Barriers
<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-100</td>
<td>10-18-22</td>
<td>44&quot; Concrete Median Barrier (Full Section)</td>
</tr>
<tr>
<td>BA-101</td>
<td>10-18-22</td>
<td>44&quot; Concrete Median Barrier Width Transition</td>
</tr>
<tr>
<td>BA-102</td>
<td>10-18-22</td>
<td>44&quot; Concrete Barrier (Half Section)</td>
</tr>
<tr>
<td>BA-103</td>
<td>10-18-22</td>
<td>34&quot; Concrete Barrier (Half Section)</td>
</tr>
<tr>
<td>BA-104</td>
<td>10-18-22</td>
<td>34&quot; Concrete Barrier for use with Reinforced Paved Shoulder</td>
</tr>
<tr>
<td>BA-105</td>
<td>10-18-22</td>
<td>34&quot; to 44&quot; Concrete Barrier Transition Section</td>
</tr>
<tr>
<td>BA-106</td>
<td>10-18-22</td>
<td>Reinforced Paved Shoulder for Concrete Barrier</td>
</tr>
<tr>
<td>BA-107</td>
<td>10-18-22</td>
<td>Concrete Barrier End Section</td>
</tr>
<tr>
<td>BA-108</td>
<td>10-18-22</td>
<td>Concrete Barrier Tapered End Section</td>
</tr>
<tr>
<td>BA-110</td>
<td>10-18-22</td>
<td>Concrete Barrier 34&quot; Single Slope to 34&quot; F-Shape (Half Section)</td>
</tr>
<tr>
<td>BA-150</td>
<td>10-18-22</td>
<td>Side Obstacle Protection with Concrete Barrier and Guardrail</td>
</tr>
</tbody>
</table>

**Concrete Barriers**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-200</td>
<td>04-20-21</td>
<td>Steel Beam Guardrail Components</td>
</tr>
<tr>
<td>BA-201</td>
<td>10-18-22</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>10-18-22</td>
<td>Steel Beam Guardrail Thrie-Beam End Anchor</td>
</tr>
<tr>
<td>BA-205</td>
<td>10-19-21</td>
<td>Steel Beam Guardrail Tangent End Terminal (MASH TL-3)</td>
</tr>
<tr>
<td>BA-206</td>
<td>10-19-21</td>
<td>Steel Beam Guardrail Flared End Terminal For Cable Connection</td>
</tr>
<tr>
<td>BA-210</td>
<td>10-19-21</td>
<td>Guardrail Post Adaptor Unit</td>
</tr>
<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>10-18-22</td>
<td>Steel Beam Guardrail Barrier Transition Section (MASH TL-2)</td>
</tr>
<tr>
<td>BA-225</td>
<td>10-19-21</td>
<td>Steel Beam Guardrail Tangent End Terminal (MASH TL-2)</td>
</tr>
<tr>
<td>BA-250</td>
<td>04-20-21</td>
<td>Steel Beam Guardrail Installation at Concrete Barrier or Bridge End Post (MASH TL-3)</td>
</tr>
<tr>
<td>BA-251</td>
<td>04-20-21</td>
<td>Steel Beam Guardrail Installation at Side Object (Two-Way Protection)</td>
</tr>
<tr>
<td>BA-252</td>
<td>04-20-21</td>
<td>Steel Beam Guardrail Installation at Side Object (One-Way Protection)</td>
</tr>
<tr>
<td>BA-253</td>
<td>10-18-22</td>
<td>Steel Beam Guardrail Installation at Railroad Signal</td>
</tr>
<tr>
<td>NO.</td>
<td>DATE</td>
<td>TITLE</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>BA-260</td>
<td>04-20-21</td>
<td>Steel Beam Guardrail Installation at Concrete Barrier or Bridge End Post (MASH TL-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Cable Guardrail</strong></td>
</tr>
<tr>
<td>BA-351</td>
<td>10-19-21</td>
<td>High Tension Cable Guardrail</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Temporary Barrier Rails</strong></td>
</tr>
<tr>
<td>BA-401</td>
<td>04-20-21</td>
<td>Temporary Barrier Rail (Precast Concrete)</td>
</tr>
<tr>
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<td></td>
<td><strong>Crash Cushions</strong></td>
</tr>
<tr>
<td>BA-500</td>
<td>04-20-21</td>
<td>Temporary Crash Cushions Sand Barrel</td>
</tr>
</tbody>
</table>

10/18/22
### Concrete Barrier, BA-100 and Footing

**Possible Contract Item:**

- 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'-5&quot;</td>
<td>20</td>
<td>155</td>
<td>12'</td>
</tr>
<tr>
<td>19'-6&quot;</td>
<td>10</td>
<td>204</td>
<td>12'</td>
</tr>
</tbody>
</table>

#### Reinforcing Bar List

- **Per Section (Approx. 20 feet):**
  - **g1**
    - Mark: g1
    - Size: 5
    - Number of Bars: 20
    - Length: 7'-5"
    - WT. (lbs.): 155
    - Max. Spacing: 12'
  - **f1**
    - Size: 3
    - Number of Bars: 10
    - Length: 12'-6"
    - Max. Spacing: 3'-0"

#### Detailed Instructions

1. **Detail 'A'**
   - Saw cut top and front face.
   - No sealing required.

2. **G1 Bent Bar**
   - Saw cut 1 min. wide x 1" deep
   - 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. **SAWED CONTRACTION JOINT**
   - Saw cut top and front face.

4. **SECTION A-A**
   - 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 3 feet.

5. **For barrier dowelled to pavement, match pavement joints.**

6. **For free-standing barrier with integral footings, use 17 foot maximum, 15 foot minimum joint spacing.**

7. **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.**

8. **Concrete Barrier, BA-100 or Concrete Barrier, BA-100 and Footing**

#### Additional Notes

- 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 2403.03 of the Standard Specifications, but the use of forms is optional. If forms are used, place backfill around the completed footing.
- Expansion joints are necessary only where specifically required by project plans. Conform expansion material to the shape of the barrier. No sealer is required.
- 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 foot 6 inch minimum intervals using a method approved by the Engineer.
- 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.

#### Construction Header

- **Construction Header** or **Contraction Joint**

#### Elevation

- 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 foot 6 inch minimum intervals using a method approved by the Engineer.

#### Revision Notes

- **REVISION**
  - 10-18-22

#### Standard Road Plan

- **BA-100**
- **STANDARD ROAD PLAN**
- **44" CONCRETE MEDIAN BARRIER**
  - **(FULL SECTION)**

#### Possible Tabulation

- **108-18**

#### Additional Specifications

- **CONCRETE QUANTITIES**
  - **Per Foot**
  - **0.19 cy**
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 2 1/4 inch dressed and beveled strip.

3. Provide 3 feet overlap of reinforcing steel between sections.

Possible Contract Item: Concrete Barrier, BA-101
Possible Tabulation: 108-18

Concrete Quantities Per Section
- Per Section 1.5 cy
**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<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>20</td>
<td>150</td>
<td>12&quot;</td>
</tr>
<tr>
<td>f1</td>
<td>5</td>
<td>10</td>
<td>204</td>
<td>—</td>
</tr>
<tr>
<td>Lap</td>
<td>5</td>
<td>10</td>
<td>2.4&quot;</td>
<td>3</td>
</tr>
</tbody>
</table>

**ELEVATION**

- Use Graco 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 foot 6 inch 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 3 feet.

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

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

**Possible Expansion Joint or End of Barrier**

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

- Construct concrete footing when barrier is not placed on concrete slab. Apply Section 2405.00, 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 line.

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

Possible Tabulation:
- 108-18

**CONCRETE QUANTITIES**

| Per foot | 0.14 cy |

**SECTION A-A**

- 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 Section 2405.00, 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 line.

**Concrete Barriers, BA-102 and Footing**

**Concrete Barriers, BA-102 or Concrete Barriers, BA-102 and Footing**

**Possible Tabulation:**

- 108-18
SAWED CONTRACTION JOINT
Saw cut top and front face. Saw cut back if exposed.

5G1 BENT BAR
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 foot 6 inch 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 3 feet.

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-107, include 6 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 complying with Materials I.M. or hydraulic cement complying with Materials I.M. 491.13.

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

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.

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
Per foot
0.12 cy

Possible Contract Item:
Concrete Barrier, BA-103 or BA-107 and Footing

Possible Tabulation:
108-18B

REINFORCING BAR LIST
Per Section (Approx. 20 feet)

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>Number of Bar</th>
<th>Length</th>
<th>Weight [lbs.]</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5G1</td>
<td>5</td>
<td>20</td>
<td>5'-10&quot;</td>
<td>122</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5F1</td>
<td>5</td>
<td>8</td>
<td>2'-2&quot;</td>
<td>294</td>
<td>---</td>
</tr>
<tr>
<td>4W</td>
<td>5</td>
<td>5</td>
<td>2'-2&quot;</td>
<td>294</td>
<td>---</td>
</tr>
</tbody>
</table>

Possible Transition:
Concrete Barrier, BA-103 or BA-107 and Footing
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 3 feet. Contraction joint locations shall match pavement joint locations.

Fillet all exposed corners with a 1/4" inch dressed and beveled strip.

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.

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

When connecting to BA-107, include 6 additional #5 bars embedded a minimum of 3 feet into the BA-104 barrier.

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. Where abutting sections are placed as separate pours, a butt joint may be used. Extend longitudinal reinforcement into the abutting section a minimum of 3 feet.

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. Fillet all exposed corners with a ½ inch dressed and beveled strip.

4. Construct concrete footing when barrier is not placed on supporting surface. Apply Article 2403.03 of the Standard Specifications, but the use of forms is optional. If forms are used, please 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.

6. When connecting to BA-107, include 6 additional #5 bars embedded a minimum of 3 feet into the BA-105 barrier. Every transition rebar over length of transition section.

Possible Contract Item:
- Concrete Barrier, BA-105 or
- Concrete Barrier, BA-105 and Footing

Possible Tabulation:

- 108-188

Concrete Quantities for one Transition Section

1.3 cy

Reinforcing Bar List

<table>
<thead>
<tr>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5g3</td>
<td>5</td>
<td>11</td>
<td>122</td>
</tr>
<tr>
<td>5f1</td>
<td>10</td>
<td>10'-2&quot;</td>
<td>104</td>
</tr>
</tbody>
</table>

*Varies from 5'-10" to 7'-2"

Elevation

Typical Section

Concrete Barrier, BA-105 or Concrete Barrier, BA-105 and Footing

Possible Tabulation:

108-188

REVISION

10-18-22

STANDARD ROAD PLAN

BA-105

Sheet 1 of 1

34" TO 44" CONCRETE BARRIER TRANSITION SECTION

34" TO 44" CONCRETE BARRIER TRANSITION SECTION

CONCRETE QUANTITIES

for one Transition Section

1.3 cy

Reinforcing Bar List

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5g3</td>
<td>5</td>
<td>11</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>5f1</td>
<td>10</td>
<td>10'-2&quot;</td>
<td>104</td>
<td></td>
</tr>
</tbody>
</table>
**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>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>6#1</td>
<td>6'1&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>5#2</td>
<td>4'</td>
<td>12&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
<td>6#1</td>
<td>8'</td>
<td>12&quot;</td>
</tr>
<tr>
<td>10&quot;</td>
<td>5#2</td>
<td>8'</td>
<td>12&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>5#3</td>
<td>8'</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

**Notes:**

1. "L-2" or "KT-2" joint. When roadway pavement is existing, use BT-3 joint. See PV-101.
3. When shoulder will be located under a concrete barrier end section, replace 5g2 and 5g3 bars with reinforcement as shown on BA-107.
4. Increase these dimensions by one inch for every inch of paved shoulder thickness greater than 9 inches.
5. Match spacing of vertical bars in concrete barrier.

**Possible Contract Item:**
Reinforced Paved Shoulder for Concrete Barrier

**Possible Tabulation:**
108-18B

**REVISIONS:**
- Changed from F-shape to Texas single slope, Change reinforcing.

**APPROVED BY DESIGN METHODS ENGINEER:**

---

**PLAN**

**TYPICAL SECTION**

**Reinforced Paved Shoulder**

**Face of Barrier**

**Concrete Barrier**

**Beveled Key**

**Roadway**

**Paved Shoulder**

**Beveled Key**

Use 2 x 8 lumber 8" long to make keys. Place keys at 2'-8" centers.
CONCRETE QUANTITIES

VERTICAL

Per End Section
0.7 cy

VERTICAL

HORIZONTAL

SHAPE

LOCATION

NO.

WEIGHT

LENGTH

REINFORCING BAR LIST

BAR

"X"

6e1 VERTICAL

1 9'-0" 62

5c2 VERTICAL

2 9'-0" 10

5c3 VERTICAL

9 9'-0" 11

5c4 VERTICAL

4 10'-0" 12

5c5-5c8 VERTICAL

8 10'-0" 27

5c9 VERTICAL

6 9'-0" 26

5c10 VERTICAL

5 10'-0" 25

TOTAL WEIGHT (LBS.)

225

SAWED CONTRACTION JOINT

Saw out top and front face. Saw out back if exposed.

CONCRETE QUANTITIES

Per End Section
0.7 cy

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 expansion material to the shape of the barrier. No sealer is required.

Fillet all exposed corners with a 1/8 inch dressed and beveled strip.

Form holes using 1 inch diameter plastic conduit.

See BA-106 for details of 5c3 bars, 6e1 bars, and reinforced paved shoulder.

Possible Contract Item:
Concrete Barrier Rail, BA-107

Possible Tabulation:
108-18B
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 3 cubic yards of concrete are required to construct barrier as shown. Amount may vary depending on individual site requirements.

Possible Contract Item: Concrete Barrier, Tapered End, BA-108
Possible Tabulation: 108-18B

REVISION: 10-18-22
APPROVED BY DESIGN METHODS ENGINEER

STANDARD ROAD PLAN
BA-108
SHEET 1 of 1

CONCRETE BARRIER
TAPERED END SECTION
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. Form 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 3 feet.

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

Fillet all exposed corners with a 3/4" minimum width x 1" deep saw cut. No sealing required.

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-110

Possible Tabulation:
108-18B
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.

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

Possible Tabulations:
108-188
112-9

REVISIONS:
Changed from F-shape to Texas single slope.
W-BEAM INSTALLATION

ELEVATION

PLANT

SECTION

SECTION WITH CURB

LAPPING PROCEDURE

Possible Contract Item:
Steel Beam Guardrail

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

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

At Bridge End Drains, cut 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).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Splice Bolt Slots (typ.)
\( \frac{3}{8} \) dia. x \( \frac{3}{4} \)" \\
Post Bolt Slot (typ.)
\( \frac{3}{8} \) dia. x \( \frac{3}{4} \)"

RAIL SPLICE

One splice bolt required per slot

SECTION

THREE-BEAM RAIL

Splice Bolt Slots (typ.)
\( \frac{3}{8} \) dia. x \( \frac{3}{4} \)"

RAIL SPLICE

One splice bolt required per slot

SECTION

ASYMMETRICAL TRANSITION SECTION

10-gauge Section

STEEL BEAM GUARDRAIL COMPONENTS
Plan - Case A

- Steel or Wood Post
- Blockout
- Ground Elevation
- Mounting Height
- Top of Bedrock
- Special Backfill
- Drilled Hole

Plan - Case B

- Steel or Wood Post
- Blockout
- Ground Elevation
- Mounting Height
- Pavement

Plan - Pavement Thickness <= 8"

- Either approach is acceptable.

Plan - Pavement Thickness > 8"

- Installation information applies to both wood and steel posts.

- 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 two drills or a 15 inch bit with one drill. If placing post before paving, provide required leave-out area. Leave-out may be round or square.

- Use a 12 inch bit with three drills or a 24 inch bit with one drill.

Post Embedded

<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 = 24&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 Bedrock

Post Installed in Pavement
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. Refer to PV-102 for curb and runout details.

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

Materials included in the Contract Item:

- Steel Post Option:
  - (9) 6" x 6" x 6'-0" posts
  - (6) 6" x 6" x 6'-9" posts
  - (12) 6" x 12" x 19" blockouts
  - (3) 6" x 12" x 16" blockouts

- Wood Post Option:
  - (9) 6" x 6" x 6'-0" posts
  - (6) 6" x 6" x 7'-0" posts
  - (12) 6" x 12" x 19" blockouts
  - (3) 6" x 12" x 16" blockouts

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

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. Refer to PV-102 for curb and runout details.

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.
Guardsrail 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. Refer to PV-102 for curb and runout details.

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.

16d nail to prevent blockout rotation.

Guardsrail 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. Refer to PV-102 for curb and runout details.

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.

16d nail to prevent blockout rotation.
Possible Contract Item:
Steel Beam Guardrail End Anchor, Bolted

Materials included in the Contract Item:
- Thrie-Beam Terminal Connector
- Concrete Barrier End Section
- or Bridge Rail End Section

Installation Line

See Detail 'A'

SECTION A-A

5 - BOLT PATTERN
Thrie-Beam Terminal Connector

1" dia. Hole (typ.)

See Detail 'B'

32" Mounting Height

Possible Curb

Possible Curb
See BA-201.

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 bolted end anchor.

Thrie-Beam Terminal Connector

(7) - 1" dia. holes

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

16" Mounting Height

See Detail 'A'

See Detail 'B'

Possible Curb

Section of Guardrail

Installation Line

1" dia. Hole (by others)

See Detail 'E'

32" Mounting Height

3" Mounting Height

7 - BOLT PATTERN

Thrie-Beam Terminal Connector

(2) Approximately 8" long Guardrail Bolts

Countersink Guardrail

" 2" 4" 3" 18"

Wedge Blockout

6" long Guardrail Bolts

(2) Approximately

See Detail 'C'

at BTS Post #15

Wedge Blockout

Thrie-Beam Guardrail

Neat Thrie Beam Guardrail

BTS Post #14

Skip BTS Post #15

THREE-BEAM TERMINAL CONNECTOR

PLAN

SECTION C-C

DETAIL 'C'

ELEVATION
Possible Contract Item:
Steel Beam Guardrail End Anchor, W-Beam

Materials included in the Contract Item:
(1) 12'-6" End Section W-Beam Rail
(2) Foundation Tube Assemblies
(2) BCT Wood Posts
(1) Rounded W-Beam End Section
(1) Cable Anchor Bracket
(1) BCT Cable Anchor Assembly
(1) Ground Strut Assembly
(1) Pipe Sleeve
(1) Bearing Plate
(1) W-Beam Post (wood or steel - match remainder of installation)
(1) W-Beam Blockout

Approved bolts, nuts, and washers

Elevation
Installation

End Section W-Beam Rail

Rounded W-Beam End Section

Foundation Tube

Post Bolt Slot (typ.)
3/8" dia. X 3/4"

Anchor Bracket Slots (typ.)
5/8" dia. X 1 1/2"

Splice Bolt Slots (typ.)
7/8" dia. X 1 1/2"

BCT Post Assemblies

Ground Strut Assembly

W-Beam post and Blockout

Rounded W-Beam End Section

BCT Cable Anchor Assembly

Pipe Sleeve

Foundation Tubes

Bearing Plate

End Section W-Beam Rail

TRAFFIC

Elevation

Installation

End Section W-Beam Rail

Rounded W-Beam End Section

Foundation Tube

Post Bolt Slot (typ.)
3/8" dia. X 3/4"

Anchor Bracket Slots (typ.)
5/8" dia. X 1 1/2"

Splice Bolt Slots (typ.)
7/8" dia. X 1 1/2"

BCT Post Assemblies

Ground Strut Assembly

W-Beam post and Blockout

Rounded W-Beam End Section

BCT Cable Anchor Assembly

Pipe Sleeve

Foundation Tubes

Bearing Plate

End Section W-Beam Rail

TRAFFIC
When attaching anchor to thrie beam, replace Asymmetrical Transition with 6'-3" of thrie beam.

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

Approved bolts, nuts, and washers

Refer to BA-200.

Cover entire face of end section with alternating black and yellow striped adhesive sheathing. 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 sheathing.
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.
Use materials meeting the respective manufacturer’s specifications. Install end terminals according to the manufacturer’s recommendations.

Drive posts using a hammer driver. Ensure posts are not damaged during installation. Posts may be placed in prebored holes if site conditions are such that posts cannot be driven. Place backfill material consisting of material removed or other suitable soil around posts. Place the backfill material in lifts not exceeding 4 inches. Thoroughly compact each lift before the next lift is placed.

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.

Refer to BA-200.
Refer to Materials I.M. 465.02 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.

Drive posts using a hammer driver. Ensure posts are not damaged during installation. Posts may be placed in prebored holes if site conditions are such that posts cannot be driven. Place backfill material consisting of material removed or other suitable soil around posts. Place the backfill material in lifts not exceeding 4 inches. Thoroughly compact each lift before the next lift is placed.

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

Refer to BA-200.

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

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

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

Imaginary Line = 31" Mounting Height

NEAREST TRAFFIC
Install post adapter unit on top of box culverts or similar situations when standard post embedments are not possible. Not intended for use on intakes.

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.

Bolt length equals slab thickness plus 2 inches.

Provide W6x9 or W6x8.5 steel guardrail post. Supply routed blockout or nail blockout to post in order to prevent twisting.

Drill holes using equipment designed to cut through concrete and reinforcing steel.

Grout spalling before placement of bottom plate using a grout consisting of equal parts by weight of Portland cement and concrete sand, mixed with sufficient water to form a paste.

Twelve inch minimum to end of top of culvert if no headwall is present.

Bolt length to provide a minimum of 8 inch embedment. Use 1 - 2.5 inch washer per bolt.

Possible Contract Items:
- Steel Beam Guardrail, Post Adapter Unit, BA-210
- Steel Beam Guardrail

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

Incidental to Adapter Unit:
- 1 - 12" x 8 1/2" x 3/8" ASTM A36 Steel Plate
- 1 - 11" x 8 1/2" x 3/8" 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:
- 108-8A
- 108-8B
- 108-8C

Revised offset to 12" in Typical Sections.

Added Sheet 2. Added washers to circle notes 1 and 6.

Approved by Design Methods Engineer.

**BASE PLATE AND POST**

**TYPICAL SECTION**

---

**TYPICAL SECTION**

---

**BASE PLATE**

---

**BOTTOM PLATE**

---
Minimum 5 posts at half post spacing

Minimum 12 inches between post and edge of culvert.

Minimum 4 inches between edge of culvert and center of anchor.
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.

### Elevations

#### Elevation - Type 1
- (1 post omitted)
- Standard W-Beam Guardrail
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 31" Mounting Height
- 10:1 max. obstruction width
- 12" min.
- 6'-6" CRT Post Location
  - A (see table)
- Rail Elements

#### Elevation - Type 2
- (2 posts omitted)
- Standard W-Beam Guardrail
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 12'-6" (3 CRT posts @ 6'-3" spacing)
- 31" Mounting Height
- 16:9 max. obstruction width
- 12" min.
- 6'-0" CRT Post Location
  - A

#### Elevation - Type 3
- (3 posts omitted)
- Standard W-Beam Guardrail
- 16'-9" (3 CRT posts @ 6'-3" spacing)
- 16'-9" (3 CRT posts @ 6'-3" spacing)
- 16'-9" (3 CRT posts @ 6'-3" spacing)
- 16'-9" (3 CRT posts @ 6'-3" spacing)
- 16'-9" (3 CRT posts @ 6'-3" spacing)
- 31" Mounting Height
- 12" max. obstruction width
- 12" min.

### Lapping Procedure
- 12" Blockout
- as shown in contract documents
- 31" Mounting Height
- 10:1 Slope (max.)
- 31" Mounting Height
- 6" preferred, 2" max.
- 24" min.

### Minimum Guardrail Length

<table>
<thead>
<tr>
<th>Installation Type</th>
<th>Minimum Guardrail Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37'-6&quot;</td>
</tr>
<tr>
<td>2</td>
<td>43'-9&quot;</td>
</tr>
<tr>
<td>3</td>
<td>59'-2&quot;</td>
</tr>
</tbody>
</table>

### 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 Curves, 6" Sloped Curves, and non-standard curbs.

### Materials Included in the Contract Item:
- Steel Beam Guardrail
- Approved bolts, nuts, and washers

### Possible Tabulations:
108-88
108-94C
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. Refer to PV-102 for curb and runout details.

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

Materials included in the Contract Item:
Steelf Post Option:
(5) W9x9 x 6'-0" posts
(2) 6" x 12" x 19" blockouts
(3) 6" x 12" x 14" blockouts
Wood Post Option:
(5) 6" x 8" x 6'-0" posts
(2) 6" x 12" x 19" blockouts
(3) 6" x 12" x 14" blockouts
(1) Asymmetrical Transition Section
(2) 3'-12" Thrie-Beam rail sections
(2) 12'-6" W-Beam rail sections
Approved bolts, nuts, and washers
Refer to BA-200 for guardrail components.
Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.

1. Possible 4 inch sloped curb. See project plans. Refer to PV-102 for curb and runout details.

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

3. Place bolt in top hole only.

4. Revised curb note.
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. Refer to PV-102 for curb and runout details.

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.

WOOD BTS POSTS #1-3

WOOD BTS POST #4

WOOD BTS POST #5
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.

Drive posts using a hammer driver. Ensure posts are not damaged during installation. Posts may be placed in prebored holes if site conditions are such that posts cannot be driven. Place backfill material consisting of material removed or other suitable soil around posts. Place the backfill material in lifts not exceeding 6 inches. Thoroughly compact each lift before the next lift is placed.

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
NEAREST TRAFFIC

LAPPING PROCEDURE

Variable Tangent (Multiple of 6'-3")

Pay Length for Steel Beam Guardrail (varies)

Pay Length for Steel Beam Guardrail (varies)

Face of Guardrail

Installation Line

Concrete Barrier or Bridge Rail

Rail Elements

Rail Splice

Rail Splice

STEEL BEAM GUARDRAIL
INSTALLATION AT CONCRETE BARRIER OR BRIDGE RAIL END SECTION (MASH TL-3)

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

Possible Tabulation:

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.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

For general guardrail details, see BA-200.

Install delineators and object markers according to SI-211.

Possible Tabulation:

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:

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.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

Install delineators and object markers according to SI-211.

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:

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.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

Install delineators and object markers according to SI-211.
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-205.
2. See BA-206.

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

Possible Tabulation:
- 108-88
LAPPING PROCEDURE

VARIABLE FLARE

12'-6"

1'-3"

VARIABLE FLARE

APPROACH TRAFFIC

INSTALLATION AT SIDE OBJECT

STEEL BEAM GUARDRAIL

INSTALLATION AT SIDE OBJECT

(ONE-WAY PROTECTION)

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

STEEL BEAM GUARDRAIL

INSTALLATION AT SIDE OBJECT

(ONE-WAY PROTECTION)

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

See BA-203.

See BA-205.

See BA-206.

Install delineators and object markers according to SI-211.

Removed Interim from standard.
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, Three-Beam
- Steel Beam Guardrail Tangent End Terminal, BA-205

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

Possible Tabulation:
108-8D

STANDARD ROAD PLAN
BA-253
Sheet 1 of 1

REVISIONS:
Modification to BA-204.
Modified pay length for Thrie-Beam End Anchor as a result of a modification to BA-205.

APPROVED BY DESIGN METHODS ENGINEER

DESIGNER INFORMATION
LAPPING PROCEDURE

VARIABLE FLARE

NEAREST TRAFFIC

For general guardrail details, see BA-200.

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

Possible Contract Items:
- Steel Beam Guardrail
- Pay length for:
  - BA-225
  - BA-202
  - BA-221
- See BA-221 for connections to concrete barriers and bridge rail end sections.
- See BA-225 for grading requirements.
Possible Contract Items:
- High Tension Cable Guardrail
- High Tension Cable Guardrail, End Anchor
- Guardrail, Special Anchor Section

Possible Tabulation:
108-9A

Length varies depending on High Tension Cable Guardrail system.

Guardrail system.
MEDIAN OBJECT PROTECTION

1. Length varies depending on High Tension Cable Guardrail system.
For loop bars 6d1, 6d2, and 6d3, use 2 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 1/2" 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".

Permanently mark one end of each rail section with manufacturing information. The "marked end" is that end of the barrier having one loop bar at the top and two loop bars at the bottom. Include the following information in the marking:

- Manufacturer Identification
- Data Manufactured (Month and Year)
- BA-401 Type A

Possibly Tabulation:
- Temporary Barrier Rail, Concrete

Possible Tabulation: 108-33
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 in the price bid for “Temporary Barrier Rail, Concrete.”

Per 12'-6" Barrier Section

<table>
<thead>
<tr>
<th>No.</th>
<th>Size</th>
<th>Shape</th>
<th>No. of Bars</th>
<th>Length / Ft.</th>
<th>Weight / Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6d1</td>
<td>6</td>
<td>4</td>
<td>12</td>
<td>6'-0&quot;</td>
<td>48.1</td>
</tr>
<tr>
<td>6d2</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>36&quot;</td>
<td>26.3</td>
</tr>
<tr>
<td>6d3</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>12'-2&quot;</td>
<td>36.1</td>
</tr>
</tbody>
</table>

BENT BAR DETAILS

(Marked and shown, invert for other end.)

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

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

Connection Pin

(316 Steel - 10.9 lbs. each)

Retainer Bolt & Nut

(3/8" dia. bolt & nut

(ASTM A490, Grade 8)
Pre-drill holes for stakes with 1 1/8" core bit.

STAKE ANCHORAGE

For use on:
- HMA Pavement (2" min. thickness)
- Composite Pavement
- PCC Pavement

TIE-DOWN STRAP (after bending)

TABLE A
ANCHORAGE REQUIREMENTS

<table>
<thead>
<tr>
<th>Object</th>
<th>Dropoff from pavement</th>
<th>Dropoff from bridge</th>
<th>Min. offset where TBR is Unanchored</th>
<th>Min. offset where TBR is Anchored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed vertical object</td>
<td>≤ 24&quot;</td>
<td>≥ 24&quot;</td>
<td>6&quot;</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>&gt; 24&quot;</td>
<td>&gt; 45&quot;</td>
<td>6&quot;</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>≥ 3&quot;</td>
<td>&gt; 3&quot;</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Fixed vertical object</td>
<td></td>
<td></td>
<td>N/A</td>
<td>24&quot;</td>
</tr>
</tbody>
</table>

* A dropoff is a slope of 2H:1V or steeper

STRAIGHT ANCHORAGE

For use on:
- Bridge Decks
- PCC Pavement
- Composite Pavement
- HMA Pavement (2" min. thickness)

0 " inch Red-Head Multi-Set II drop-in anchor with 1 1/8" dia. x 1 1/2" long ASTM A325 structural bolt OR Red-Head Large Diameter Tapcon (3/4" dia. x 4 1/2" min.) OR Simpson Titen HD Wedge Bolt (3/4" dia. x 5" min.).

3 stakes required per rail section.

Pre-drill holes for stakes with 1 1/8" core bit.
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>Bar Size</th>
<th>Shape</th>
<th>No. of Bars</th>
<th>Length ft</th>
<th>Weight lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4d1</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>23'</td>
<td>2.6</td>
</tr>
<tr>
<td>4d2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>34'</td>
<td>3.9</td>
</tr>
<tr>
<td>6d1</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>37'</td>
<td>3.9</td>
</tr>
<tr>
<td>6d2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>42'</td>
<td>4.2</td>
</tr>
<tr>
<td>4d3</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>27'</td>
<td>4.9</td>
</tr>
<tr>
<td>4d4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>12'-5&quot;</td>
<td>16.2</td>
</tr>
<tr>
<td>4d5</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>6'-0&quot;</td>
<td>10.2</td>
</tr>
</tbody>
</table>

LOOP ASSEMBLY

<table>
<thead>
<tr>
<th>Bar</th>
<th>Bar Size</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>4d1</td>
<td>10°</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4d2</td>
<td>13°</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4d3</td>
<td>17°</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4d4</td>
<td>20°</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4d5</td>
<td>23°</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4d6</td>
<td>25°</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

1 inch radius allowed.

For stirrup assembly 2 at each size required for stimpur assembly (Connection to "Marked End" shown, invert for other end).

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

12'-6" measured from face of rail to outside edge of loop bar.

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

PLAN

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

TAPERED END SECTION

CENTER OF GRAVITY

2" min. clear

DETAILED 'A'

PERSPECTIVE VIEW

TRAFFIC

FRONT ELEVATION

END SECTION

TEMPORARY BARRIER RAIL (PRECAST CONCRETE)
Possible Tabulation:
Temporary Crash Cushion
Embankment In Place

Possible Contract Items:

**EMBANKMENT DIMENSIONS**

<table>
<thead>
<tr>
<th>For Object Width</th>
<th>Sand Barrel Layout Required</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-0&quot; - 10'-7&quot;</td>
<td>1</td>
<td>2-3'</td>
<td>2-3'</td>
<td>3.72(23+12')</td>
<td></td>
</tr>
<tr>
<td>10'-8&quot; - 17'-9&quot;</td>
<td>2</td>
<td>2-3'</td>
<td>2-3'</td>
<td>3.72(23+12')</td>
<td></td>
</tr>
<tr>
<td>17'-10&quot; - 24'-3&quot;</td>
<td>4</td>
<td>2-3'</td>
<td>2-3'</td>
<td>3.72(23+12')</td>
<td></td>
</tr>
</tbody>
</table>

**EMBANKMENT TYPICAL SECTION**

BARREL INSTALLATION LINE LAYOUT
Angle of Barrel Installation Line is measured from a line parallel to roadway centerline.

- **For object located within the traveled way where space is limited,** Barrel Installation Line may be parallel to roadway centerline. In this case, **dimension equals dimension.**
- **For object located 15 feet or greater from edge of traveled way:**

**LOCATION STATION**

**OBJECT**

**LOCATION STATION**

**EMBANKMENT PLAN**

**EMBANKMENT TYPICAL SECTION**

**EMBANKMENT PLAN**

**EMBANKMENT TYPICAL SECTION**

**BARREL INSTALLATION LINE LAYOUT**
Angle of Barrel Installation Line is measured from a line parallel to roadway centerline.

- **Where distance to object is less than 15 feet from edge of traveled way:**
- **Where distance to object is 15 feet or greater from edge of traveled way:**
SAND BARREL LAYOUT

PROTECTING OBJECT BETWEEN OPPOSING TRAFFIC

For wide object, 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.

OBJECT

PROTECTING WIDE OBJECT

Mount marker plate on the leading barrel, centered on the barrel installation line.
0.032 inch aluminum plate sheeted with yellow Type III or Type IV retroreflective sheeting

Self-adhesive sheeting meeting the above requirements may be substituted for the marker plate.

Mount plate using four 1/4" bolts, nuts, and washers meeting the requirements of Article 4185.09 for Type A signs.

SAND BARREL DELINEATION

SAND BARREL LAYOUT

Border of Object

30" min.

Approach Traffic

Leading Barrel

Barrel Installation Line

Sand Barrel (36" nominal dia.)

Sand Weight (lbs)

30" min.

Approach Traffic

Opposing Traffic

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

OBJECT

REVISION: 04-20-21

STANDARD ROAD PLAN
BA-500
REVISIONS:

Changed Obstacle to Object.

APPROVED BY DESIGN METHODS ENGINEER

TEMPORARY CRASH CUSHIONS
SAND BARREL