



U.S. Department
of Transportation
**Federal Highway
Administration**

1200 New Jersey Ave., SE
Washington, D.C. 20590

March 31, 2020

In Reply Refer To:
HSST-1/B-334

Ms. Shelby G. Carlson
Wyoming Department of Transportation
5300 Bishop Blvd.
Cheyenne, WY 82009
United States

Dear Ms. Carlson:

This letter is in response to your November 18, 2019 request for the Federal Highway Administration (FHWA) to review a roadside safety device, hardware, or system for eligibility for reimbursement under the Federal-aid highway program. This FHWA letter of eligibility is assigned FHWA control number B-334 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

Decision

The following device is eligible within the length-of-need, with details provided in the form which is attached as an integral part of this letter:

- Box Beam Guardrail

Scope of this Letter

To be found eligible for Federal-aid funding, new roadside safety devices should meet the crash test and evaluation criteria contained in the American Association of State Highway and Transportation Officials' (AASHTO) Manual for Assessing Safety Hardware (MASH). However, the FHWA, the Department of Transportation, and the United States Government do not regulate the manufacture of roadside safety devices. Eligibility for reimbursement under the Federal-aid highway program does not establish approval, certification or endorsement of the device for any particular purpose or use.

This letter is not a determination by the FHWA, the Department of Transportation, or the United States Government that a vehicle crash involving the device will result in any particular outcome, nor is it a guarantee of the in-service performance of this device. Proper manufacturing, installation, and maintenance are required in order for this device to function as tested.

This finding of eligibility is limited to the crashworthiness of the system and does not cover other structural features, nor conformity with the Manual on Uniform Traffic Control Devices.

Eligibility for Reimbursement

Based solely on a review of crash test results and certifications submitted by the manufacturer, and the crash test laboratory, FHWA agrees that the device described herein meets the crash test and evaluation criteria of the AASHTO's MASH. Therefore, the device is eligible for reimbursement under the Federal-aid highway program if installed under the range of tested conditions.

Name of system: Box Beam Guardrail
Type of system: Longitudinal Barrier
Test Level: MASH Test Level 3 (TL3)
Testing conducted by: Texas A&M Transportation Institute
Date of request: November 18, 2019

FHWA concurs with the recommendation of the accredited crash testing laboratory on the attached form.

Full Description of the Eligible Device

The device and supporting documentation, including reports of the crash tests or other testing done, videos of any crash testing, and/or drawings of the device, are described in the attached form.

Notice

This eligibility letter is issued for the subject device as tested. Modifications made to the device are not covered by this letter. Any modifications to this device should be submitted to the user (i.e., state DOT) as per their requirements.

You are expected to supply potential users with sufficient information on design, installation and maintenance requirements to ensure proper performance.

You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the test and evaluation criteria of AASHTO's MASH.

Issuance of this letter does not convey property rights of any sort or any exclusive privilege. This letter is based on the premise that information and reports submitted by you are accurate and correct. We reserve the right to modify or revoke this letter if: (1) there are any inaccuracies in the information submitted in support of your request for this letter, (2) the qualification testing was flawed, (3) in-service performance or other information reveals safety problems, (4) the system is significantly different from the version that was crash tested, or (5) any other information indicates that the letter was issued in error or otherwise does not reflect full and complete information about the crashworthiness of the system.

Standard Provisions

- To prevent misunderstanding by others, this letter of eligibility designated as FHWA control number B-334 shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder.
- This FHWA eligibility letter is not an expression of any Agency view, position, or determination of validity, scope, or ownership of any intellectual property rights to a specific device or design. Further, this letter does not impute any distribution or licensing rights to the requester. This FHWA eligibility letter determination is made based solely on the crash-testing information submitted by the requester. The FHWA reserves the right to review and revoke an earlier eligibility determination after receipt of subsequent information related to crash testing.

Sincerely,



Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	November 18, 2019	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Roger Bligh	
	Company:	Texas A&M Transportation Institute	
	Address:	3135 TAMU, College Station, TX 77843-3135	
	Country:	U.S.A.	
To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies		

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

Device & Testing Criterion - Enter from right to left starting with Test Level

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'B': Rigid/Semi-Rigid Barriers	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	Box Beam Guardrail	AASHTO MASH	TL3

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the AASHTO Manual for Assessing Safety Hardware and that the evaluation results meet the appropriate evaluation criteria in the MASH.

Individual or Organization responsible for the product:

Contact Name:	Shelby G. Carlson, P.E., Chief Engineer	Same as Submitter <input type="checkbox"/>
Company Name:	Wyoming Department of Transportation	Same as Submitter <input type="checkbox"/>
Address:	5300 Bishop Blvd., Cheyenne, WY 82009	Same as Submitter <input type="checkbox"/>
Country:	U.S.A.	Same as Submitter <input type="checkbox"/>

Enter below all disclosures of financial interests as required by the FHWA 'Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.

Texas A&M Transportation Institute (TTI) was contracted by Wyoming Department of Transportation to perform full-scale crash testing of the Box Beam Guardrail. There are no shared financial interests in the Box Beam Guardrail by TTI, or between Wyoming Department of Transportation and TTI, other than costs involved in the actual crash tests and reports for this submission to FHWA.

PRODUCT DESCRIPTION

Help

- New Hardware or Significant Modification
 Modification to Existing Hardware

The Box Beam guardrail system, also known as the G3 guardrail system, consists of an HSS6 × 6 × 3/16 inch steel rail supported by S3×5.7 steel posts embedded 3 ft and spaced at 72 inches. The posts have 8 × 24 × 1/4 inch soil plates attached. The box beam rail rests on a 5 × 3 1/2 × 3/8 inch steel angle such that the top of the beam is nominally 28 inches above grade. A 3/8-inch diameter × 7 1/2-inch long A307 through bolt attaches the box beam rail to the angle, and a 1/2-inch diameter × 1 1/2-inch long A307 bolt attaches the angle to the post. The rail splices consist of two interior 5 3/8 × 27 × 5/8 inch steel plates (one on the top and one on the bottom of the beam), each having four 3/4-inch diameter × 2-inch long A325 bolts.

CRASH TESTING

By signature below, the Engineer affiliated with the testing laboratory, agrees in support of this submission that all of the critical and relevant crash tests for this device listed above were conducted to meet the MASH test criteria. The Engineer has determined that no other crash tests are necessary to determine the device meets the MASH criteria.


Engineer Name:	Roger P. Bligh, Ph.D., P.E.		
Engineer Signature:	Roger Bligh	Digitally signed by Roger Bligh Date: 2019.11.15 09:27:20 -06'00'	
Address:	TTI; 3135 TAMU, College Station, TX 77843-3135	Same as Submitter	<input checked="" type="checkbox"/>
Country:	U.S.A.	Same as Submitter	<input checked="" type="checkbox"/>

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-10(1100C)	Test 3-10 was sponsored by Wyoming DOT to complete the MASH test matrix on the Box Beam guardrail. The results of test 610031-01-1 conducted on January 11, 2019 are found in TTI Test Report No. 610031-01-1 (Wyoming DOT Report No. WY-1903F). The Box Beam guardrail successfully contained and redirected the 1100C vehicle. The vehicle did not penetrate, underide, or override the installation. Maximum dynamic lateral deflection of the rail during the test was 28.8 inches. The vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 11° and 6°, respectively. Occupant risk indices (occupant impact velocity and ride down accelerations) were within the preferred values of MASH. No deformation or intrusion of the vehicle occupant compartment was observed.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-11 (2270P)	Test 3-11 was sponsored by NCHRP under Project 22-14(03), which evaluated the impact performance of common roadside safety systems following MASH criteria. The results of test 476460-1-6 conducted on May 15, 2009 are found in NCHRP Web-Only Document 157: Volume I: Evaluation of Existing Roadside Safety Hardware Using Updated Criteria and TTI Test Report No. 476460-1-6 Appendix I: MASH TL-3 Testing and Evaluation of the G3 Weak Post Box-Beam Guardrail. The Box Beam guardrail successfully contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection of the rail during the test was 4.8 ft. The vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 14° and 8°, respectively. Occupant risk indices (occupant impact velocity and ride down accelerations) were within the preferred values of MASH. Maximum occupant compartment deformation was 0.75 inches in the lateral area across the cab at the driver's side kickpanel.	PASS
3-20 (1100C)	MASH 2016 Test Designation 3-20 evaluates transitions. The Box Beam guardrail is not a transition and, therefore, Test 3-20 is not relevant.	Non-Relevant Test, not conducted
3-21 (2270P)	MASH 2016 Test Designation 3-21 evaluates transitions. The Box Beam guardrail is not a transition and, therefore, Test 3-21 is not relevant.	Non-Relevant Test, not conducted

Full Scale Crash Testing was done in compliance with MASH by the following accredited crash test laboratory (cite the laboratory's accreditation status as noted in the crash test reports.):

Laboratory Name:	Texas A&M Transportation Institute	
Laboratory Signature:	Digitally signed by Darrell L. Kuhn 'Date: 2019.11.14 14:27:08 -06'00	
Address:	TTI; 3135 TAMU, College Station, TX 77843-3135	Same as Submitter <input checked="" type="checkbox"/>
Country:	U.S.A.	Same as Submitter <input checked="" type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	ISO 17025-2017 Laboratory A2LA Certificate Number: 2821.01 Valid To: April 30, 2021	

SubmitterSignature*: **RogerBligh** Digitally signed by RogerBligh
Date: 2019.11.25 10:43:32
-06'00'

Submit Form

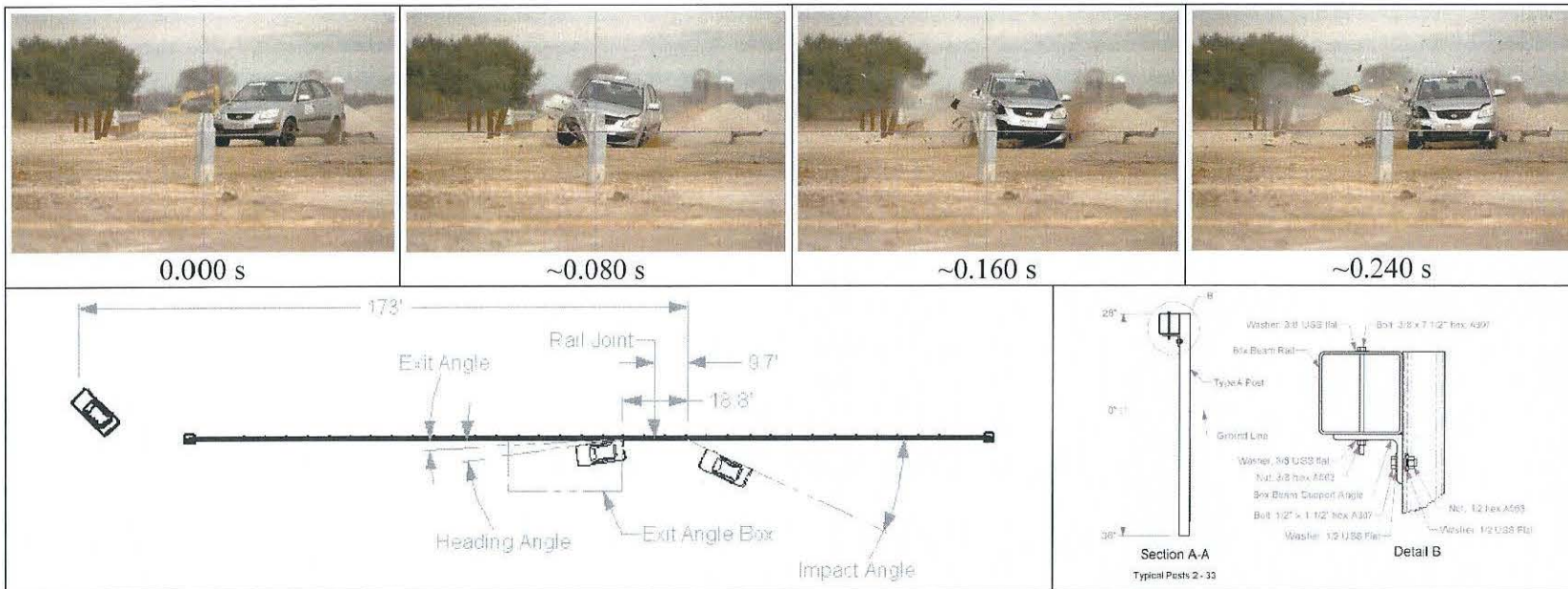
ATTACHMENTS

Attach to this form:

- 1) Additional disclosures of related financial interest as indicated above.
- 2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
- 3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [[Hardware Guide Drawing Standards](#)]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		
Number	Date	Key Words



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 3-10
 TTI Test No. 610031-01-1
 Test Date 2019-01-11

Test Article

Type Longitudinal Barrier – Guardrail
 Name..... Wyoming Box Beam Shoulder Barrier
 Installation Length..... 226 ft-10 inches
 Material or Key Elements... HSS 6x6x³/₁₆ inch rail supported by S3x5.7 posts w/ soil plates spaced at 72 inches; height 28 inches above grade
 Soil Type and Condition Embedded in AASHTO M147-65(2004), grading B Soil (crushed limestone)

Test Vehicle

Type/Designation 1100C
 Make and Model 2009 Kia Rio
 Curb..... 2500 lb
 Test Inertial..... 2441 lb
 Dummy 165 lb
 Gross Static..... 2606 lb

Impact Conditions

Speed 63.9 mi/h
 Angle 24.6°
 Location/Orientation 9 ft-9 inches upstrm of splice btw 14-15

Impact Severity

..... 58 kip-ft

Exit Conditions

Speed Not obtainable
 Trajectory/Heading Angle... 11.8°/2.7°

Occupant Risk Values

Longitudinal OIV 14.4 ft/s
 Lateral OIV 19.0 ft/s
 Longitudinal Ridedown 5.7 g
 Lateral Ridedown 10.4 g
 THIV 25.5 km/h
 PHD 11.1 g
 ASI..... 0.87
 Max. 0.050-s Average
 Longitudinal -5.6 g
 Lateral..... -7.0 g
 Vertical..... -2.3 g

Post-Impact Trajectory

Stopping Distance..... 173 ft downstream
 13 ft twd field side

Vehicle Stability

Maximum Yaw Angle 43°
 Maximum Pitch Angle 6°
 Maximum Roll Angle 11°
 Vehicle Snagging No
 Vehicle Pocketing No

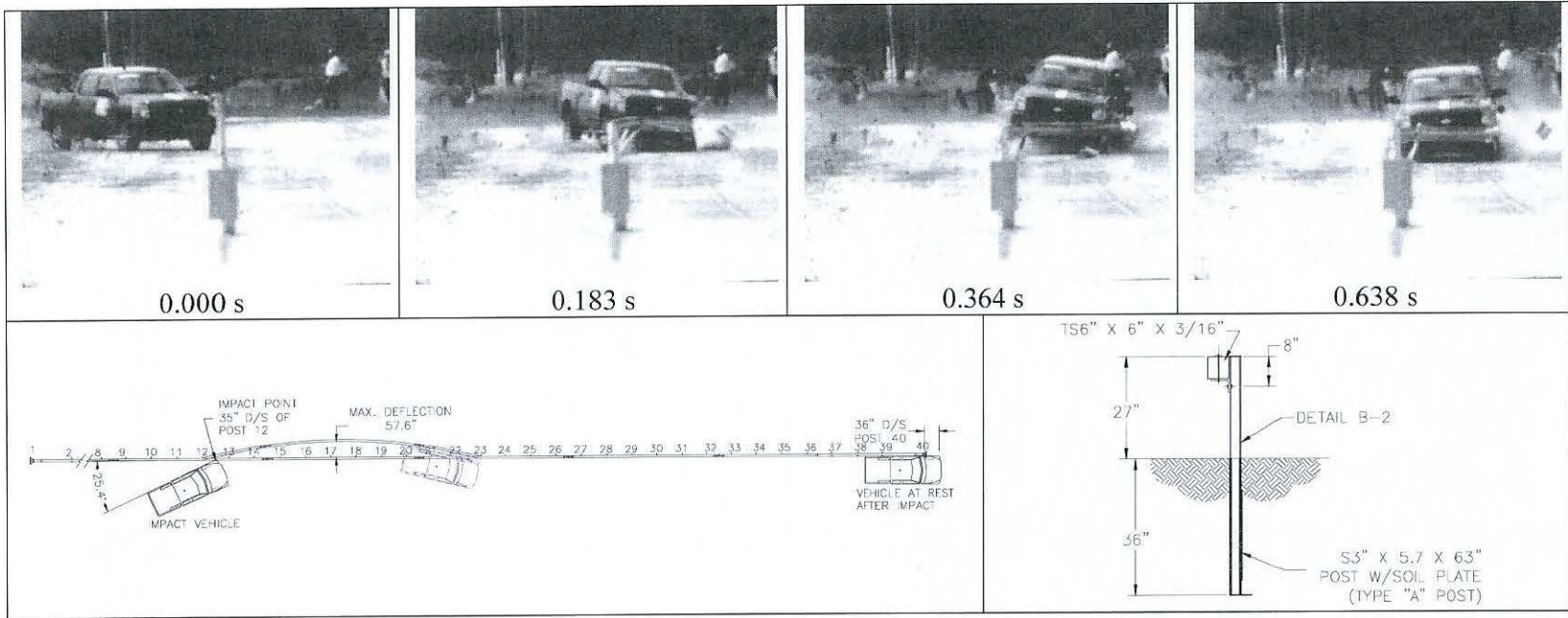
Test Article Deflections

Dynamic..... 28.8 inches
 Permanent 11.5 inches
 Working Width..... 34.8 inches
 Height of Working Width 28.0 inches

Vehicle Damage

VDS..... 01RFQ5
 CDC..... 01FREW4
 Max. Exterior Deformation..... 7.0 inches
 OCDI..... RF0000000
 Max. Occupant Compartment Deformation..... None

Figure 5.7. Summary of Results for MASH Test 3-10 on Wyoming Box Beam Shoulder Barrier.



General Information

Test Agency..... Texas Transportation Institute
 Test No. RF476460-1-6
 Date 2009-05-15

Test Article

Type..... Longitudinal Barrier
 Name G3 Weak Post Box-Beam guardrail
 Installation Length 240 ft
 Material or Key Elements Box-Beam rail element on S3x5.7 posts spaced 6 ft.

Soil Type and Condition..... Crushed Limestone, Dry

Test Vehicle

Type/Designation..... 2270P
 Make and Model..... 2007 Chevrolet Silverado Pickup
 Mass
 Curb..... 4942 lb
 Test Inertial..... 5011 lb
 Gross Static..... 5011 lb

Impact Conditions

Speed63.2 mi/h
 Angle25.4 degrees

Exit Conditions

SpeedNot obtainable
 Angleparallel

Occupant Risk Values

Impact Velocity
 Longitudinal.....11.2 ft/s
 Lateral15.1 ft/s
 Ridedown Accelerations
 Longitudinal.....-5.7 G
 Lateral 7.2 G
 THIV18.9 km/h
 PHD 7.2 G
 Max. 0.050-s Average

Longitudinal.....-3.5 G
 Lateral 5.2 G
 Vertical1.8 G

Post-Impact Trajectory

Stopping Distance 51.1 ft downstream;
 Adjacent traffic face

Vehicle Stability

Maximum Yaw Angle..... 34 degrees
 Maximum Pitch Angle..... 8 degrees
 Maximum Roll Angle..... 14 degrees
 Vehicle Snagging..... No
 Vehicle Pocketing..... No

Test Article Deflections

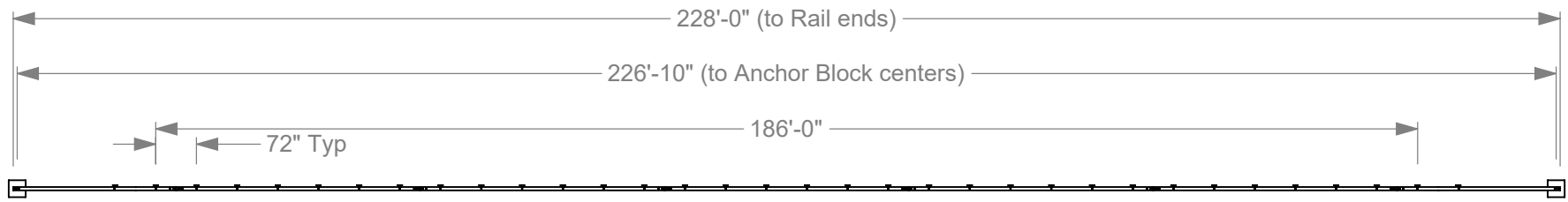
Dynamic..... 57.7 inches
 Permanent..... 39.5 inches
 Working Width 5.6 ft

Vehicle Damage

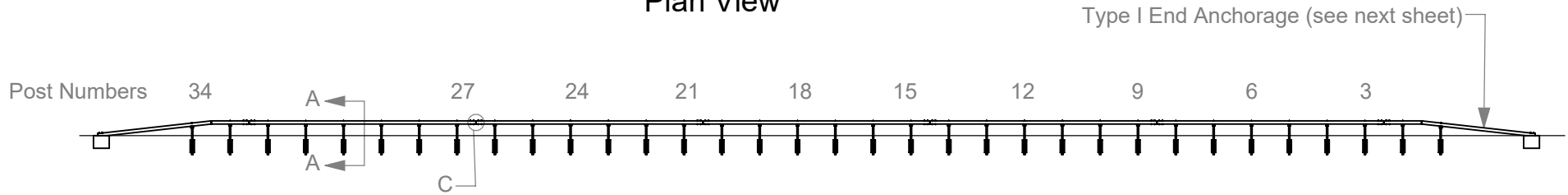
VDS..... 11LFQ4
 CDC..... 11FLEW4
 Max. Exterior Vehicle Crush..... 14.0 inches
 Max. Occupant Compartment
 Deformation..... 0.75 inches

Figure 76. Summary of results for MASH test 3-11 on the G3 Weak Post Box-Beam guardrail.

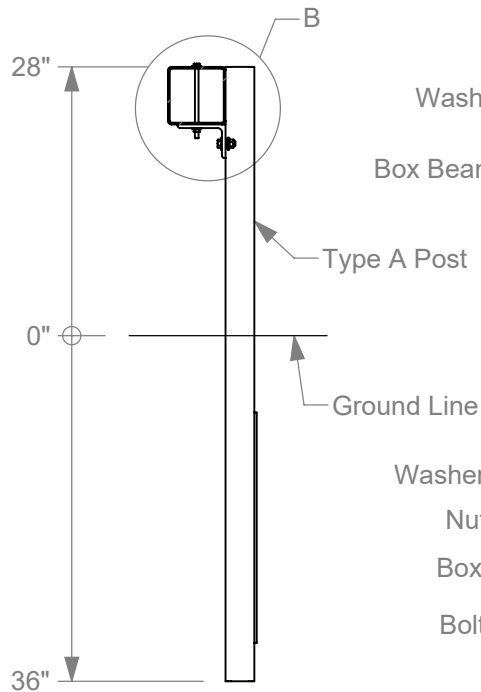
Test Installation



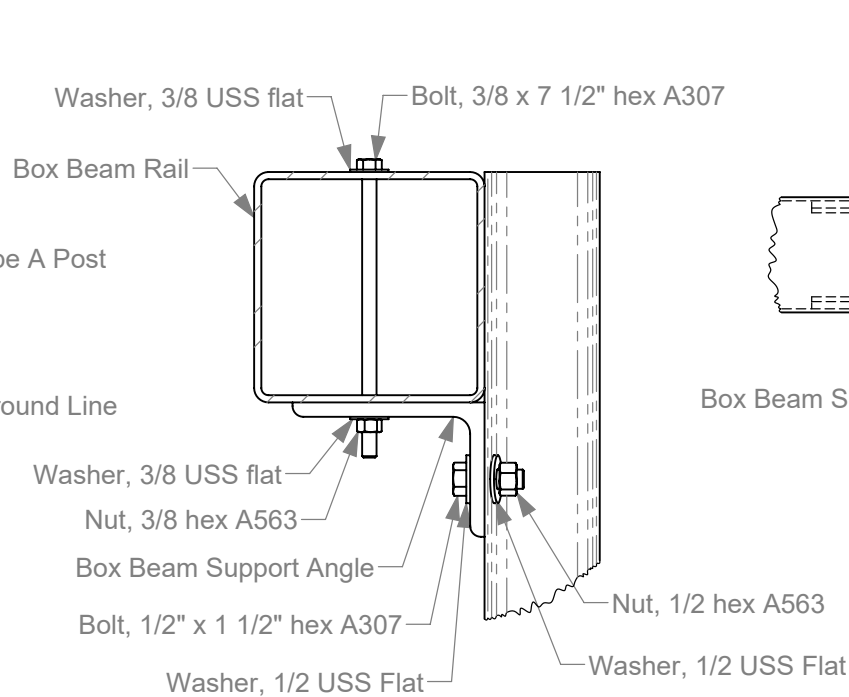
Plan View



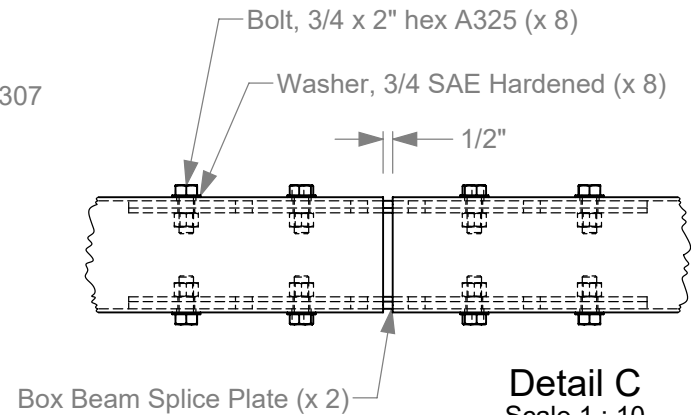
Elevation View



Section A-A
 Scale 1 : 20
 Typical Posts 2 - 33



Detail B
 Scale 1 : 5



Detail C
 Scale 1 : 10
 Typ 6 places

- 1a. All steel components, including hardware, shall be galvanized.
- 1b. Threads not shown on bolts for clarity.

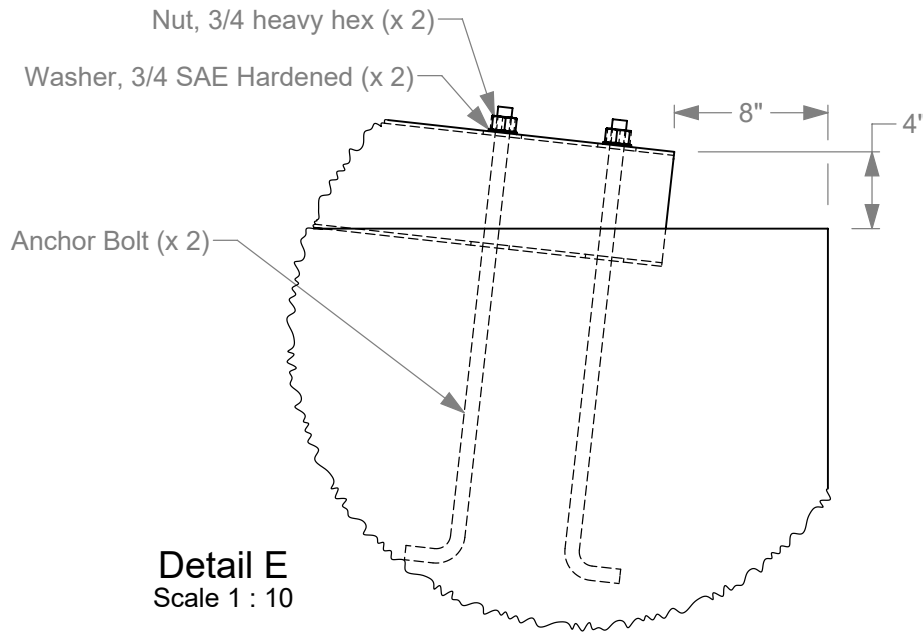
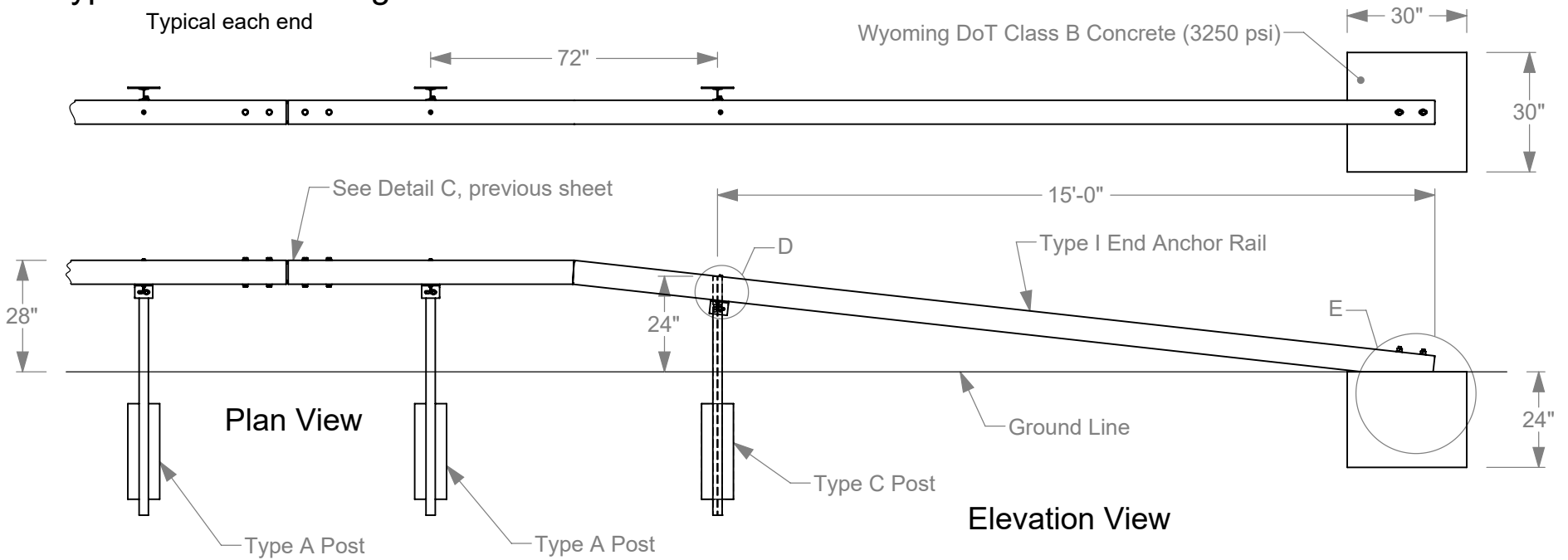


Roadside Safety and Physical Security Division - Proving Ground

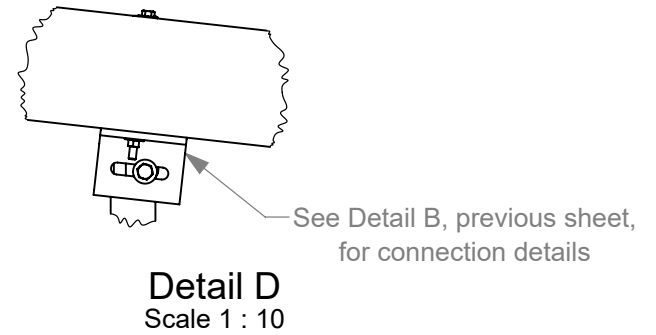
Project #610031 Wyoming Box Beam Rail		2019-02-28
Drawn by GES	Scale 1:300	Sheet 1 of 5 Test Installation

Type 1 End Anchorage

Typical each end




Detail E
Scale 1 : 10

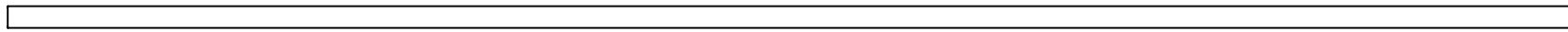
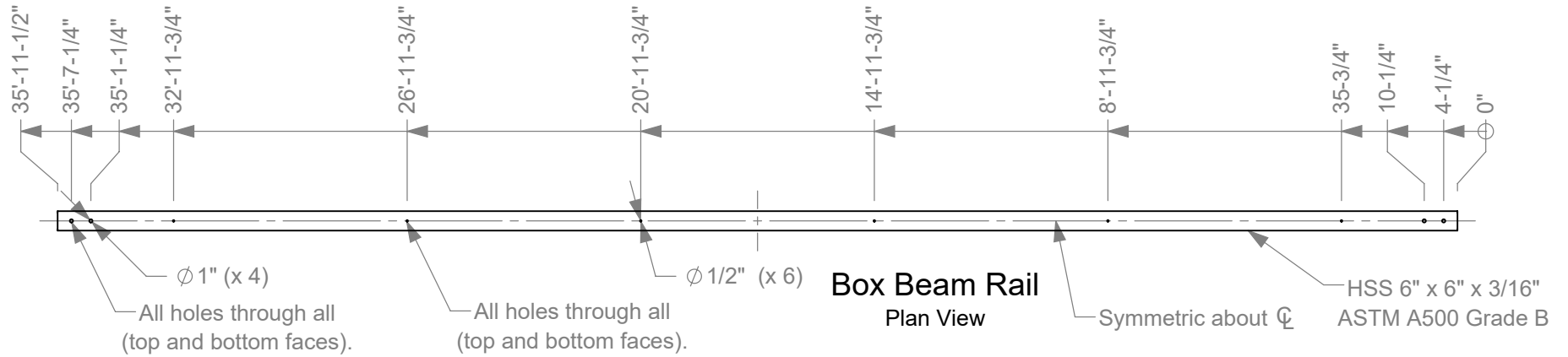


Detail D
Scale 1 : 10

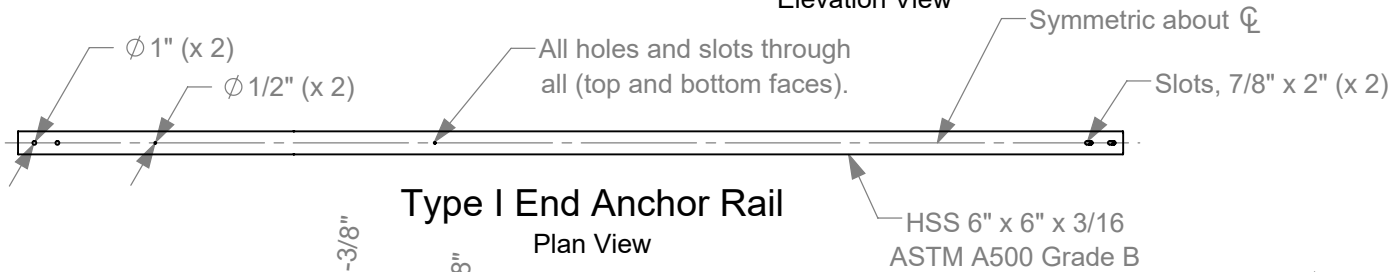
2a. All steel components, including hardware, shall be galvanized.

	Roadside Safety and Physical Security Division - Proving Ground	
	Project #610031 Wyoming Box Beam Rail	2019-02-28
Drawn by GES	Scale 1:40	Sheet 2 of 5 Type 1 End Anchorage

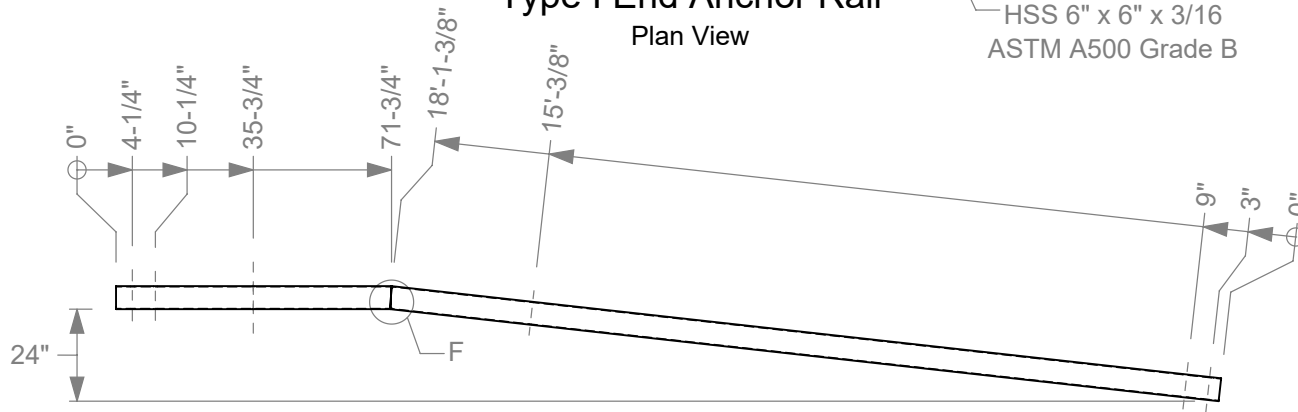
Rail Details



Box Beam Rail
Elevation View



Type I End Anchor Rail
Plan View



Type I End Anchor Rail
Elevation View

Detail F
Scale 1 : 10

- 3a.** All welding must be performed by certified welders using industry standard practices.
- 3b.** Galvanize all components after fabrication is complete.
- 3c.** Cut 3 sides (inverted V-shape, 5/8" wide at bottom), bend, and weld.



Roadside Safety and Physical Security Division - Proving Ground

Project #610031 Wyoming Box Beam Rail

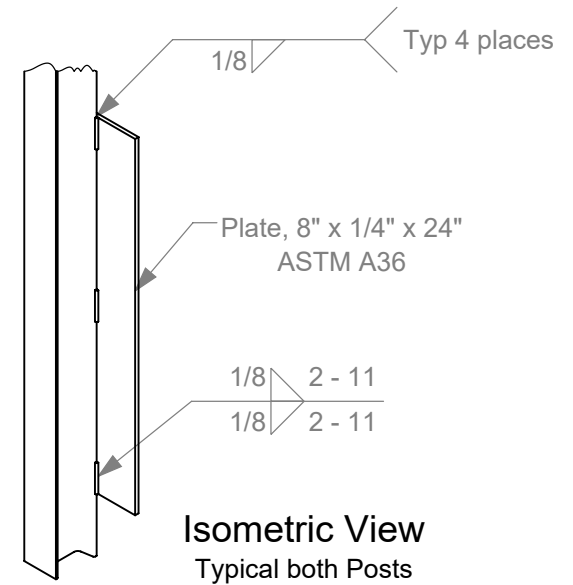
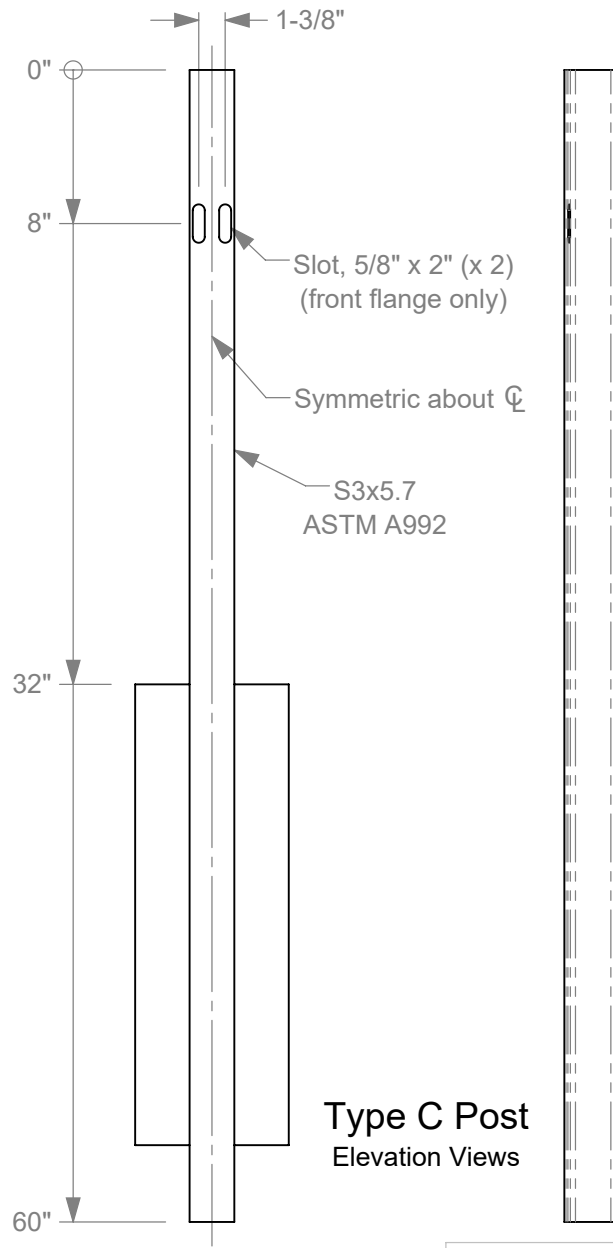
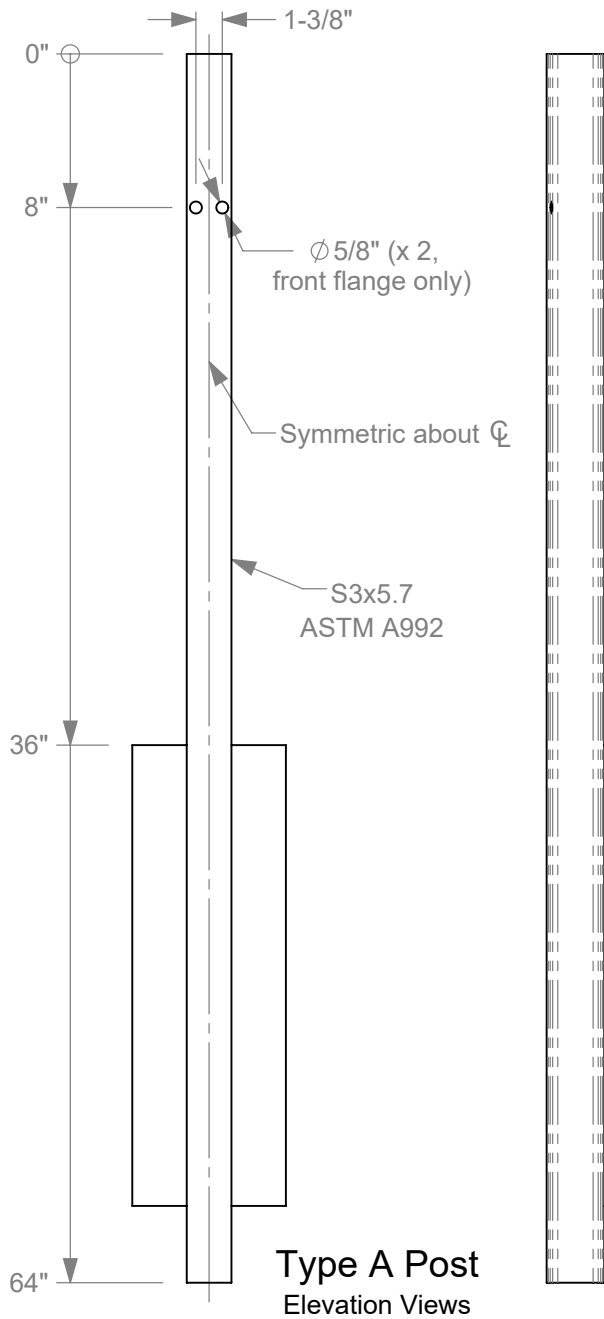
2019-02-28

Drawn by GES


Scale 1:50

Sheet 3 of 5 Rail Details

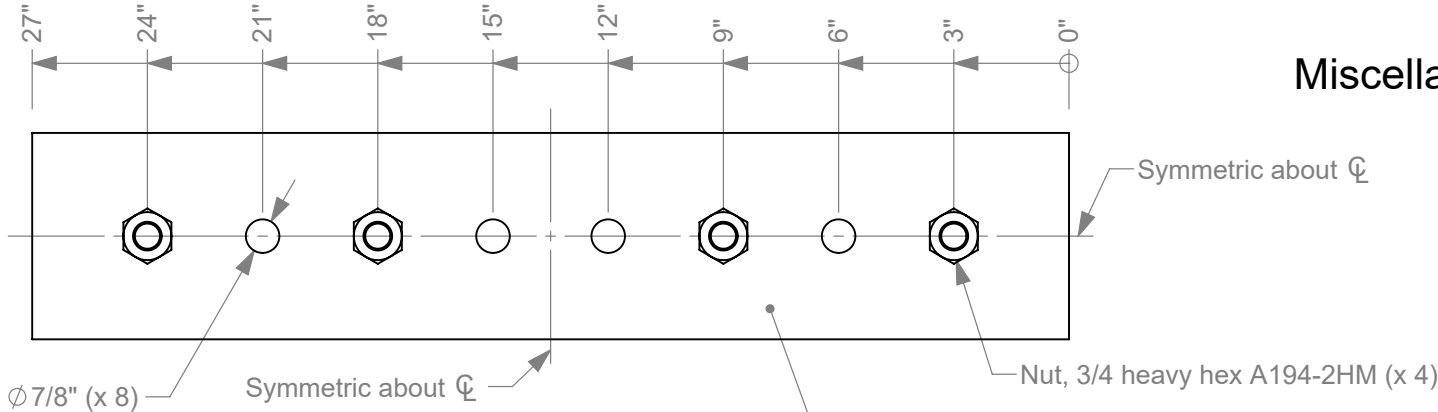
Post Details



- 4a. All welding must be performed by certified welders using industry standard practices.
- 4b. Galvanize all components after fabrication is complete.

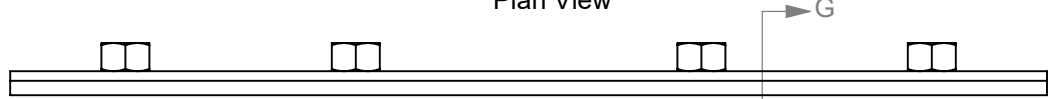
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		Project #610031 Wyoming Box Beam Rail	2019-02-28
Drawn by GES	Scale 1:10	Sheet 4 of 5 Post Details	

Miscellaneous Parts



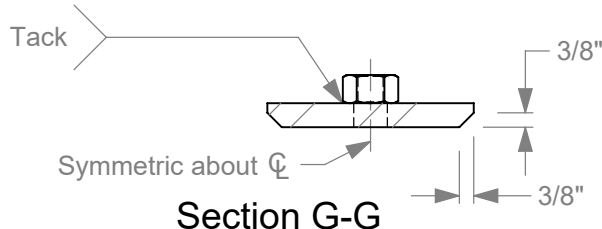
Box Beam Splice Plate

Plan View

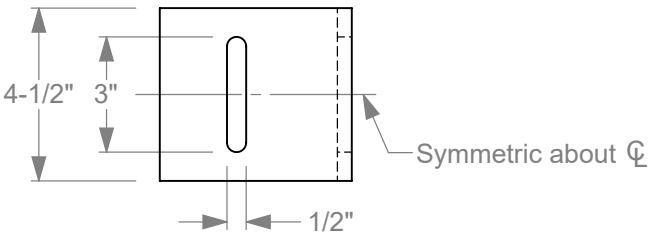


Box Beam Splice Plate

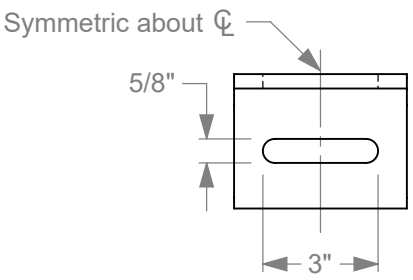
Elevation View



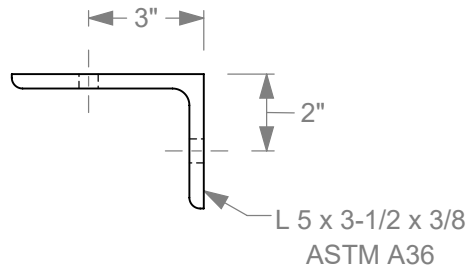
Section G-G



Symmetric about ζ

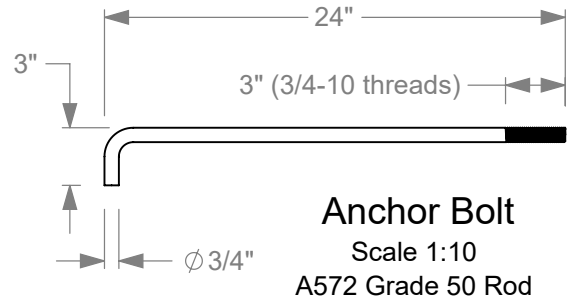


Symmetric about ζ



L 5 x 3-1/2 x 3/8
ASTM A36

B1 Box Beam Support Angle



Anchor Bolt

Scale 1:10
A572 Grade 50 Rod

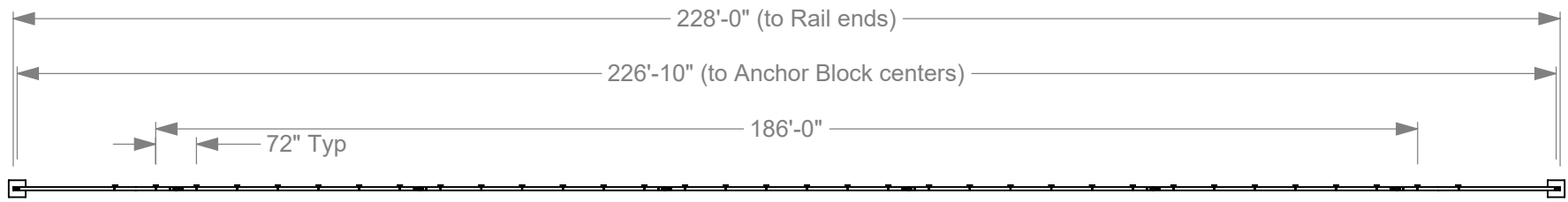
- 5a.** All welding must be performed by certified welders using industry standard practices.
- 5b.** Galvanize all components after fabrication is complete.



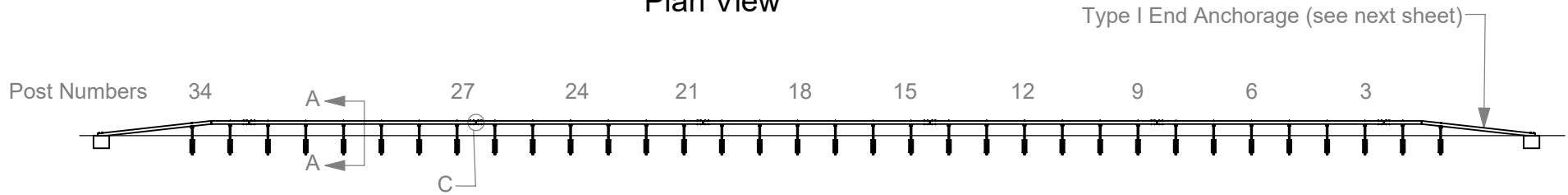
Roadside Safety and Physical Security Division - Proving Ground

Project #610031 Wyoming Box Beam Rail		2019-02-28
Drawn by GES	Scale 1:5	Sheet 5 of 5 Miscellaneous Parts

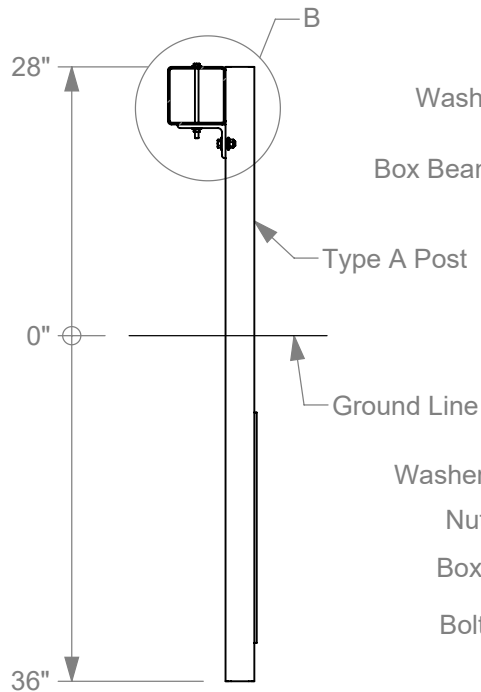
Test Installation



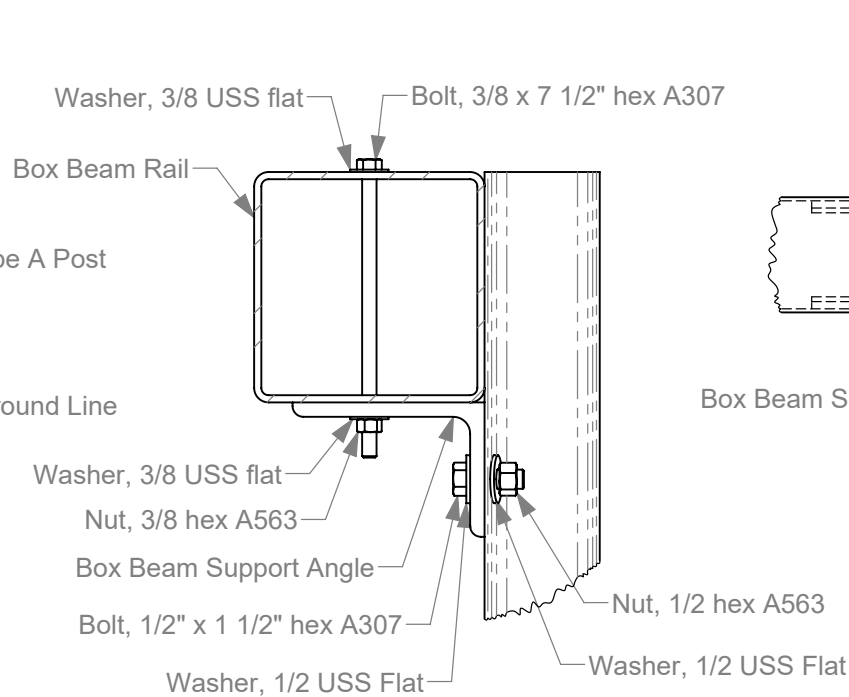
Plan View



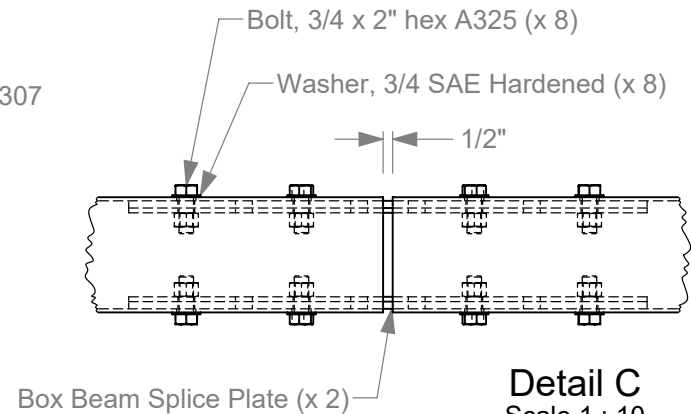
Elevation View



Section A-A
 Scale 1 : 20
 Typical Posts 2 - 33



Detail B
 Scale 1 : 5



Detail C
 Scale 1 : 10
 Typ 6 places

- 1a. All steel components, including hardware, shall be galvanized.
- 1b. Threads not shown on bolts for clarity.

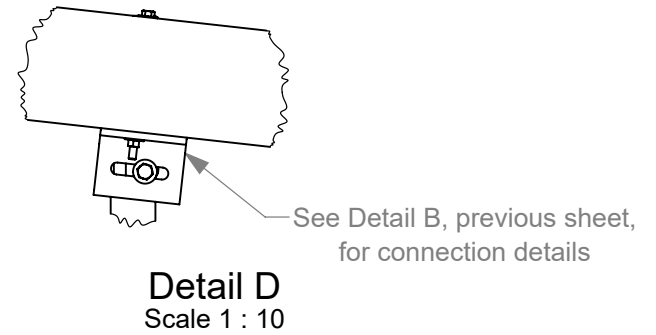
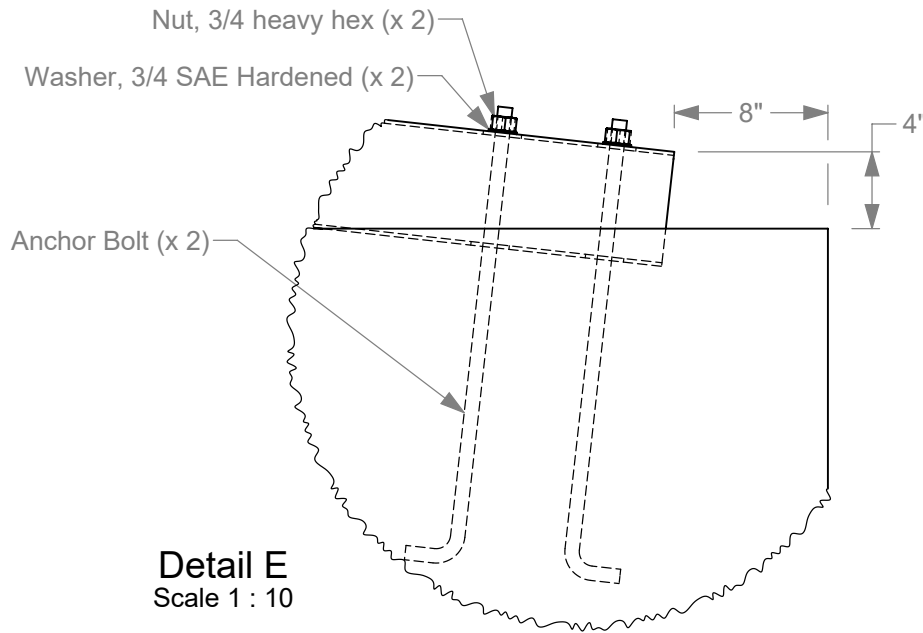
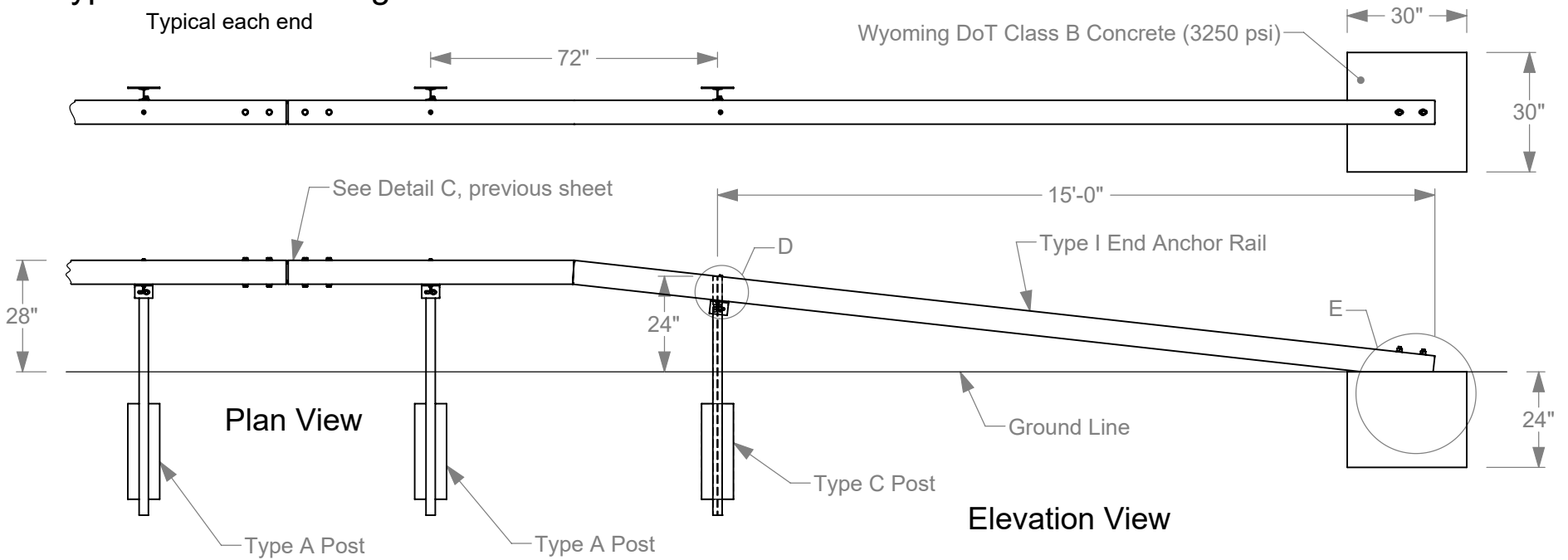


Roadside Safety and Physical Security Division - Proving Ground


Project #610031 Wyoming Box Beam Rail		2019-02-28
Drawn by GES	Scale 1:300	Sheet 1 of 5 Test Installation

Type 1 End Anchorage

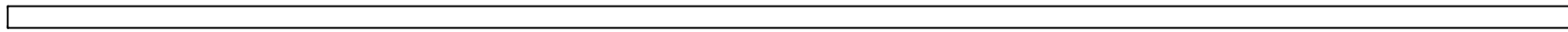
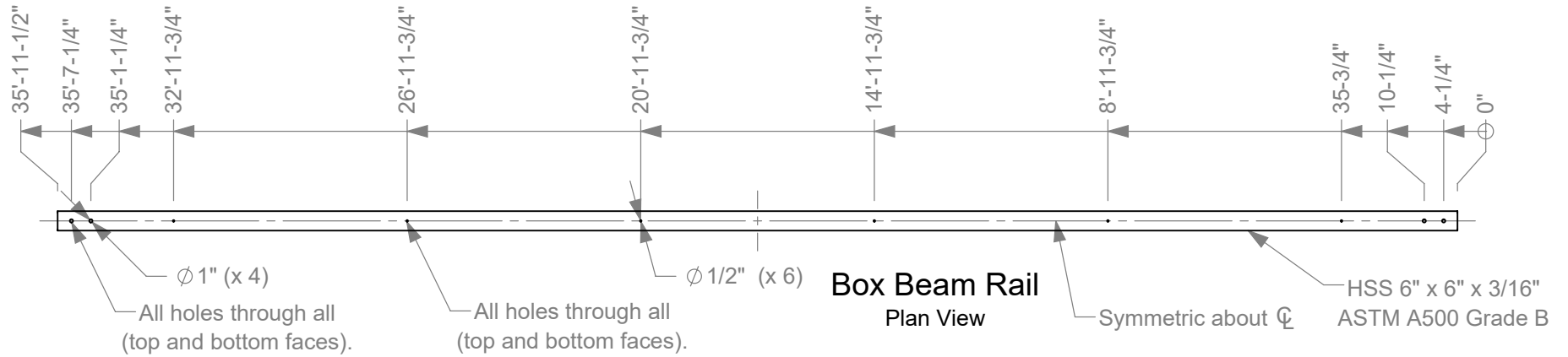
Typical each end



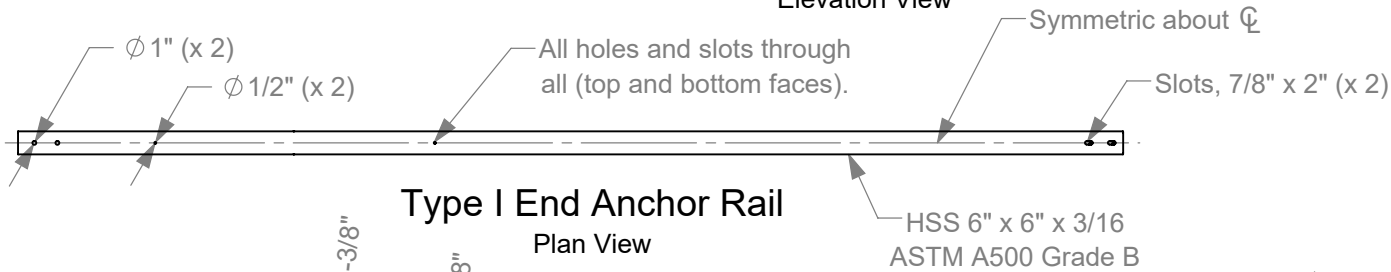
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	Project #610031 Wyoming Box Beam Rail	2019-02-28
Drawn by GES	Scale 1:40	Sheet 2 of 5 Type 1 End Anchorage

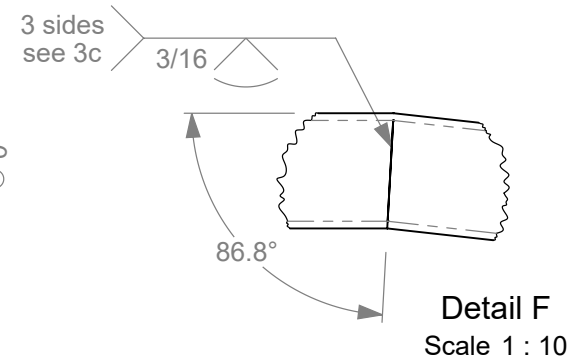
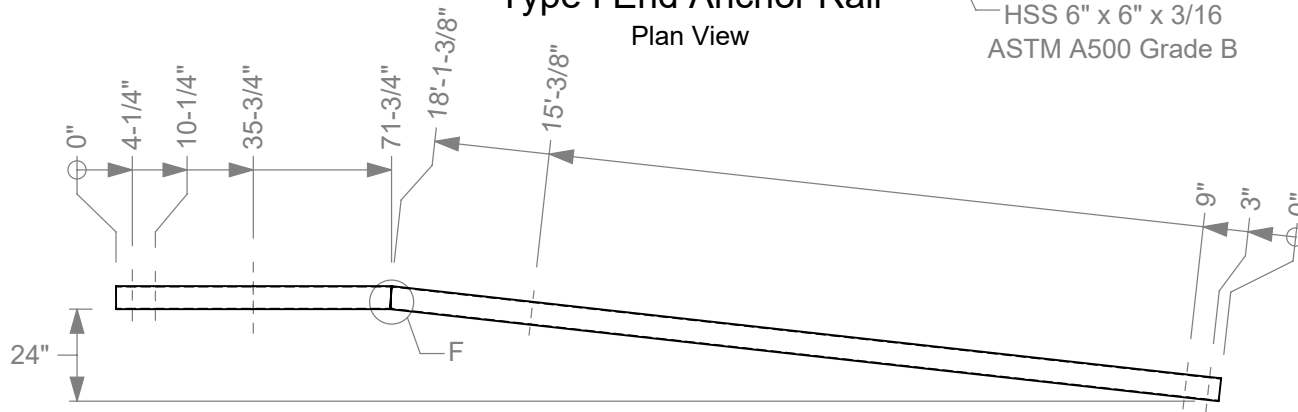
Rail Details



Box Beam Rail
Elevation View



Type I End Anchor Rail
Plan View



Type I End Anchor Rail
Elevation View

- 3a.** All welding must be performed by certified welders using industry standard practices.
- 3b.** Galvanize all components after fabrication is complete.
- 3c.** Cut 3 sides (inverted V-shape, 5/8" wide at bottom), bend, and weld.



Roadside Safety and Physical Security Division - Proving Ground

Project #610031 Wyoming Box Beam Rail

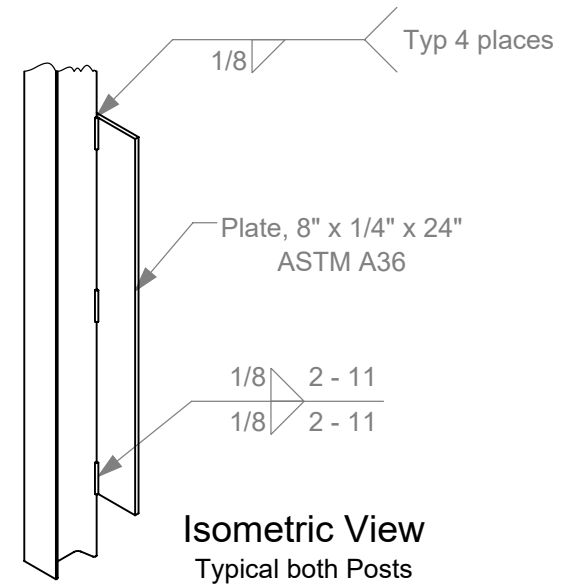
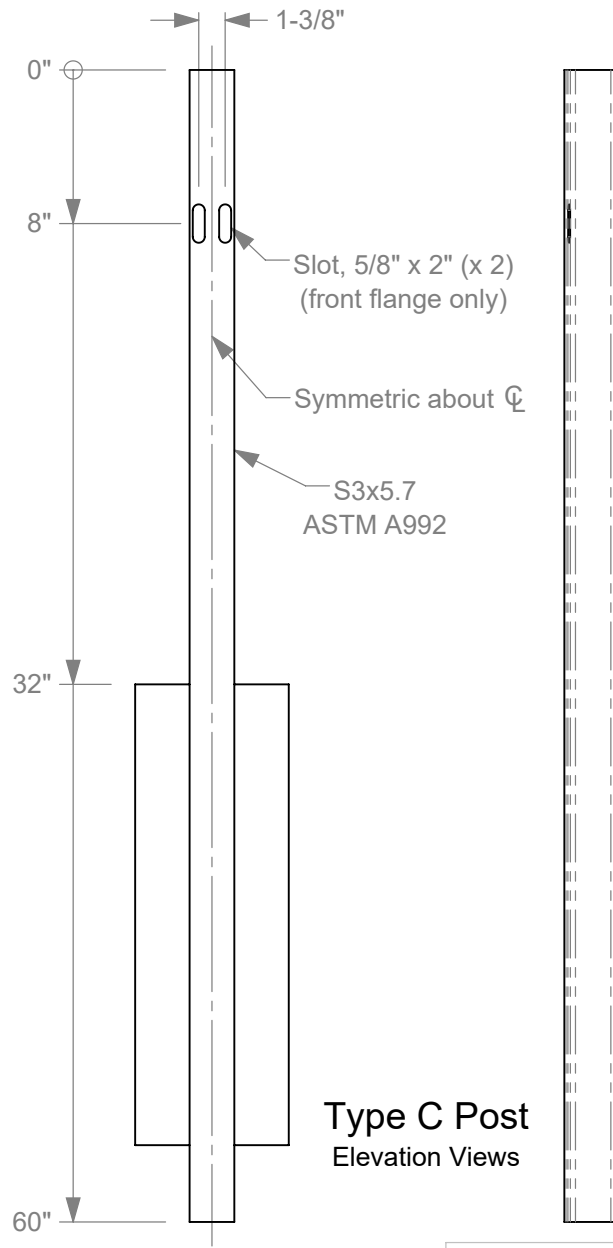
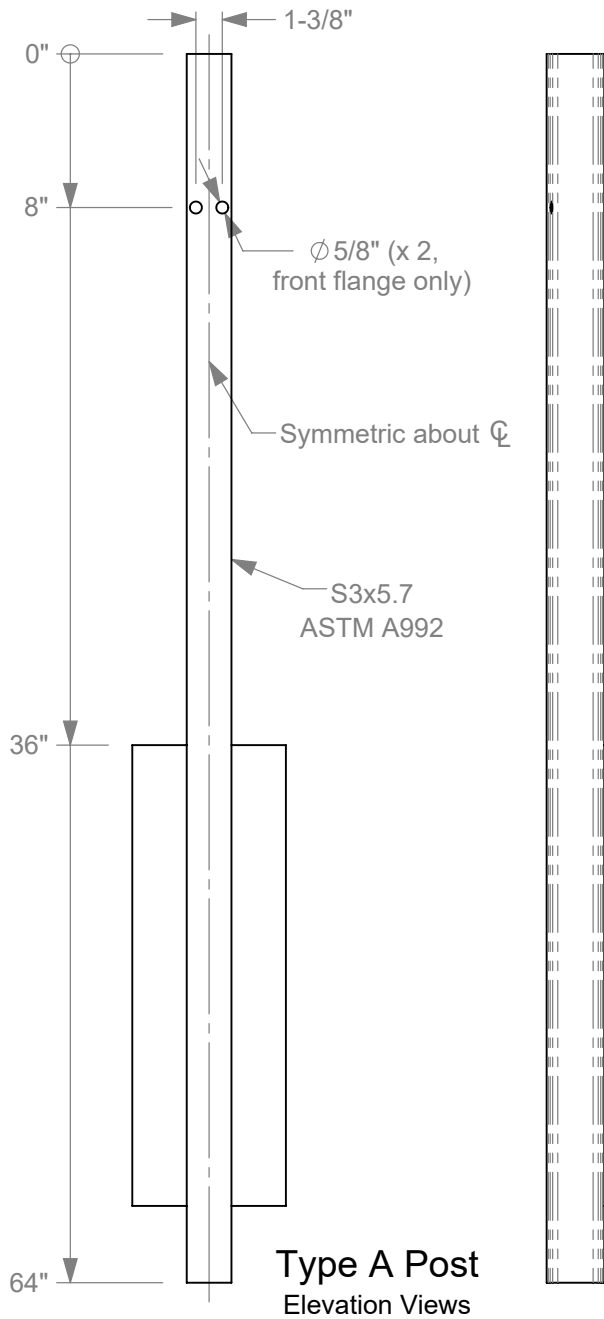
2019-02-28

Drawn by GES


Scale 1:50

Sheet 3 of 5 Rail Details

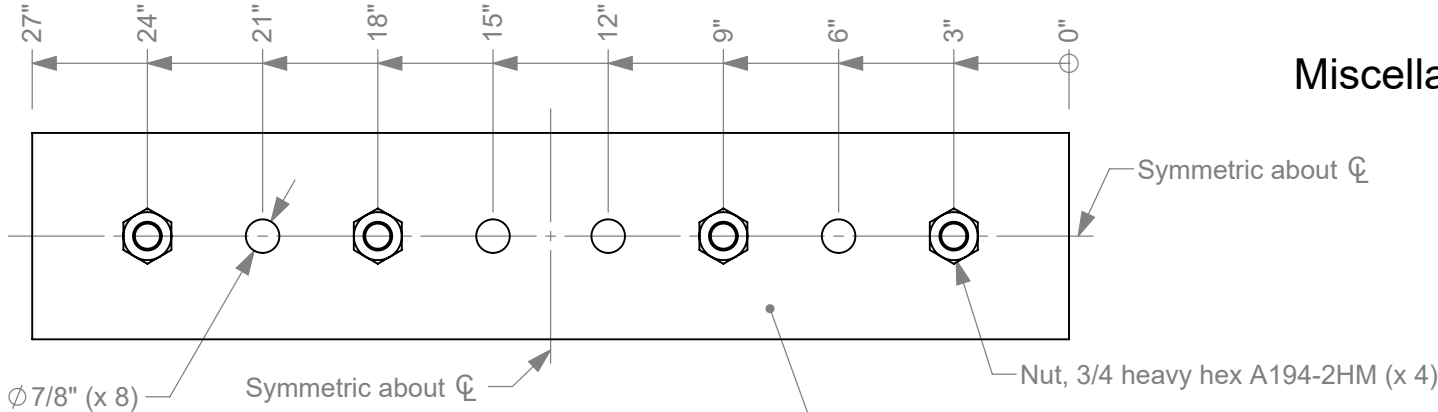
Post Details



- 4a. All welding must be performed by certified welders using industry standard practices.
- 4b. Galvanize all components after fabrication is complete.

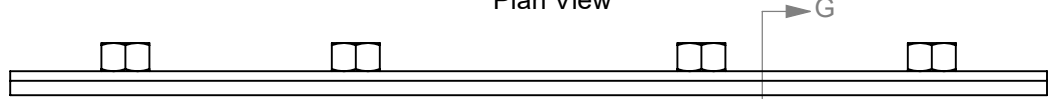
		Roadside Safety and Physical Security Division - Proving Ground	
		Project #610031 Wyoming Box Beam Rail	2019-02-28
Drawn by GES	Scale 1:10	Sheet 4 of 5 Post Details	

Miscellaneous Parts



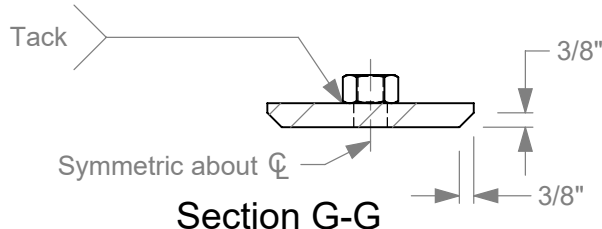
Box Beam Splice Plate

Plan View

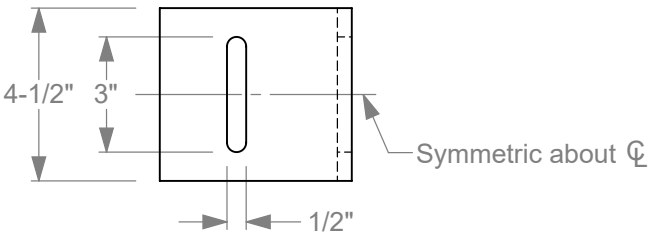


Box Beam Splice Plate

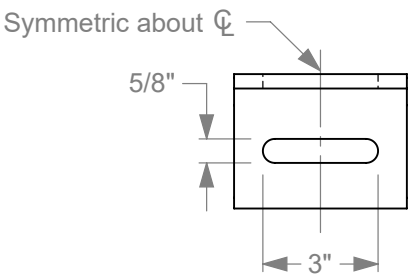
Elevation View



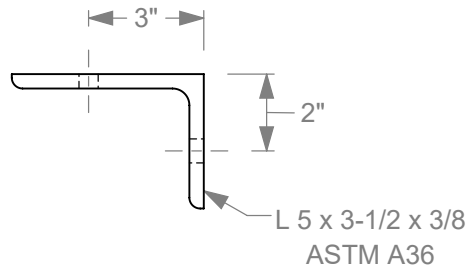
Section G-G



Symmetric about ζ

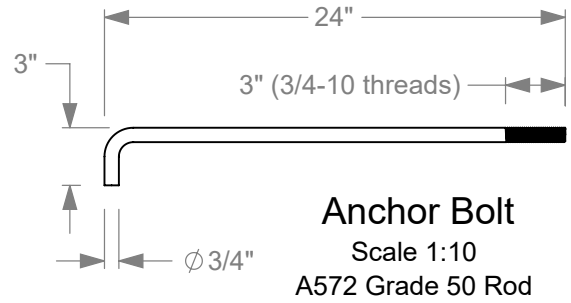


Symmetric about ζ



L 5 x 3-1/2 x 3/8
ASTM A36

B1 Box Beam Support Angle



Anchor Bolt

Scale 1:10
A572 Grade 50 Rod

- 5a.** All welding must be performed by certified welders using industry standard practices.
- 5b.** Galvanize all components after fabrication is complete.



Roadside Safety and Physical Security Division - Proving Ground

Project #610031 Wyoming Box Beam Rail		2019-02-28
Drawn by GES	Scale 1:5	Sheet 5 of 5 Miscellaneous Parts