Barriers
## Barriers

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>TITLE</th>
</tr>
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<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>
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<tr>
<td>BA-104</td>
<td>10-15-19</td>
<td>34&quot; Concrete Barrier for use with Reinforced Paved Shoulder</td>
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<tr>
<td>BA-105</td>
<td>10-15-19</td>
<td>34&quot; to 44&quot; Concrete Barrier Transition Section</td>
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<tr>
<td>BA-106</td>
<td>10-21-14</td>
<td>Reinforced Paved Shoulder for Concrete Barrier</td>
</tr>
<tr>
<td>BA-107</td>
<td>10-15-19</td>
<td>Concrete Barrier End Section</td>
</tr>
<tr>
<td>BA-108</td>
<td>10-17-17</td>
<td>Concrete Barrier Tapered End Section</td>
</tr>
<tr>
<td>BA-150</td>
<td>10-15-19</td>
<td>Side Obstacle Protection with Concrete Barrier and Guardrail</td>
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<tr>
<td></td>
<td></td>
<td><strong>Steel Beam Guardrail</strong></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>
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<td>BA-204</td>
<td>10-15-19</td>
<td>Steel Beam Guardrail Thrie-Beam End Anchor</td>
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<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>
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<td>BA-210</td>
<td>04-19-16</td>
<td>Guardrail Post Adaptor Unit</td>
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<tr>
<td>BA-211</td>
<td>10-21-14</td>
<td>Steel Beam Guardrail Long - Span System for Post Conflicts</td>
</tr>
<tr>
<td>BA-221</td>
<td>04-18-17</td>
<td>Steel Beam Guardrail Barrier Transition Section (MASH TL-2)</td>
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<tr>
<td>BA-225</td>
<td>10-17-17</td>
<td>Steel Beam Guardrail Tangent End Terminal (MASH TL-2)</td>
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<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>
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<tr>
<td>BA-251</td>
<td>04-19-16</td>
<td>Steel Beam Guardrail Installation at Side Obstacle (Two-Way Protection)</td>
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<td>BA-252</td>
<td>04-19-16</td>
<td>Steel Beam Guardrail Installation at Side Obstacle (One-Way Protection)</td>
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<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>
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## Barriers

<table>
<thead>
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<th>TITLE</th>
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<tbody>
<tr>
<td>BA-351</td>
<td>10-15-19</td>
<td>High Tension Cable Guardrail</td>
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<td><strong>Cable Guardrail</strong></td>
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<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>
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</table>

### Temporary Barrier Rails

### Crash Cushions
Concrete Barrier, BA-100 and Footing

Possible Contract Item:

4"
Per Foot
3"
5"
9"
10"
12"
44"

SECTION A-A

Concrete Quantities

<table>
<thead>
<tr>
<th>Mark</th>
<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>14</td>
<td>7'-4&quot;</td>
<td>197</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>f1</td>
<td>5</td>
<td>7</td>
<td>19'-0&quot;</td>
<td>141</td>
<td></td>
</tr>
</tbody>
</table>

F-SHAPE BARRIER FACE

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'-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.

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".

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: 108-18

G1 BENT BAR

SAWED CONTRACTION JOINT

Saw cut top and front face

3" min. wide x 1" deep saw cut. No sealer required.

DETAIL 'A'

Special Shaping for Barrier over Intake

CONCRETE QUANTITIES

Per Foot
0.10 cy

REINFORCING BAR LIST

Per Section (Approx. 20 feet)

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>WT (lbs)</th>
<th>Max. Spacing</th>
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<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>14</td>
<td>7'-4&quot;</td>
<td>197</td>
<td>1'-6&quot;</td>
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<tr>
<td>f1</td>
<td>5</td>
<td>7</td>
<td>19'-0&quot;</td>
<td>141</td>
<td></td>
</tr>
</tbody>
</table>

Possible Expansion Joint or End of Barrier

Contraction Joint

or End of Barrier

Concrete Median Barrier

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

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

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

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

**REINFORCING BAR LIST Per Section (E-C)**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length (ft)</th>
<th>Weight (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>f1</td>
<td>5</td>
<td>7</td>
<td>6 ft</td>
<td>42</td>
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<tr>
<td>g2</td>
<td>5</td>
<td>1</td>
<td>89&quot;</td>
<td>8</td>
</tr>
<tr>
<td>g3</td>
<td>5</td>
<td>1</td>
<td>89&quot;</td>
<td>8</td>
</tr>
<tr>
<td>g4</td>
<td>5</td>
<td>1</td>
<td>92&quot;</td>
<td>8</td>
</tr>
<tr>
<td>g5</td>
<td>5</td>
<td>1</td>
<td>94&quot;</td>
<td>8</td>
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</table>

**CONCRETE QUANTITIES Per Section**

1.3 cy
**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Size</th>
<th>Number of Bars</th>
<th>Per Section (Approx. 20 feet)</th>
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<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>t</td>
<td>5</td>
<td>7</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.

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

Construct concrete footing when barrier is not placed on concrete slab. Apply Section 2403.53, but the use of forms if 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:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>491.11</td>
<td>Concrete Grout</td>
</tr>
<tr>
<td>491.13</td>
<td>Hydraulic Cement Grout</td>
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</table>

**Concrete Quantities**

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

**CONSTRUCTION HEADER or Construction Joint**

**Possible Expansion Joint or End of Barrier**

---

**SAWED CONTRACTION JOINT**

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

**SECTION A-A**

**DETAIL 'A'**

Special Shaping for Barrier over intake.

---

**STANDARD ROAD PLAN**

IOWA DOT

44" CONCRETE BARRIER

(HALF SECTION)

**REVISIONS:**
- Removed INTERIM from the standard.
- Approved by Design Methods Engineer.
**SAWED CONTRACTION JOINT**

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

**DETAIL ‘A’**

Special Shaping for Barrier over Intake

**CONCRETE QUANTITIES**

Per foot

0.10 cy

---

**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Bar</th>
<th>Size</th>
<th>Number of Bars</th>
<th>Length</th>
<th>Weight (lbs)</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>14</td>
<td>5'-8&quot;</td>
<td>83</td>
<td>1'-4&quot;</td>
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<tr>
<td>M</td>
<td>5</td>
<td>5</td>
<td>19'-6&quot;</td>
<td>94</td>
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</tr>
</tbody>
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**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.

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

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

---

**REVISIONS:**

Removed INTERIM from the standard.

---

**APPROVED BY DESIGN METHODS ENGINEER**

---

**STANDARD ROAD PLAN**

**BA-103**

**34" CONCRETE BARRIER**

(HALF SECTION)
Sawed Contraction Joint

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

Reinforced Paved 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.

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". Contraction joint locations shall match pavement joint locations.

Fillet all exposed corners with a 1/2 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.

Possible Contract Item: Concrete Barrier, BA-104

Possible Tabulation: 108-18B

Concrete Barrier, BA-104

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 1'-6".

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

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

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

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

Concrete Barrier, BA-105 and Footing
Concrete Barrier, BA-105 or Footing
Possible Contract Item:
Concrete Barrier, BA-105 or Footing
Possible Tabulation:
108-18B

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>
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<tbody>
<tr>
<td>g1</td>
<td>5</td>
<td>8</td>
<td>*</td>
<td>53.5</td>
</tr>
<tr>
<td>f1</td>
<td>5</td>
<td>7</td>
<td>10'-0&quot;</td>
<td>73.5</td>
</tr>
<tr>
<td>f2</td>
<td>5</td>
<td>2</td>
<td>9'-8&quot;</td>
<td>11.8</td>
</tr>
</tbody>
</table>

* Varies from 5'-7" to 7'-3"

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

CONCRETE QUANTITIES

| CONCRETE QUANTITIES for one Transition Section | 1.2 cy |

ELEVATION

Possible Transition Section:
BA-105 Transition Section (10'-0"
or BA-107
Possible Transition Section:
BA-102
or possible BA-103
1. Place keys at 2'-8'' centers.
2. Use 2 x 8 lumber 8'' long to make keys.
3. Match roadway pavement thickness (6'' min.)
4. 1'-2'' or K1-2 joint. When roadway pavement is existing, use 'BT-3' joint. See PV-101.
5. No 'CD' joint baskets required within 4' of outside edge of shoulder.
6. When shoulder will be located under a concrete barrier and section, replace 5g2 and 5g3 bars with reinforcement as shown on BA-107.
7. Increase these dimensions by one inch for every inch of paved shoulder thickness greater than 9 inches.
8. Match spacing of vertical bars in concrete barrier.

### 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>4''</td>
<td>6x1</td>
<td>18''</td>
<td>12''</td>
</tr>
<tr>
<td>6''</td>
<td>5x2</td>
<td>10''</td>
<td>12''</td>
</tr>
<tr>
<td>6''</td>
<td>6x1</td>
<td>18''</td>
<td>12''</td>
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<tr>
<td>10''</td>
<td>5x2</td>
<td>10''</td>
<td>12''</td>
</tr>
<tr>
<td>12''</td>
<td>5x2</td>
<td>12''</td>
<td>12''</td>
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</table>

### ESTIMATED SHOULDER QUANTITIES

<table>
<thead>
<tr>
<th>Concrete Sq. Yds.</th>
<th>4''</th>
<th>6''</th>
<th>8''</th>
<th>10''</th>
<th>12''</th>
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</thead>
<tbody>
<tr>
<td>0.52</td>
<td>0.64</td>
<td>0.76</td>
<td>1.06</td>
<td>1.29</td>
<td>1.51</td>
</tr>
</tbody>
</table>

### BENT BAR DETAILS

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

### TYPICAL SECTION

Use 2 x 8 lumber 8'' long to make keys. Place keys at 2'-6'' centers.
Saw cut top and front face.
Saw cut back if exposed.

Use 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".

Fillet all exposed corners with a 4 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:
108-188
SECTION C-C

Elevation:
- Face of Approach Barrier and Bridge Barrier Rail Coincide at This Point
- Edge of Travelled Way
- Bridge Approach Pavement

Full Barrier Rail Section:
- Concrete Approach Barrier
- 30' Concrete Approach Barrier
- Bridge Approach Pavement

Plan:
- Normal Pavement Jointing
- 2' Boxout
- BT-2' or KT-2'
- 'E' Joint
- 30' Concrete Approach Barrier
- Bridge Approach Pavement

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

Possible Intake - 'E' Joint

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

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

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

Amount may vary depending on individual site requirements.

Possible Intake - 'E' Joint

Normal Pavement Jointing

Y = Distance from P ft.

X = Offset to Rounded Top

Tapered End Section

Concrete Approach Barrier, Tapered End, BA-108

Possible Tabulation:

Concrete Barrier, Tapered End, BA-108

For joint detail, see PV-101.

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

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

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

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

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

For joint detail, see PV-101.

Bottom width of barrier is maintained at 17 inches.

Bottom width of barrier transitions from 8 to 17 inches.

Required sidewalk will be measured and paid for separately.

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

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

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:

Concrete Barrier, Tapered End, BA-108

For joint detail, see PV-101.

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:

Concrete Barrier, Tapered End, BA-108

For joint detail, see PV-101.
"L-2" or "KT-2" joint. When roadway pavement is existing, use "BT-3" joint. See PV-101.

Refer to BA-250.

"C" Joint; match existing roadway joints when possible. See PV-101.

Refer to project typicals.

Refer to BA-106.

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

Possible Tabulations:
108-18B
112-9
W-BEAM INSTALLATION

ELEVATION

SECTION

SECTION WITH CURB

Rail 6'' x 12'' Blockout (typ.)
6' 0'' Steel Post (typ.)
6' x 12'' Blockout (typ.)

16d Nail (typ.)

Rail Elements

Rail Splice (typ.)

W-Beam Rail

3'-1"

Ground Elevation

16d Nail

31'' Mounting Height

10:1 Slope (max.)

31'' Mounting Height

Ground Elevation

Possible Contract Item:
Steel Beam Guardrail

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).

When specified by the contract documents, install posts at 3'-12'' 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.
ASYNMETRICAL TRANSITION SECTION

W-BEAM RAIL

Thrie-Beam Rail

10-gauge Section

BA-200
STANDARD ROAD PLAN

REVISIONS:
Modified THRIE-BEAM BLOCKOUT detail on Sheet 2.

APPROVED BY: DESIGN METHODS ENGINEER

SHEET 3 of 4
### PLAN - CASE A

<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

- **Drilled Hole(s)**
- **Special Backfill**
- **Top of Bedrock**
- **Post Embedment**

#### PLAN - CASE B

- **Drilled Hole**
- **Special Backfill**
- **Top of Bedrock**

### POST INSTALLED IN PAVEMENT

- **Drilled Hole(s)**
- **Drilled Hole or Leave-out**

### Installation Information

- 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.

Installation information applies to both wood and steel posts.

---

**STEEL BEAM GUARDRAIL COMPONENTS**
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 8'' x 6'-0'' posts
- (6) 6'' x 8'' x 6'-9'' posts
- (12) 6'' x 12'' x 19'' blockouts
- (3) 6'' x 12'' x 14'' blockouts
Wood Post Option:
- (9) 6'' x 8'' x 6'-0'' posts
- (6) 6'' x 8'' x 7'-0'' posts
- (12) 6'' x 12'' x 19'' blockouts
- (3) 6'' x 12'' x 14'' blockouts
(1) Asymmetrical Transition Section
(2) 12'-6'' W-Beam rail sections*
(1) 18'-9'' Thrie-Beam rail section*
(1) 12'-6'' Thrie-Beam rail section* (3) 6'' x 12'' x 14'' blockouts
(1) 12'-6'' Thrie-Beam rail sections

Refer to BA-200 for guardrail components

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

NEAREST TRAFFIC
Rail Elements

LAPPING PROCEDURES

BA-201

STANDARD ROAD PLAN

REVISION 04-18-17

SHEET 1 of 3

STEEL BEAM GUARDRAIL
BARRIER TRANSITION SECTION
(MASH TL-3)
Guardsrail mounting height at barrier connection is 32 inches. Transition guardsrail 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.
Washers

16
15

Approved

Hex Nuts

8
7

Approved

x sufficient length Hex Bolts

8
7

Approved

Thrie-Beam Terminal Connector

Materials included in the Contract Item:

Steel Beam Guardrail End Anchor, Bolted

Possible Contract Item:

BA-201

Thrie-Beam Terminal Connector

2" long 1'' Slotted Holes

Connector

Terminal

Thrie-Beam

32'' Mounting Height

BTS Post #15

Thrie-Beam Guardrail

Concrete Barrier End Section or Bridge Rail End Section

1' dia. Holes

Installation Line

5 - BOLT PATTERN

Thrie-Beam Terminal Connector

32'' Mounting Height

Possible Curb

See Detail 'A'

See Detail 'B'

Possible Curb

ELEVATION

PLAN

SECTION A-A

1'' Hole (typ.)

32'' Mounting Height

Installation Line

1'' Hole (typ.)

1'' dia. Hole (typ.)

2'' long 1'' Slotted Holes

1'' x 2'' Post Bolt Slot

1'' dia. Holes (typ.)

Neutral Axis

30''

32'' Mounting Height

Possible Curb

See BA-201.

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

STANDARD ROAD PLAN

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

STEELE BEAM GUARDRAIL

BOLTED END ANCHOR

APPROVED BY DESIGN METHODS ENGINEER

SHEET 1 of 3

REVISION

10-20-15

16
13
3
32" Mounting Height

Skip BTS Post #15

BTS Post #14

(7) - 1" dia. Holes

Thrie-Beam Terminal Connector

See Detail 'A'

7 - BOLT PATTERN
Thrie-Beam Terminal Connector

37½

Possible Curb

Possible Curb

32" Mounting Height

 ע

See BA-201.
**Thrie-Beam Terminal Connector**

- **Type C**

**Plan**
- 7 - 1" dia. Holes
- Wedge Blockout at BTS Post #15
  - See Detail 'C'

**Elevation**
- Possible Curb
- Thrie-Beam Terminal Connector

**Section C-C**
- 32" Mounting Height
- Installation Line
- See Detail 'A'

**Detail 'C'**
- Countersink Guardrail Bolt so bolt does not protrude past outside edge of Wedge Blockout.

**Notes**
1. See BA-201.
2. Use treated spacer boards (1 in. x 6 in. or 2 in. x 6 in.) to produce a tight fit between the wedge blockout and endpost. A nominal 1" inch gap is acceptable. Spacer boards are incidental to bolted end anchor.

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 Bockout

Approved bolts, nuts, and washers.
Possible Contract Item:
Steel Beam Guardrail End Anchor, Thrie-Beam

Materials included in the Contract Item:
(1) 12'-6" Thrie-Beam rail section
(2) Asymmetrical Transition Section
(1) W-Beam post (wood or steel - match remainder of installation)
(1) W-Beam blockout
(2) Thrie-Beam blockouts
(1) BCT Wood Post
(1) 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.

1. Slotted holes 2" x 1\(\frac{1}{2}\)" long.
2. Refer to BA-200.
3. Cover entire face of end section with alternating black and yellow striped adhesive sheeting. Stripes shall be approximately 3 inches in width and shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the end anchor. Yellow stripes shall meet the retroreflectivity requirements for Type III or Type IV reflective sheeting.
Possible Contract Item:
- Steel Beam Guardrail Tangent End Terminal, BA-205

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

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

Steel Beam Guardrail Tangent End Terminal (MASH TL-3)

- 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. 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.

- Steel Beam Guardrail Tangent End Terminal, BA-205
- 108-8A
- 108-8B
- 108-8C
- 108-8D

NEAREST TRAFFIC
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
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.

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.

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

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.

The possible contract items:

Steel Beam Guardrail, Post Adapter Unit, BA-210

Incidental to Adapter Unit:
1 - 12" x 6\(^2\) x \(\frac{1}{2}\) ASTM A36 Steel Plate
1 - 11" x 6\(^2\) x \(\frac{1}{2}\) ASTM A36 Steel Plate
4 - \(\frac{1}{2}\)\(^{\circ}\)" 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-A0
108-B0
108-C0

IOWA DOT
STANDARD ROAD PLAN
BA-210

GUARDRAIL POST ADAPTER UNIT
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.

<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>50'-0&quot;</td>
</tr>
</tbody>
</table>

1. A minimum length of w-beam guardrail must be installed both upstream and downstream of the outermost CRT posts. Refer to the Minimum Guardrail Length table. This length includes the length of any end terminals, end anchors, and transition sections.

2. A minimum of 62'-6" of w-beam guardrail must be installed between the outermost CRT post and the beginning of any Variable Flare (VF) section.

3. 6" maximum for guardrail placed behind 6" Standard Curbs, 6" Sloped Curbs, and non-standard curbs.

Possible Contract Items:
- Steel Beam Guardrail

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

Possible Tabulations:
- 108-59
- 108-8C

ELEVATION - TYPE 1
(1 post omitted)

ELEVATION - TYPE 2
(2 posts omitted)

ELEVATION - TYPE 3
(3 posts omitted)

LAPPING PROCEDURE

A 12" Blockout

6'-0" CRT POST

TYPICAL SECTION AT CRT POST
Level Ground

TYPICAL SECTION AT CRT POST
Behind Curb

TYPICAL SECTION AT BOX CULVERT

FOR POST CONFLICTS
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.

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

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

Wood Post Option:
(5) 6" x 8" x 6'-0" posts  
(2) 6" x 12" x 18" blockouts  
(3) 6" x 12" x 14" blockouts  

(1) Asymmetrical Transition Section  
(2) 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
**STEEL BTS POSTS #1-3**

<table>
<thead>
<tr>
<th>Height Mounting</th>
<th>Section or Shoulder Bridge Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>31&quot;</td>
<td>1</td>
</tr>
</tbody>
</table>

**STEEL BTS POST #4**

<table>
<thead>
<tr>
<th>Height Mounting</th>
<th>Section or Shoulder Bridge Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>32&quot;</td>
<td>1</td>
</tr>
</tbody>
</table>

**STEEL BTS POST #5**

<table>
<thead>
<tr>
<th>Height Mounting</th>
<th>Section or Shoulder Bridge Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>32&quot;</td>
<td>1</td>
</tr>
</tbody>
</table>

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.

**WOOD BTS POST #4**

Remove bottom bolts on STEEL BTS POST #4 view on page 2.

**APPROVED BY DESIGN METHODS ENGINEER**
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.

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

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

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

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.

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

Possible Tabulation:
108-8A

Illustration:

Steel Beam Guardrail Tangent End Terminal 38'-3"

Impact Head

12" max offset to end of rail

Ground Line

31" Mounting Height

Impact Head

LAPPING PROCEDURE

NEAREST TRAFFIC

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

2. Refer to BA-200.

3. 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.
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\(\frac{1}{2}\)" if no VF is used. Minimum VT1 of 53'-1\(\frac{1}{2}\)" if VF is used.

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

Possible Tabulation:

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

For grading requirements, see EW-301.

For general guardrail details, see BA-206.

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

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

Possible Tabulation:
108-88

For general guardrail details, see BA-206.
LAPPING PROCEDURE

VARIABLE FLARE

Approach Traffic

Edge of Traveled Way

End Terminal (47'-6" for Tangent, 37'-5" for Flared)

Installation Line

Face of Guardrail

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

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

Rail Splice

Variable Tangent (Multiple of 6.25')

Variable Flare (Multiple of 6.25')

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

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

End Anchor (9'-6"")

Possible Tabulation:

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

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

Install delineators and object markers according to SI-211.

For grading requirements, see EW-301.

For general guardrail details, see BA-200.

For general guardrail details, see BA-200.

Possible Tabulation:

108-BC

REVISED: 04-19-16

STANDARD ROAD PLAN

IOWA DOT

STEEL BEAM GUARDRAIL
INSTALLATION AT SIDE OBSTACLE
(ONE-WAY PROTECTION)
For grading requirements, refer to EW-301.

For additional guardrail requirements, refer to BA-200.

Refer to BA-205.

Refer to BA-204.

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

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

Possible Tabulation:
- 108-8D

LOCATION STATION

INSTALLATION AT RAILROAD SIGNAL

STANDARD ROAD PLAN

REV/SIGN

3  05/18/16

REVISIONS: Updated to MASH approved end terminal. Removed circle note 1. Added VT

APPROVED BY DESIGN METHODS ENGINEER

IOWA DOT

STEEL BEAM GUARDRAIL

ET

INSTALLATION LINE

TRAFFIC

LAPPING PROCEDURE

LOCATION STATION

NEAREST TRAFFIC

ET

TRAFFIC

END TERMINAL

47'-8" for Tangent

EDGE OF TRAVELED WAY

0-6

1-6

2-6

3-6

18'-9"

34'-0"

38'-0"

73'-9"

47'-8"

38'-0"

34'-0"

18'-9"

21'-10"
NEAREST TRAFFIC

2

1

3

LAPPING PROCEDURE

12'-6''

1'-3''

VARIABLE FLARE

EW-301

BA-200

EW-301

SI-211

For general guardrail details, see BA-200.

For grading requirements, see BA-225.

Install delineators and object markers according to SI-211.

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

1. See BA-221.
2. See BA-202 for connections to concrete barriers and bridge rail end sections.
3. See BA-225.
4. Minimum VT1 of 25'-0" if no VF is used. Minimum VT1 of 37'-6" if VF is used.
ROADSIDE OBSTACLE, TWO-WAY PROTECTION

ROADSIDE OBSTACLE, ONE-WAY PROTECTION

Possible Contract Items:
- High Tension Cable Guardrail
- End Anchor
- Guardrail, Special Anchor Section

Possible Tabulation:
108-9A
MEDIAN OBSTACLE PROTECTION

TRAFFIC

Edge of Traveled Way

End Anchor
(length varies)

Protection Length

End Anchor
(length varies)

High Tension Cable Guardrail

LOCATION STATION

BA-351

REVISION
10-15-19

SHEET 2 of 2

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

APPROVED BY DESIGN METHODS ENGINEER
For loop bars 6d1, 6d2, and 6d3, use 3/8" smooth steel bars with a minimum yield strength of 60 ksi, a tensile strength of not less than 1.25 times the yield strength but a minimum of 80 ksi, a minimum 14% elongation in 8 inches, and passing a 180 degree bend test using a 3/8" pin bend diameter. Install loops within 3/8" 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
- Date Manufactured (Month and Year)
- BA-401 Type A
- BA-401 Date of Manufacture (Month and Year)
- Manufacturer Identification

Lifting hole: 4 inch diameter PVC Pipe.

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. Include costs for furnishing, installing and maintaining markers in the price bid for "Temporary Barrier Rail, Concrete."

---

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

**REINFORCING A415 Gr. 60**

<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>6a1</td>
<td>4</td>
<td>A</td>
<td>12</td>
<td>8'-0&quot;</td>
<td>48.1</td>
</tr>
<tr>
<td>6a7</td>
<td>6</td>
<td>C</td>
<td>4</td>
<td>35&quot;</td>
<td>26.3</td>
</tr>
<tr>
<td>4a1</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>12'-2&quot;</td>
<td>38.1</td>
</tr>
<tr>
<td>4d1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>10'-0&quot;</td>
<td>16.3</td>
</tr>
</tbody>
</table>

**LOOP ASSEMBLY**

<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>6a1</td>
<td>6</td>
<td>C</td>
<td>2</td>
<td>8'-0&quot;</td>
<td>25.3</td>
</tr>
<tr>
<td>5b1</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>7'-2&quot;</td>
<td>22.8</td>
</tr>
<tr>
<td>6d3</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>8'-0&quot;</td>
<td>25.5</td>
</tr>
</tbody>
</table>

---

**BENT BAR DETAILS**

(Dimensions are out to out unless otherwise noted.)

**BARRIER MARKER PLACEMENT**

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

Marked end shown, invert for other end.
Pre-drill holes for stakes with 1 3/4" dia. x 5" min. (3 stakes required per rail section.

Pre-drill holes for stakes with 1 3/4" core bit.

3" dia. x 4 3/4" long ASTM A325 structural bolt OR Red Head Large Diameter Tapcon (2 1/2" dia. x 4 3/4" min.) OR Simpson Titen HD Wedge Bolt (2" dia. x 5" min.).

See Table A

**TABLE A**

<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Dropoff Depth</th>
<th>Min. offset obstacle is anchored</th>
<th>Min. offset object where IBT is anchored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dropoff from pavement</td>
<td>≤ 24&quot;</td>
<td>24&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td></td>
<td>&gt; 24&quot;</td>
<td>45&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Dropoff from bridge</td>
<td>≤ 3&quot;</td>
<td>1&quot;</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>&gt; 3&quot;</td>
<td>45&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Fixed vertical object</td>
<td>N/A</td>
<td>24&quot;</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

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

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

PLAN

DETAL 'A'

CENTER OF GRAVITY

2' min. clear

2' min. clear

TRAFFIC

PERSPECTIVE VIEW

FRONT ELEVATION

END SECTION

Per 12'-6" Barrier Taper Section

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>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>2.9</td>
</tr>
<tr>
<td>4x3</td>
<td>4</td>
<td>2</td>
<td>27&quot;</td>
<td>3.3</td>
</tr>
<tr>
<td>4x4</td>
<td>4</td>
<td>2</td>
<td>33&quot;</td>
<td>3.7</td>
</tr>
<tr>
<td>4x5</td>
<td>4</td>
<td>2</td>
<td>37&quot;</td>
<td>4.2</td>
</tr>
<tr>
<td>4x6</td>
<td>4</td>
<td>2</td>
<td>4'4&quot;</td>
<td>4.5</td>
</tr>
<tr>
<td>4F1</td>
<td>4</td>
<td>2</td>
<td>12'0&quot;</td>
<td>16.5</td>
</tr>
<tr>
<td>4F2</td>
<td>4</td>
<td>2</td>
<td>7'6&quot;</td>
<td>10.2</td>
</tr>
<tr>
<td>5F5</td>
<td>5</td>
<td>2</td>
<td>11'0&quot;</td>
<td>12.3</td>
</tr>
</tbody>
</table>

LOOP ASSEMBLY

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Shape</th>
<th>No. of Bars</th>
<th>Length</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>6d1</td>
<td>5</td>
<td>1</td>
<td>8'-5&quot;</td>
<td>12.6</td>
</tr>
<tr>
<td>6d2</td>
<td>5</td>
<td>1</td>
<td>7'-7&quot;</td>
<td>11.4</td>
</tr>
<tr>
<td>6d3</td>
<td>5</td>
<td>1</td>
<td>8'-3&quot;</td>
<td>12.8</td>
</tr>
</tbody>
</table>

REVISIONS:
Added Designer Info button.

APPROVED BY DESIGN METHODS ENGINEER
Possible Tabulation:
Temporary Crash Cushion
Embankment In Place
Possible Contract Items:
6'-0"
35'-0"
EMBANKMENT DIMENSIONS
BARREL INSTALLATION LINE LAYOUT
Angle of Barrel Installation Line is measured from a line parallel to roadway centerline.

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

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

EMBANKMENT TYPICAL SECTION

EMBANKMENT PLAN

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

Possible Tabulation:
Temporary Crash Cushion

Barrel Widths:
For obstacle
Required Layouts
Sand Barrel

2:1 max.
3:1 pref,

<table>
<thead>
<tr>
<th></th>
<th>For Obstacle Width</th>
<th>Sand Barrel Layout Required</th>
<th></th>
<th>[if negative]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2'-0&quot; - 6'-0&quot;</td>
<td>1</td>
<td>26'-0&quot;</td>
<td>( +3'-0&quot; )</td>
<td>( +2'-0&quot; )</td>
<td>( 3.75' \times ) ( +12'-0&quot; )</td>
</tr>
<tr>
<td>3'-0&quot; - 10'-0&quot;</td>
<td>2</td>
<td>26'-0&quot;</td>
<td>( +12'-0&quot; )</td>
<td>( +16'-0&quot; )</td>
<td>( 3.75' \times ) ( +38'-0&quot; )</td>
</tr>
<tr>
<td>10'-0&quot; - 17'-0&quot;</td>
<td>3</td>
<td>26'-0&quot;</td>
<td>( +19'-0&quot; )</td>
<td>( +17'-0&quot; )</td>
<td>( 3.75' \times ) ( +64'-0&quot; )</td>
</tr>
<tr>
<td>17'-0&quot; - 30'-0&quot;</td>
<td>4</td>
<td>26'-0&quot;</td>
<td>( +28'-0&quot; )</td>
<td>( +24'-0&quot; )</td>
<td>( 3.75' \times ) ( +88'-0&quot; )</td>
</tr>
</tbody>
</table>

20'-0"
**SAND BARREL DELINEATION**

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

**MARKER PLATE**

Mount plate using four 3/8" 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.

**SAND BARREL LAYOUT**

- **PROTECTING OBSTACLES BETWEEN OPPOSING TRAFFIC**
  - Ensure barrels do not extend beyond edge of obstacle for opposing traffic.
  - Approach Traffic
  - 30" min.
  - Barrel Installation Line
  - Leading Barrel
  - OBSTACLE

- **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.

**TEMPORARY CRASH CUSHIONS**

**SAND BARREL**

Dimensions and details as per the standard road plan.