Barriers
<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-100</td>
<td>04-21-20</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>04-21-20</td>
<td>44&quot; Concrete Barrier (Half Section)</td>
</tr>
<tr>
<td>BA-103</td>
<td>04-21-20</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>
</tr>
<tr>
<td>BA-105</td>
<td>10-15-19</td>
<td>34&quot; to 44&quot; Concrete Barrier Transition Section</td>
</tr>
<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>
</tr>
<tr>
<td></td>
<td>10-17-17</td>
<td>Steel Beam Guardrail</td>
</tr>
<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>
</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>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>
</tr>
<tr>
<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>
</tr>
<tr>
<td>BA-251</td>
<td>04-19-16</td>
<td>Steel Beam Guardrail Installation at Side Obstacle (Two-Way Protection)</td>
</tr>
<tr>
<td>BA-252</td>
<td>10-20-20</td>
<td>Steel Beam Guardrail Installation at Side Obstacle (One-Way Protection)</td>
</tr>
<tr>
<td>BA-253</td>
<td>04-19-16</td>
<td>Steel Beam Guardrail Installation at Railroad Signal</td>
</tr>
<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>
</tr>
</tbody>
</table>
## Barriers

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA-351</td>
<td>10-15-19</td>
<td>High Tension Cable Guardrail</td>
</tr>
<tr>
<td>BA-401</td>
<td>10-15-19</td>
<td>Temporary Barrier Rail (Precast Concrete)</td>
</tr>
<tr>
<td>BA-500</td>
<td>04-19-16</td>
<td>Temporary Crash Cushions Sand Barrel</td>
</tr>
</tbody>
</table>
Concrete Barrier, BA-100 and Footing

Possible Contract Item:

4"

Per Foot

5"

3"

CONCRETE QUANTITIES

<table>
<thead>
<tr>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>WT (lbs)</th>
<th>Max. Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>7'-4&quot;</td>
<td>197</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>f1</td>
<td>6</td>
<td>7</td>
<td>19'-9&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'-6" 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.

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-100 or Concrete Barrier, BA-100 and Footing

Possible Tabulation: 106-18
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.

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.

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

Provide 18 inch overlap of reinforcing steel between sections.
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>f1</td>
<td>5</td>
<td>7</td>
<td>19'-6&quot;</td>
<td>141</td>
<td></td>
</tr>
</tbody>
</table>

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 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.

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 2403.03, 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:

Concrete Barrier, BA-102 and Footing

SECTION A-A

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
0.11 cy
SAWED CONTRACTION JOINT
Saw cut top and front face. Saw cut back if exposed.

DETAIL 'A'
Special Shaping for Barrier over Intake

REINFORCING BAR LIST
Per Section (Approx. 20 feet)

<table>
<thead>
<tr>
<th>Bar</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>5'-8&quot;</td>
<td>83</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>m</td>
<td>5</td>
<td>19'-6&quot;</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

CONCRETE QUANTITIES
Per Foot
0.10 cy

34" CONCRETE BARRIER
(HALF 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.

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.

Possible Contract Item: Concrete Barrier, BA-104

Possible Tabulation: 108-18B

**ESTIMATED QUANTITIES FOR BARRIER**

<table>
<thead>
<tr>
<th>Per Linear Foot</th>
<th>Concrete - Cu. Yds.</th>
<th>Reinforcing Steel - Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Section (Approximately 20')</td>
<td>0.12</td>
<td>17.6</td>
</tr>
</tbody>
</table>

**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Bar</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5g1</td>
<td>15</td>
<td>2'-8&quot;</td>
<td>1'-4&quot;</td>
</tr>
<tr>
<td>6f1</td>
<td>9</td>
<td>18'-4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**SAWED CONTRACTION JOINT**

* Saw cut top and front face, saw cut back if exposed.

**SECTION A-A**

**BARRIER FACE**

**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.

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'-4".
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. File all exposed corners with a 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.

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-105 or Concrete Barrier, BA-105 and Footing

Possible Tabulation:
108-18B

Concrete Barrier, BA-105 and Footing

### REINFORCING BARS 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>g1</td>
<td>5</td>
<td>8</td>
<td>5'-3&quot;</td>
<td>53.5</td>
</tr>
<tr>
<td>h1</td>
<td>5</td>
<td>7</td>
<td>10'-0&quot;</td>
<td>73.5</td>
</tr>
<tr>
<td>d2</td>
<td>5</td>
<td>2</td>
<td>9'-4&quot;</td>
<td>11.6</td>
</tr>
</tbody>
</table>

* Varies from 5'-7" to 7'-3"
REINFORCING BAR LIST
Per Shoulder Panel (Approximately 20 Linear Feet)

<table>
<thead>
<tr>
<th>Bar</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'</td>
<td>6x1</td>
<td>8'</td>
</tr>
<tr>
<td>6'</td>
<td>5x2</td>
<td>8'</td>
</tr>
<tr>
<td>8'</td>
<td>6x1</td>
<td>8'</td>
</tr>
<tr>
<td>10'</td>
<td>5x2</td>
<td>8'</td>
</tr>
<tr>
<td>12'</td>
<td>5x2</td>
<td>8'</td>
</tr>
</tbody>
</table>

Applies to all Shoulder Widths

5x2 varies
5x3 varies

---

REINFORCED PAVED SHOULDER
FOR CONCRETE BARRIER

Possible Contract Item:
Reinforced Paved Shoulder for Concrete Barrier

Possible Tabulation:
108-18B

Face of Barrier
Paved Shoulder
Beveled Key
Concrete Barrier

Match roadway pavement thickness (8' min.)

5x2 bars spaced at 12'

Beveled Key
Use 2 x 8 lumber 8' long to make keys. Place keys at 2'-0" centers.

REVISION
10-21-14
APPROVED BY DESIGN METHODS ENGINEER

STANDARD ROAD PLAN
BA-106
SHEET 1 of 1

REVISIONS:
1. Changed Possible Contract Item.

FOR CONCRETE BARRIER

Possible Location of Vertical Bars in Concrete Barrier.

Increase these dimensions by one inch for every inch of
paved shoulder thickness greater than 6 inches.

Match spacing of vertical bars in concrete barrier.


No 'CD' joint baskets required within 4' of outside edge of
shoulder.

When shoulder will be located under a concrete barrier
end section, replace 5g2 and 5g3 bars with
reinforcement as shown on BA-107.

Match spacing by one inch for every inch of
paved shoulder thickness greater than 6 inches.

'CD' joint. When roadway pavement is existing,
use 'BT-3' joint. See PV-101.

No 'CD' joint baskets required within 4' of outside edge of
shoulder.
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. 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.

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 3/8 inch dressed and beveled strip.

4. Form holes using 1 inch diameter plastic conduit.

5. See BA-106 for details of 5c3 bars, 5c2 bars, and reinforced paved shoulder.

Possible Contract Item:
Concrete Barrier Rail, BA-107

Possible Tabulation:
108-18B

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

CONCRETE QUANTITIES
Per End Section
0.62 cy

BENT BAR DETAIL
All dimensions are out to out. D = pin diameter.

REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>BAR</th>
<th>LOCATION</th>
<th>SEQ NO</th>
<th>LENGTH</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5c1</td>
<td>VERTICAL</td>
<td>8</td>
<td>6'-9&quot;</td>
<td>42</td>
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<tr>
<td>5c2</td>
<td>VERTICAL</td>
<td>2</td>
<td>5'-6&quot;</td>
<td>10</td>
</tr>
<tr>
<td>5c4</td>
<td>VERTICAL</td>
<td>6</td>
<td>6'-5&quot;</td>
<td>26</td>
</tr>
<tr>
<td>5c15</td>
<td>VERTICAL</td>
<td>5</td>
<td>5'-4&quot;</td>
<td>26</td>
</tr>
<tr>
<td>5c4</td>
<td>HORIZONTAL</td>
<td>5</td>
<td>5'-1&quot;</td>
<td>28</td>
</tr>
<tr>
<td>5c2</td>
<td>HORIZONTAL</td>
<td>4</td>
<td>6'-6&quot;</td>
<td>26</td>
</tr>
<tr>
<td>5c1</td>
<td>HORIZONTAL</td>
<td>1</td>
<td>3'-6&quot;</td>
<td>4</td>
</tr>
</tbody>
</table>

TOTAL WEIGHT (LBS) 225

REVISIONS:
New logo.
APPROVED BY DESIGN METHODS ENGINEER

STANDARD ROAD PLAN
BA-107
SHEET 1 of 1

REVISION 3
10-15-19

CONCRETE BARRIER
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.

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

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

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

For joint detail, see PV-101.

Possible Contract Item:
Concrete Barrier, Tapered End, BA-108
Possible Tabulation:
108-18B
Possible Contract Items:
Concrete Barrier Items
Steel Beam Guardrail Items
PCC Paved Shoulder
Reinforced Paved Shoulder

Possible Tabulations:
108-18B
112-9

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.
W-BEAM INSTALLATION

1. 6" x 12" Blockout (typ.)
2. 3'-1" height
3. 16d Nail (typ.)
4. 6" Wood Post (optional)

Rail Elements

LAPPING PROCEDURE

Possible Contract Item:
Steel Beam Guardrail

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

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

- Splice Bolt Slots (typ.): \( \frac{3}{8} \)" dia. \( \times \frac{3}{4} " \)
- Post Bolt Slot (typ.): \( \frac{3}{8} " \) dia. \( \times \frac{3}{4} " \)
- Required per slot: One splice bolt

**THREE-BEAM RAIL**

- Splice Bolt Slots (typ.): \( \frac{3}{8} \)" dia. \( \times \frac{3}{4} " \)
- Post Bolt Slot (typ.): \( \frac{3}{8} " \) dia. \( \times \frac{3}{4} " \)
- Required per slot: One splice bolt

**ASYMMETRICAL TRANSITION SECTION**

- 10-gauge Section
Installation information applies to both wood and steel posts.

3. 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.

1. 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 into 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.
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'-0" posts
- (6) 6" x 6" x 6'-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'-0" posts
- (6) 6" x 6" x 6'-5" 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*
(5) 6'-0" W-beam rail sections
(1) 6'-3" 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

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

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'-0" posts
- (6) 6" x 6" x 6'-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'-0" posts
- (6) 6" x 6" x 6'-5" 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*
(5) 6'-0" W-beam rail sections
(1) 6'-3" 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

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'-0" posts
- (6) 6" x 6" x 6'-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'-0" posts
- (6) 6" x 6" x 6'-5" 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*
(5) 6'-0" W-beam rail sections
(1) 6'-3" 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

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'-0" posts
- (6) 6" x 6" x 6'-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'-0" posts
- (6) 6" x 6" x 6'-5" 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*
(5) 6'-0" W-beam rail sections
(1) 6'-3" 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

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'-0" posts
- (6) 6" x 6" x 6'-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'-0" posts
- (6) 6" x 6" x 6'-5" 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*
(5) 6'-0" W-beam rail sections
(1) 6'-3" 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

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'-0" posts
- (6) 6" x 6" x 6'-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'-0" posts
- (6) 6" x 6" x 6'-5" 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*
(5) 6'-0" W-beam rail sections
(1) 6'-3" 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.

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.
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.
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.
Materials included in the Contract Item:
- Steel Beam Guardrail End Anchor, Bolted
- Possible Contract Item: BA-201

Possible Contract Item:
- Thrie-Beam Terminal Connector
- Approved 2" x sufficient length Hex Bolts
- Approved ½" Hex Nuts
- Approved 2" Washers

Concrete Barrier End Section or Bridge Rail End Section
(5) - 1" dia. Holes

Possible Curb

Lap the Terminal Connector on the outside of the nested thrie beam rails for attachments on the trailing end of a bridge.

See BA-201.
(7) - 1" dia. Holes

32" Mounting Height

Possible Curb

See Detail 'A'

See Detail 'B'

32" Mounting Height

Curb

Installation Line

Possible Curb

SECTION B-B

THREE-BEAM TERMINAL CONNECTOR

THREE-BEAM TERMINAL CONNECTOR
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 end post. A nominal 1 inch gap is acceptable. Spacer boards are incidental to bolted end anchor.

(3) Approximately 6" long guardrail bolts

Countersink guardrail bolt so bolt does not protrude past outside edge of wedge blockout.

Wedge Blockout

Section of guardrail


THREE-BEAM TERMINAL CONNECTOR

BTS Post #15

Thrie-Beam Terminal Connector

Nested Thrie Beam Guardrail

32" Mounting Height

SECTION C-C

Installation Line

See Detail 'A'

1" dia. Hole
(by others)

32" Mounting Height

See Detail 'B'

Possible Curb

ELEVATION

PLAN

(7) - 1" dia. Holes

Wedge Blockout at BTS Post #15

See Detail 'C'

(2) Approximately 6" long guardrail bolts

(1) See BA-201.

Revised by others

BA-201

Thrie-Beam Terminal Connector

6" long Guardrail Bolts

Approximately

Wedge Blockout

6" Mounting Height

32" Mounting Height

Revised by others

PLAN

SECTION C-C

BA-202

STEEL BEAM GUARDRAIL

BOLTED END ANCHOR

REVISION 3-20-15

REVISIONS: Changed BTS post numbers to match changes in BA-201.

APPROVED BY DESIGN METHODS ENGINEER
Rounded W-Beam End Section

Materials included in the Contract Item:
- (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

Possibly Contract Item:
- Steel Beam Guardrail End Anchor, W-Beam

Approved bolts, nuts, and washers

Refer to BA-200.

Existing logo.

APPROVED BY DESIGN METHODS ENGINEER
Refer to BA-200.

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
(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) Cable Assembly
(1) Foundation Tube Assembly with Soil Plate
(1) Pipe Sleeve
Approved bolts, nuts, and washers.
New layout, notes, and title to reflect MASH approved end terminal.

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

Possible Contract Item:
- 108-8A
- 108-8B
- 108-8C
- 108-8D

Impact Head

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 sheathing.

Refer to BA-200.

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.

Refer to Materials I.M. 455.02 for a list of approved sources.

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 sheathing.

Refer to BA-200.

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.

Refer to Materials I.M. 455.02 for a list of approved sources.

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 sheathing.

Refer to BA-200.

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

Possible Contract Item:
- 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

COVERS:
Retitled. Modified graphics and notes.
Install post adapter unit on top of box culverts or similar situations when standard post embeddings 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.

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

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.

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

1. Twelve inch minimum to end of top of culvert if no headwall is present.
2. Bolt length to provide a minimum of 8 inch embedment.

Possible Contract Items:
- Steel Beam Guardrail, Post Adapter Unit, BA-210
- 6" x 12" x 14" Blockout
- W6 x 9 or W6 x 8.5 Steel Guardrail Post (variable length)

Possible Tabulations:
- 108-SA
- 108-BB
- 108-BC

Possible Details:
- B. 10:1 Slope (max.)
- Height 10" min.
- Mounting 31"
- Drill 1" dia. (typ.)
- 3-pass weld
- 3" dia. (typ.)
- 11" min.
- 8" min.

**Diagram Details:**
- **Typical Section (Bolt Through Connection):**
  - Base Plate
  - Steel Guardrail Post
  - 12" Blockout

- **Base Plate and Post:**
  - 3-pass weld
  - 3" dia. (typ.)

- **Typical Section (Epoxy Connection):**
  - Base Plate
  - Steel Guardrail Post
  - 13" Blockout
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.

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.

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.

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 0'-0" CRT posts
(6) 6" x 12" x 14'-0" blockouts
Approved bolts, nuts, and washers

Possible Tabulations:
108-69
108-8C

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

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

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

Location Station
12'-6" min.
12'-6" max.
12'-6"
12'-6"
12'-6"

Rail Elements
Lapping Procedure

Rail Elements

Distance

Location Station
12'-6" min.
12'-6" max.
12'-6"
12'-6"
12'-6"

Rail Elements
Lapping Procedure

Rear View
Front View
Side View

6'-0" CRT Post
Level Ground

TYPICAL SECTION AT CRT POST
TYPICAL SECTION AT CRT POST
TYPICAL SECTION AT BOX CULVERT

Installation Type Minimum
Guardrail Length
1 37'-0"
2 43'-9"
3 50'-0"

Possible Contract Item:
Steel Beam Guardrail

Materials included in the Contract Item:
(6) 6" x 8" x 0'-0" CRT posts
(6) 6" x 12" x 14'-0" blockouts
Approved bolts, nuts, and washers

Possible Tabulations:
108-69
108-8C

ELEVATION
Ground

TRAFFIC NEAREST

TYPICAL SECTION AT BOX CULVERT

CURT Post Location
A
Behind 4' curb
28'
Behind 6' curb
20'
Level ground
32'

TYPICAL SECTION AT CRT POST

Level Ground

BEhind Curb

6'-0"
15"
12"
31"
10.1 Slope (max.)

Gound Elevation

12" Blockout

12" Blockout

31" Mounting Height

12" Blockout

31" Mounting Height

Face of Culvert Headwall

24" min.

6" preferred,
2" max.

REVISION
10-21-14
SHEET 1 of 1
STANDARD ROAD PLAN
BA-211
STEEL BEAM GUARDRAIL
LONG-SPAN SYSTEM
FOR POST CONFLICTS

REVISIONS:
New.

APPROVED BY DESIGN METHODS ENGINEER
At Bridge End Drains, out Scour Protection (Transition Mat and Turf Reinforcement Mat) or remove rock as required to place posts 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

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

POST W6x9 or W6x8.5

BLOCKOUT

INSTALLATION

STEEL BTS POST #4

POST W6x9 or W6x8.5

BLOCKOUT

INSTALLATION

STEEL BTS POST #5

POST W6x9 or W6x8.5

BLOCKOUT

INSTALLATION
WOOD BTS POSTS #1-3

WOOD BTS POST #4

WOOD BTS POST #5

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.

Blockout #3

6' x 8" Wood Post

Mounting Height

Ground Elevation 10.1 Slope (max.)

Bridge Approach Section or Shoulder

Place bolt in top hole only.

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

16d nail to prevent blockout rotation.
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.
   - 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.
5. 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
**APPROACH TRAFFIC**

**LAPPING PROCEDURE**

- **Variable Tangent** (Multiple of 6.25"
  - Min. 12.5"
  - (Multiple of 6.25"
- **Variable Flare** (Multiple of 6.25"
  - Min. 12.5"
  - (Multiple of 6.25"

**INSTALLATION AT SIDE OBSTACLE**

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

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

**Possible Tabulation:**
- 108-8B

**For grading requirements, see EW-301.**

**For general guardrail details, see BA-200.**

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

Install delineators and object markers according to SI-211.
LAPPING PROCEDURE

VARIABLE FLARE

Edge of Travelled Way
End Terminal (40'-4" for Tangent, 37'-4" for Flared)
Variable Tangent (Multiple of 6.25')
Variable Flare (Multiple of 6.25')
Variable Tangent (Multiple of 6.25')
Min. 12.5' (Multiple of 6.25')
Variable Tangent (Multiple of 6.25')
Min. 12.5'
Variable Tangent (Multiple of 6.25')
Min. 12.5'
Variable Tangent (Multiple of 6.25')
Min. 12.5'
End Anchor (9'-6")

Steep Beam Guardrail Tangent End Terminal
(50'-6")

Install delineators and object markers according to SI-211.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

See BA-205.

Possible Contract Items:
Steel Beam Guardrail
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 Tabulation:
- Object Marker, Type 3
- Object Marker, Type 2
- Delineator, Rigid - Type I
- Steel Beam Guardrail End Anchor, Thrie-Beam: Steel Beam Guardrail Tangent End Terminal, BA-205
- Steel Beam Guardrail End Anchor, Thrie-Beam

Possible Contract Items:
- 108-8D
- 108-8D (Min. 21'-10"
- Variable Tangent (47'-8" for Tangent)
- Edge of Travelled Way
- Installation Line

LAPPING PROCEDURE

LOCATION STATION

NEAREST TRAFFIC

PLAN
LAPPING PROCEDURE

VARIABLE FLARE

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
- High Tension Cable Guardrail, End Anchor
- High Tension Cable Guardrail, Special Anchor Section

Possible Tabulation:
108-SA

LOCATION STATION

ROADSIDE OBSTACLE, TWO-WAY PROTECTION

ROADSIDE OBSTACLE, ONE-WAY PROTECTION
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 3/16" pin bend diameter. Install loops within 5% 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 reed.

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".

1. 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
   - Date Manufactured (Month and Year)
   - BA-401 Type A

2. Lifting hole. 4 inch diameter PVC Pipe.

3. 1 inch radius allowed.

Possible Contract Item: 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 and promptly repair or replace any damaged or missing markers to face oncoming traffic and match the barrier in a manner approved by the manufacturer.

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 markers to face oncoming traffic and match the barrier in a manner approved by the manufacturer.

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 markers to face oncoming traffic and match the barrier in a manner approved by the manufacturer.

<table>
<thead>
<tr>
<th>Bar</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>4</td>
<td>6</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>6</td>
<td>6'-0&quot;</td>
<td>26.3</td>
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<tr>
<td>6d3</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>12'-2&quot;</td>
<td>38.1</td>
</tr>
<tr>
<td>6d4</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>4'-0&quot;</td>
<td>16.3</td>
</tr>
<tr>
<td>6d5</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>8'-0&quot;</td>
<td>25.3</td>
</tr>
<tr>
<td>6d6</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>6'-0&quot;</td>
<td>22.8</td>
</tr>
<tr>
<td>6d7</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>8'-0&quot;</td>
<td>25.5</td>
</tr>
</tbody>
</table>
Pre-drill holes for stakes with 1 1/2" core bit.

3 stakes required per rail section.

Pre-drill holes for stakes with 1 1/2" core bit.
**TAPERED END SECTION**

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

- **PLAN**
  - Center of Gravity measured from face of rail to outside edge of loop bar.
  - 8" V bar Spa. for details. Location to be determined by the Contractor.

- **DETAIL ‘A’**
  - 2” min. clear
  - See chamfer detail

- **PERIOD VIEW**
  - Possible Curb
  - See chamfer detail

- **FRONT ELEVATION**
  - 12”-6” measured from face of rail to outside edge of loop bar.

- **END SECTION**
  - 1 inch radius allowed.

---

**BENT BAR DETAILS**

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

**PER 12'-6" BARRIER TAPER SECTION**

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Bar Shape</th>
<th>No. of Bars</th>
<th>Length</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>4x1</td>
<td>4</td>
<td>2</td>
<td>23&quot;</td>
<td>2.6</td>
</tr>
<tr>
<td>4x2</td>
<td>4</td>
<td>2</td>
<td>25&quot;</td>
<td>2.8</td>
</tr>
<tr>
<td>4x3</td>
<td>4</td>
<td>2</td>
<td>37&quot;</td>
<td>3.3</td>
</tr>
<tr>
<td>4x4</td>
<td>4</td>
<td>2</td>
<td>39&quot;</td>
<td>3.7</td>
</tr>
<tr>
<td>4x6</td>
<td>4</td>
<td>2</td>
<td>35&quot;</td>
<td>4.5</td>
</tr>
<tr>
<td>6d1</td>
<td>5</td>
<td>2</td>
<td>12.3</td>
<td>16.5</td>
</tr>
<tr>
<td>6d2</td>
<td>5</td>
<td>2</td>
<td>7.7</td>
<td>10.0</td>
</tr>
<tr>
<td>6d3</td>
<td>5</td>
<td>2</td>
<td>11.9</td>
<td>12.3</td>
</tr>
</tbody>
</table>

**LOOP ASSEMBLY**

<table>
<thead>
<tr>
<th>Bar</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>4x1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4x2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4x3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4x4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4x6</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**REINFORCING A615 Gr. 60**

**TEMPORARY BARRIER RAIL**

(PRECAST CONCRETE)
**Temporary Crash Cushion**

**Embankment In Place**

**Possible Contract Items:**
- 6'-0" Width
- 25'-0" Edge of Paverement
- 35'-0" Embankment Dimensions
- 3'-0" Barrell Installation Line

**Embankment Plan**

**Embankment Typical Section**

**Embankment Dimensions**

<table>
<thead>
<tr>
<th>For Obstacle Width</th>
<th>Sand Barrel Layout Required</th>
<th>(\text{Z} ) 3.73 (V + XYZ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-6&quot; or less</td>
<td>1</td>
<td>(V + 0')</td>
</tr>
<tr>
<td>3'-7&quot; - 10'-7&quot;</td>
<td>2</td>
<td>(V + 3'-3'')</td>
</tr>
<tr>
<td>10'-8&quot; - 17'-9&quot;</td>
<td>3</td>
<td>(V + 3'-3'') or (V + 6'')</td>
</tr>
<tr>
<td>17'-10&quot; - 32'-3&quot;</td>
<td>4</td>
<td>(V + 6'') or (V + 9'')</td>
</tr>
</tbody>
</table>

For obstacles located within the traveled way where space is limited, Barrel Installation Line may be parallel to roadway centerline. In this case, \(\text{Z}\) dimension equals \(\text{X}\) dimension.

Possible Tabulation:
- 108-30

**Barrel Installation Line Layout**

Angle of Barrel Installation Line is measured from a line parallel to roadway centerline.

**Approach Traffic**

**Shoulder Width**

**Edge of Pavement**

**Edge of Shoulder**

**Edge of Special Shaping**

**Possible Toe of Embankment**

**Embankment Toe**

**Embankment Dimensions**

**Sand Barrel**

**Temporary Crash Cushion**
**SAND BARREL LAYOUT**

- Edge of Obstacle
- Barrel Installation Line
- Sand Barrel (8" nominal dia.)
- Sand Weight (lbs)

**PROTECTING OBSTACLES BETWEEN OPPOSING TRAFFIC**

- Approach Traffic
- Opposing Traffic
- Ensure barrels do not extend beyond edge of obstacle for 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.

**SAND BARREL DELINEATION**

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

**MARKER PLATE**

- Mount plate using four 
  8 bolts, nuts, and washers meeting the requirements of Article 4186.09 for Type A signs.
- Self-adhesive sheeting meeting the above requirements may be substituted for the marker plate.

- 0.032 inch aluminum plate sheeted with yellow Type III or Type IV retroreflective sheeting

**TEMPORARY CRASH CUSHIONS**

- BA-500
- Sheet 2 of 2
- Approved by Jeff Williams, Transportation Engineer

**IOWA DOT STANDARD ROAD PLAN**

- REVISED: Changed formula in Column Z