guardrail Tangent End Terminal, BA-205

Possible Tabulation:

108-8C
For grading requirements, refer to EW-301.

For additional guardrail requirements, refer to BA-200.

1. Refer to BA-205.
2. Refer to BA-204.

Possible Contract Items:
- Steel Beam Guardrail End Anchor, Thrie-Beam
- Steel Beam Guardrail Tangent End Terminal, BA-205

Incidental to Steel Beam Guardrail End Anchor, Thrie-Beam:
- Delimiter, Rigid - Type I
- Object Marker, Type 2
- Object Marker, Type 3

Possible Tabulation:
- 108-8D (Min. 21'-10")
- 18'-9"
- 18'-9"
- 21'-10"
- 52'-6"

For additional guardrail requirements, refer to BA-200.

LAPPING PROCEDURE
NEAREST TRAFFIC

LAPPING PROCEDURE

VARIABLE FLARE

Install delineators and object markers according to SI-211.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

1. See BA-221.
2. See BA-202 for connections to concrete barriers and bridge rail end sections.
3. See BA-225.
4. Minimum VT1 of 25'-0" if no VF is used. Minimum VT1 of 37'-8" if VF is used.

Possible Contract Items:
- Steel Beam Guardrail
- Steel Beam Guardrail Barrier Transition Section, BA-221
- Steel Beam Guardrail End Anchor, Bolted
- Steel Beam Guardrail Tangent End Terminal, BA-225

Possible Tabulation:
108-8A
Possible Contract Items:
- High Tension Cable Guardrail
- End Anchor Guardrail, Special Anchor Section

Possible Tabulation:
- 108-9A

REVISIONS:
- Added Guardrail, Special Anchor Section as Possible Contract Item.
- Changed Edge of Pavement to Edge of Traveled Way.

APPROVED BY DESIGN METHODS ENGINEER
MEDIAN OBSTACLE PROTECTION

TRAFFIC

Edge of Traveled Way

End Anchor (length varies)

Protection Length

End Anchor (length varies)

High Tension Cable Guardrail

LOCATION STATION

REVISIONS:
- Added Guardrail, Special Anchor Section as Possible Contract Item.
- Changed Edge of Pavement to Edge of Traveled Way.

APPROVED BY DESIGN METHODS ENGINEER

STANDARD ROAD PLAN

IOWA DOT

HIGH TENSION CABLE GUARDRAIL
For loop bars 6d1, 6d2, and 6d3, use 3/8" smooth steel bars with a minimum yield strength of 60 ksi, a tensile strength of not less than 1.25 times the yield strength but a minimum of 80 ksi, a minimum 14% elongation in 8 inches, and passing a 180 degree bend test using a 3/8" pin bend diameter.

Install loops within 3 of the plan dimensions.

Use Grade 60, ASTM A615 for all other reinforcements. Do not lift or move using loop bars 6d1, 6d2 or 6d3.

Provide for an approved monitoring schedule with a person on call and available 24 hours a day, each day of the week, to realign barrier which has been struck. Initiate service within one hour of notification of need.

Unless stated otherwise in the plans, the barrier rail sections shall be the property of the Contractor. Remove from the site upon completion of work.

Following removal of anchorage, fill all holes with an approved non-shrink grout.

Tapered end section is not designed for use within 30 feet of traffic on facilities with speed limits 55 mph or greater, nor within 10 feet of traffic on facilities with speed limits 40 mph to 50 mph.

Estimated quantity of concrete for one taper section is 0.6 cubic yards.

Include the cost of anchorage, when required in the price bid for "Temporary Barrier Rail, Concrete".

Possible Contract Item: Temporary Barrier Rail, Concrete

Possible Tabulation: 108-33

© IOWA DOT

STANDARD ROAD PLAN

BA-401

TEMPORARY BARRIER RAIL
(PRECAST CONCRETE)
**BARRIER MARKER PLACEMENT**

- Retainer bolt & nut are required for connections with 2-loop barriers (previous designs) or in conjunction with Strap Anchorages.

- Furnish and install Barrier Markers. Attach to the barrier in a manner approved by the manufacturer. Markers to face oncoming traffic and match the barrier in a manner approved by the manufacturer. Maintain the markers and promptly repair or replace any damaged or missing units. Include costs for furnishing, installing and maintaining markers in the price bid for "Temporary Barrier Rail, Concrete."

**Per 12'-6" Barrier Section**

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>No. of Bar</th>
<th>Length Ft.</th>
<th>Weight Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a1</td>
<td>6d1</td>
<td>12</td>
<td>6'-0&quot;</td>
<td>48.1</td>
</tr>
<tr>
<td>6d2</td>
<td>4</td>
<td>6</td>
<td>35'-0&quot;</td>
<td>26.3</td>
</tr>
<tr>
<td>6d3</td>
<td>4</td>
<td>3</td>
<td>12'-0&quot;</td>
<td>38.1</td>
</tr>
<tr>
<td>6a2</td>
<td>4</td>
<td>2</td>
<td>10'-0&quot;</td>
<td>18.3</td>
</tr>
</tbody>
</table>

**LOOP ASSEMBLY**

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>No. of Bar</th>
<th>Length Ft.</th>
<th>Weight Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6a1</td>
<td>6</td>
<td>2</td>
<td>8'-0&quot;</td>
<td>25.3</td>
</tr>
<tr>
<td>6a2</td>
<td>2</td>
<td>2</td>
<td>7'-0&quot;</td>
<td>22.8</td>
</tr>
<tr>
<td>6a3</td>
<td>2</td>
<td>2</td>
<td>6'-0&quot;</td>
<td>25.5</td>
</tr>
</tbody>
</table>
Pre-drill holes for stakes with 1 3/8" dia. x 5" min. (OR Simpson 2 1/2" dia. x 4 3/4" min.)

Titen HD Wedge Bolt (2 3/8" dia. x 6" long ASTM A325 structural bolt OR Red Head Large Diameter Tapcon (2 3/8" dia. x 4 3/4" min.) OR Simpson Red Head Multi-Set II drop-in anchor with 2 3/8" dia. x 10" long)

3 stakes required per rail section.

Pre-drill holes for stakes with 1 3/8" core bit.

See Table A

TABLE A
ANCHORAGE REQUIREMENTS

<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Dropoff Depth</th>
<th>Min. Offset (ft)</th>
<th>Min. Offset (ft) (when TBR is bracket-anchored)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement from pavement</td>
<td>≤ 24&quot;</td>
<td>24&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Pavement from bridge</td>
<td>≥ 3'</td>
<td>1&quot;</td>
<td>N/A</td>
</tr>
<tr>
<td>HMA Pavement from pavement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCC Pavement from pavement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pavement from bridge</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fixed vertical object: N/A 24" 6"

A dropoff is a slope of 2H:1V or steeper.
TAPERED END SECTION

SIDE ELEVATION
(For connection to "marked end" of barrier. Invert loop bars for other end.)

PLAN

CENTER OF GRAVITY

DETAIL 'A'

2" min. clear

PERSPECTIVE VIEW

8" Tempory Barrier Rail

FRONT ELEVATION

END SECTION

BENT BAR DETAILS
(Dimensions are out to out of bars unless otherwise noted.)

Per 12'-6" Barrier Taper Section

<table>
<thead>
<tr>
<th>Bar</th>
<th>Dia.</th>
<th>Shape</th>
<th>No. of Bars</th>
<th>Length</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>4V1</td>
<td>6d1</td>
<td>4</td>
<td>2</td>
<td>23&quot;</td>
<td>2.0</td>
</tr>
<tr>
<td>4V2</td>
<td>6d2</td>
<td>4</td>
<td>2</td>
<td>26&quot;</td>
<td>2.6</td>
</tr>
<tr>
<td>4V3</td>
<td>6d3</td>
<td>4</td>
<td>2</td>
<td>33&quot;</td>
<td>3.3</td>
</tr>
<tr>
<td>4V4</td>
<td>6d4</td>
<td>4</td>
<td>2</td>
<td>33&quot;</td>
<td>3.7</td>
</tr>
<tr>
<td>4V5</td>
<td>6d5</td>
<td>4</td>
<td>4</td>
<td>34.5&quot;</td>
<td>4.5</td>
</tr>
<tr>
<td>4V6</td>
<td>6d6</td>
<td>4</td>
<td>2</td>
<td>12.0&quot;</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Loop Assembly

<table>
<thead>
<tr>
<th>Bar</th>
<th>Dia.</th>
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<th>Length</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>4V1</td>
<td>6d1</td>
<td>5</td>
<td>1</td>
<td>8-5&quot;</td>
<td>12.6</td>
</tr>
<tr>
<td>4V2</td>
<td>6d2</td>
<td>5</td>
<td>1</td>
<td>7-7&quot;</td>
<td>11.2</td>
</tr>
<tr>
<td>4V3</td>
<td>6d3</td>
<td>5</td>
<td>1</td>
<td>8-7&quot;</td>
<td>12.2</td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
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<td>6d1</td>
<td>5</td>
<td>1</td>
<td>8-5&quot;</td>
<td>12.6</td>
</tr>
<tr>
<td>4V2</td>
<td>6d2</td>
<td>5</td>
<td>1</td>
<td>7-7&quot;</td>
<td>11.2</td>
</tr>
<tr>
<td>4V3</td>
<td>6d3</td>
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<td>1</td>
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<td>8-7&quot;</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Provide two lifting slots. See Section A-A for details. Location to be determined by the Contractor.

1 inch radius allowed.

Provide two lifting slots. See Section A-A for details. Location to be determined by the Contractor.

(For connection to "marked end" of barrier. Invert loop bars for other end.)

(Per 12'-6" Barrier Taper Section)

(See Detail 'A'

See chamfer detail

2 equal spaces

2" clear

2" clear

1-1/2" clear

1-1/2" clear

8" measured from face of rail to outside edge of loop bar.

Bent Bar Details
(For connection to "marked end" of barrier. Invert loop bars for other end.)

Dimensions are out to out of bars unless otherwise noted.

Provide two lifting slots. See Section A-A for details. Location to be determined by the Contractor.

1 inch radius allowed.

Provide two lifting slots. See Section A-A for details. Location to be determined by the Contractor.

(For connection to "marked end" of barrier. Invert loop bars for other end.)

Dimensions are out to out of bars unless otherwise noted.

Provide two lifting slots. See Section A-A for details. Location to be determined by the Contractor.

1 inch radius allowed.

Provide two lifting slots. See Section A-A for details. Location to be determined by the Contractor.

(For connection to "marked end" of barrier. Invert loop bars for other end.)

Dimensions are out to out of bars unless otherwise noted.

Provide two lifting slots. See Section A-A for details. Location to be determined by the Contractor.

1 inch radius allowed.
Possible Tabulation:
Temporary Crash Cushion
Embankment In Place
Possible Contract Items:
6'-0''
35'-0''
EMBANKMENT DIMENSIONS
BARREL INSTALLATION LINE LAYOUT
Angle of Barrel Installation Line is measured from a line parallel to roadway centerline.

For obstacles located within the traveled way where space is limited, Barrel Installation Line may be parallel to roadway centerline. In this case, X dimension equals Y dimension.

Approach Traffic

EMBANKMENT PLAN

EMBANKMENT TYPICAL SECTION

EMBANKMENT DIMENSIONS

<table>
<thead>
<tr>
<th>For Obstacle Width</th>
<th>Sand Barrel Layout Required</th>
<th>X</th>
<th>Y (must be negative)</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-6'' - 10'-7''</td>
<td>1</td>
<td>26&quot;</td>
<td>+ 0.0&quot;</td>
<td>3.75 + 12.0&quot;</td>
</tr>
<tr>
<td>10'-8'' - 17'-9''</td>
<td>2</td>
<td>26&quot;</td>
<td>+ 12.0&quot;</td>
<td>3.75 + 38.0&quot;</td>
</tr>
<tr>
<td>17'-10'' - 25'-11&quot;</td>
<td>3</td>
<td>26&quot;</td>
<td>+ 19.0&quot;</td>
<td>3.75 + 64.0&quot;</td>
</tr>
<tr>
<td>25'-0'' - 32'-3&quot;</td>
<td>4</td>
<td>26&quot;</td>
<td>+ 26.0&quot;</td>
<td>3.75 + 90.0&quot;</td>
</tr>
</tbody>
</table>

Where distance to obstacle is less than 15 feet from edge of traveled way:

Where distance to obstacle is 15 feet or greater from edge of traveled way:

Approach Traffic
PROTECTING OBSTACLES BETWEEN OPPOSING TRAFFIC

Ensure barrels do not extend beyond edge of obstacle for opposing traffic

Approach Traffic

OBSTACLE

30" min.

Leading Barrel

OBSTACLE

30" min.

Opposing Traffic

PROTECTING WIDE OBSTACLES

For wide obstacles, repeat sand barrel layout as needed

An installation consisting of multiple sand barrel layouts, similar to the one shown, will be measured as a single crash cushion.

All barrels separated by 6 inches.

Approach Traffic

Leading Barrel

SAND BARREL DELINEATION

Mount marker plate on the leading barrel, centered on the barrel installation line.

MARKER PLATE

BARREL INSTALLATION LINE

SAND BARREL LAYOUT

Sand Barrel Layout

TEMPORARY CRASH CUSHIONS

SAND BARREL

IOWA DOT

STANDARD ROAD PLAN

BA-500

REVISIONS:

Changed formula in Column Z.

APPROVED BY DESIGN METHODS ENGINEER

DRAWN: 6-19-15

REVISED: 6-19-15

SHEET 2 of 2