

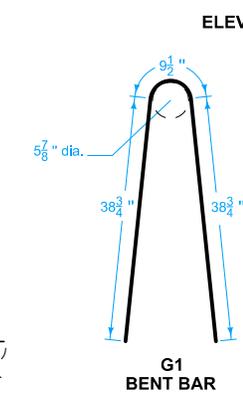
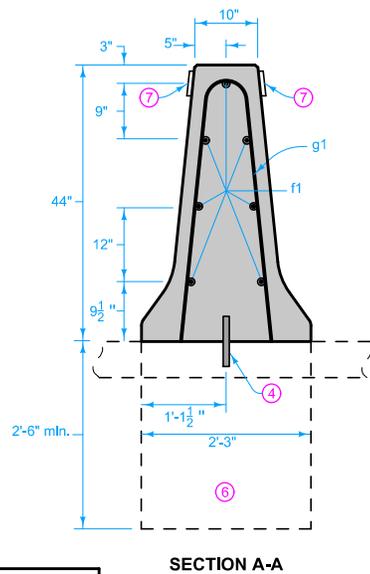
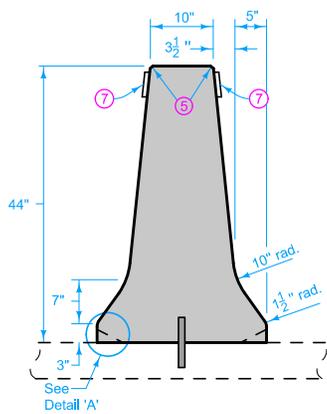
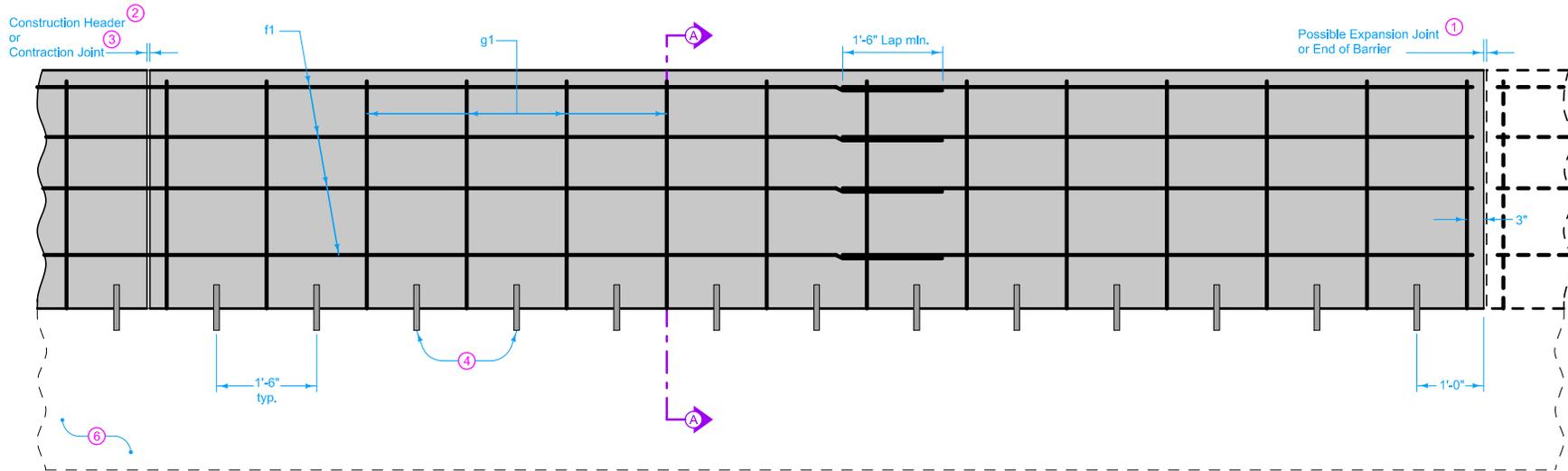
Barriers

Barriers

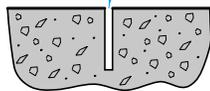
NO.	DATE	TITLE
Concrete Barriers		
BA-100	04-21-20	44" Concrete Median Barrier (Full Section)
BA-101	10-21-14	44" Concrete Median Barrier Width Transition
BA-102	04-21-20	44" Concrete Barrier (Half Section)
BA-103	04-21-20	34" Concrete Barrier (Half Section)
BA-104	10-15-19	34" Concrete Barrier for use with Reinforced Paved Shoulder
BA-105	10-15-19	34" to 44" Concrete Barrier Transition Section
BA-106	10-21-14	Reinforced Paved Shoulder for Concrete Barrier
BA-107	10-15-19	Concrete Barrier End Section
BA-108	10-17-17	Concrete Barrier Tapered End Section
BA-150	10-15-19	Side Obstacle Protection with Concrete Barrier and Guardrail
Steel Beam Guardrail		
BA-200	04-16-19	Steel Beam Guardrail Components
BA-201	04-18-17	Steel Beam Guardrail Barrier Transition Section (MASH TL-3)
BA-202	10-20-15	Steel Beam Guardrail Bolted End Anchor
BA-203	10-15-19	Steel Beam Guardrail W-Beam End Anchor
BA-204	10-15-19	Steel Beam Guardrail Thrie-Beam End Anchor
BA-205	04-19-16	Steel Beam Guardrail Tangent End Terminal (MASH TL-3)
BA-206	10-15-19	Steel Beam Guardrail Flared End Terminal For Cable Connection
BA-210	04-19-16	Guardrail Post Adaptor Unit
BA-211	10-21-14	Steel Beam Guardrail Long - Span System for Post Conflicts
BA-221	04-18-17	Steel Beam Guardrail Barrier Transition Section (MASH TL-2)
BA-225	10-17-17	Steel Beam Guardrail Tangent End Terminal (MASH TL-2)
BA-250	10-18-16	Steel Beam Guardrail Installation at Concrete Barrier or Bridge End Post (MASH TL-3)
BA-251	04-19-16	Steel Beam Guardrail Installation at Side Obstacle (Two-Way Protection)
BA-252	10-20-20	Steel Beam Guardrail Installation at Side Obstacle (One-Way Protection)
BA-253	04-19-16	Steel Beam Guardrail Installation at Railroad Signal
BA-260	10-18-16	Steel Beam Guardrail Installation at Concrete Barrier or Bridge End Post (MASH TL-2)

Barriers

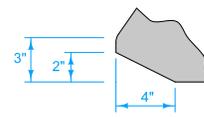
NO.	DATE	TITLE
BA-351	10-15-19	Cable Guardrail High Tension Cable Guardrail
BA-401	10-15-19	Temporary Barrier Rails Temporary Barrier Rail (Precast Concrete)
BA-500	04-19-16	Crash Cushions Temporary Crash Cushions Sand Barrel



1/8" min. wide x 1" deep saw cut. No sealing required.



Saw cut top and front face



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.

- Fillet all exposed corners with a 3/4 inch dressed and beveled strip.
- Construct concrete footing when barrier is not placed on concrete slab. Apply Article 2403.03 of the Standard Specifications, but the use of forms is optional. If forms are used, place backfill around the completed footing.
- Place barrier markers at 100 foot increments in areas with non-continuous lighting, or 250 foot increments in areas with continuous lighting. Marker color to be the same as adjacent edge line.

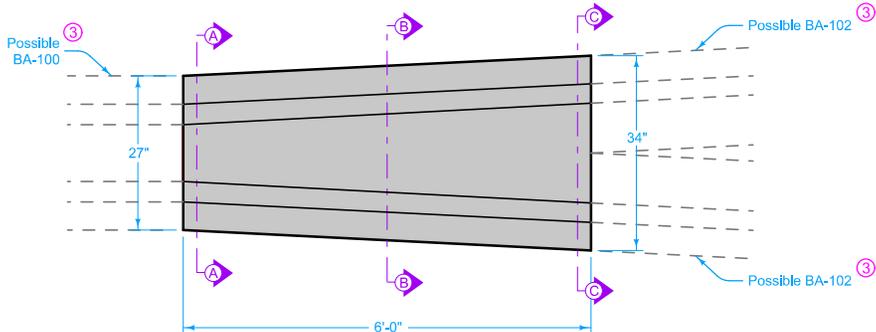
Possible Contract Item:
Concrete Barrier, BA-100 or
Concrete Barrier, BA-100 and Footing

Possible Tabulation:
108-18

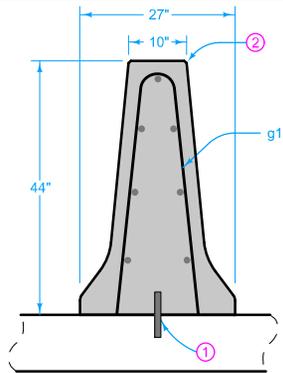
REINFORCING BAR LIST Per Section (Approx. 20 feet)					
Mark	Size	Number of Bars	Length	WT. (lbs.)	Max. Spacing
g1	5	14	7'-4"	107	1'-6"
f1	5	7	19'-6"	141	

CONCRETE QUANTITIES
Per Foot
0.15 cy

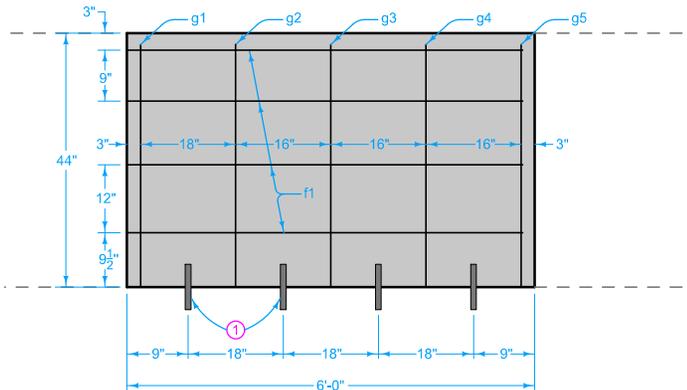
	REVISION
	3 04-21-20
STANDARD ROAD PLAN	BA-100
REVISIONS: Removed INTERIM from the standard.	SHEET 1 of 1
 APPROVED BY DESIGN METHODS ENGINEER	
44" CONCRETE MEDIAN BARRIER (FULL SECTION)	



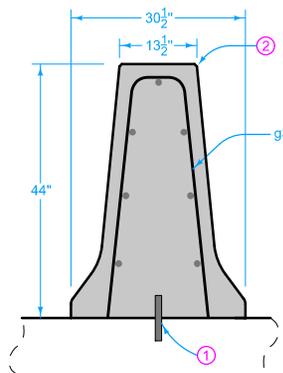
PLAN



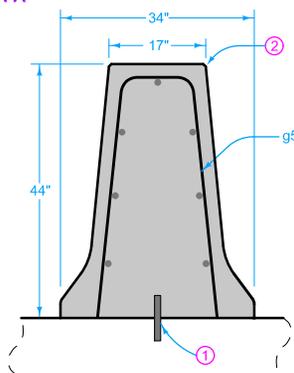
SECTION A-A



ELEVATION



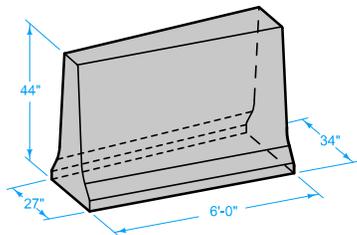
SECTION B-B



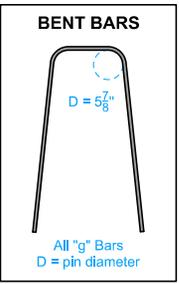
SECTION C-C

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

- ① Use 1 inch diameter deformed dowel bars of sufficient length to ensure 6 inch minimum embedment in barrier and supporting surface. Install bars either in supporting surface when placed or in drilled holes using polymer grout complying with Materials I.M. 491.11 or hydraulic cement grout complying with Materials I.M. 491.13.
- ② Fillet all exposed corners with a 3/4 inch dressed and beveled strip.
- ③ Provide 18 inch overlap of reinforcing steel between sections.



ISOMETRIC



BENT BARS

REINFORCING BAR LIST Per Section (6'-0")				
Mark	Size	Number of Bars	Length	Weight (lbs.)
f1	5	7	69"	42
g1	5	1	87"	8
g2	5	1	89"	8
g3	5	1	91"	8
g4	5	1	92"	8
g5	5	1	94"	8

CONCRETE QUANTITIES
Per Section
1.3 cy

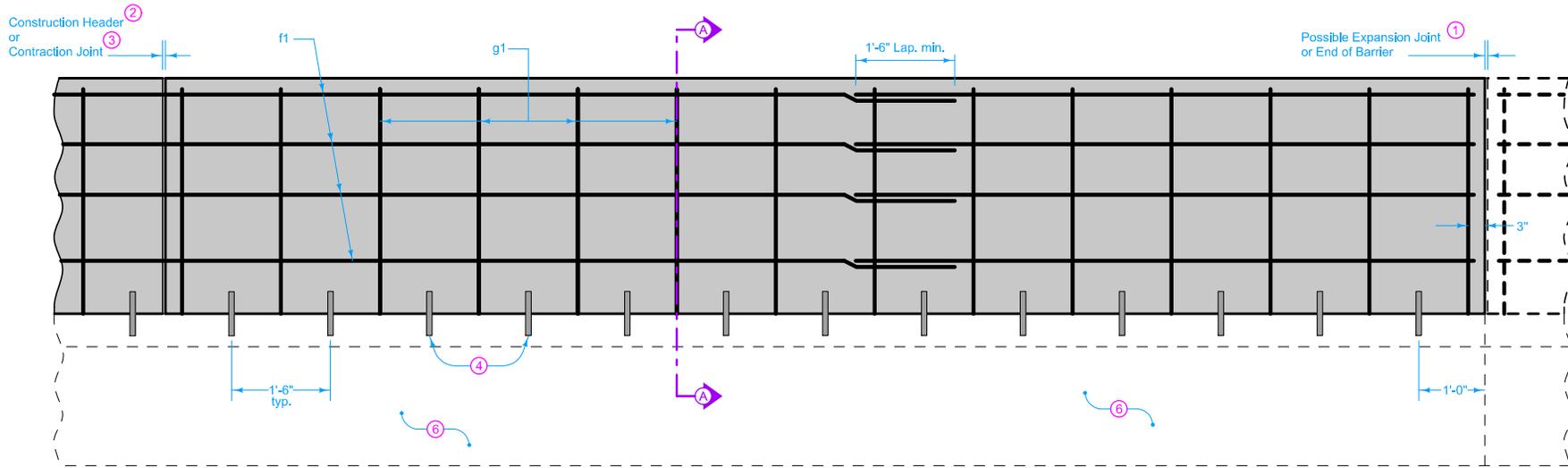
Possible Contract Item:
Concrete Barrier, BA-101

Possible Tabulation:
108-18

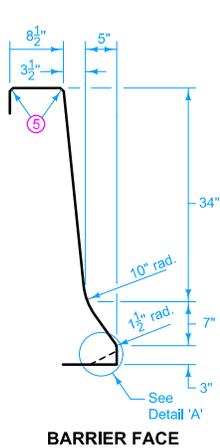
	REVISION
	1 | 10-21-14
STANDARD ROAD PLAN	BA-101
SHEET 1 of 1	

REVISIONS: Added CONCRETE QUANTITIES Per Section.
Brian Smith
APPROVED BY DESIGN METHODS ENGINEER

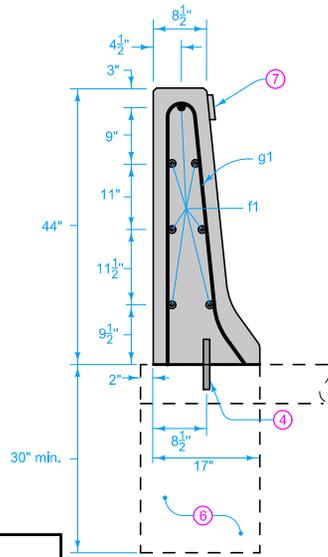
44" CONCRETE MEDIAN BARRIER
WIDTH TRANSITION



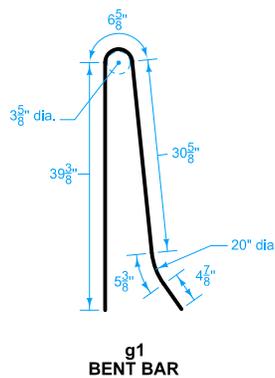
ELEVATION



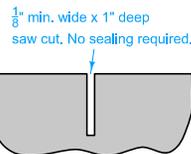
BARRIER FACE



SECTION A-A

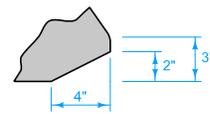


g1 BENT BAR



SAWED CONTRACTION JOINT

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



DETAIL 'A'

Special Shaping for Barrier over Intake

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".
- ③ For barrier dowelled to pavement, match pavement joints. For free-standing barrier with integral footings, use 17 foot maximum, 15 foot minimum joint spacing.
- ④ 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.

- ⑤ Fillet all exposed corners with a 3/4 inch dressed and beveled strip.
- ⑥ 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.
- ⑦ Place barrier markers at 100 foot increments in areas with non-continuous lighting, or 250 foot increments in areas with continuous lighting. Marker color to be the same as adjacent edge line.

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

Possible Tabulation:
108-18

REINFORCING BAR LIST Per Section (Approx. 20 feet)					
Bar	Size	Number of Bars	Length	Weight (lbs.)	Spacing
g1	5	14	7'-3"	106	1'-6"
f1	5	7	19'-6"	141	—

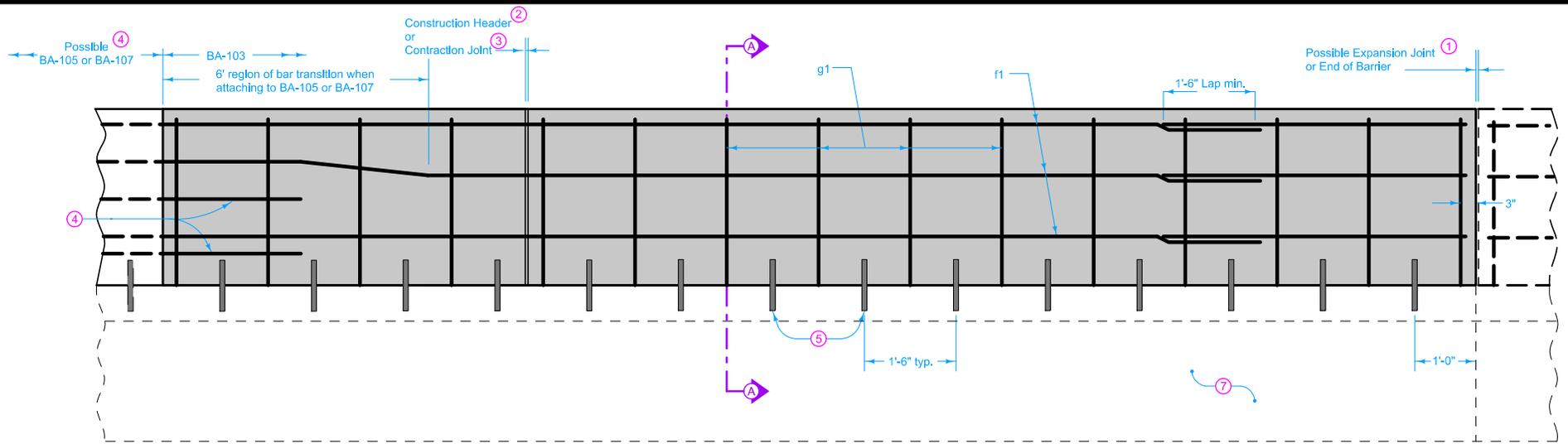
CONCRETE QUANTITIES Per foot
0.11 cy

 STANDARD ROAD PLAN	REVISION 4 04-21-20
	BA-102
	SHEET 1 of 1

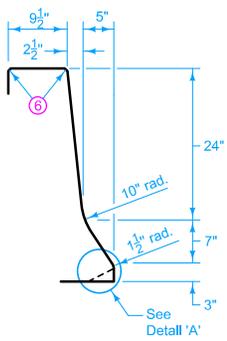
REVISIONS: Removed INTERIM from the standard.

APPROVED BY DESIGN METHODS ENGINEER

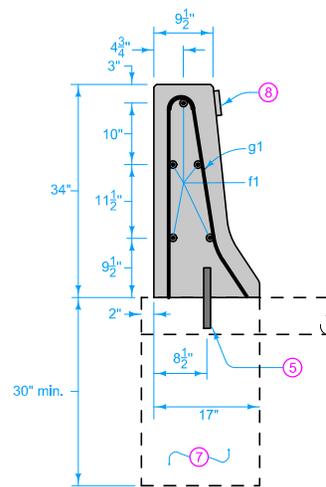
44" CONCRETE BARRIER
(HALF SECTION)



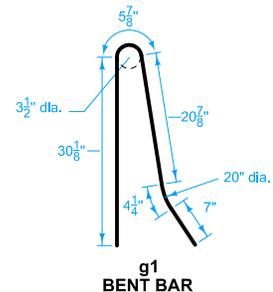
ELEVATION



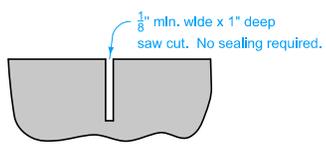
BARRIER FACE



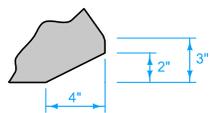
SECTION A-A



g1 BENT BAR



SAWED CONTRACTION JOINT



DETAIL 'A'

Special Shaping for Barrier over Intake

- 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.

- Fill all exposed corners with a 3/4 inch dressed and beveled strip.
- Construct concrete footing when barrier is not placed on concrete slab. Apply Article 2403.03 of the Standard Specifications, but the use of forms is optional. If forms are used, place backfill around the completed footing.
- Place barrier markers at 100 foot increments in areas with non-continuous lighting, or 250 foot increments in areas with continuous lighting. Marker color to be the same as adjacent edge line.

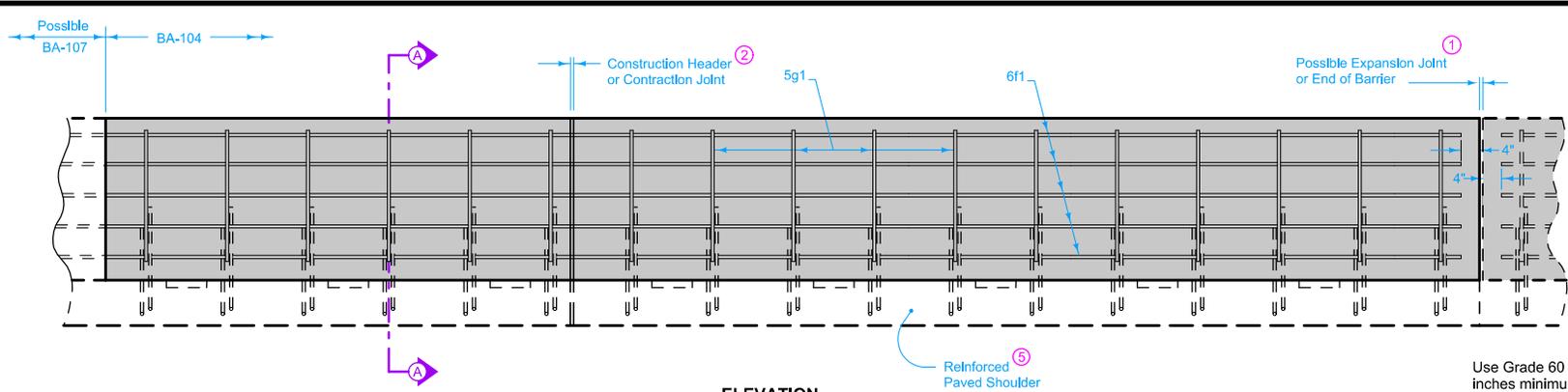
Possible Contract Item:
Concrete Barrier, BA-103 or
Concrete Barrier, BA-103 and Footing

Possible Tabulation:
108-18B

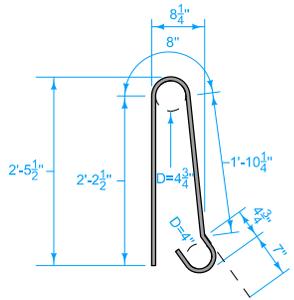
REINFORCING BAR LIST Per Section (Approx. 20 feet)					
Bar	Size	Number of Bars	Length	Weight (lbs.)	Spacing
g1	5	14	5'-8"	83	1'-6"
f1	5	5	19'-6"	98	—

CONCRETE QUANTITIES Per foot 0.10 cy
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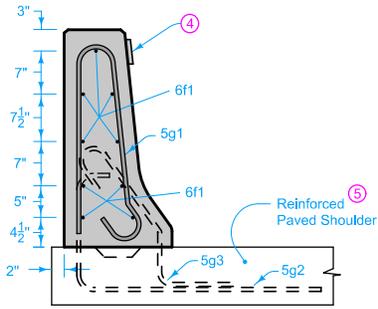
	REVISION
	3 04-21-20
STANDARD ROAD PLAN	BA-103
SHEET 1 of 1	
REVISIONS: Removed INTERIM from the standard.	
APPROVED BY DESIGN METHODS ENGINEER	
34" CONCRETE BARRIER (HALF SECTION)	



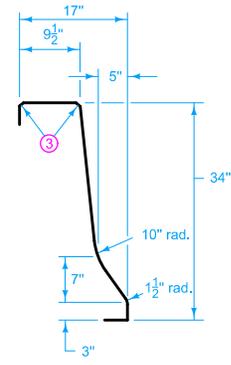
ELEVATION



5g1 BENT BAR



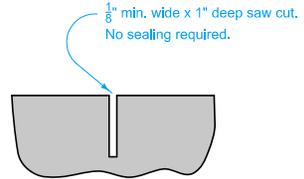
SECTION A-A



BARRIER FACE

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 3/4 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.



SAWED CONTRACTION JOINT

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

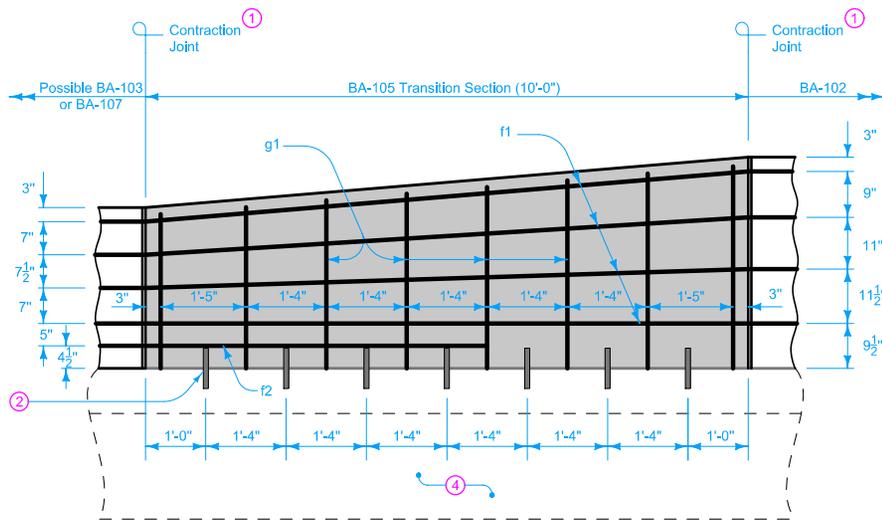
ESTIMATED QUANTITIES FOR BARRIER Per Linear Foot	
Concrete - Cu. Yds.	0.12
Reinforcing Steel - Lbs.	17.5

REINFORCING BAR LIST Per Section (Approximately 20')			
Bar	Number of Bars	Length	Spacing
5g1	15	5'-8 1/2"	1'-4"
6f1	9	19'-4"	—

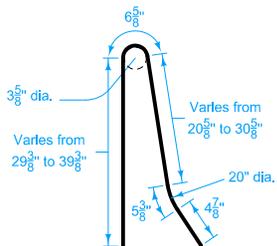
Possible Contract Item:
Concrete Barrier, BA-104

Possible Tabulation:
108-18B

	REVISION	
	1	10-15-19
STANDARD ROAD PLAN		BA-104
		SHEET 1 of 1
REVISIONS: New Logo.		
APPROVED BY DESIGN METHODS ENGINEER		
34" CONCRETE BARRIER FOR USE WITH REINFORCED PAVED SHOULDER		



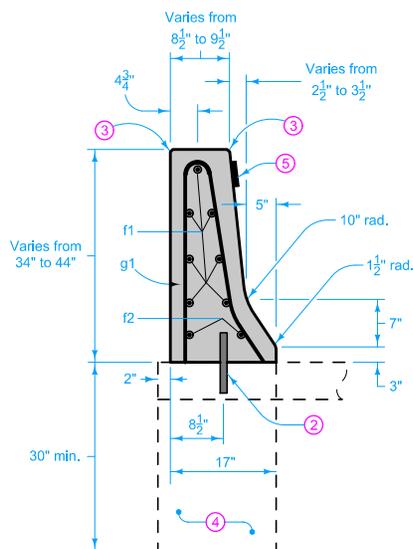
ELEVATION



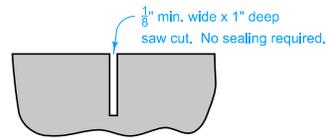
g1 BENT BAR

REINFORCING BAR LIST for one Transition Section				
Bar	Size	Number of Bars	Length	Weight (lbs.)
g1	5	8	*	53.5
f1	5	7	10'-0"	73.5
f2	5	2	5'-8"	11.8

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



TYPICAL SECTION



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

CONCRETE QUANTITIES
for one Transition Section
1.2 cy

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

- 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".
- 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.
- Filllet all exposed corners with a 3/4 inch dressed and beveled strip.
- Construct concrete footing when barrier is not placed on concrete slab. Apply Article 2403.03 of the Standard Specifications, but the use of forms is optional. If forms are used, place backfill around the completed footing.
- Place barrier markers at 100 foot increments in areas with non-continuous lighting, or 250 foot increments in areas with continuous lighting. Marker color to be the same as adjacent edge line.

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

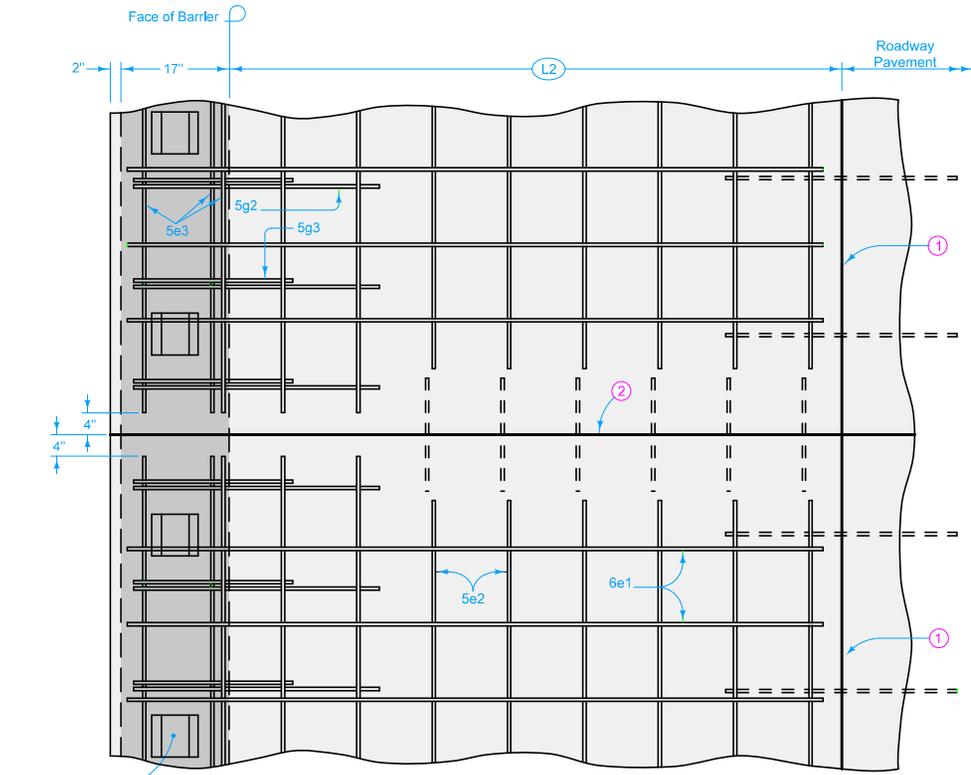
Possible Tabulation:
108-18B

	REVISION
	1 10-15-19
STANDARD ROAD PLAN	BA-105
	SHEET 1 of 1

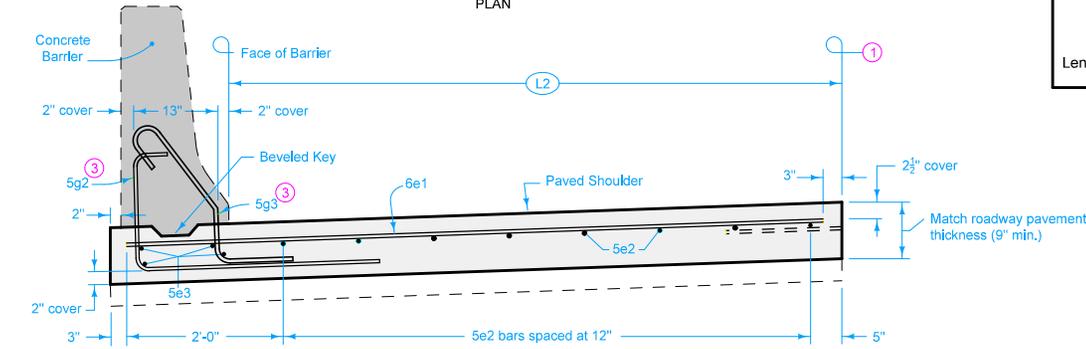
REVISIONS: New Logo.

APPROVED BY DESIGN METHODS ENGINEER

34" TO 44" CONCRETE BARRIER
TRANSITION SECTION



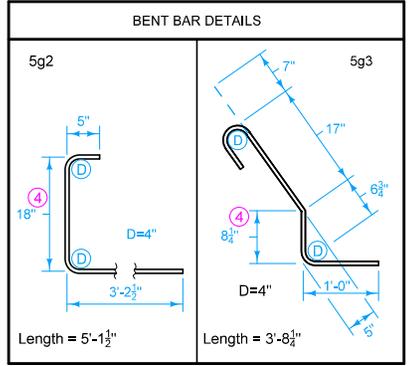
PLAN



TYPICAL SECTION

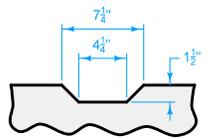
REINFORCING BAR LIST				
Per Shoulder Panel (Approximately 20 Linear Feet)				
(L2)	Bar	Number of Bars	Length	Spacing
4'	6e1	18	5'-1"	12"
	5e2	4	18'-0"	12"
6'	6e1	18	7'-1"	12"
	5e2	6	18'-0"	12"
8'	6e1	18	9'-1"	12"
	5e2	8	18'-0"	12"
10'	6e1	18	11'-1"	12"
	5e2	10	18'-0"	12"
12'	6e1	18	13'-1"	12"
	5e2	12	18'-0"	12"
Applies to all Shoulder Widths	5e3	4	18'-8"	See Drawing
	5g2 (3)	varies	varies	(5)
	5g3 (3)	varies	varies	(5)

ESTIMATED SHOULDER QUANTITIES					
Per Linear Foot					
	(L2)				
	4'	6'	8'	10'	12'
Concrete Sq. Yds.	0.62	0.84	1.06	1.29	1.51



Length = 5'-1 1/2"

Length = 3'-8 3/4"



BEVELED KEY

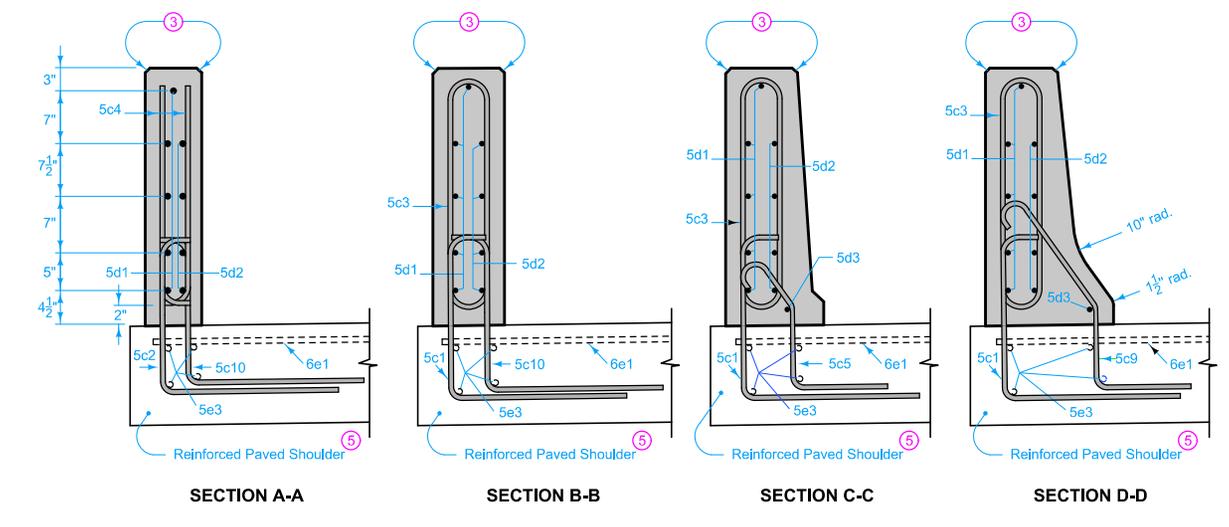
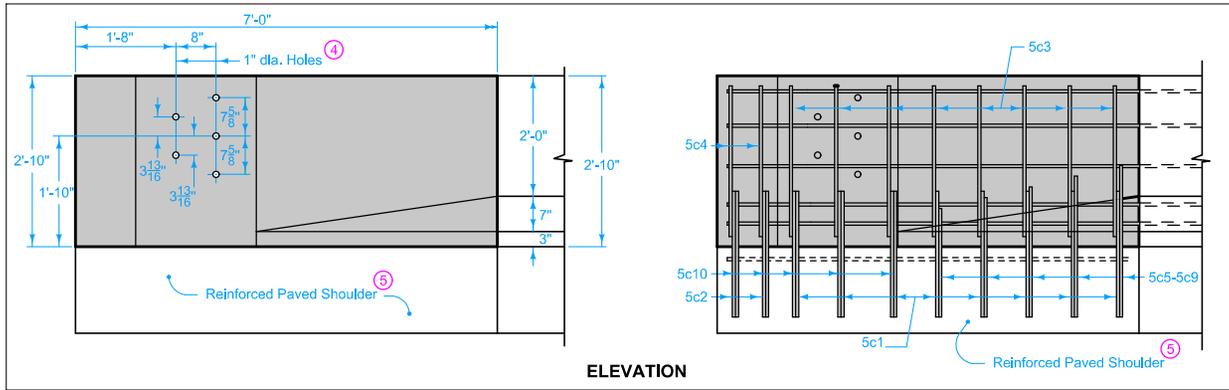
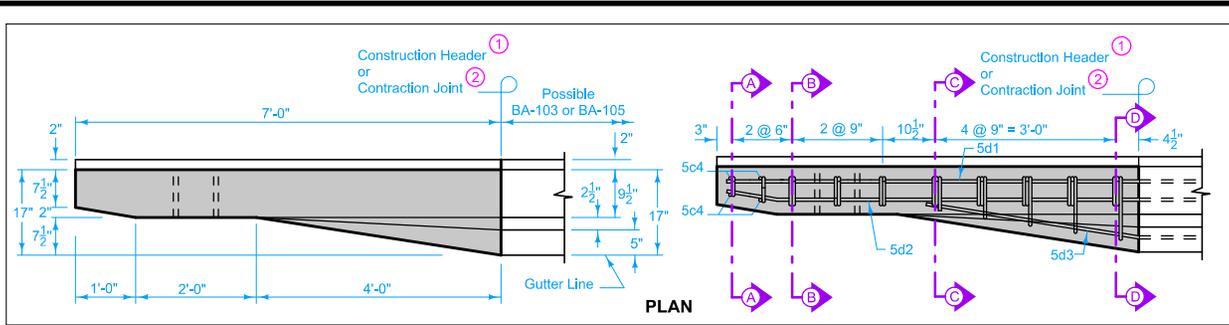
Use 2 x 8 lumber 8" long to make keys. Place keys at 2'-8" centers.

- 1 'L-2' or 'KT-2' joint. When roadway pavement is existing, use 'BT-3' joint. See PV-101.
- 2 'CD' joint. Match roadway joint locations. See PV-101. No 'CD' joint baskets required within 4' of outside edge of shoulder.
- 3 When shoulder will be located under a concrete barrier end section, replace 5g2 and 5g3 bars with reinforcement as shown on BA-107.
- 4 Increase these dimensions by one inch for every inch of paved shoulder thickness greater than 9 inches.
- 5 Match spacing of vertical bars in concrete barrier.

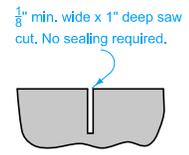
Possible Contract Item:
Reinforced Paved Shoulder for Concrete Barrier

Possible Tabulation:
108-18B

	REVISION
	4 10-21-14
STANDARD ROAD PLAN	BA-106
SHEET 1 of 1	
REVISIONS: Changed Possible Contract Item.	
 APPROVED BY DESIGN METHODS ENGINEER	
REINFORCED PAVED SHOULDER FOR CONCRETE BARRIER	

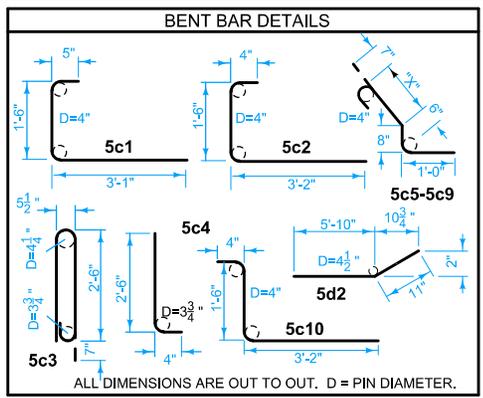


BAR	"X"
5c5	0 3/16"
5c6	8 11/16"
5c7	10 1/8"
5c8	1'-1 1/8"
5c9	1'-4 1/8"



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

CONCRETE QUANTITIES	
Per End Section	0.62 cy



REINFORCING BAR LIST					
BAR	LOCATION	SHAPE	NO.	LENGTH	WEIGHT
5c1	VERTICAL	L	8	5'-0"	42
5c2	VERTICAL	L	2	5'-0"	10
5c3	VERTICAL	U	8	6'-1"	51
5c4	VERTICAL	L	4	2'-10"	12
5c5-5c9	VERTICAL	L	5	VARIES	17
5c10	VERTICAL	L	5	5'-0"	26
5d1	HORIZONTAL	—	5	6'-8"	35
5d2	HORIZONTAL	—	4	6'-9"	28
5d3	HORIZONTAL	—	1	3'-5"	4
TOTAL WEIGHT (LBS.)					225

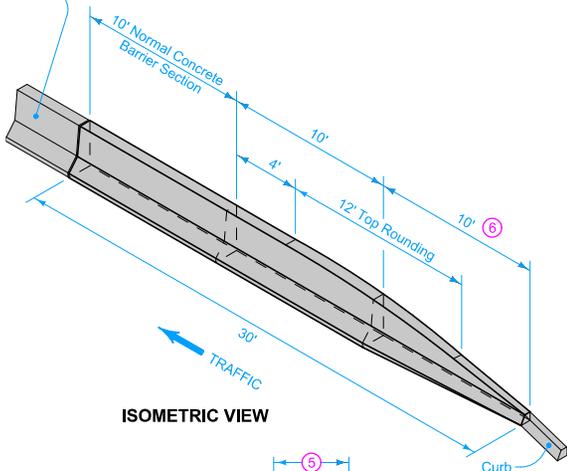
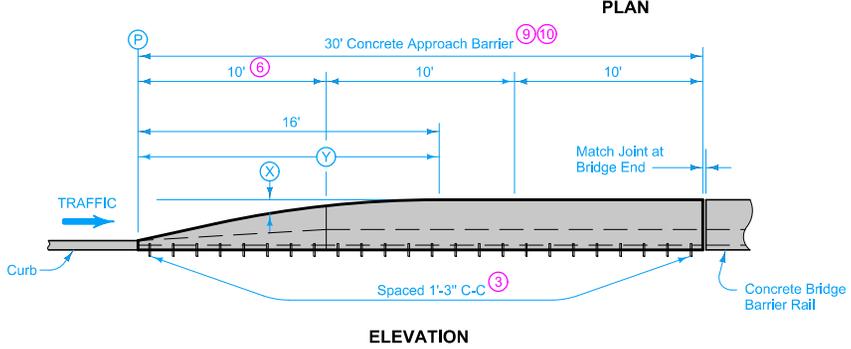
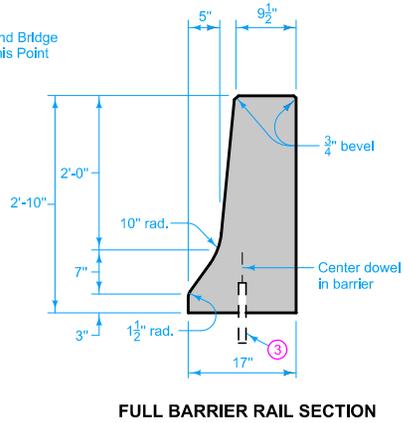
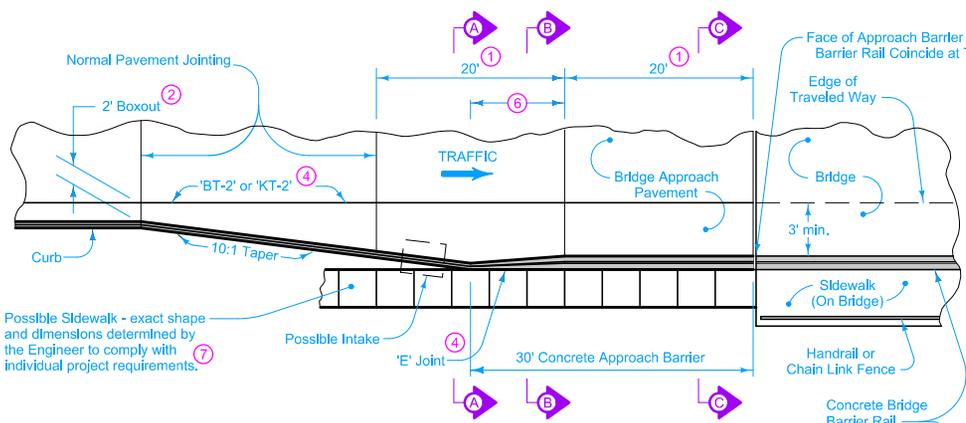
Use Grade 60 epoxy - coated reinforcing bars. Provide 2 inches minimum cover. Anchor all reinforcement to prevent movement. Secure each section at the front, back, and at 3'-6" intervals using a method approved by the Engineer.

- 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".
- Fillet all exposed corners with a 3/4 inch dressed and beveled strip.
- Form holes using 1 inch diameter plastic conduit.
- See BA-106 for details of 5e3 bars, 6e1 bars, and reinforced paved shoulder.

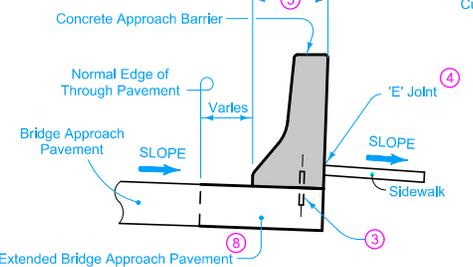
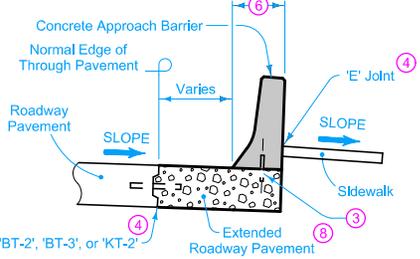
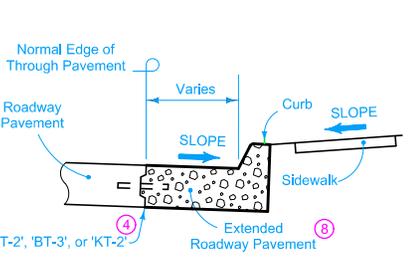
Possible Contract Item:
Concrete Barrier Rail, BA-107

Possible Tabulation:
108-18B

	REVISION	3	10-15-19
	STANDARD ROAD PLAN	BA-107	
	REVISIONS: New Igo.	SHEET 1 of 1	
 APPROVED BY DESIGN METHODS ENGINEER			
CONCRETE BARRIER END SECTION			



OFFSETS FOR ROUNDED BARRIER TOP																	
Y = Distance from (P)	ft.	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0
X = Offset to Rounded Top	ft.	2.13	1.91	1.70	1.48	1.26	1.06	0.87	0.70	0.54	0.42	0.30	0.20	0.12	0.06	0.02	0.00



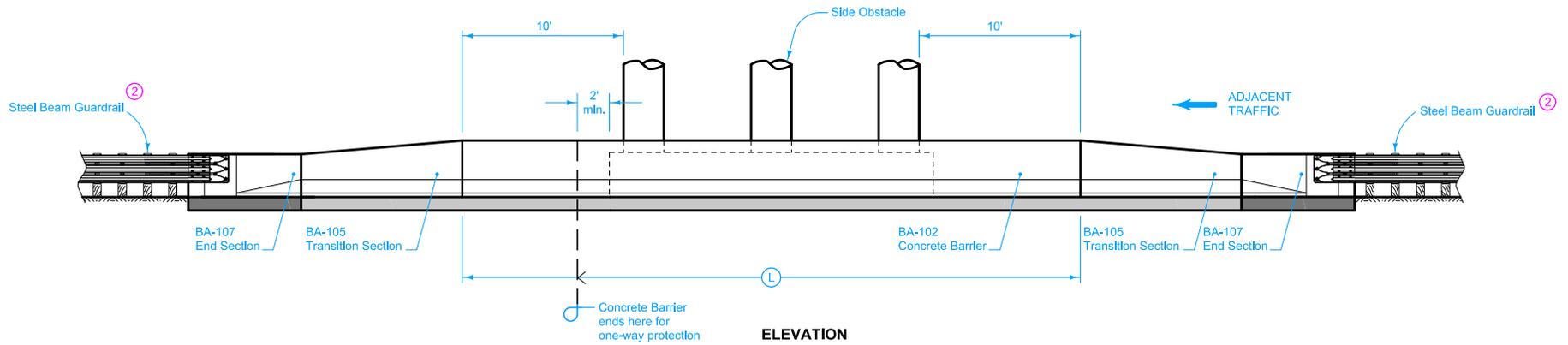
Install a 'C' joint in concrete approach barrier to match the location of each joint in both roadway and bridge approach pavement.

- 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.

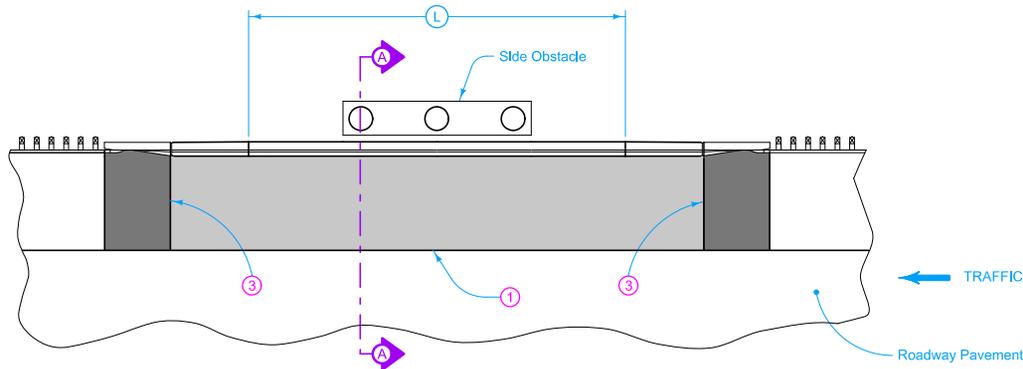
Possible Contract Item:
Concrete Barrier, Tapered End, BA-108

Possible Tabulation:
108-18B

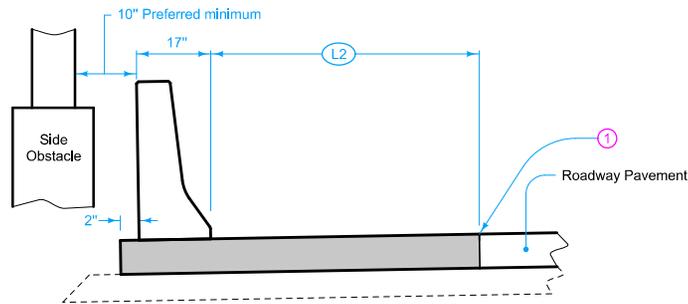
<h2 style="margin: 0;">STANDARD ROAD PLAN</h2>	REVISION
	2 | 10-17-17
	BA-108
SHEET 1 of 1	
REVISIONS: Added Designer Info button. Modified PLAN view to move 'BT-2' or 'KT-2' joint on Bridge Approach Pavement.	
<small>APPROVED BY DESIGN METHODS ENGINEER</small>	
CONCRETE BARRIER TAPERED END SECTION	



ELEVATION



PLAN



SECTION A-A

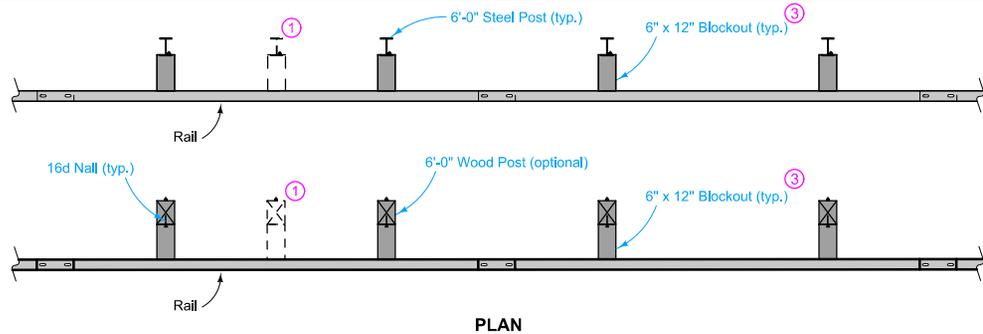
- ① "L-2" or "KT-2" joint. When roadway pavement is existing, use "BT-3" joint. See PV-101.
- ② Refer to BA-250.
- ③ "C" Joint; match existing roadway joints when possible. See PV-101.
- ④ Refer to project typicals.
- ⑤ Refer to BA-106.

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

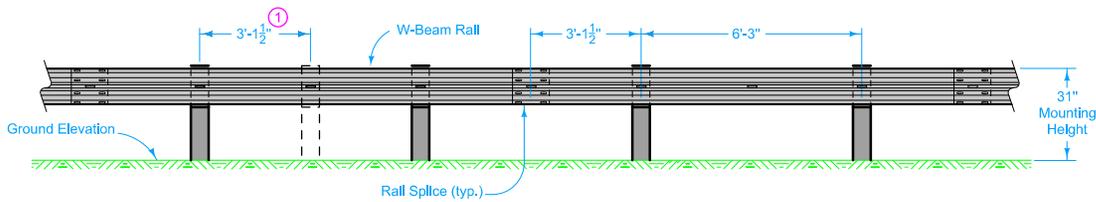
Possible Tabulations:
 108-18B
 112-9

LEGEND	
	PCC Paved Shoulder ④
	Reinforced PCC Paved Shoulder ⑤

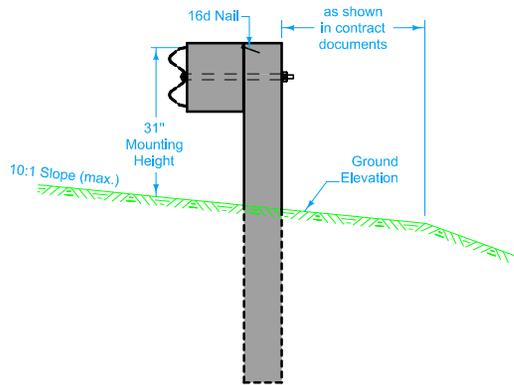
	REVISION
	2 | 10-15-19
STANDARD ROAD PLAN	BA-150
REVISIONS: New Isgo.	SHEET 1 of 1
 APPROVED BY DESIGN METHODS ENGINEER	
SIDE OBSTACLE PROTECTION WITH CONCRETE BARRIER AND GUARDRAIL	



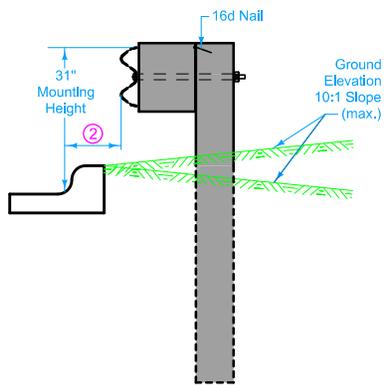
PLAN



ELEVATION



SECTION

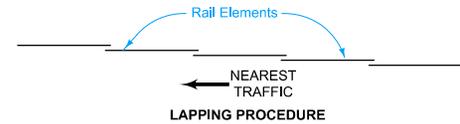


SECTION WITH CURB

W-BEAM INSTALLATION

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).

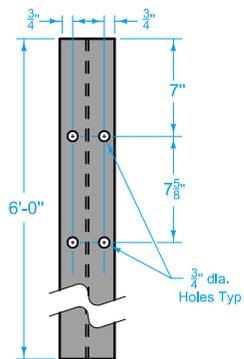
- ① When specified by the contract documents, install posts at 3'-1½" spacing.
- ② 6" maximum for 6" Standard or 6" Sloped curbs and for non-standard curbs.
- ③ Wood or composite only. Steel blockouts will not be allowed.



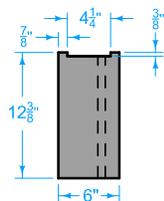
Possible Contract Item:
Steel Beam Guardrail

	REVISION
	5 | 04-16-19
STANDARD ROAD PLAN	BA-200
SHEET 1 of 4	
REVISIONS: Modified THRIE-BEAM BLOCKOUT detail on Sheet 2.	
 APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL COMPONENTS	

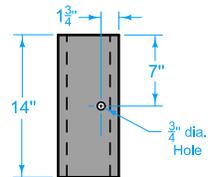
STEEL POST AND BLOCKOUT DETAILS



6'-0" STEEL POST
W6x9 or W6x8.5

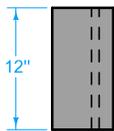


PLAN

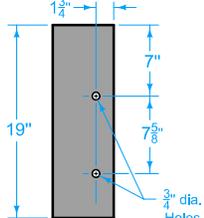


ELEVATION

W-BEAM BLOCKOUT ③

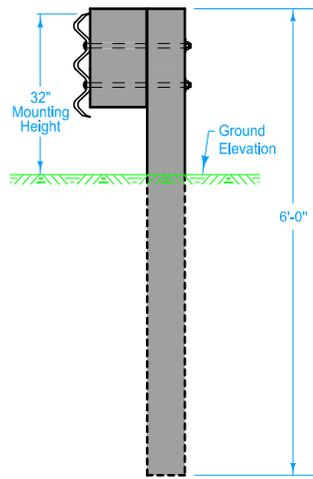


PLAN



ELEVATION

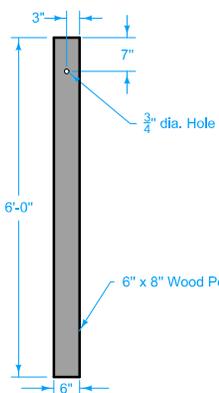
THRIE-BEAM BLOCKOUT ③



THRIE-BEAM INSTALLATION

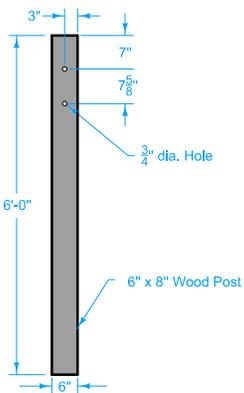
③ Wood or composite only. Steel blockouts will not be allowed.

WOOD POST AND BLOCKOUT DETAILS

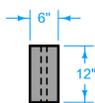


W-BEAM

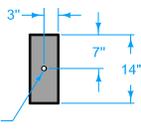
POSTS



THRIE-BEAM

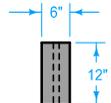


PLAN

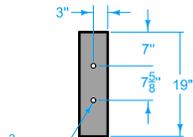


ELEVATION

W-BEAM BLOCKOUT ③



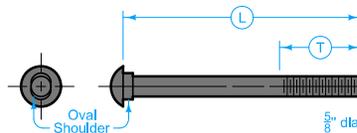
PLAN



ELEVATION

THRIE-BEAM BLOCKOUT ③

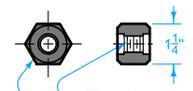
BOLT DETAILS



BOLT

APPLICATION	T	L
Splice Bolt	1 1/16"	1 1/4"
Bolt for Steel Post with 8" Blockout	2 1/2"	10"
Bolt for Steel Post with 12" Blockout	2 1/2"	14"
Bolt for Wood Post with 8" Blockout	2 1/2"	18"
Bolt for Wood Post with 12" Blockout	2 1/2"	22"

T = Min. Thread Length L = Bolt Length

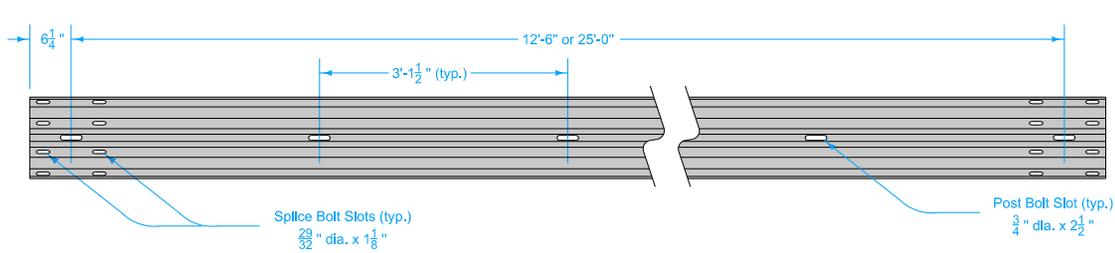


NUT

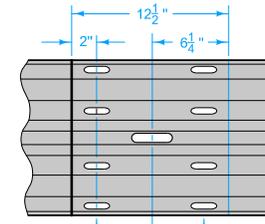
HARDWARE

<p>STANDARD ROAD PLAN</p> <p>REVISIONS: Modified THRIE-BEAM BLOCKOUT detail on Sheet 2.</p> <p>APPROVED BY DESIGN METHODS ENGINEER</p>	REVISION 5 04-16-19
	BA-200
	SHEET 2 of 4

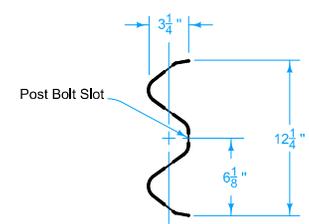
STEEL BEAM GUARDRAIL COMPONENTS



ELEVATION

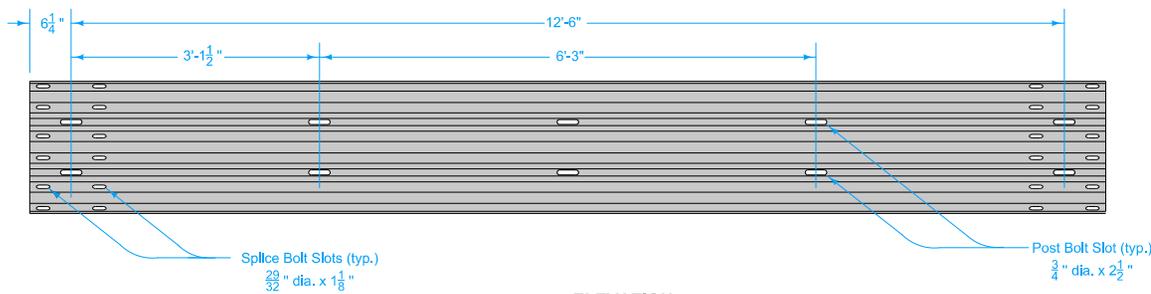


RAIL SPLICE

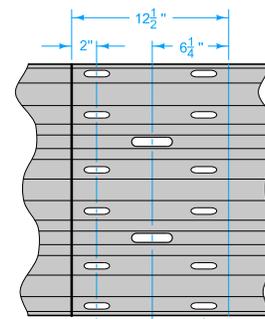


SECTION

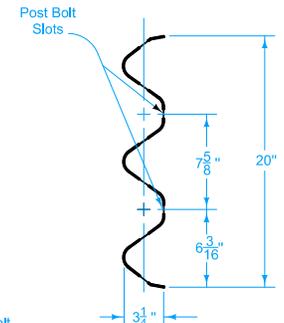
W-BEAM RAIL



ELEVATION

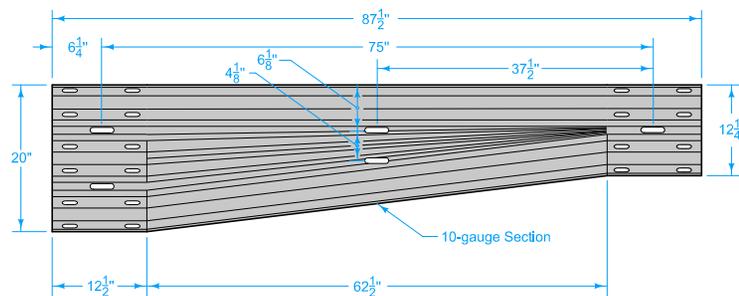


RAIL SPLICE



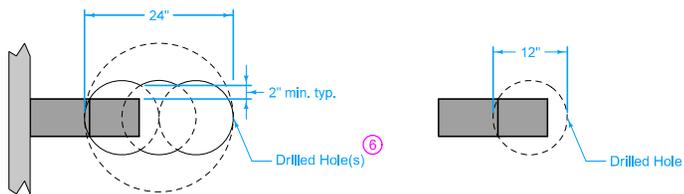
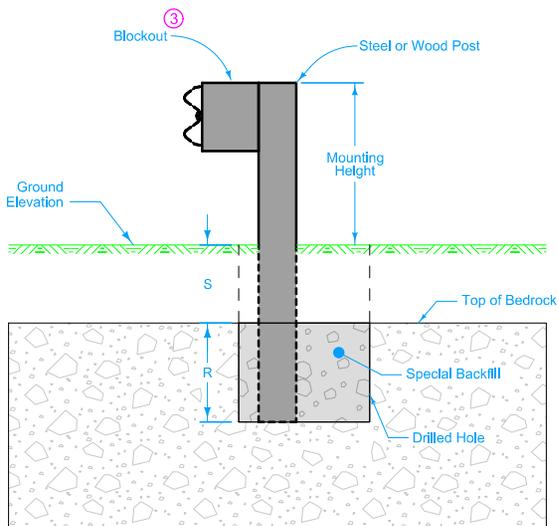
SECTION

THRIE-BEAM RAIL



ASYMMETRICAL TRANSITION SECTION

<p>STANDARD ROAD PLAN</p> <p>REVISIONS: Modified THRIE-BEAM BLOCKOUT detail on Sheet 2.</p> <p>APPROVED BY DESIGN METHODS ENGINEER</p> <p>STEEL BEAM GUARDRAIL COMPONENTS</p>	<p>REVISION</p> <p>5 | 04-16-19</p>
	<p>BA-200</p> <p>SHEET 3 of 4</p>
	<p><i>Handwritten Signature</i></p> <p>APPROVED BY DESIGN METHODS ENGINEER</p>

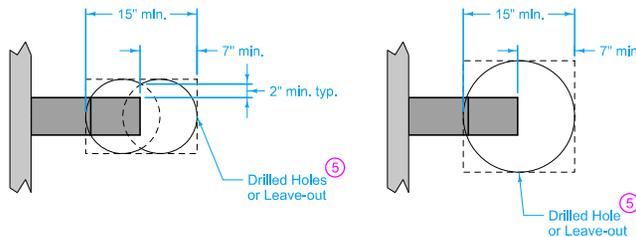
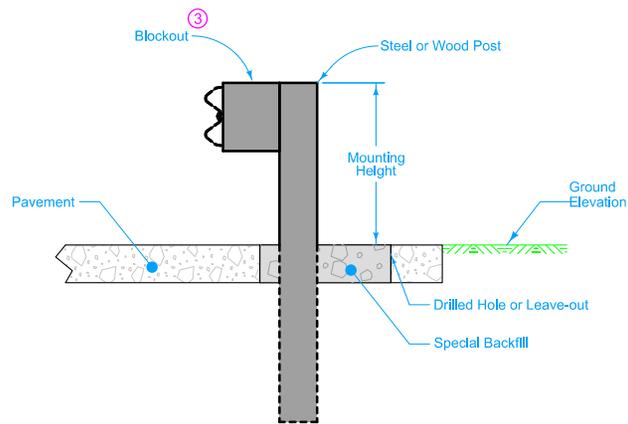


PLAN - CASE A

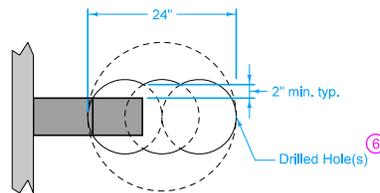
PLAN - CASE B

Post Embedment (4)		
Case	Depth to Bedrock	Minimum Depth to Drill into Bedrock
A	S = 0" to 16"	R = 24"
B	S = 16" to 52"	R = Post Length - Mounting Height - S

POST INSTALLED IN BEDROCK



PLAN - PAVEMENT THICKNESS <= 8"
Either approach is acceptable.



PLAN - PAVEMENT THICKNESS > 8"

POST INSTALLED IN PAVEMENT

Installation information applies to both wood and steel posts.

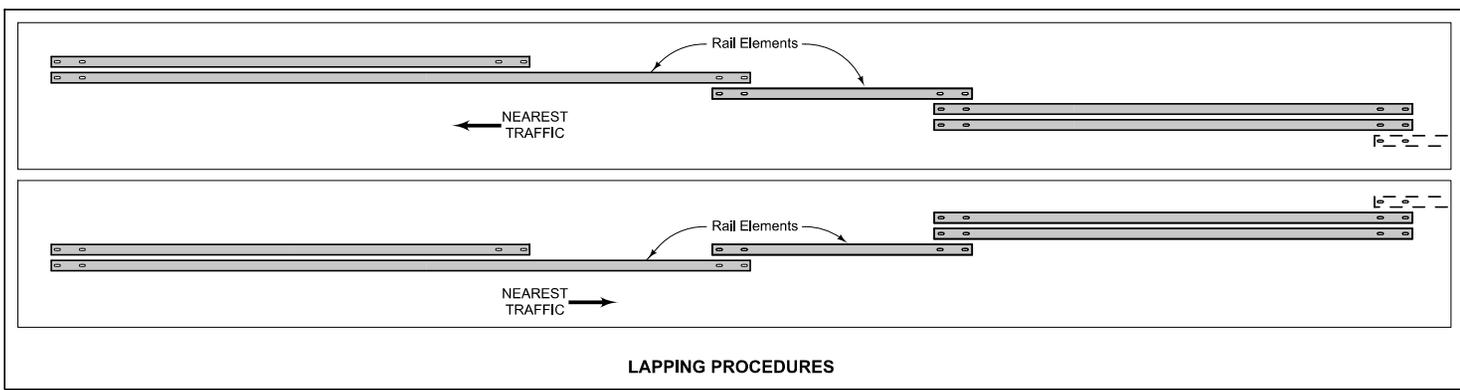
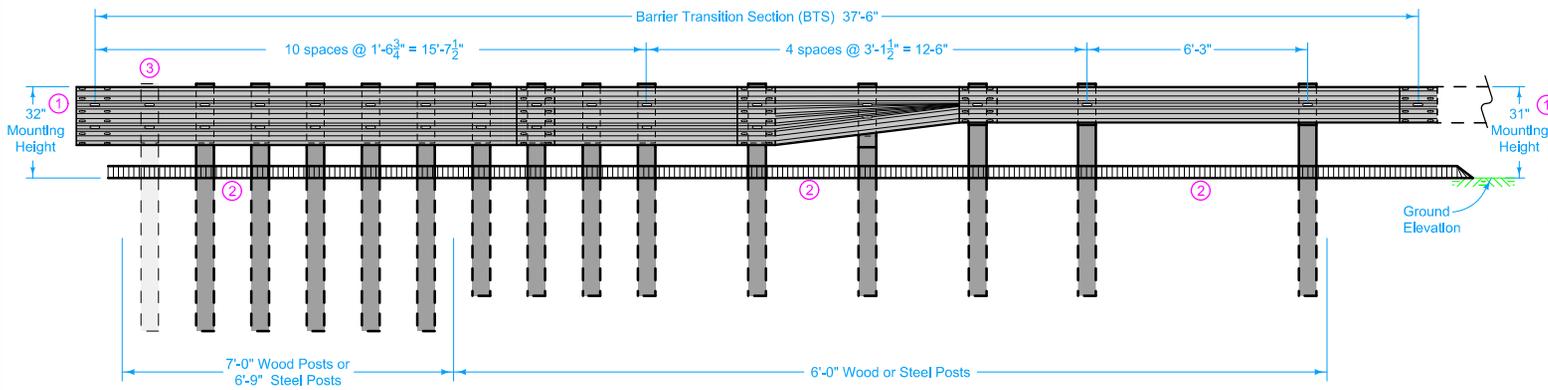
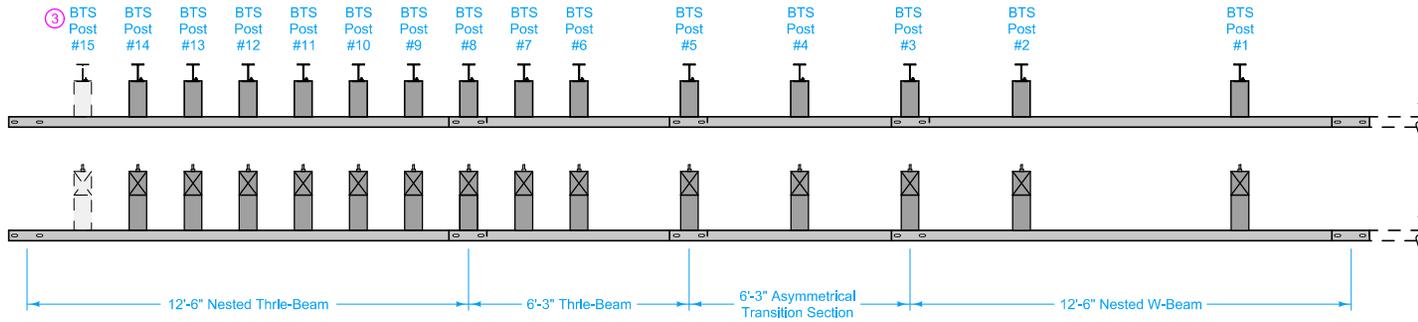
- (3) Wood or composite only. Steel blockouts will not be allowed.
- (4) Post extends to bottom of hole in all cases. Trim top of post as required and treat with preservative according to Section 4161 of the Standard Specifications.
- (5) Use a 12 inch bit with two drills or a 15 inch bit with one drill.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

 STANDARD ROAD PLAN	REVISION
	5 | 04-16-19
	BA-200
SHEET 4 of 4	

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

Steve Miller
APPROVED BY DESIGN METHODS ENGINEER

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" Thrie-Beam rail sections*

(1) 6'-3" Thrie-Beam rail section*

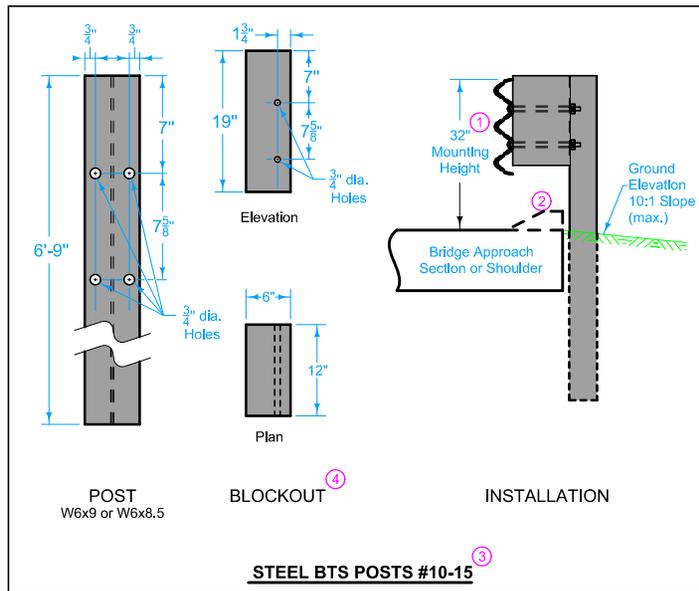
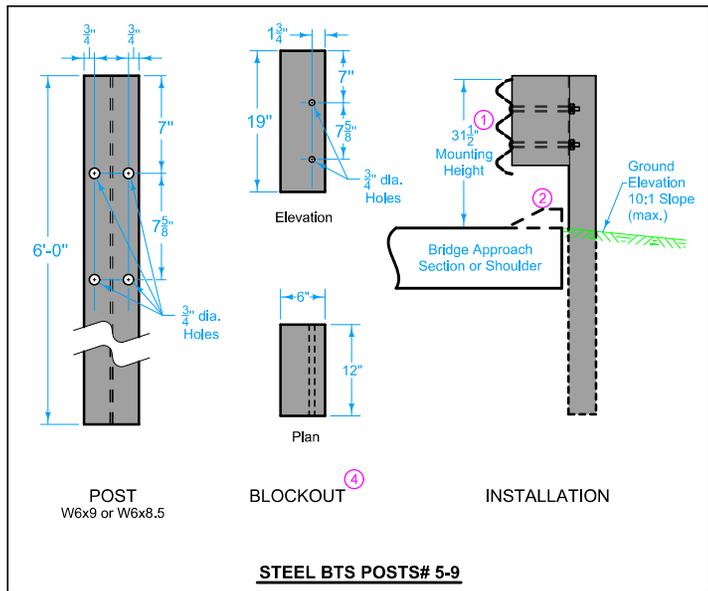
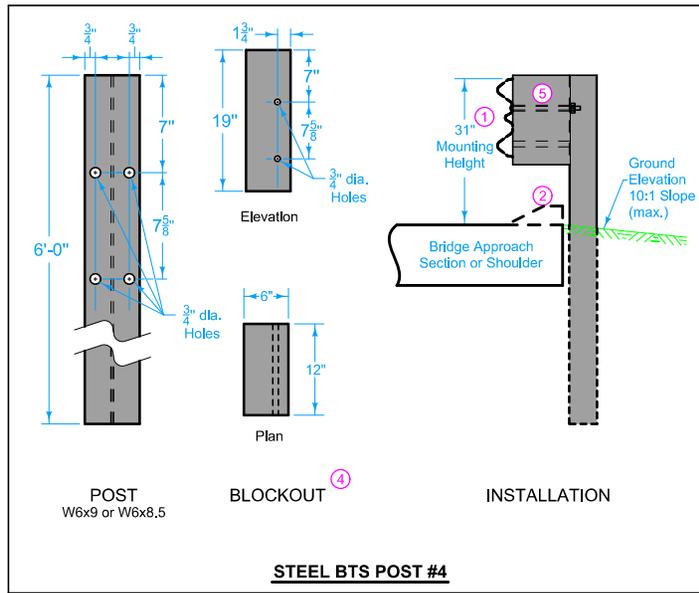
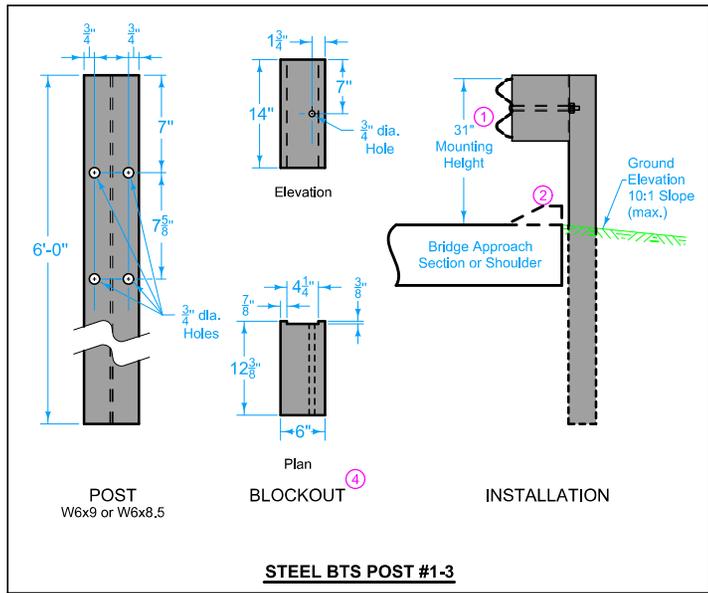
(2) 12'-6" W-Beam rail sections

Approved bolts, nuts, and washers

Refer to BA-200 for guardrail components

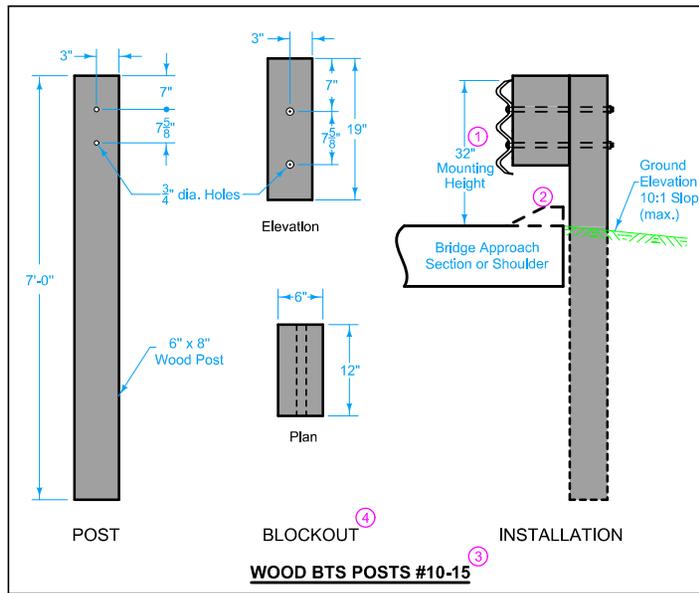
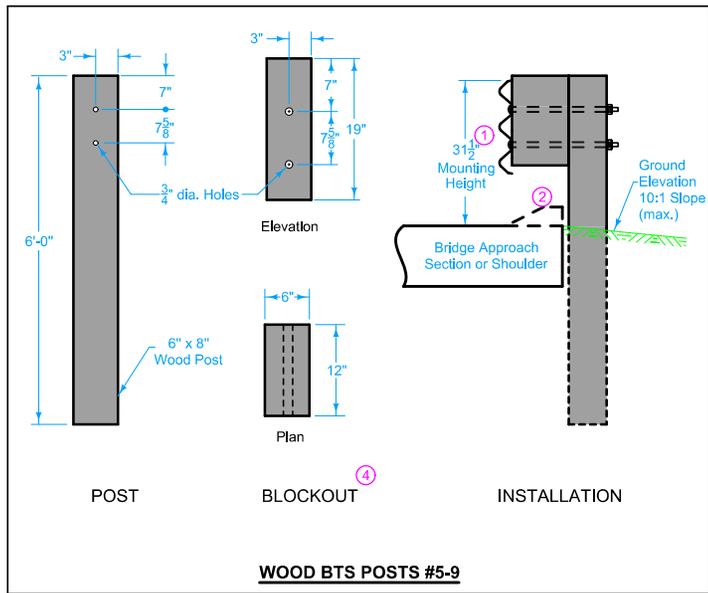
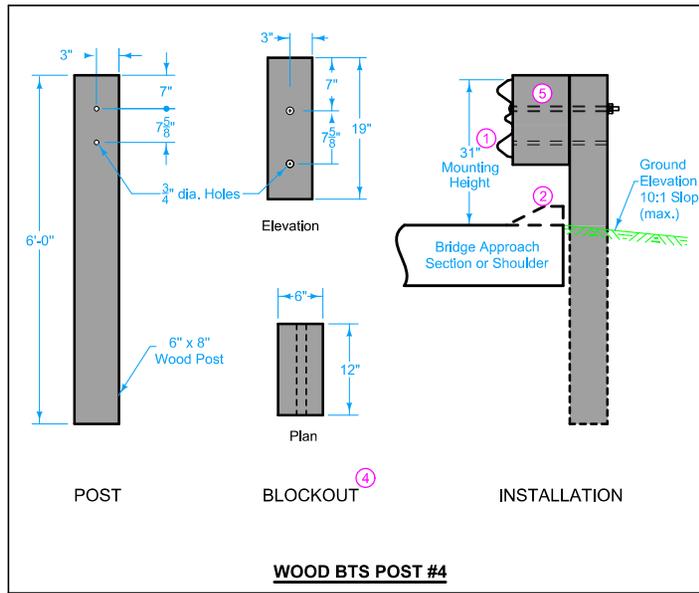
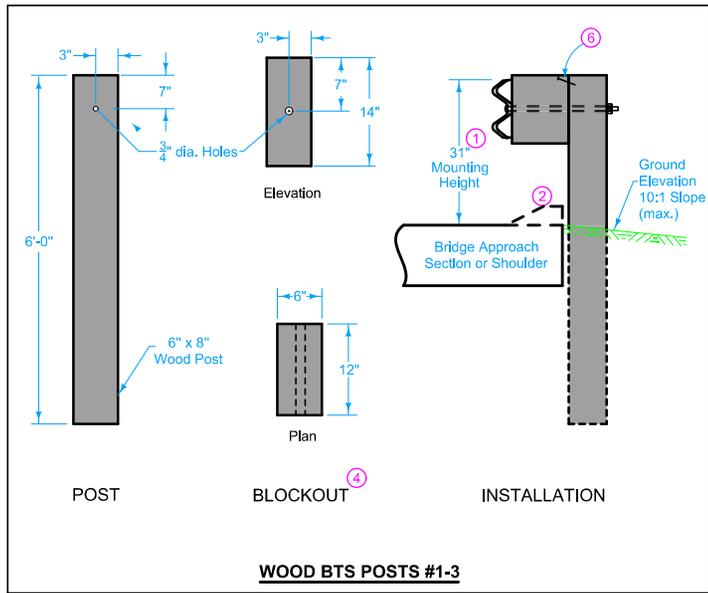
* One 18'-9" Thrie-Beam rail section may be substituted for one of the 12'-6" sections and the 6'-3" section as shown

 STANDARD ROAD PLAN	REVISION 5 | 04-18-17
	BA-201
	SHEET 1 of 3
REVISIONS: Changed Circle Note 5. Changed hole spacing dimensions on WOOD BTS POST #4 view on page 3. Added Circle Note 6 on Page 3.	
 APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL BARRIER TRANSITION SECTION (MASH TL-3)	



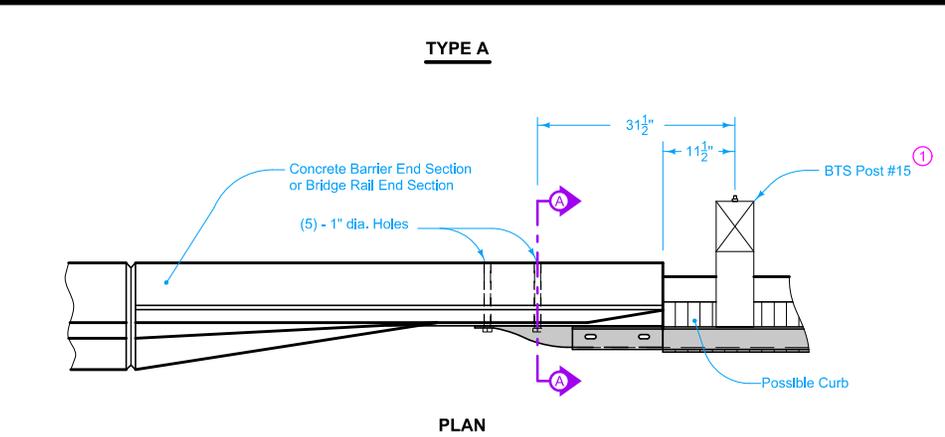
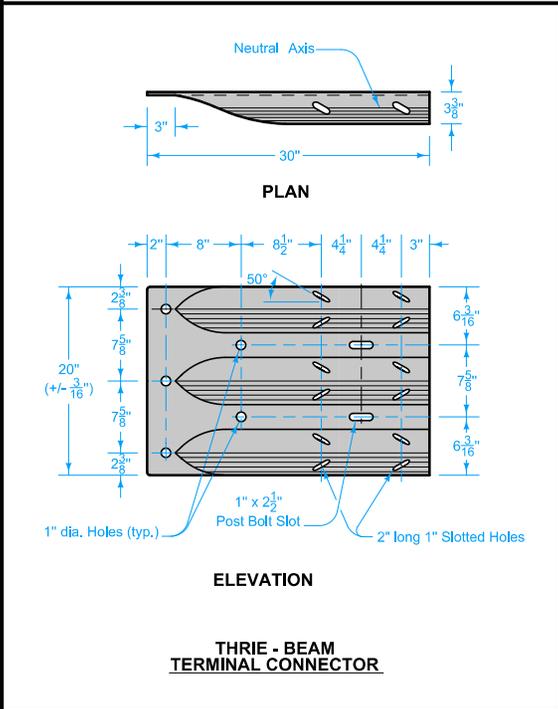
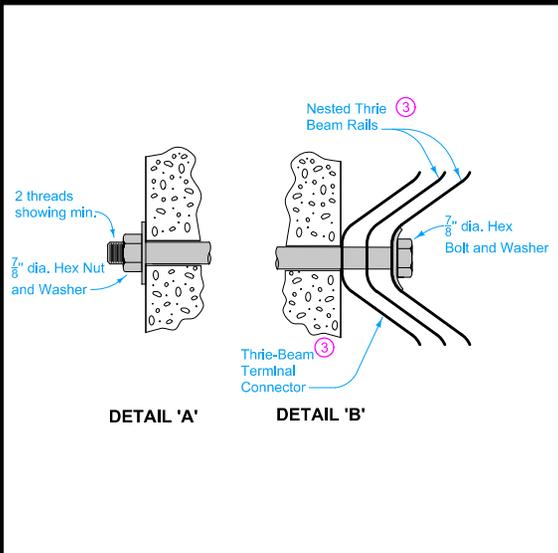
- ① Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.
- ② Possible 4 inch sloped curb. See project plans.
- ③ Depending on end anchor type, BTS Post #15 may be eliminated or modified. See BA-202.
- ④ Wood or composite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

IOWA DOT	REVISION
	5 | 04-18-17
	STANDARD ROAD PLAN
BA-201	SHEET 2 of 3
REVISIONS: Changed Circle Note 5. Changed hole spacing dimensions on WOOD BTS POST #4 view on page 3. Added Circle Note 6 on Page 3.	
<i>Brian Smith</i> APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL BARRIER TRANSITION SECTION (MASH TL-3)	

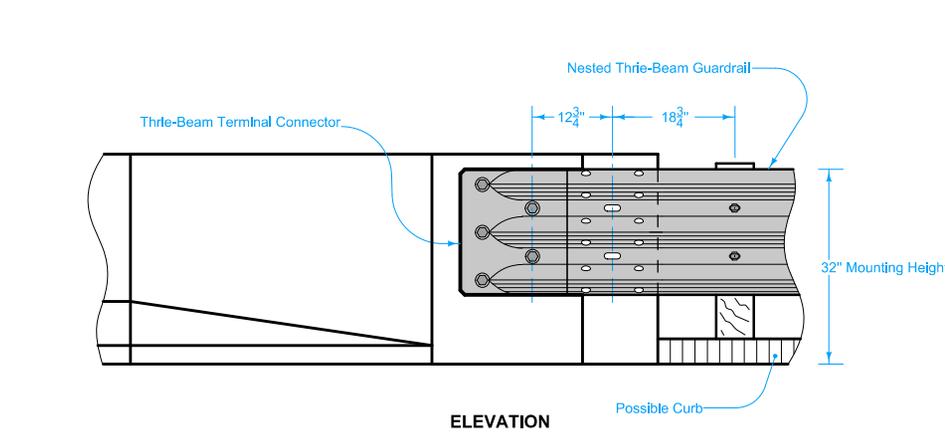


- ① Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.
- ② Possible 4 inch sloped curb. See project plans.
- ③ Depending on end anchor type, BTS Post #15 may be eliminated or modified. See BA-202.
- ④ Wood or composite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

 STANDARD ROAD PLAN	REVISION 5 | 04-18-17
	BA-201
	SHEET 3 of 3
REVISIONS: Changed Circle Note 5. Changed hole spacing dimensions on WOOD BTS POST #4 view on page 3. Added Circle Note 6 on Page 3.	
 APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL BARRIER TRANSITION SECTION (MASH TL-3)	

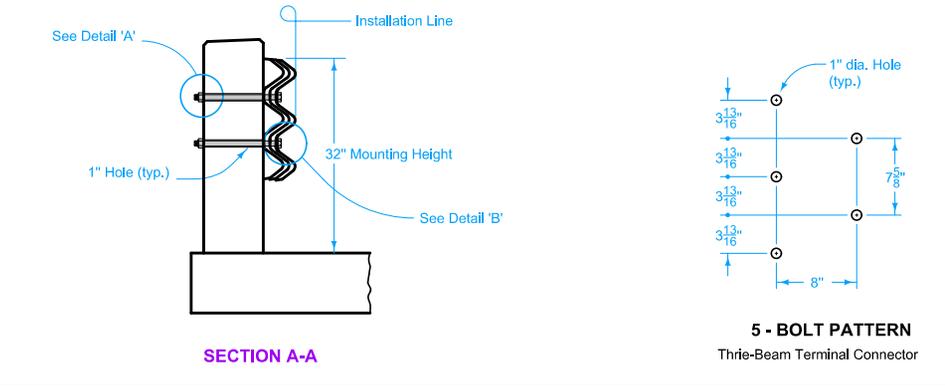


- ① See BA-201.
- ③ Lap the Terminal Connector on the outside of the nested thrie beam rails for attachments on the trailing end of a bridge.



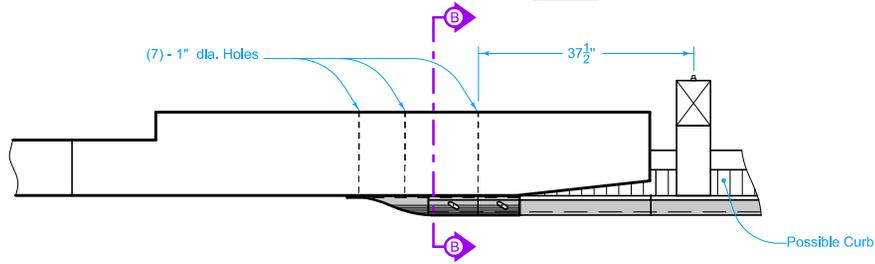
Possible Contract Item:
 Steel Beam Guardrail End Anchor, Bolted

Materials included in the Contract Item:
 Thrie-Beam Terminal Connector
 Approved 7/8" x sufficient length Hex Bolts
 Approved 7/8" Hex Nuts
 Approved 15/16" Washers



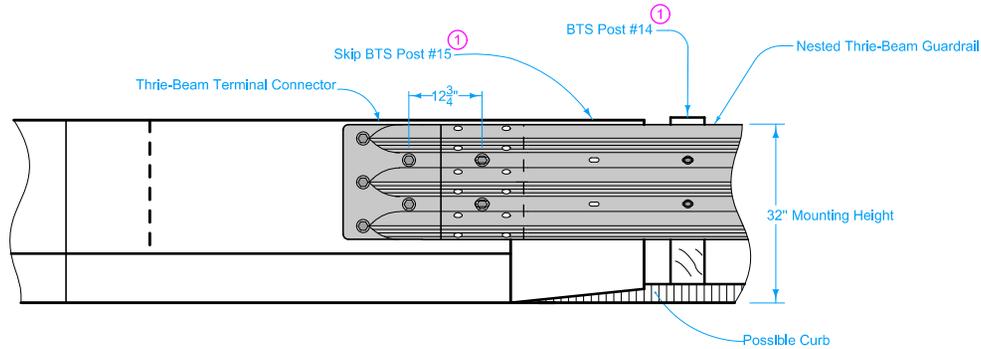
<p>STANDARD ROAD PLAN</p> <p>REVISIONS: Changed BTS post numbers to match changes to BA-201.</p> <p><i>Brian Smith</i> APPROVED BY DESIGN METHODS ENGINEER</p>	REVISION 3 | 10-20-15
	<p>BA-202</p> <p>SHEET 1 of 3</p>
	<p>STEEL BEAM GUARDRAIL BOLTED END ANCHOR</p>

TYPE B

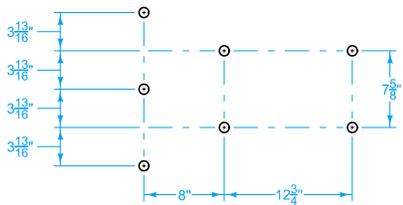


① See BA-201.

PLAN

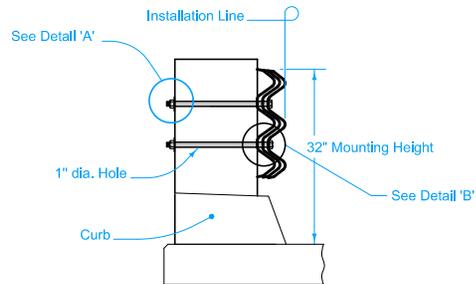


ELEVATION



7 - BOLT PATTERN

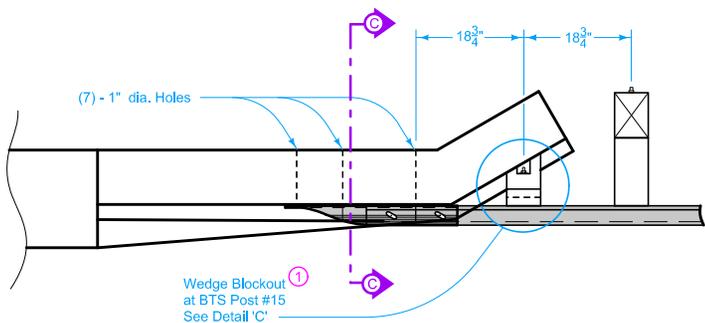
Thrie - Beam Terminal Connector



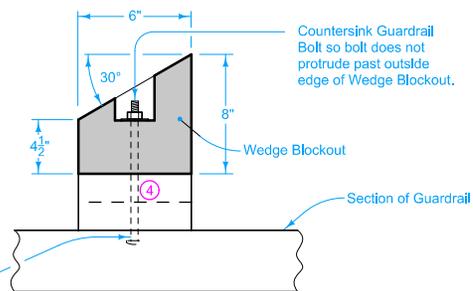
SECTION B-B

	REVISION	
	3	10-20-15
STANDARD ROAD PLAN	BA-202	
	SHEET 2 of 3	
REVISIONS: Changed BTS post numbers to match changes to BA-201.		
<i>Brian Smith</i> APPROVED BY DESIGN METHODS ENGINEER		
STEEL BEAM GUARDRAIL BOLTED END ANCHOR		

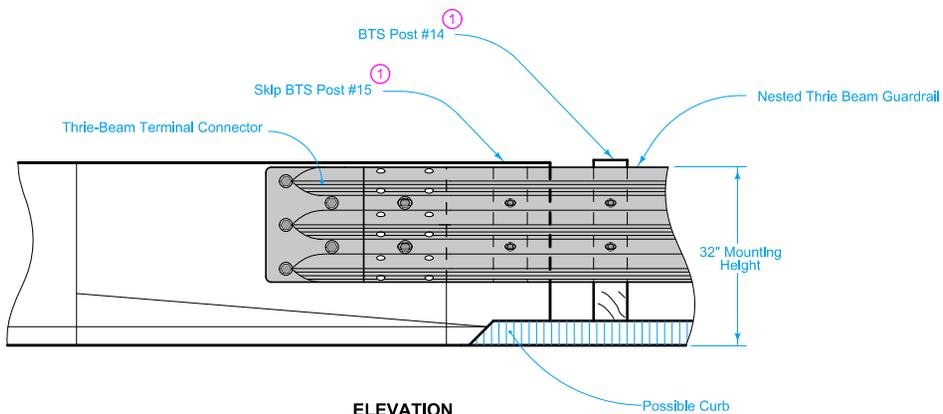
TYPE C



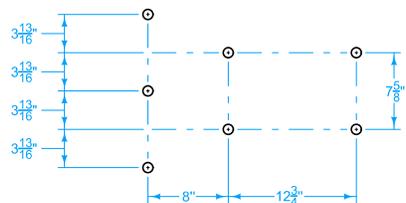
PLAN



DETAIL 'C'

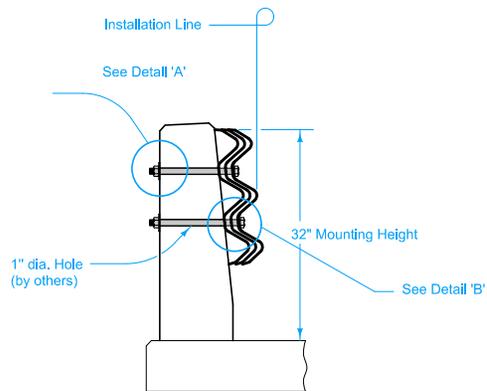


ELEVATION



7 - BOLT PATTERN

Thrie - Beam Terminal Connector



SECTION C-C

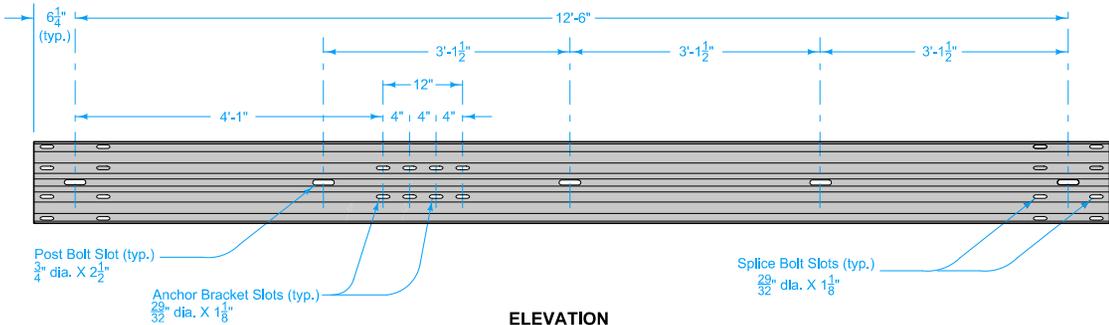
- ① See BA-201.
- ④ Use treated spacer boards (1 in. x 6 in. or 2 in. x 6 in.) to produce a tight fit between the wedge blockout and endpost. A nominal 1 inch gap is acceptable. Spacer boards are incidental to bolted end anchor.

 STANDARD ROAD PLAN	REVISION
	3 | 10-20-15
	BA-202
SHEET 3 of 3	

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

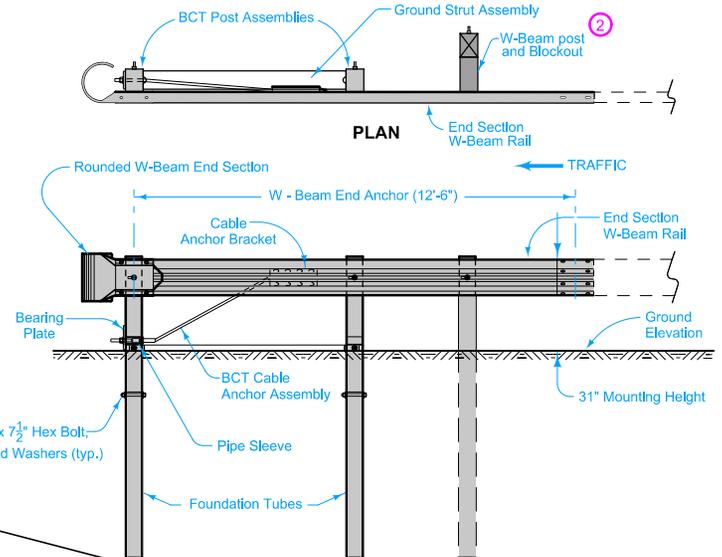
Brian Smith
APPROVED BY DESIGN METHODS ENGINEER

**STEEL BEAM GUARDRAIL
BOLTED END ANCHOR**



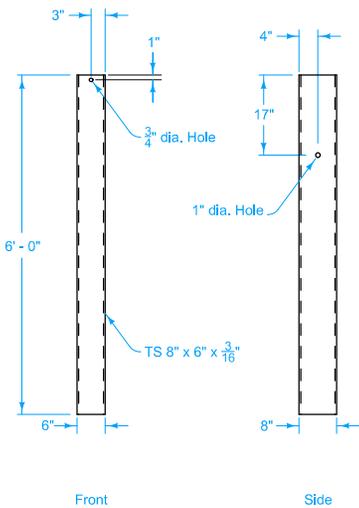
ELEVATION

END SECTION W-BEAM RAIL

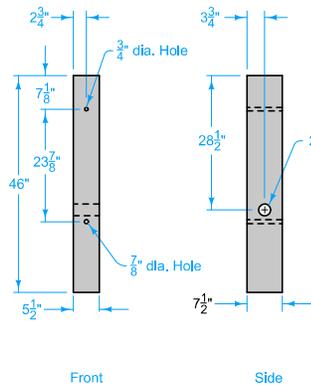


ELEVATION

INSTALLATION

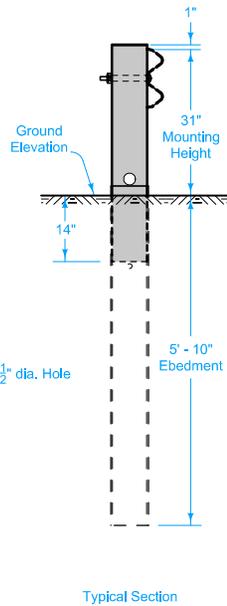


FOUNDATION TUBE

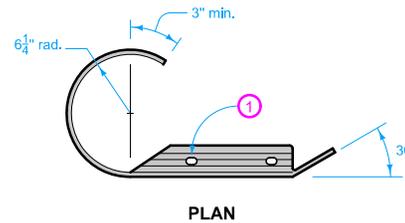


POST

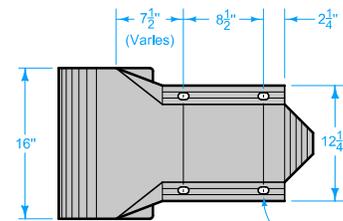
BCT POST ASSEMBLY



INSTALLATION



PLAN



ELEVATION

ROUNDED W-BEAM END SECTION

- ① 29/32" x 1 1/8" slots (29/32" x 3" slots acceptable).
- ② Refer to BA-200.

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

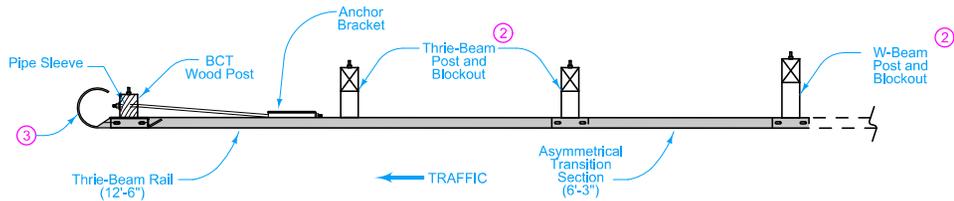
- Materials included in the Contract Item:
- (1) 12'-6" End Section W-Beam Rail
 - (2) Foundation Tube Assemblies
 - (2) BCT Wood Posts
 - (1) Rounded W-Beam End Section
 - (1) Cable Anchor Bracket
 - (1) BCT Cable Anchor Assembly
 - (1) Ground Strut Assembly
 - (1) Pipe Sleeve
 - (1) Bearing Plate
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

	REVISION	10-15-19
	2	
STANDARD ROAD PLAN		BA-203
REVISIONS: New Logo.		SHEET 1 of 1

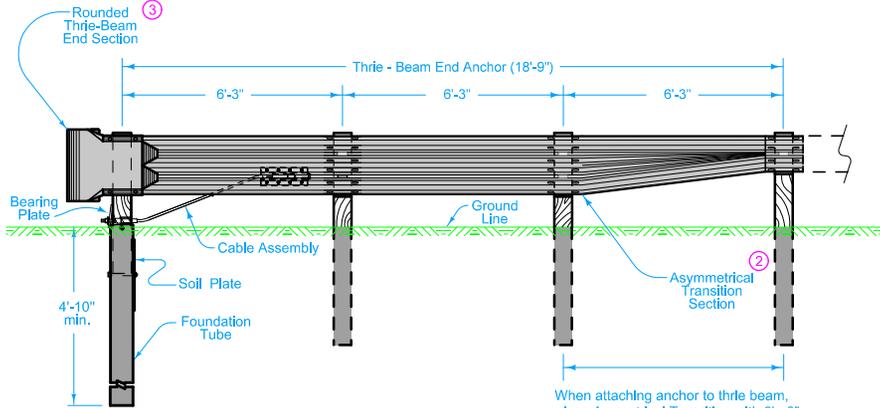
APPROVED BY DESIGN METHODS ENGINEER

Steve Miller

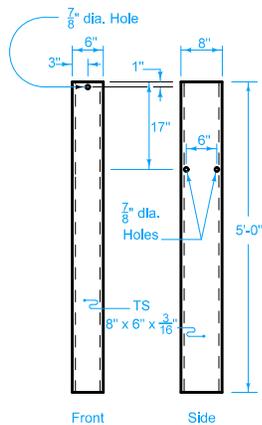
**STEEL BEAM GUARDRAIL
W-BEAM END ANCHOR**



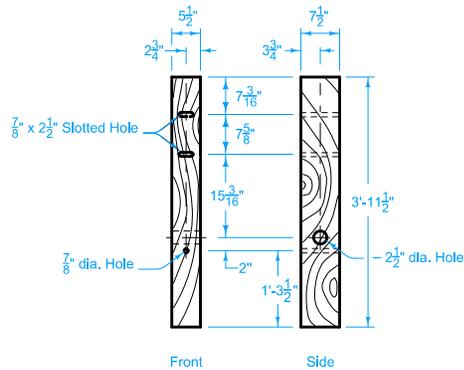
PLAN



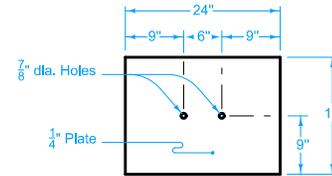
ELEVATION



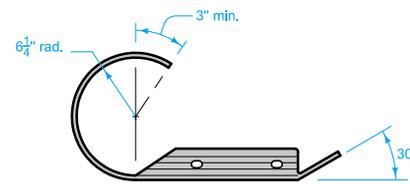
FOUNDATION TUBE



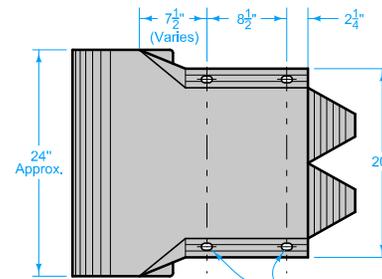
BCT WOOD POST



SOIL PLATE



PLAN



ELEVATION

ROUNDED THRIE-BEAM END SECTION

- ① Slotted holes $\frac{23}{32}$ " x $1\frac{1}{8}$ " long.
- ② Refer to **BA-200**.
- ③ Cover entire face of end section with alternating black and yellow striped adhesive sheeting. Stripes shall be approximately 3 inches in width and shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the end anchor. Yellow stripes shall meet the retroreflectivity requirements for Type III or Type IV reflective sheeting.

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

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

IOWA DOT	REVISION	
	2	10-15-19
STANDARD ROAD PLAN	BA-204	
SHEET 1 of 1		

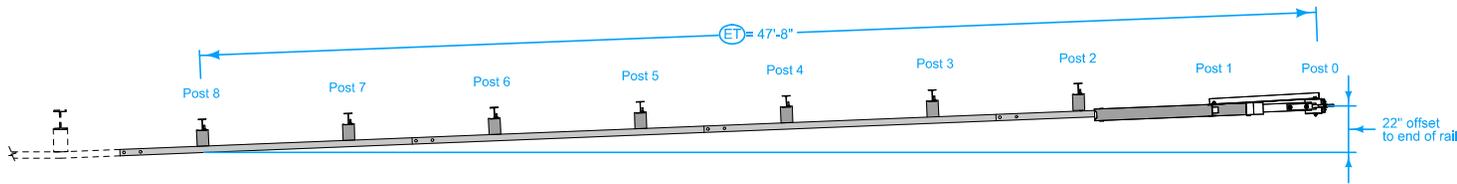
REVISIONS: New Isgo.

Handwritten Signature

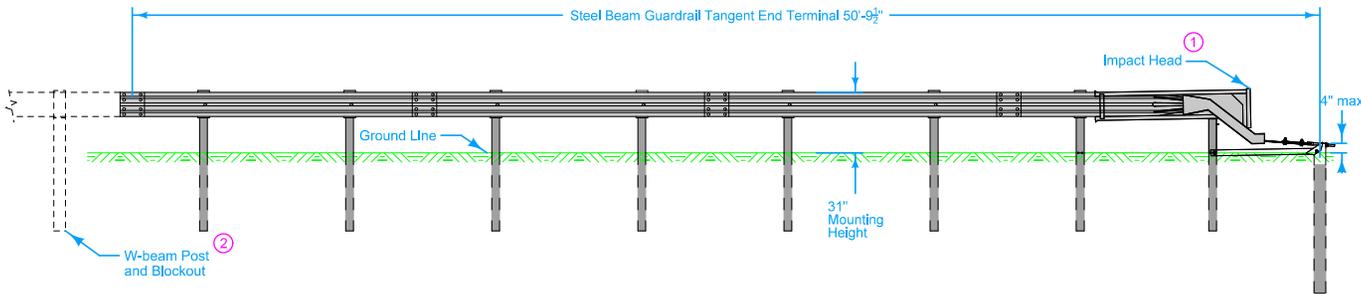
APPROVED BY DESIGN METHODS ENGINEER

**STEEL BEAM GUARDRAIL
THRIE-BEAM END ANCHOR**

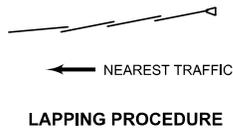
**DESIGNER
INFO**



PLAN



ELEVATION



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.

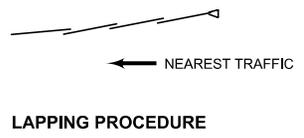
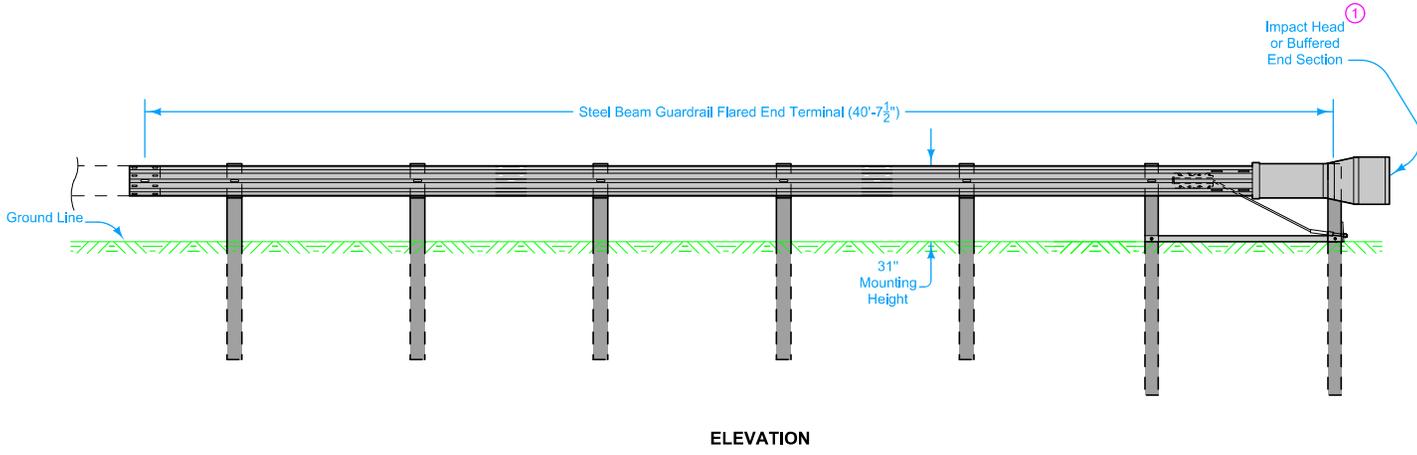
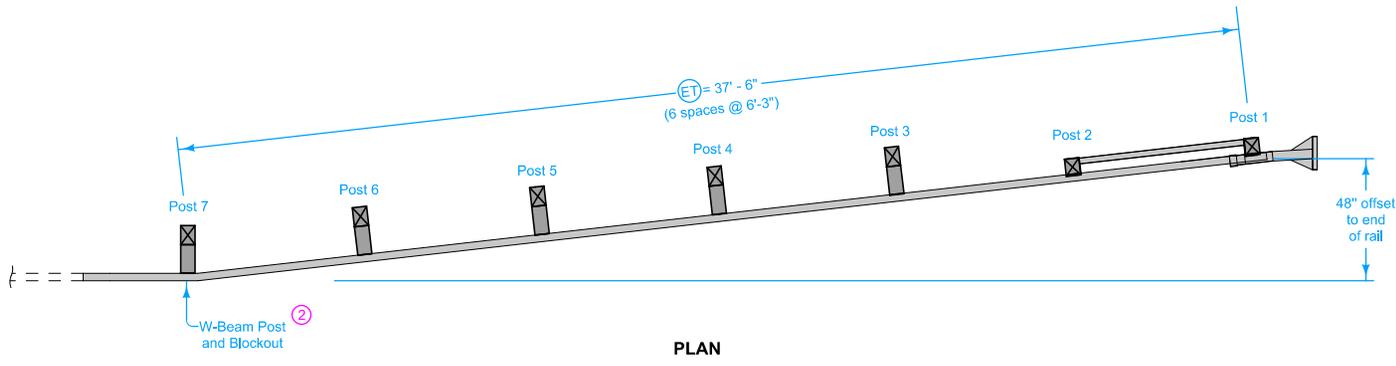
Note: at the Contractor's option, and at no cost to the Contracting Authority, alternate post designs developed by the manufacturer and accepted by the FHWA for use within the end terminal may be substituted for the post design shown. When such a substitution is made, provide the Engineer with three 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-205

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

	REVISION
	2 | 04-19-16
STANDARD ROAD PLAN	BA-205
SHEET 1 of 1	
REVISIONS: New layout, notes, and title to reflect MASH approved end terminal.	
 APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL TANGENT END TERMINAL (MASH TL-3)	



Refer to Materials LM. 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.

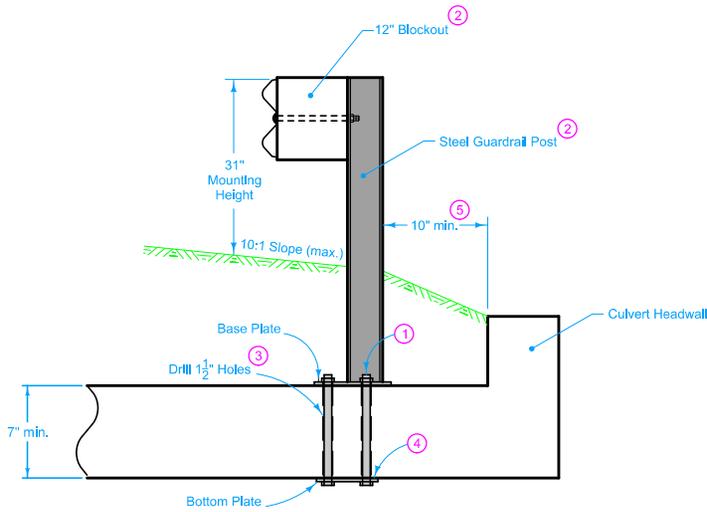
- ① Cover entire face of impact head or buffered end section with alternating black and yellow striped adhesive sheeting meeting the following requirements:
 - Stripes are approximately 3 inches wide and slope down at a 45 degree angle toward the side on which traffic is to pass the end terminal.
 -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

- ② Refer to BA-200.

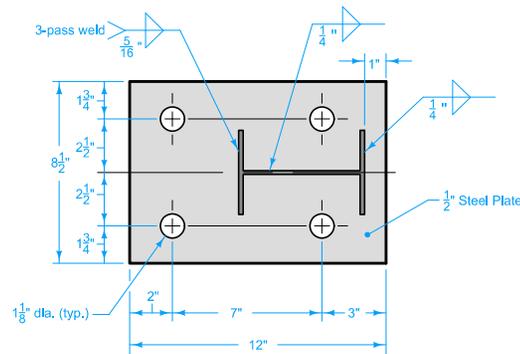
Possible Contract Item:
Steel Beam Guardrail Flared End Terminal, BA-206

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

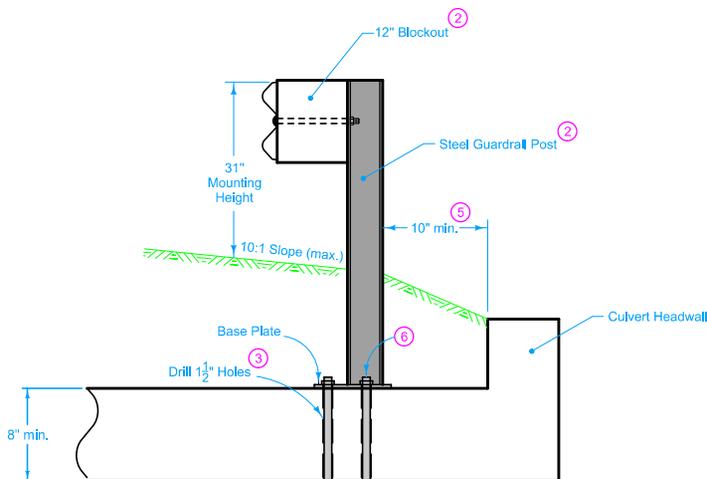
IOWA DOT	REVISION 4 | 10-15-19
	BA-206
STANDARD ROAD PLAN	SHEET 1 of 1
REVISIONS: Retitled. Modified graphics and notes.	
APPROVED BY DESIGN METHODS ENGINEER <i>Handwritten Signature</i>	
STEEL BEAM GUARDRAIL FLARED END TERMINAL FOR CABLE CONNECTION	



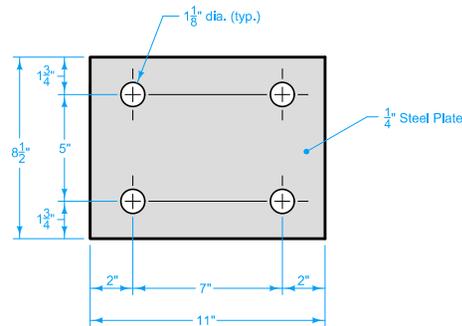
**TYPICAL SECTION
(Bolt Through Connection)**



BASE PLATE AND POST



**TYPICAL SECTION
(Epoxy Connection)**



BOTTOM PLATE

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.

- ① Bolt length equals slab thickness plus 2 inches.
- ② Provide W6x9 or W6x8.5 steel guardrail post. Supply routed blockout or nail blockout to post in order to prevent twisting.
- ③ Drill holes using equipment designed to cut through concrete and reinforcing steel.
- ④ Grout casting 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.
- ⑤ Twelve inch minimum to end of top of culvert if no headwall is present.
- ⑥ Bolt length to provide a minimum of 8 inch embedment.

Possible Contract Items:

- Steel Beam Guardrail
- Steel Beam Guardrail, Post Adapter Unit, BA-210

Incidental to Adapter Unit:

- 1 - 12" x 8 1/2" x 1/2" ASTM A36 Steel Plate
- 1 - 11" x 8 1/2" x 1/4" ASTM A36 Steel Plate
- 4 - 1" ASTM A307 Hex Head bolts with one nut and two washers per bolt

Incidental to Steel Beam Guardrail:

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

Possible Tabulations:

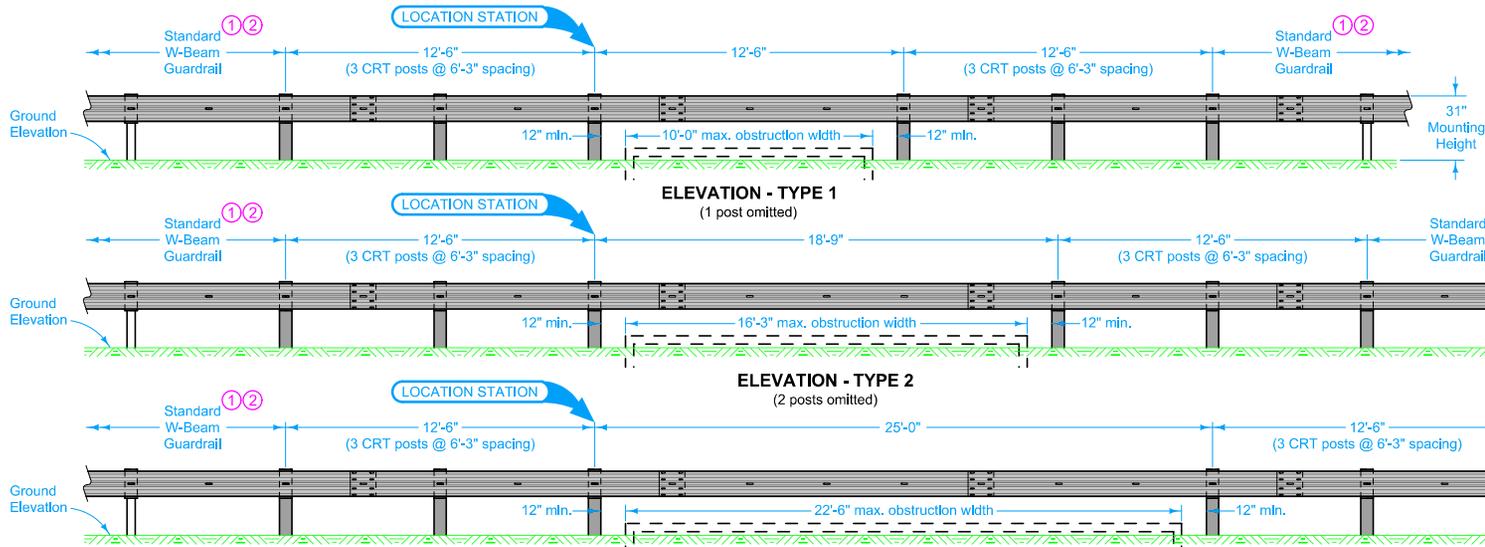
- 108-8A
- 108-8B
- 108-8C

IOWA DOT	REVISION	
	2	04-19-16
	STANDARD ROAD PLAN	
BA-210		SHEET 1 of 1

REVISIONS: Added EPOXY CONNECTION detail, circle notes 5 and 6, and possible tabulations. Changed standard note to state use is not intended for intakes.

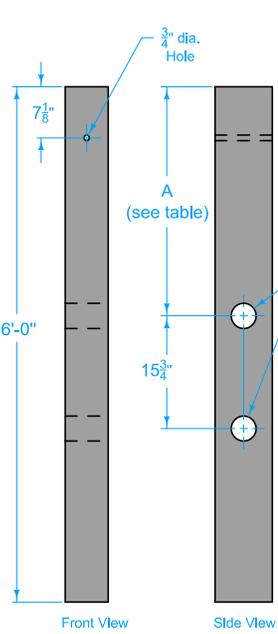
Brian Smith
APPROVED BY DESIGN METHODS ENGINEER

GUARDRAIL POST ADAPTER UNIT

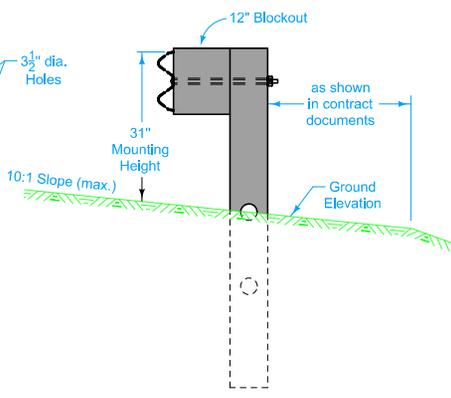


This sheet is intended to show the method of installing w-beam guardrail at locations where normal post placements are not possible due to conflicts with underground structures.

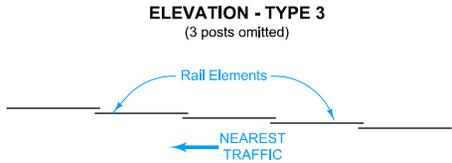
Installation Type	Minimum Guardrail Length ^①
1	37'-6"
2	43'-9"
3	50'-0"



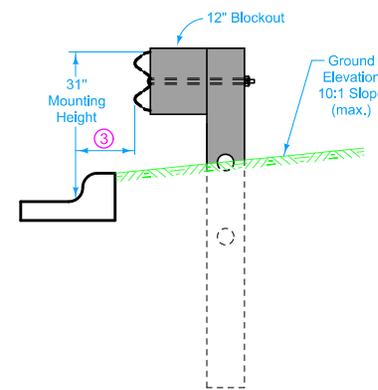
CRT Post Location	A
Behind 4" curb	28"
Behind 6" curb	26"
Level ground	32"



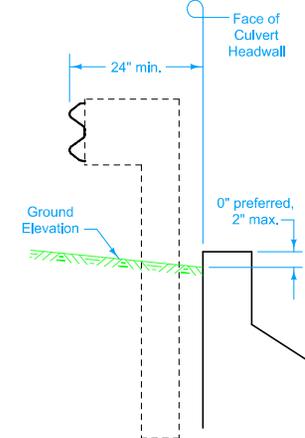
TYPICAL SECTION AT CRT POST
Level Ground



LAPPING PROCEDURE



TYPICAL SECTION AT CRT POST
Behind Curb



TYPICAL SECTION AT BOX CULVERT

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

Possible Contract Item:
Steel Beam Guardrail

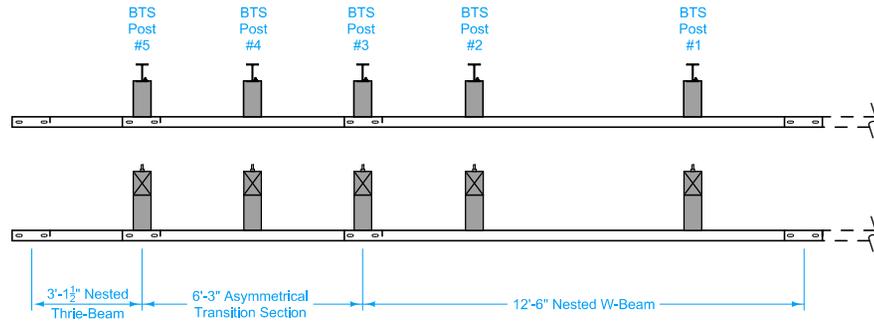
Materials included in the Contract Item:
(6) 6" x 8" x 6'-0" CRT posts
(6) 6" x 12" x 14 1/2" blockouts
Approved bolts, nuts, and washers

Possible Tabulations:
108-8B
108-8C

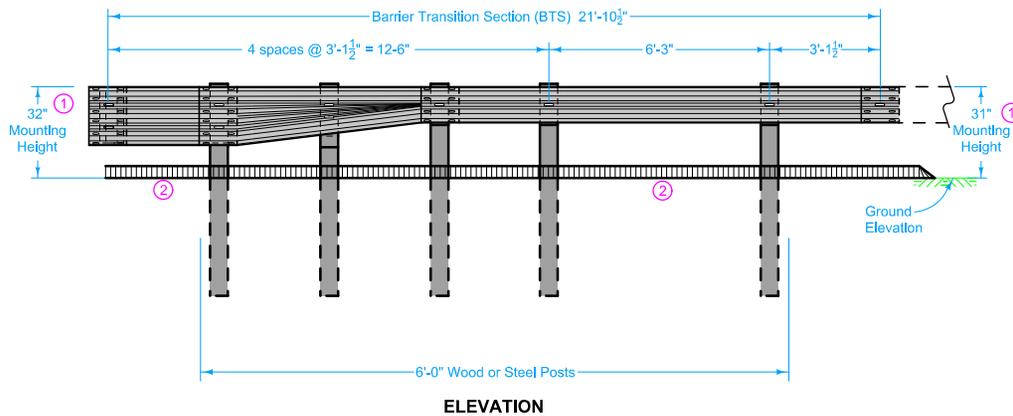
IOWA DOT	REVISION
	New 10-21-14
STANDARD ROAD PLAN	BA-211
REVISIONS: New.	SHEET 1 of 1

Brian Smith
APPROVED BY DESIGN METHODS ENGINEER

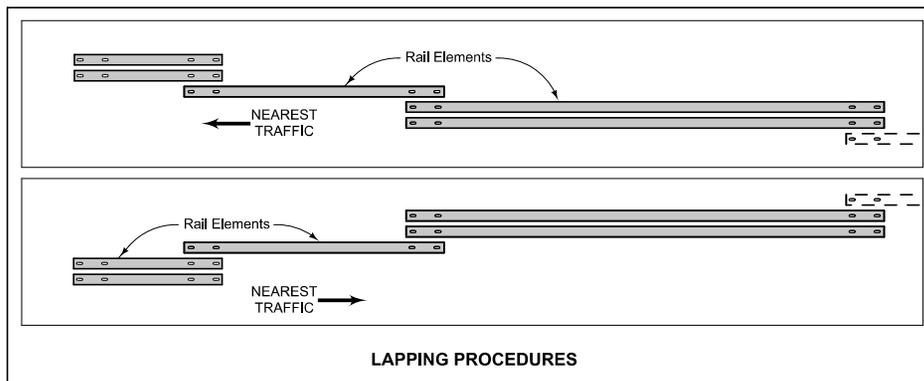
**STEEL BEAM GUARDRAIL
LONG-SPAN SYSTEM
FOR POST CONFLICTS**



PLAN



ELEVATION



LAPPING PROCEDURES

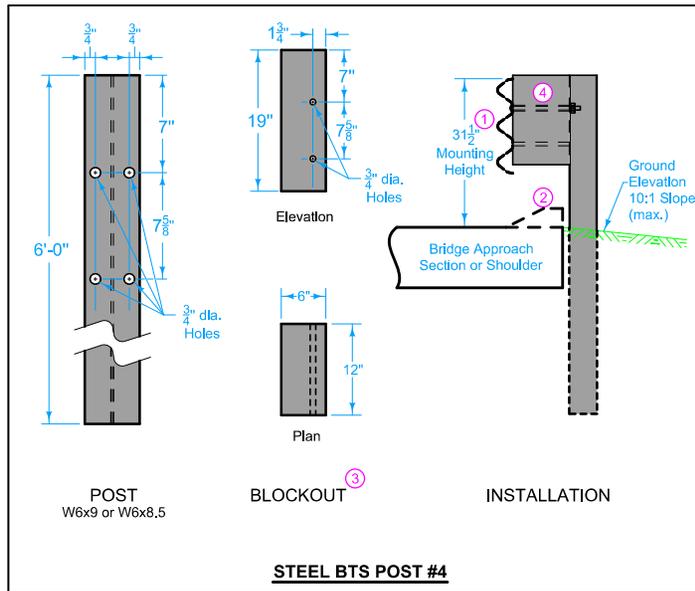
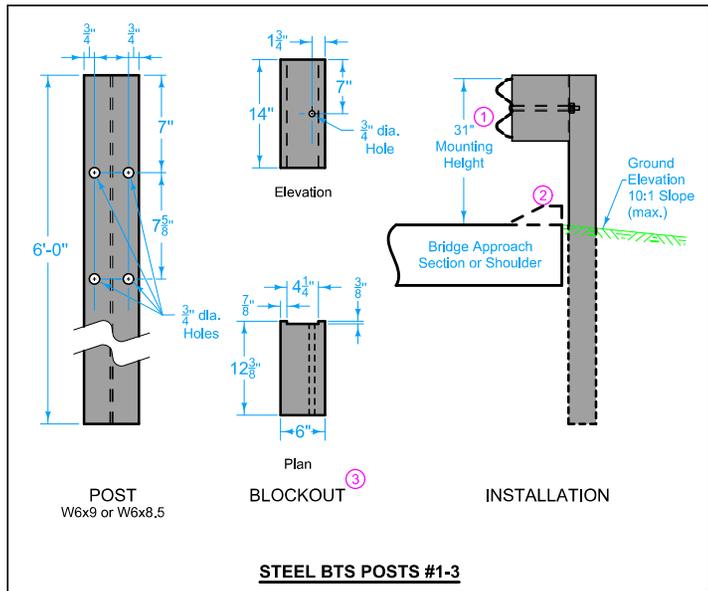
At Bridge End Drains, cut Scour Protection (Transition Mat and Turf Reinforcement Mat) or remove rock as required to place post(s) such that Bridge End Drains abut post(s).

- 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.

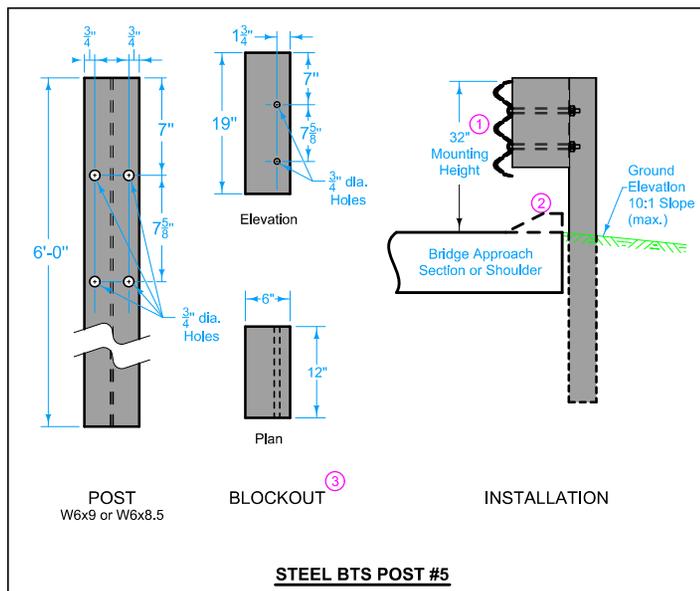
Possible Contract Item:
Steel Beam Guardrail Barrier Transition Section, BA-221

- Materials included in the Contract Item:
- Steel Post Option:
- (5) 6" x 8" x 6'-0" posts
 - (2) 6" x 12" x 19" blockouts
 - (3) 6" x 12" x 14" blockouts
- Wood Post Option:
- (5) 6" x 8" x 6'-0" posts
 - (2) 6" x 12" x 19" blockouts
 - (3) 6" x 12" x 14" blockouts
- (1) Asymmetrical Transition Section
 - (2) 3'-1 1/2" Thrie-Beam rail sections
 - (2) 12'-6" W-Beam rail sections
- Approved bolts, nuts, and washers
Refer to BA-200 for guardrail components

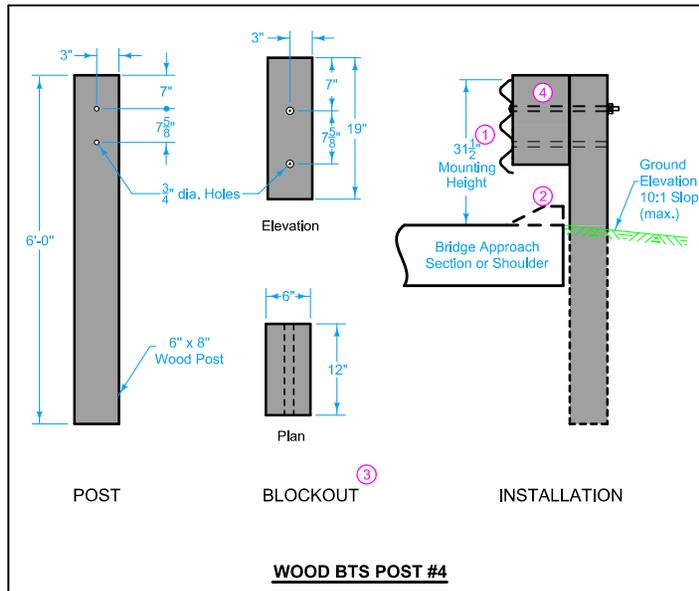
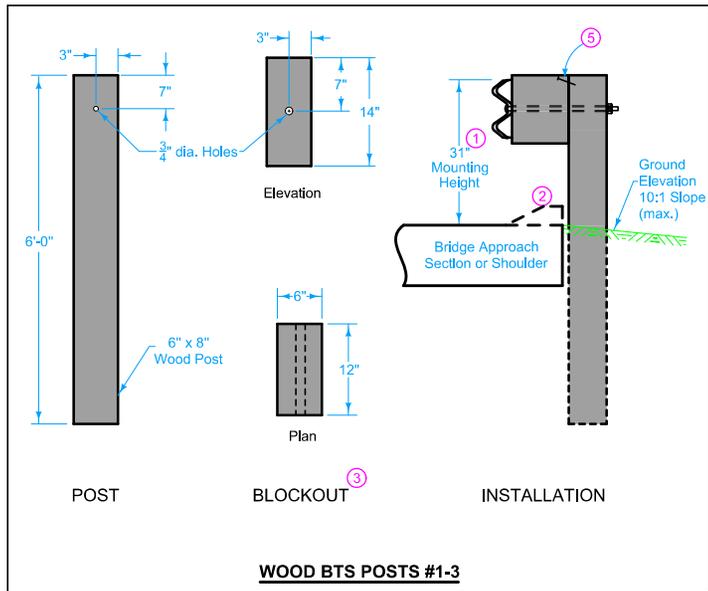
<p>STANDARD ROAD PLAN</p>	REVISION
	1 | 04-18-17
	BA-221
SHEET 1 of 3	
<small>REVISIONS: Removed bottom bolts on STEEL BTS POST #4 view on page 2 and on WOOD BTS POST #4 view on page 3.</small>	
<p>APPROVED BY DESIGN METHODS ENGINEER</p>	
<p>STEEL BEAM GUARDRAIL BARRIER TRANSITION SECTION (MASH TL-2)</p>	



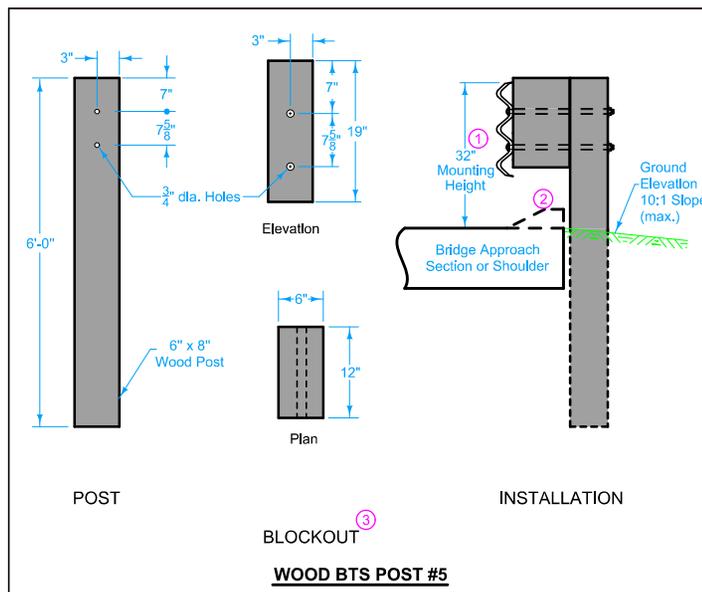
- ① Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.
- ② Possible 4 inch sloped curb. See project plans.
- ③ Wood or composite only. Steel blockouts will not be allowed.
- ④ Place bolt in top hole only.



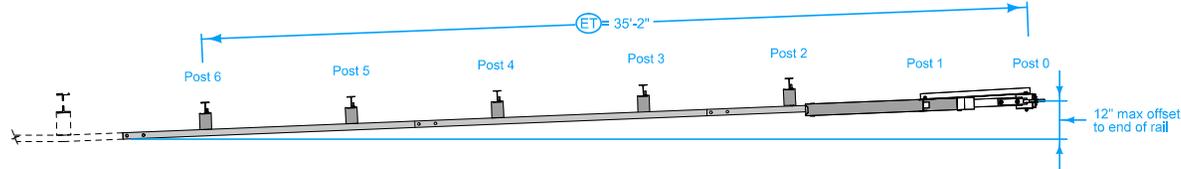
 STANDARD ROAD PLAN	REVISION 1 04-18-17
	BA-221
	SHEET 2 of 3
REVISIONS: Removed bottom bolts on STEEL BTS POST #4 view on page 2 and on WOOD BTS POST #4 view on page 3.	
 APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL BARRIER TRANSITION SECTION (MASH TL-2)	



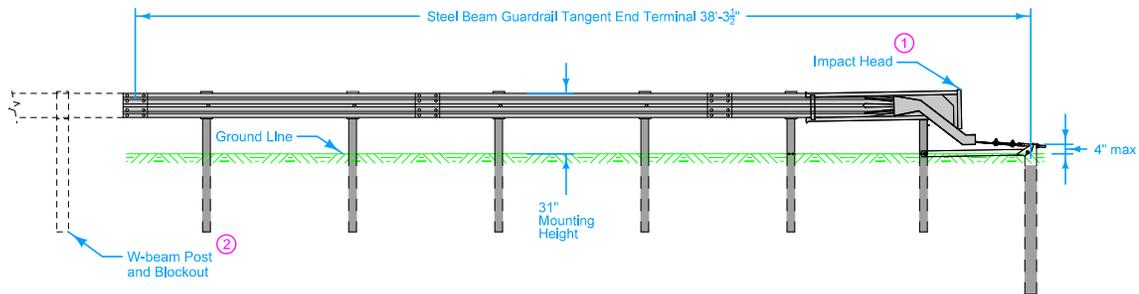
- ① Guardrail mounting height at barrier connection is 32 inches. Transition guardrail mounting height down to 31 inches at BTS Post #3.
- ② Possible 4 inch sloped curb. See project plans.
- ③ Wood or composite only. Steel blockouts will not be allowed.
- ④ Place bolt in top hole only.
- ⑤ 16d nail to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



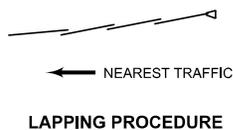
 STANDARD ROAD PLAN	REVISION
	1 | 04-18-17
	BA-221
SHEET 3 of 3	
REVISIONS: Removed bottom bolts on STEEL BTS POST #4 view on page 2 and on WOOD BTS POST #4 view on page 3.	
 APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL BARRIER TRANSITION SECTION (MASH TL-2)	



PLAN



ELEVATION



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.

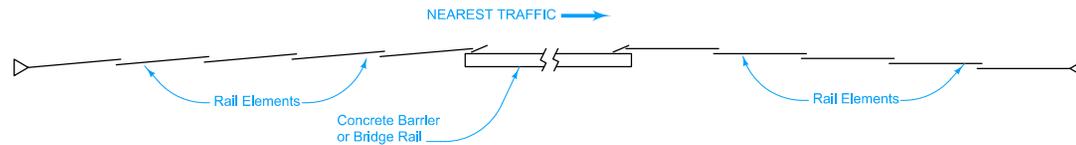
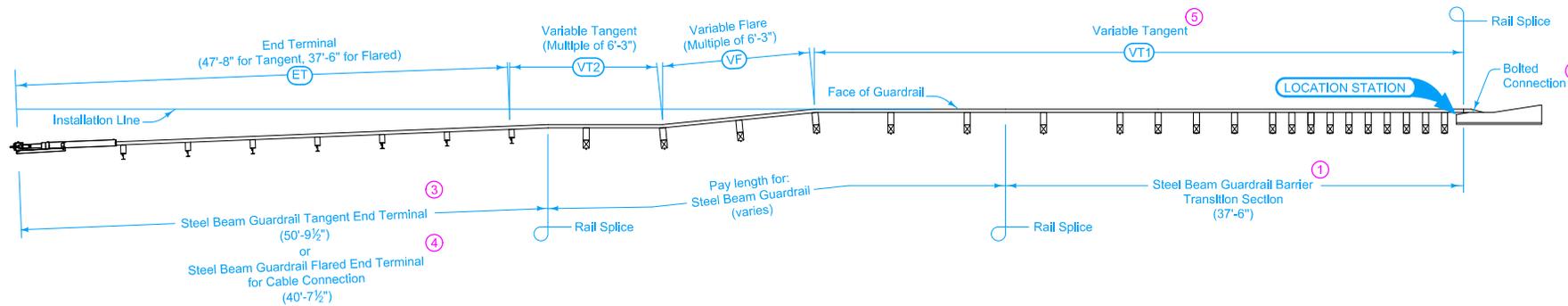
Note: at the Contractor's option, and at no cost to the Contracting Authority, alternate post designs developed by the manufacturer and accepted by the FHWA for use within the end terminal may be substituted for the post design shown. When such a substitution is made, provide the Engineer with three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

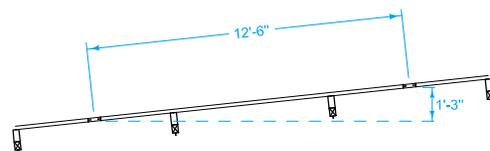
Possible Contract Item:
Steel Beam Guardrail Tangent End Terminal, BA-225

Possible Tabulation:
108-8A

	REVISION
	1 | 10-17-17
STANDARD ROAD PLAN	BA-225
SHEET 1 of 1	
REVISIONS: Changed 16" offset to 12" max offset.	
APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL TANGENT END TERMINAL (MASH TL-2)	



LAPPING PROCEDURE



VARIABLE FLARE

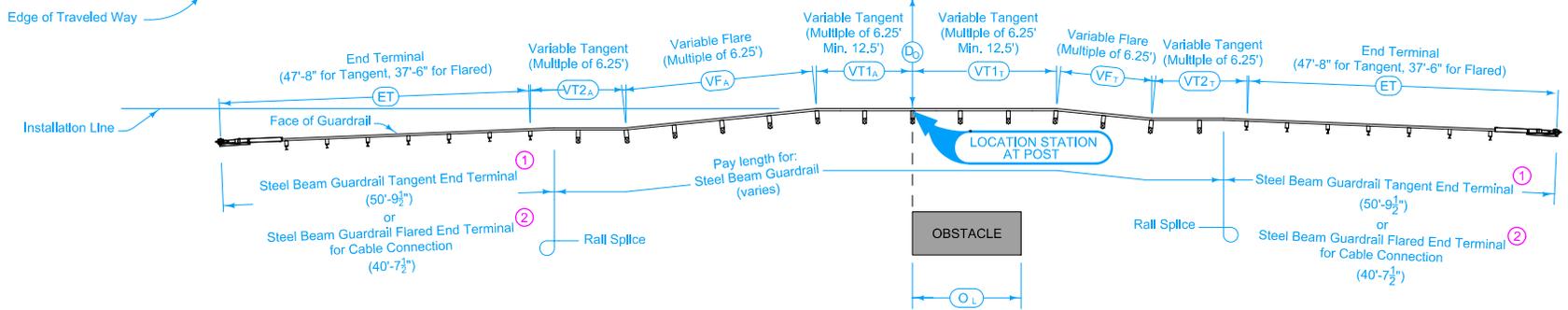
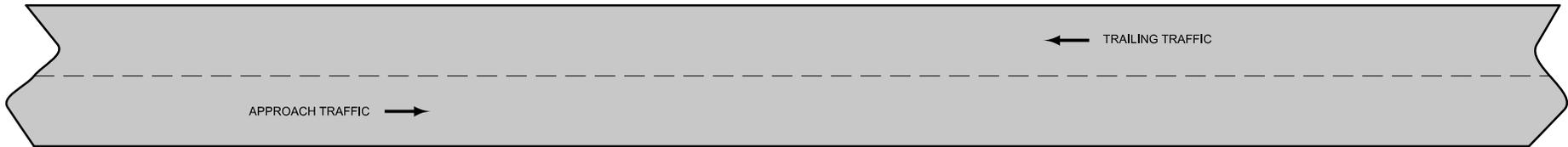
Install delineators and object markers according to [SI-211](#).
 For grading requirements, see [EW-301](#).
 For general guardrail details, see [BA-200](#).

- ① See [BA-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 40'-7 1/2" if no VF is used. Minimum VT1 of 53'-1 1/2" if VF is used.

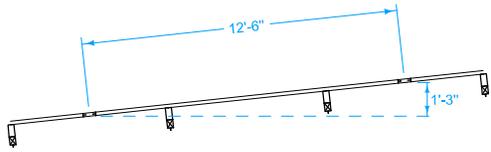
Possible Contract Items:
 Steel Beam Guardrail
 Steel Beam Guardrail Barrier Transition Section, BA-201
 Steel Beam Guardrail End Anchor, Bolted
 Steel Beam Guardrail Tangent End Terminal, BA-205
 Steel Beam Guardrail Flared End Terminal, BA-206

Possible Tabulation:
[108-8A](#)

IOWA DOT	REVISION	
	6	10-18-16
STANDARD ROAD PLAN		BA-250
		SHEET 1 of 1
REVISIONS: Added MASH TL-3 designation to title, Changed Barrier Transition Section contract item to specify BA-201.		
<i>Brian Smith</i>		
APPROVED BY DESIGN METHODS ENGINEER		
STEEL BEAM GUARDRAIL INSTALLATION AT CONCRETE BARRIER OR BRIDGE RAIL END SECTION (MASH TL-3)		



LAPPING PROCEDURE



VARIABLE FLARE

Install delineators and object markers according to [SI-211](#).

For grading requirements, see [EW-301](#).

For general guardrail details, see [BA-200](#).

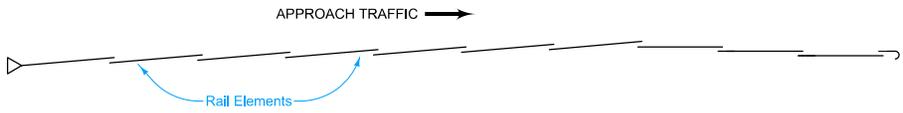
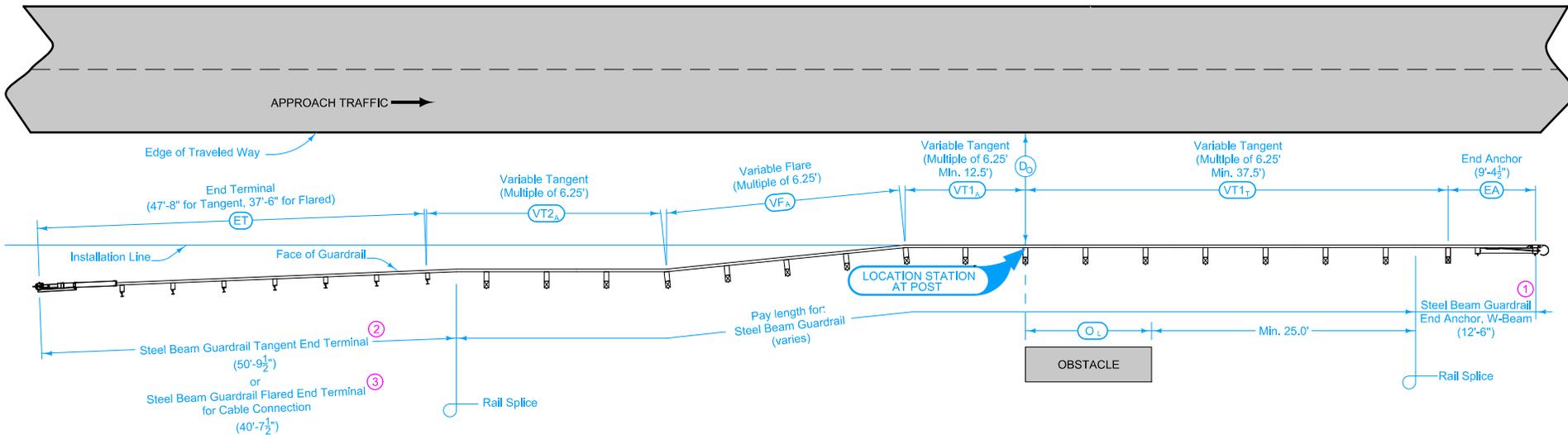
① See [BA-205](#).

② See [BA-206](#).

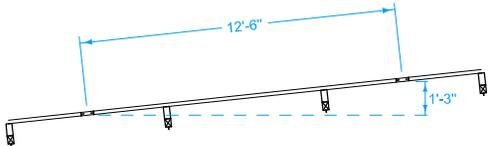
Possible Contract Items:
 Steel Beam Guardrail
 Steel Beam Guardrail Tangent End Terminal, BA-205
 Steel Beam Guardrail Flared End Terminal, BA-206

Possible Tabulation:
[108-8B](#)

	REVISION
	3 | 04-19-16
	STANDARD ROAD PLAN
BA-251	
SHEET 1 of 1	
REVISIONS: Updated layout and possible contract items to reflect update to MASH approved end terminals. Added a min. 12.5 to VT1L.	
APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL INSTALLATION AT SIDE OBSTACLE (TWO-WAY PROTECTION)	



LAPPING PROCEDURE



VARIABLE FLARE

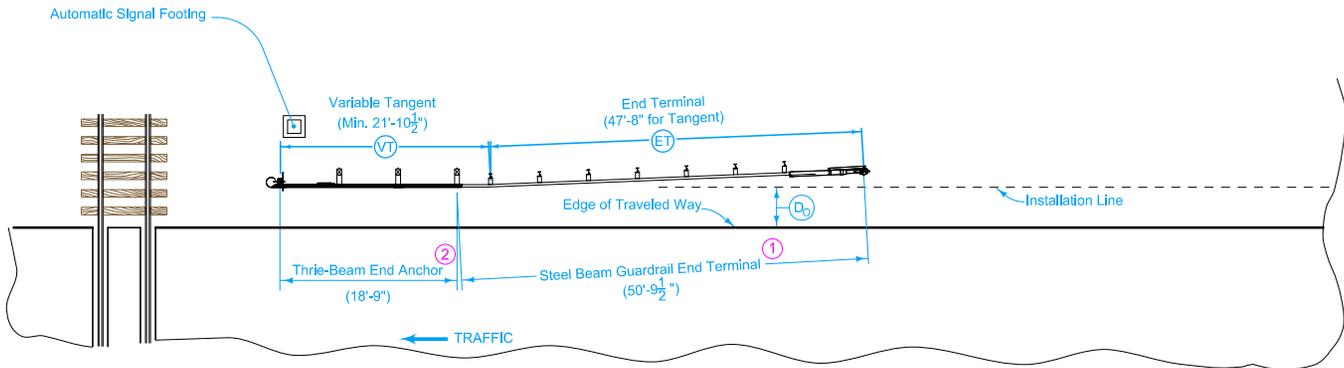
Install delineators and object markers according to [SI-211](#).
 For grading requirements, see [EW-301](#).
 For general guardrail details, see [BA-200](#).

- ① See [BA-203](#).
- ② See [BA-205](#).
- ③ See [BA-206](#).

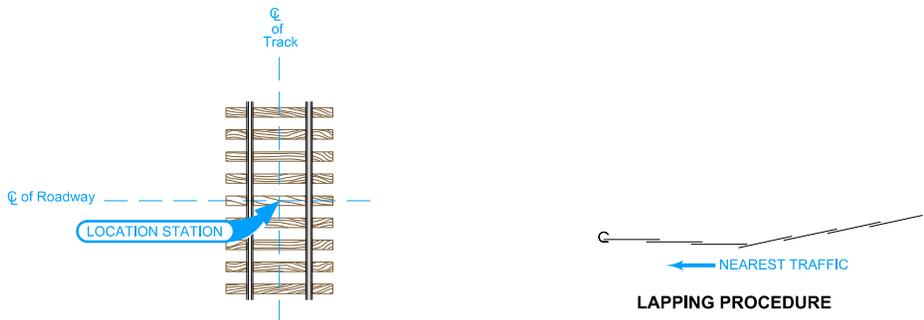
Possible Contract Items:
 Steel Beam Guardrail
 Steel Beam Guardrail End Anchor, W-Beam
 Steel Beam Guardrail Flared End Terminal, BA-206
 Steel Beam Guardrail Tangent End Terminal, BA-205

Possible Tabulation:
[108-8C](#)

INTERIM	REVISION	
	6	10-20-20
STANDARD ROAD PLAN		BA-252
		SHEET 1 of 1
REVISIONS: Modified to reflect change to require a minimum of 25' of W-beam between downstream end of obstacle and BA-203.		
<i>Handwritten Signature</i>		
APPROVED BY DESIGN METHODS ENGINEER		
STEEL BEAM GUARDRAIL INSTALLATION AT SIDE OBSTACLE (ONE-WAY PROTECTION)		



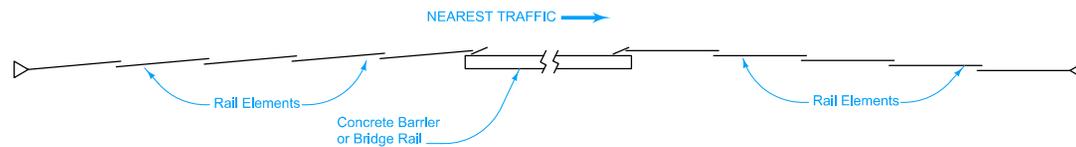
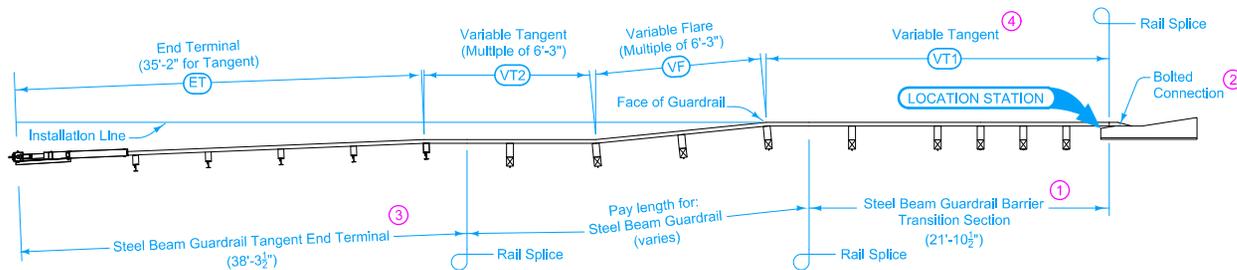
PLAN



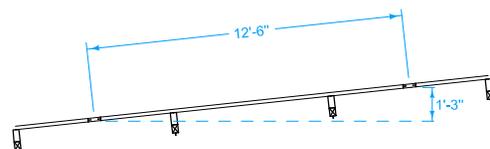
For grading requirements, refer to [EW-301](#).
 For additional guardrail requirements, refer to [BA-200](#).
 ① Refer to [BA-205](#).
 ② Refer to [BA-204](#).

Possible Contract Items:
 Steel Beam Guardrail End Anchor, Thrie-Beam
 Steel Beam Guardrail Tangent End Terminal, BA-205
 Incidental to Steel Beam Guardrail End Anchor, Thrie-Beam:
 Delineator, Rigid - Type 1
 Object Marker, Type 2
 Object Marker, Type 3
 Possible Tabulation:
 108-8D

	REVISION
	3 | 04-19-16
STANDARD ROAD PLAN	BA-253
SHEET 1 of 1	
REVISIONS: Updated to MASH approved end terminal. Removed circle note 1. Added VT.	
APPROVED BY DESIGN METHODS ENGINEER	
STEEL BEAM GUARDRAIL INSTALLATION AT RAILROAD SIGNAL	



LAPPING PROCEDURE



VARIABLE FLARE

Install delineators and object markers according to [SI-211](#).

For grading requirements, see [EW-301](#).

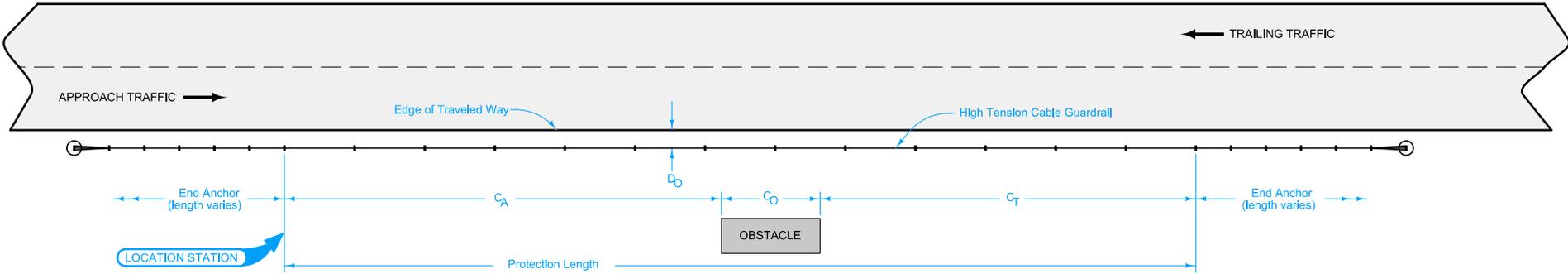
For general guardrail details, see [BA-200](#).

- ① See [BA-221](#).
- ② See [BA-202](#) for connections to concrete barriers and bridge rail end sections.
- ③ See [BA-225](#).
- ④ Minimum VT1 of 25'-0" if no VF is used. Minimum VT1 of 37'-6" if VF is used.

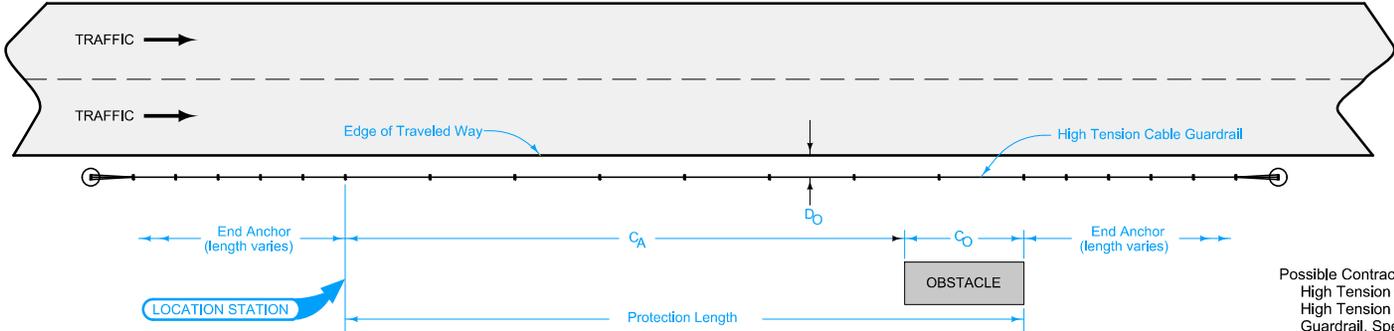
Possible Contract Items:
 Steel Beam Guardrail
 Steel Beam Guardrail Barrier Transition Section, BA-221
 Steel Beam Guardrail End Anchor, Bolted
 Steel Beam Guardrail Tangent End Terminal, BA-225

Possible Tabulation:
[108-8A](#)

	REVISION
	NEW 10-18-16
STANDARD ROAD PLAN	BA-260
REVISIONS: NEW	SHEET 1 of 1
 <small>APPROVED BY DESIGN METHODS ENGINEER</small>	
STEEL BEAM GUARDRAIL INSTALLATION AT CONCRETE BARRIER OR BRIDGE RAIL END SECTION (MASH TL-2)	



ROADSIDE OBSTACLE, TWO-WAY PROTECTION

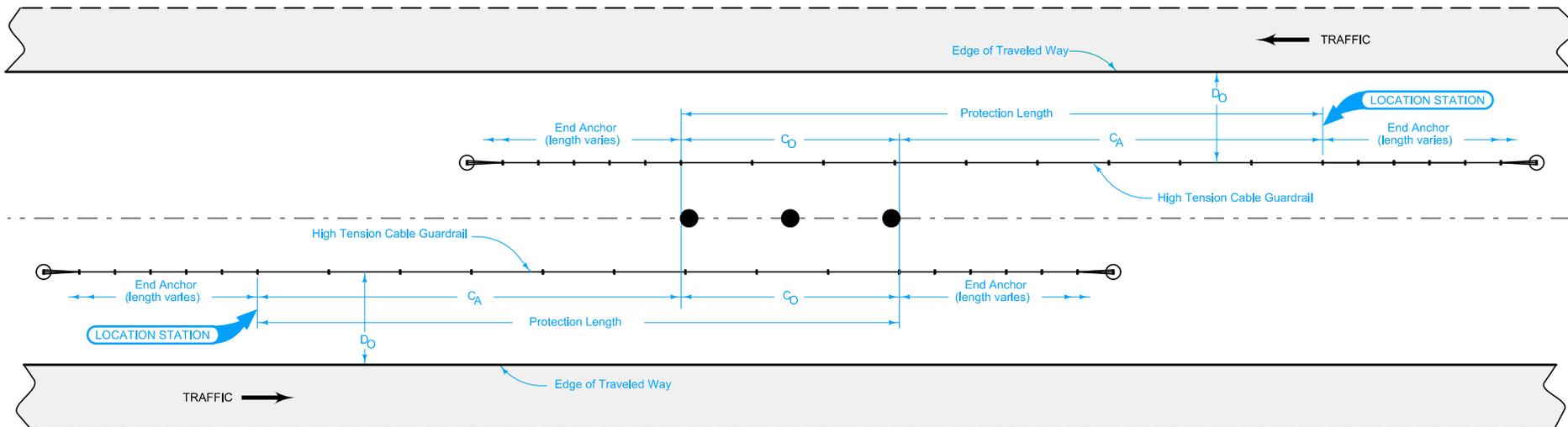


ROADSIDE OBSTACLE, ONE-WAY PROTECTION

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

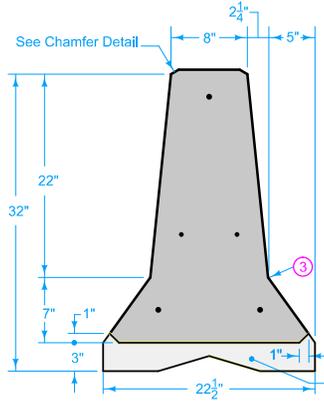
Possible Tabulation:
 108-9A

	REVISION	
	1	10-15-19
STANDARD ROAD PLAN		BA-351
		SHEET 1 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 		
HIGH TENSION CABLE GUARDRAIL		

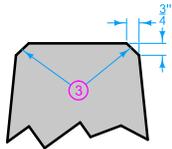


MEDIAN OBSTACLE PROTECTION

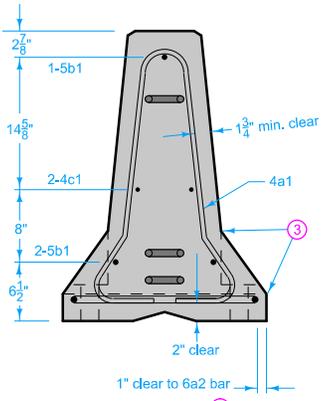
	REVISION	
	1	10-15-19
STANDARD ROAD PLAN	BA-351	
	SHEET 2 of 2	
<small>REVISIONS: Added Guardrail, Special Anchor Section as Possible Contract Item. Changed Edge of Pavement to Edge of Traveled Way.</small>		
<small>APPROVED BY DESIGN METHODS ENGINEER</small> 		
HIGH TENSION CABLE GUARDRAIL		



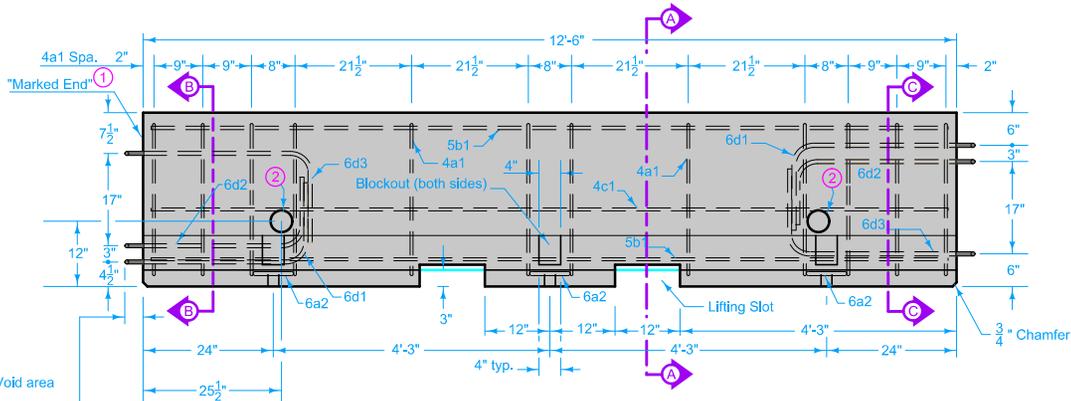
SECTION A-A
Lifting Slot



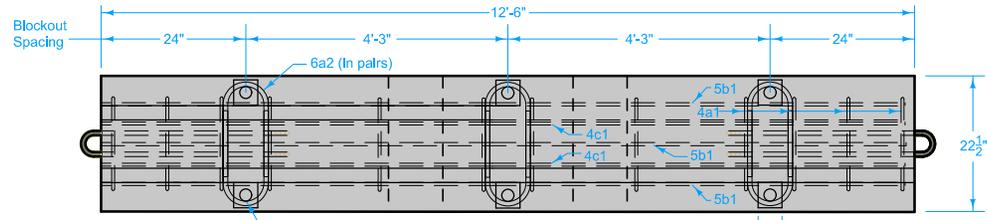
CHAMFER DETAIL



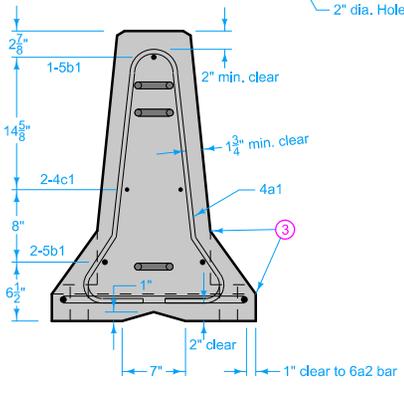
SECTION B-B
Stirrup Placement



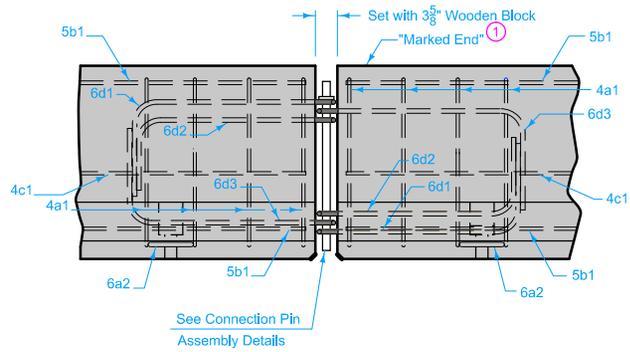
ELEVATION



PLAN



SECTION C-C
Stirrup Placement



BARRIER CONNECTION
(Elevation)

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 3/2" pin bend diameter. Install loops within 1/8" 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".

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

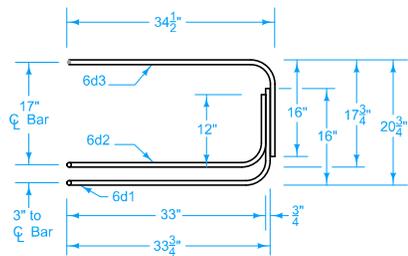
2 Lifting hole, 4 inch diameter PVC Pipe.

3 1 inch radius allowed.

Possible Contract Item:
Temporary Barrier Rail, Concrete

Possible Tabulation:
108-33

IOWA DOT	REVISION	
	2	10-15-19
STANDARD ROAD PLAN		BA-401
		SHEET 1 of 4
REVISIONS: Added Designer Info button.		
 APPROVED BY DESIGN METHODS ENGINEER		
TEMPORARY BARRIER RAIL (PRECAST CONCRETE)		

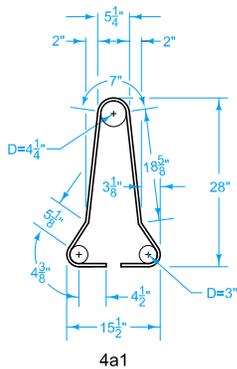


Elevation
(Marked end shown, invert for other end.)

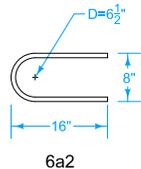


Plan
6d1, 6d2, 6d3

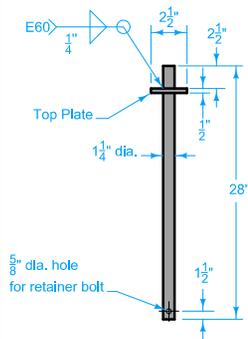
BENT BAR DETAILS
(Dimensions are out to out of bars unless otherwise noted.)



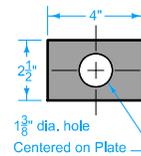
4a1



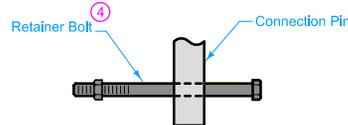
6a2



CONNECTION PIN
(A36 Steel - 10.9 lbs. each)



1/2" Top Plate



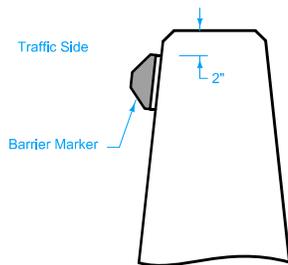
RETAINER BOLT & NUT
1/2" dia. bolt & nut
(ASTM A490, Grade 8)

CONNECTION PIN ASSEMBLY

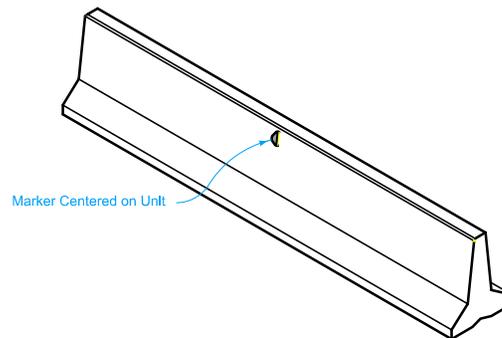
- ④ Retainer bolt & nut are required for connections with 2-loop barriers (previous designs) or in conjunction with Strap Anchorage.
- ⑤ Furnish and install Barrier Markers. Attach to the barrier in a manner approved by the manufacturer. Markers to face oncoming traffic and match the adjacent edge line in color. Maintain the markers and promptly repair or replace any damaged or missing units. Include costs for furnishing, installing and maintaining markers in the price bid for "Temporary Barrier Rail, Concrete."

Per 12'-6" Barrier Section

REINFORCING A615 Gr. 60					
Bar	Bar Size	Shape	No. of Bars	Length Ft.	Weight Lbs.
4a1	4		12	6'-0"	48.1
6a2	6		6	35"	26.3
5b1	5		3	12'-2"	38.1
4c1	4		2	12'-2"	16.3
LOOP ASSEMBLY					
6d1	6		2	8'-5"	25.3
6d2	6		2	7'-7"	22.8
6d3	6		2	8'-6"	25.5

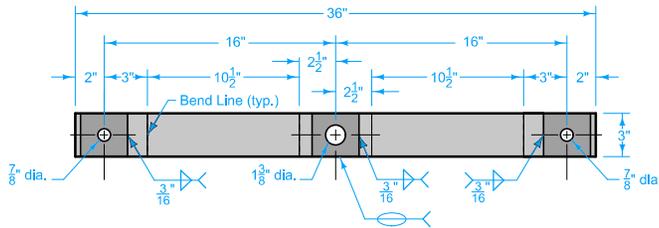


BARRIER MARKER PLACEMENT



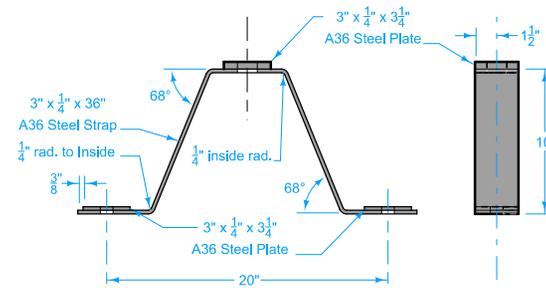
	REVISION	2	10-15-19
	STANDARD ROAD PLAN	BA-401	
SHEET 2 of 4			
REVISIONS: Added Designer Info button.			
APPROVED BY DESIGN METHODS ENGINEER			
TEMPORARY BARRIER RAIL (PRECAST CONCRETE)			

STRAP ANCHORAGE

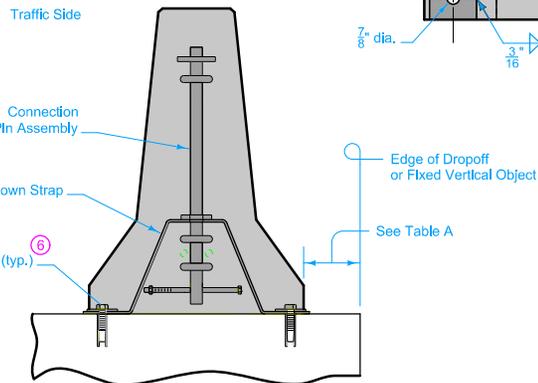


For use on:
Bridge Decks
PCC Pavement

**TIE-DOWN STRAP
(before bending)**



**TIE-DOWN STRAP
(after bending)**

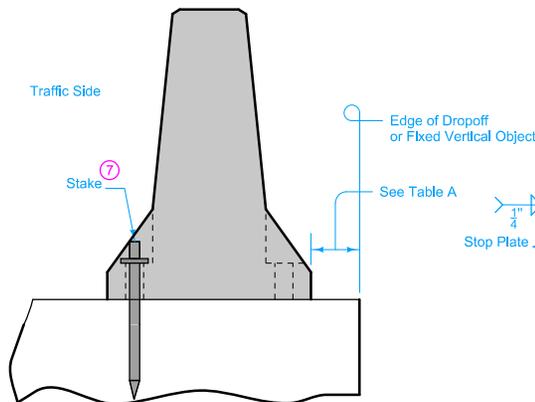


END VIEW

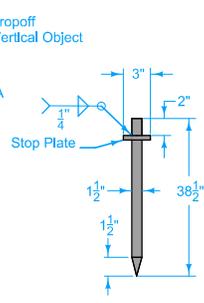
- ⑥ 3/4 inch Red Head Multi-Set II drop-in anchor with 3/4" dia. x 1 3/4" long ASTM A325 structural bolt OR Red Head Large Diameter Tapcon (3/4" dia. x 4 1/2" min.) OR Simpson Titen HD Wedge Bolt (3/4" dia. x 5" min.).
- ⑦ 3 stakes required per rail section.
- ⑧ Pre-drill holes for stakes with 1 5/8" core bit.

STAKE ANCHORAGE

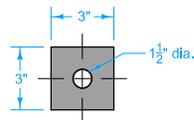
For use on:
HMA Pavement (2" min. thickness)
Composite Pavement ⑧
PCC Pavement ⑧



TYPICAL SECTION



STAKE



1/2" STOP PLATE

**TABLE A
ANCHORAGE REQUIREMENTS**

Obstacle	Dropoff Depth	Min. offset where TBR is Anchored	
		where TBR is Unanchored	where TBR is Anchored
Dropoff*	≤ 24"	24"	6"
	> 24"	45"	6"
Fixed vertical object	≤ 3"	1"	N/A
	> 3"	45"	6"

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

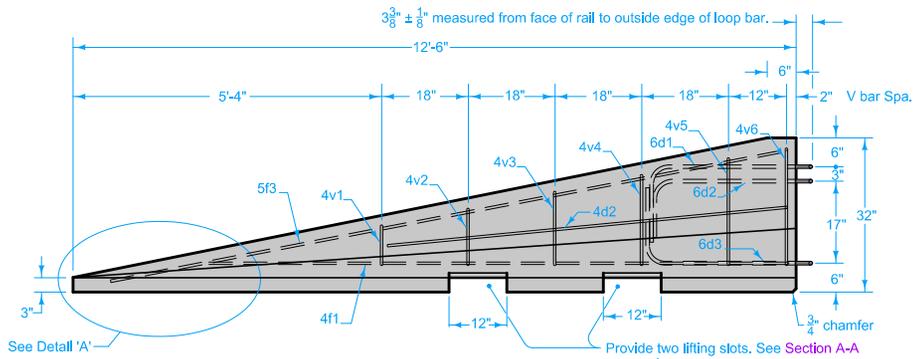
IOWA DOT	REVISION
	2 | 10-15-19
STANDARD ROAD PLAN	BA-401
SHEET 3 of 4	

REVISIONS: Added Designer Info button.

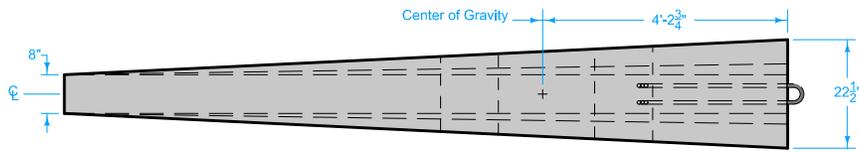
APPROVED BY DESIGN METHODS ENGINEER

**TEMPORARY BARRIER RAIL
(PRECAST CONCRETE)**

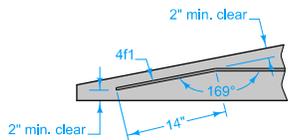
TAPERED END SECTION



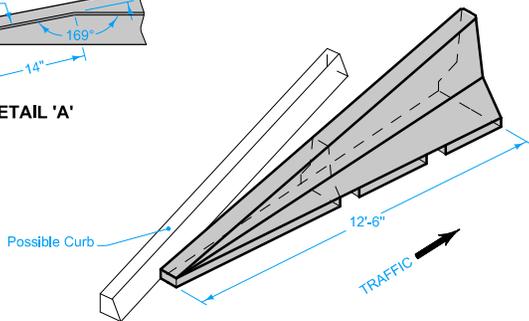
SIDE ELEVATION
(For connection to "marked end" of barrier.
Invert loop bars for other end.)



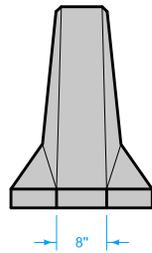
PLAN



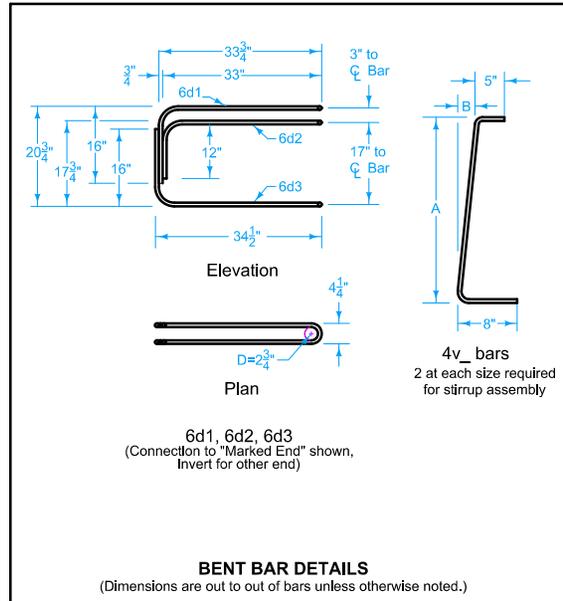
DETAIL 'A'



PERSPECTIVE VIEW



FRONT ELEVATION



BENT BAR DETAILS

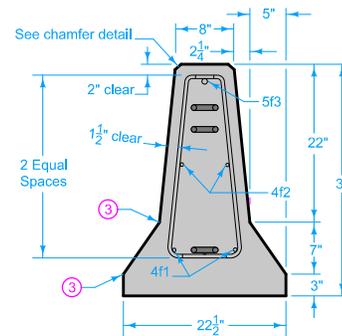
(Dimensions are out to out of bars unless otherwise noted.)

③ 1 inch radius allowed.

Per 12'-6" Barrier Taper Section

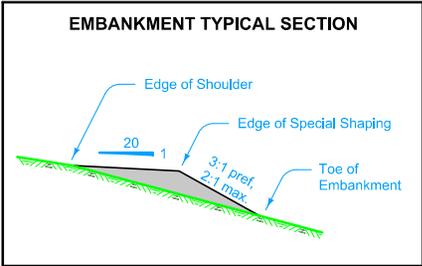
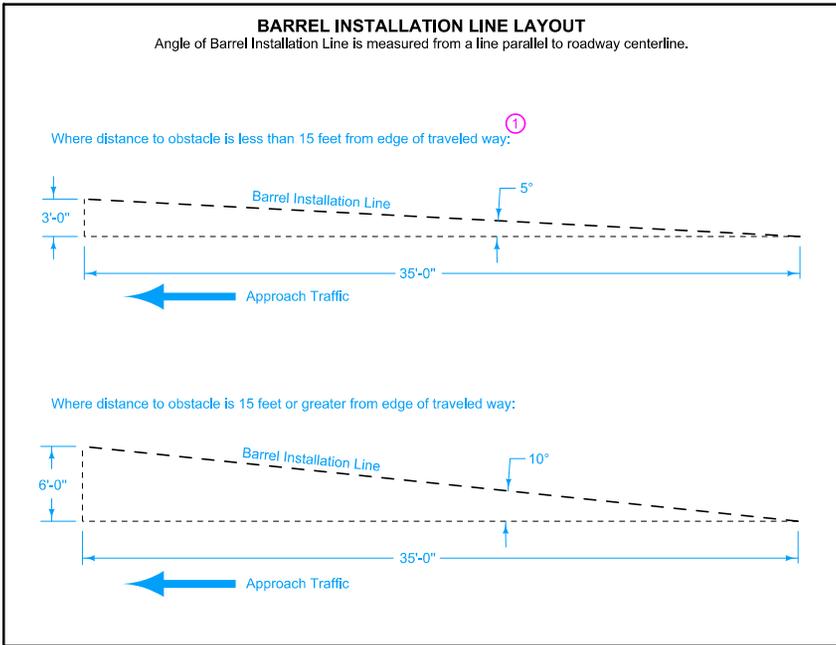
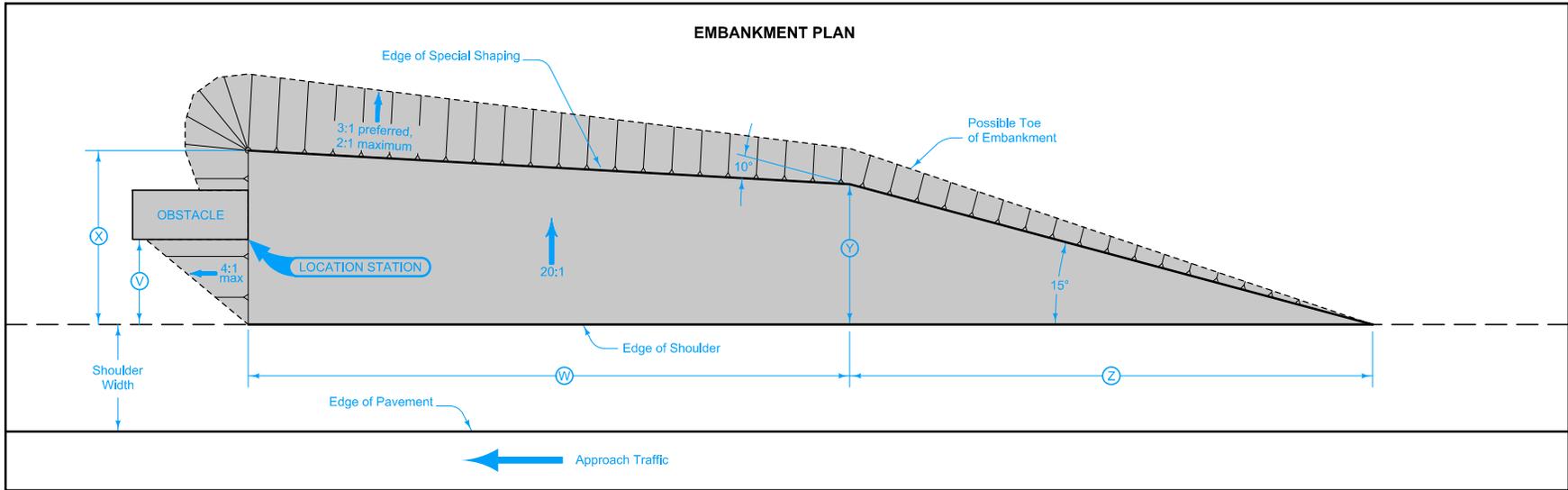
REINFORCING A615 Gr. 60					
Bar	Bar Size	Shape	No. of Bars	Length ft.	Weight lbs.
4v1	4	[	2	23"	2.6
4v2	4	[	2	26"	2.9
4v3	4	[	2	30"	3.3
4v4	4	[	2	33"	3.7
4v5	4	[	2	3'-2"	4.2
4v6	4	[	2	3'-4"	4.5
4f1	4	—	2	12'-0"	16.0
4f2	4	—	2	7'-6"	10.0
5f3	5	—	1	11'-9"	12.3
LOOP ASSEMBLY					
6d1	6	[	1	8'-5"	12.6
6d2	6	[	1	7'-7"	11.4
6d3	6	[	1	8'-6"	12.8

Bar	A	B
4v1	10"	1"
4v2	13"	1 1/4"
4v3	17"	1 5/8"
4v4	20"	1 7/8"
4v5	24 1/2"	2 3/8"
4v6	27"	2 3/4"



END SECTION

<p>STANDARD ROAD PLAN</p> <p>REVISIONS: Added Designer Info button.</p> <p>APPROVED BY DESIGN METHODS ENGINEER</p>	REVISION 2 | 10-15-19
	BA-401 SHEET 4 of 4
	<p>TEMPORARY BARRIER RAIL (PRECAST CONCRETE)</p>



① For obstacles located within the traveled way where space is limited, Barrel Installation Line may be parallel to roadway centerline. In this case, Y dimension equals X dimension.

Possible Contract Items:
Embankment In Place
Temporary Crash Cushion

Possible Tabulation:
108-30

EMBANKMENT DIMENSIONS

For Obstacle Widths:	Sand Barrel Layouts Required	W	X	Y (must not be negative)	Z
3'-6" or less	1	24'-3"	V + 5'-3"	V + 3'-3"	3.73(V) + 12'-0"
3'-7" - 10'-7"	2	25'-0"	V + 12'-3"	V + 10'-0"	3.73(V) + 38'-0"
10'-8" - 17'-9"	3	25'-9"	V + 19'-3"	V + 17'-0"	3.73(V) + 64'-0"
17'-10" - 32'-3"	4	26'-6"	V + 26'-3"	V + 24'-0"	3.73(V) + 89'-0"

IOWA DOT	REVISION
	1 04-19-16
STANDARD ROAD PLAN	BA-500
SHEET 1 of 2	
REVISIONS: Changed formula in Column Z.	
<i>Brian Smith</i> APPROVED BY DESIGN METHODS ENGINEER	
TEMPORARY CRASH CUSHIONS SAND BARREL	

