



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

February 27, 2020

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

In Reply Refer To:
HSST-1/B-332

Mr. Hassan Raza
Pennsylvania Department of Transportation
400 North St, 7th Floor
Harrisburg, Pennsylvania 17120
USA

Dear Mr. Raza:

This letter is in response to your December 3, 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-332 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:

- PennDOT W-Beam Guiderail over Underground Structure

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: PennDOT W-Beam Guiderail over Underground Structure

Type of system: Longitudinal Barrier

Test Level: MASH Test Level 3 (TL3)

Testing conducted by: Texas A&M Transportation Institute

Date of request: December 3, 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-332 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:	December 03, 2019	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Christine Spangler, P.E.	
	Company:	Pennsylvania Department of Transportation	
	Address:	400 North St., 7th Floor, Harrisburg, Pennsylvania 17120	
	Country:	USA	
	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 (Roadside, Median, Bridge Railings)	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	PennDOT W-Beam Guiderail over Underground Structure	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:	Hassan Raza	Same as Submitter <input type="checkbox"/>
Company Name:	Pennsylvania Department of Transportation	Same as Submitter <input checked="" type="checkbox"/>
Address:	400 North St., 7th Floor, Harrisburg, Pennsylvania 17120	Same as Submitter <input checked="" type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" 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 Gannett Fleming, Inc. to perform full-scale crash testing of the PennDOT W-Beam Guiderail over Underground Structure. There are no shared financial interests in the PennDOT W-Beam Guiderail over Underground Structure by TTI, or between PennDOT and TTI, or between Gannett Flemming, Inc. and TTI other than the costs involved in the actual crash tests and reports for this submission to FHWA.

PRODUCT DESCRIPTION

New Hardware or Significant Modification
 Modification to Existing Hardware

The test installation for the PennDOT W-Beam Guiderail over Underground Structure consisted of a 31-inch tall W-beam guardrail supported by steel posts installed in compacted base, with a Texas Department of Transportation (TxDOT) downstream anchor terminal (DAT) [GF (31) DAT-14] on each end, for a total installation length of 181 ft-3 inches. Timber blockouts for steel posts (PDB-01b) were installed on posts 3 through 28 using 10-inch long guardrail bolts and recessed guardrail nuts (FBB03).

Standard 12-gauge W-beam guardrail (type RWM04a) was used in the system. The top of the W-beam was 31 inches above grade, and the guardrail splices were located mid-span between every other post. Posts were equally spaced at 6 ft-3 inches.

Posts 3 through 13 and 20 through 28 were 6-ft W6x8.5 guardrail line posts (PWE01). These posts were installed approximately 40 inches deep in drilled holes that were backfilled and compacted with soil meeting Grading B of AASHTO standard specification M147-65(2004) "Materials for Aggregate and Soil Aggregate Subbase, Base and Surface Courses."

Posts 14 through 19 were attached to steel reinforced concrete slabs, 60 inches square by 8-inches thick, with their tops located 6 inches below grade. Posts 14 through 19 were fabricated from 37 $\frac{1}{8}$ -inch long sections of W6x8.5 welded to $\frac{3}{4}$ -inch thick base plates. The posts were secured to the slabs with $\frac{7}{8}$ -inch diameter x 8 $\frac{1}{2}$ -inch long bolts that were integrally cast in the slabs. The slabs were covered with the aforementioned Grading B soil to the grade level of the surrounding soil.

Each TxDOT GF (31) DAT-14 terminal was 9 ft-4 $\frac{1}{2}$ inches long as measured from their anchor posts to the W-beam splice between posts 2 and 3 and posts 28 and 29, respectively.

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:	D. Lance Bullard, Jr. P.E.	
Engineer Signature:	D. Lance Bullard, Jr.	Digitally signed by D. Lance Bullard, Jr. Date: 2019.12.02 08:26:12 -06'00'
Address:	TTI, TAMU 3135, College Station, TX 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-10 (1100C)	<p>TTI Crash Test Report No. 612281-02 contains the results of this 3-10 Test No. 612281-02-1 conducted on May 20, 2019. The CIP for MASH Test 3-10 was 8.3 ft ±1 ft upstream of the centerline of post #16.</p> <p>The 1100C test vehicle was traveling at a speed of 61.2 mi/h as it made contact with the PennDOT W-Beam Guiderail over Underground Structure system 8.3 ft upstream of the centerline of post #16 and at an impact angle of 25.0°.</p> <p>The PennDOT W-Beam Guiderail over Underground Structure system contained and redirected the 1100C vehicle. The vehicle did not penetrate, underide, or override the installation. The maximum dynamic deflection of the system during the test was 27.0 inches.</p> <p>Two blockouts released from the posts and metal rail element, however these did not penetrate or show potential for penetrating the occupant compartment, or present hazard to others in the area.</p> <p>No occupant compartment deformation or intrusion was observed.</p> <p>The 1100C vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 7° and 6°, respectively.</p> <p>Occupant risk factors were within the preferred limits of MASH. Longitudinal OIV was 18.0 ft/s, and lateral OIV was 17.7 ft/s. Longitudinal occupant ridedown acceleration was 8.0 g, and lateral occupant ridedown acceleration was 9.8 g.</p> <p>The PennDOT W-Beam Guiderail over Underground Structure system performed acceptably for MASH Test 3-10.</p>	PASS

Required Test Number	Narrative Description	Evaluation Results
3-11 (2270P)	<p>TTI Crash Test Report No. 612281-02 contains the results of this 3-11 Test No. 612281-02-2 conducted on July 8, 2019. The CIP for MASH Test 3-11 was 11.8 ft ±1 ft upstream of the centerline of post #16.</p> <p>The 22270P test vehicle was traveling at a speed of 62.6 mi/h as it made contact with the PennDOT W-Beam Guiderail over Underground Structure system 11.1 ft upstream of the centerline of post #16 and at an impact angle of 24.8°.</p> <p>The PennDOT W-Beam Guiderail over Underground Structure system contained and redirected the 2270P vehicle. The vehicle did not underride, override, or penetrate the installation. Maximum dynamic deflection during the test was 53.1 inches.</p> <p>Several blockouts released from the posts and metal rail element, however these did not penetrate or show potential for penetrating the occupant compartment, or present hazard to others in the area.</p> <p>No occupant compartment deformation or intrusion was observed.</p> <p>The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 9° and 4°, respectively.</p> <p>Occupant risk factors were within the preferred limits of MASH. Longitudinal OIV was 16.1ft/s, and lateral OIV was 13.8 ft/s. Longitudinal occupant ridedown acceleration was 8.1 g, and lateral occupant ridedown acceleration was 7.7 g.</p> <p>The PennDOT W-Beam Guiderail over Underground Structure system performed acceptably for MASH Test 3-11.</p>	PASS
3-20 (1100C)	<p>This Optional Test was not performed. This request is only for a stand alone longitudinal barrier system, and not for a Transition between two different barrier systems. Therefore, Test 3-20 is Non-Relevant.</p>	Non-Relevant Test, not conducted

3-21 (2270P)	This Optional Test was not performed. This request is only for a stand alone longitudinal barrier system, and not for a Transition between two different barrier systems. Therefore, Test 3-21 is Non-Relevant.	Non-Relevant Test, not conducted
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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: 2019.11.27 09:20:32 -06'00	
Address:	TTI, TAMU 3135, College Station, TX 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input 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	

Submitter Signature*: Christine A. Spangler

Digitally signed by Christine A. Spangler
Date: 2019.12.04 09:38:05 -05'00'

Submit Form

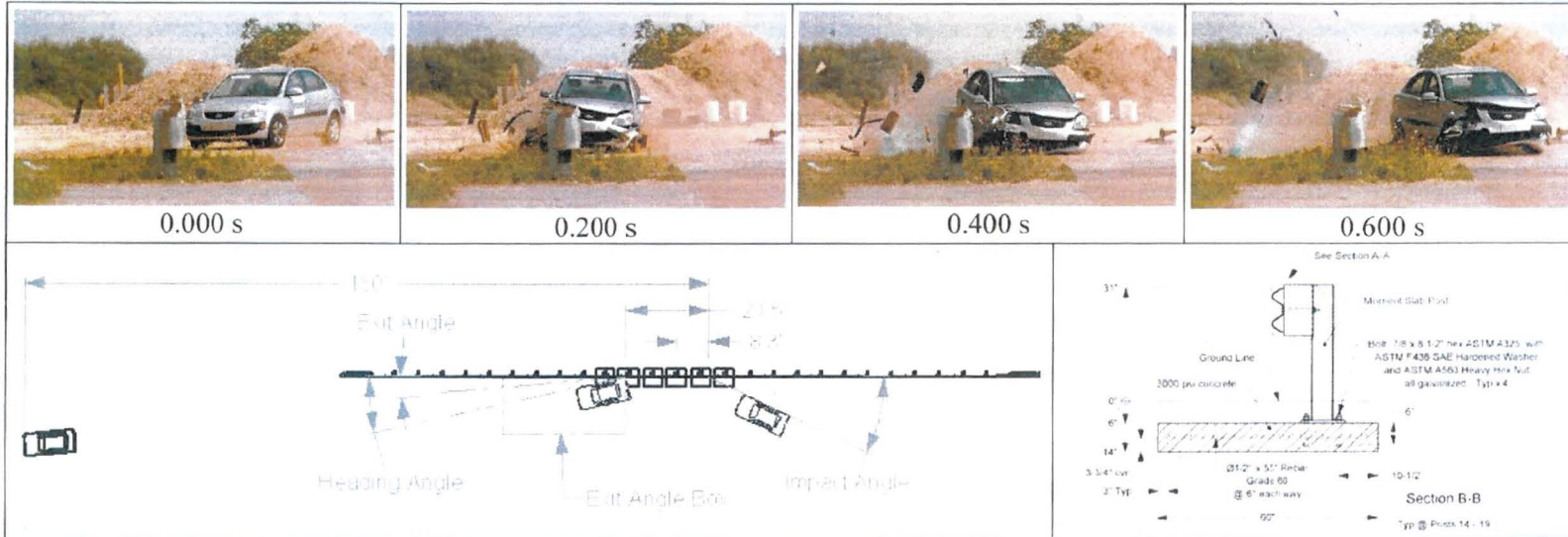
ATTACHMENTS

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..... 612281-02-1
 Test Date..... 2019-05-20

Test Article

Type..... Longitudinal Barrier – Guardrail
 Name..... W-Beam Guiderail over Underground Structure
 Installation Length..... 181 ft-3 inches
 Material or Key Elements... 31-inch tall W-beam guardrail with W6x8.5 posts with six 8-inch thick steel reinforced concrete slabs, 60 inches square, cast at post locations 14 through 19, with their tops 6 inches below grade

Soil Type and Condition

AASHTO M147-65(2004), grading B Soil (crushed limestone), Damp

Test Vehicle

Type/Designation..... 1100C
 Make and Model..... 2009 Kia Rio
 Curb..... 2475 lb
 Test Inertial..... 2420 lb
 Dummy..... 165 lb
 Gross Static..... 2585 lb

Impact Conditions

Speed..... 61.2 mi/h
 Angle..... 25°
 Location/Orientation..... 99.9 inches upstream of post 16

Impact Severity

54 kip-ft

Exit Conditions

Speed..... 34.5 mi/h
 Trajectory/Heading Angle... 15.6° / 15.9°

Occupant Risk Values

Longitudinal OIV..... 18.0 ft/s
 Lateral OIV..... 17.7 ft/s
 Longitudinal Ridedown..... 8.0 g
 Lateral Ridedown..... 9.8 g
 THIV..... 27.6 km/h
 PHD..... 12.0 g
 ASI..... 0.95
 Max. 0.050-s Average
 Longitudinal..... -6.5 g
 Lateral..... -7.6 g
 Vertical..... -3.0 g

Post-Impact Trajectory

Stopping Distance..... 180 ft downstream
 18 ft toward traffic

Vehicle Stability

Maximum Yaw Angle..... 41°
 Maximum Pitch Angle..... 6°
 Maximum Roll Angle..... 7°
 Vehicle Snagging..... No
 Vehicle Pocketing..... No

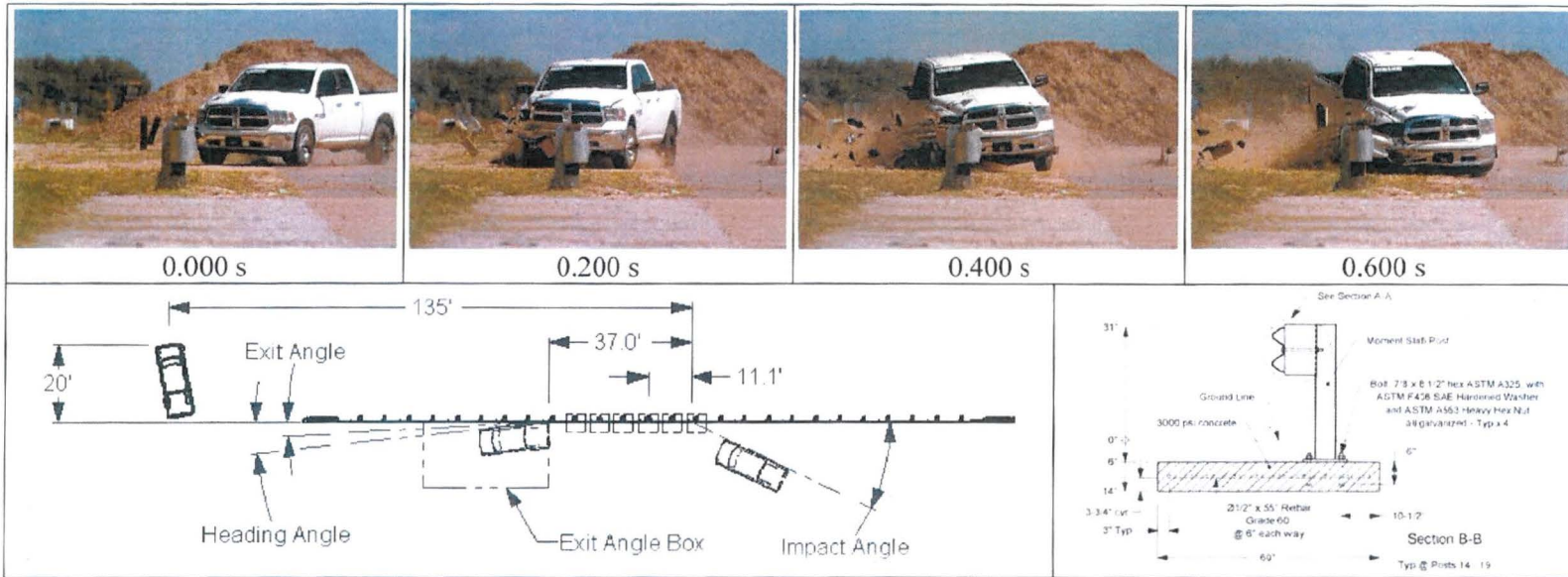
Test Article Deflections

Dynamic..... 27.0 inches
 Permanent..... 20.5 inches
 Working Width..... 30.5 inches
 Height of Working Width..... 39.8 inches

Vehicle Damage

VDS..... 01RFQ4
 CDC..... 01FREW3
 Max. Exterior Deformation..... 8.0 inches
 OCDI..... RF0000000
 Max. Occupant Compartment Deformation..... None

Figure 5.6. Summary of Results for MASH Test 3-10 on W-Beam Guiderail over Underground Structure.



General Information

Test Agency Texas A&M Transportation Institute (TTI)
 Test Standard Test No. MASH Test 3-11
 TTI Test No. 612281-02-2
 Test Date 2019-07-08

Test Article

Type Longitudinal Barrier – Guardrail
 Name W-Beam Guardrail over Underground
 Installation Length Structure
 Material or Key Elements ... 181 ft-3 inches
 31-inch tall W-beam guardrail with W6x8.5 posts with six 8-inch thick steel reinforced concrete slabs, 60 square, cast at post locations 14 through 19, with their tops 6 inches below grade

Soil Type and Condition AASHTO M147-65(2004), grading B Soil (crushed limestone), Damp

Test Vehicle

Type/Designation 2270P
 Make and Model 2014 RAM 1500 Pickup
 Curb 4997 lb
 Test Inertial 5042 lb
 Dummy No Dummy
 Gross Static 5042 lb

Impact Conditions

Speed 62.6 mi/h
 Angle 24.8°
 Location/Orientation 11.1 ft upstream of centerline of post 16

Impact Severity

Impact Severity 116 kip-ft
Exit Conditions
 Speed 31.6 mi/h
 Trajectory/Heading Angle ... 17.0° / 13.3°

Occupant Risk Values

Longitudinal OIV 16.1 ft/s
 Lateral OIV 13.8 ft/s
 Longitudinal Ridedown 8.1 g
 Lateral Ridedown 7.7 g
 THIV 22.9 km/h
 PHD 10.0 g
 ASI 0.66

Max. 0.050-s Average

Longitudinal -5.0 g
 Lateral -4.8 g
 Vertical 2.0 g

Post-Impact Trajectory

Stopping Distance 135 ft downstream
 20 ft twd field side

Vehicle Stability

Maximum Yaw Angle 41°
 Maximum Pitch Angle 4°
 Maximum Roll Angle 9°
 Vehicle Snagging No
 Vehicle Pocketing No

Test Article Deflections

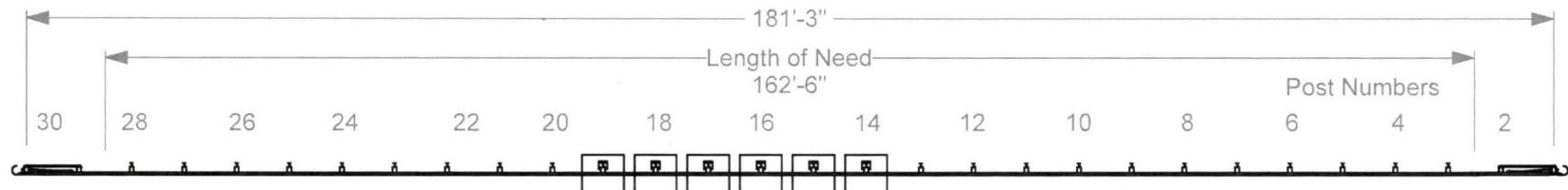
Dynamic 53.1 inches
 Permanent 17.1 inches
 Working Width 62.4 inches
 Height of Working Width 54.3 inches

Vehicle Damage

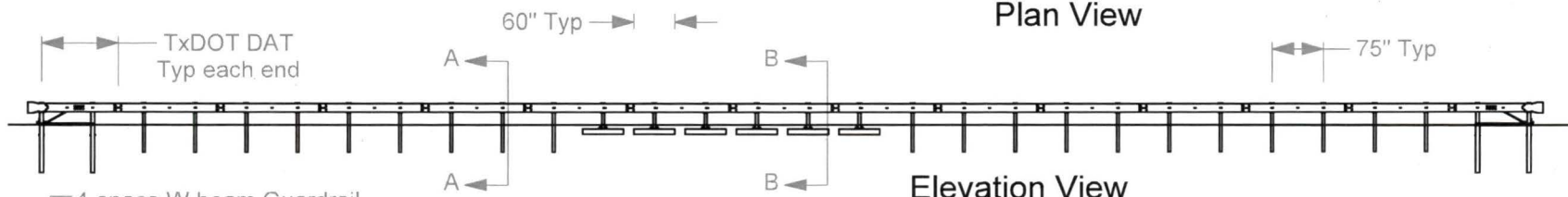
VDS 01RFQ6
 CDC 01FREW4
 Max. Exterior Deformation 11.0 inches
 OCDI FS0000000
 Max. Occupant Compartment Deformation None

Figure 6.6. Summary of Results for MASH Test 3-11 on W-Beam Guardrail over Underground Structure.

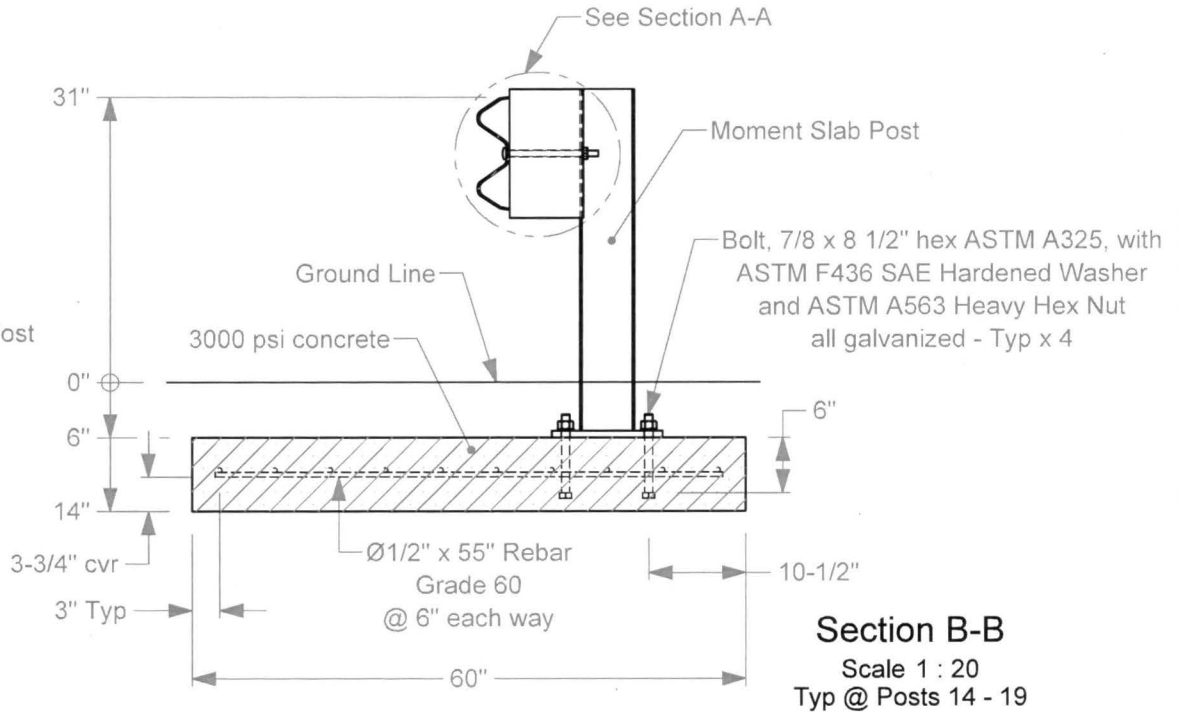
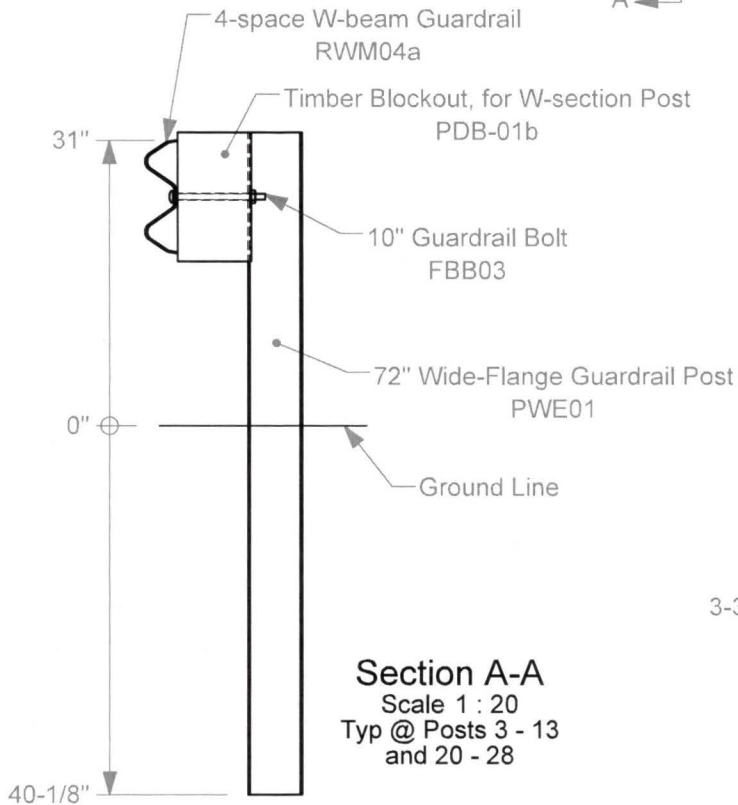
Test Installation



Plan View



Elevation View



1a. Backfill Post holes, and around and above Moment Slabs, with AASHTO M147-65(2004), grade B crushed limestone road base, compacted to MASH standard.



Roadside Safety and Physical Security Division - Proving Ground

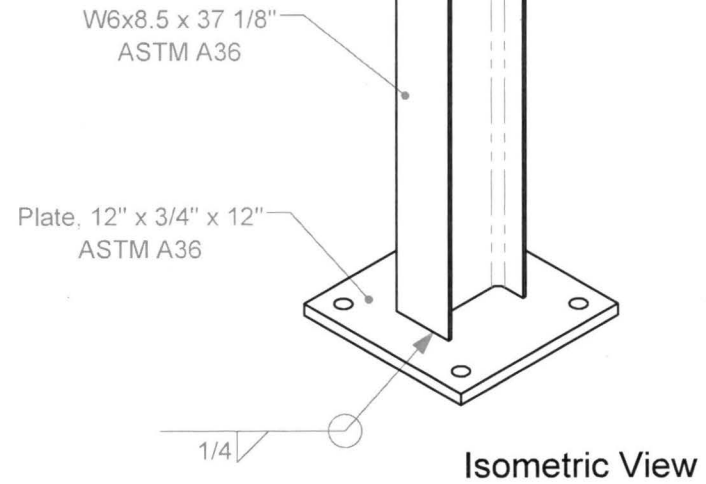
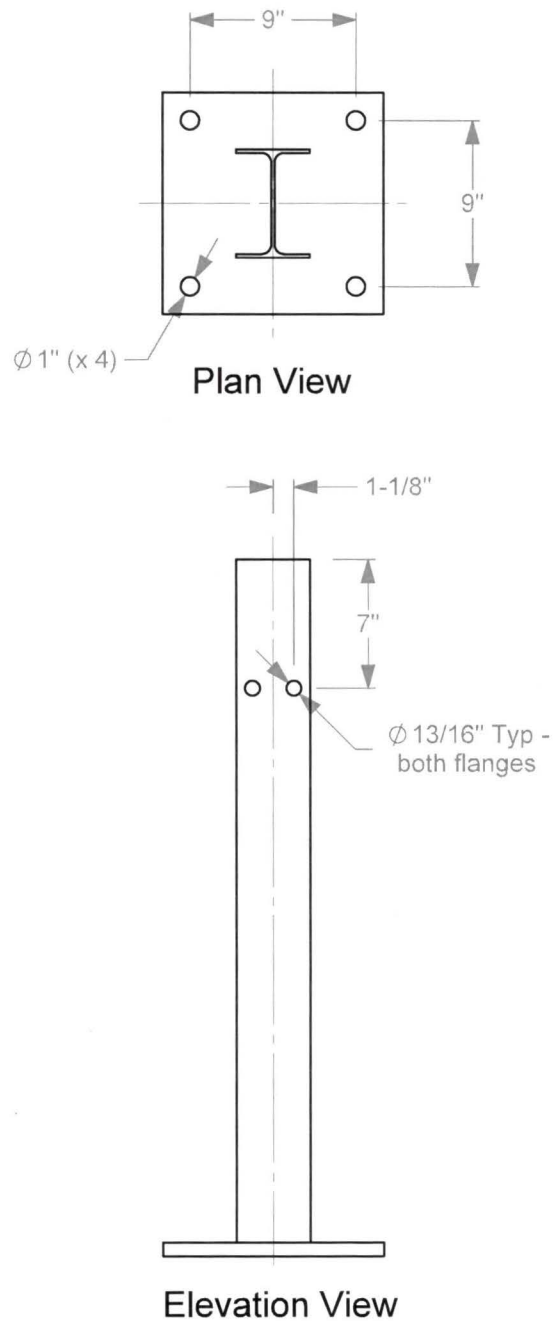
Project #612281 Moment Slab

2019-04-18

Drawn by GES Scale 1:250

Sheet 1 of 2 Test Installation

Post Details



- 2a. All welding must be performed by certified welders using industry standard practices.
- 2b. Galvanize all components after fabrication is complete.



Roadside Safety and
 Physical Security Division -
 Proving Ground

Project #612281 Moment Slab

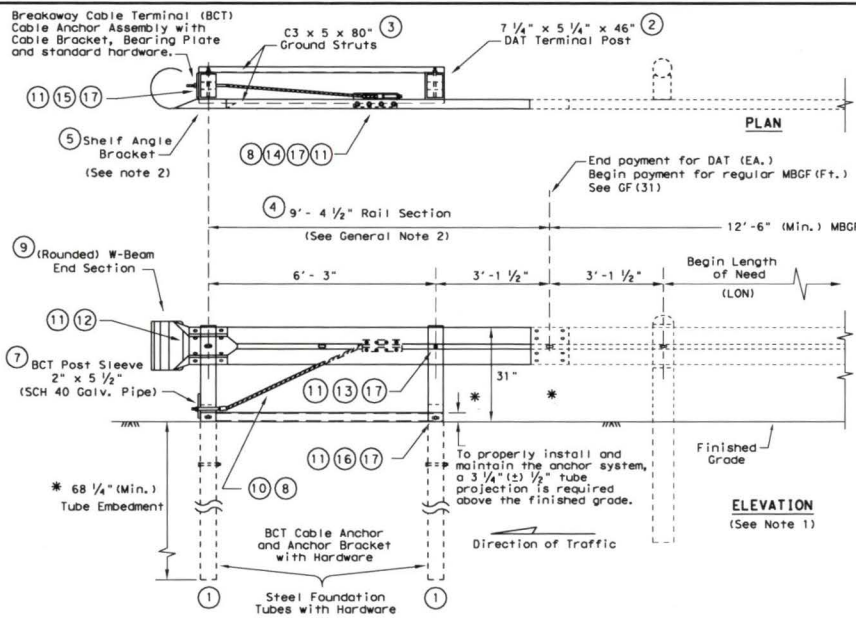
2019-04-18

Drawn by GES Scale 1:10

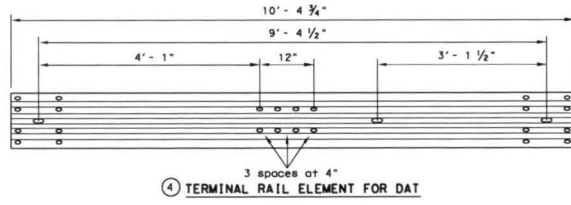
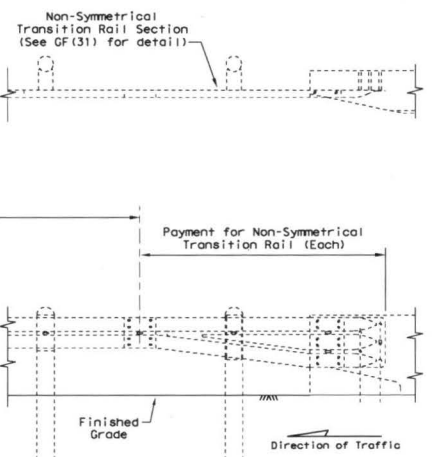
Sheet 2 of 2 Post Details

DISCLAIMER: This standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damage resulting from its use.

DATE: FILE:



DOWNSTREAM ANCHOR TERMINAL (DAT)
 Only for downstream use, when located outside the horizontal clearance area of opposing traffic.



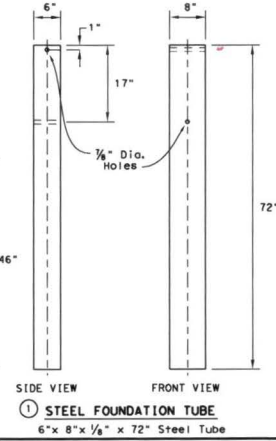
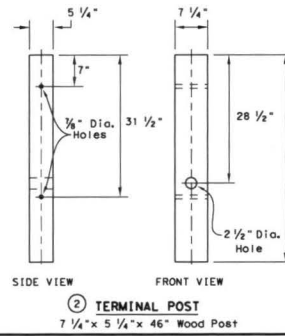
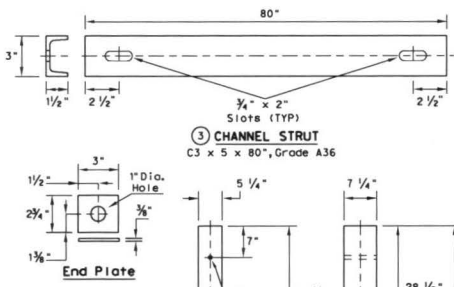
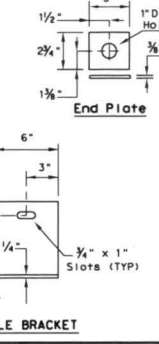
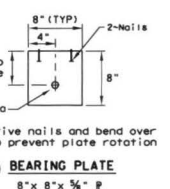
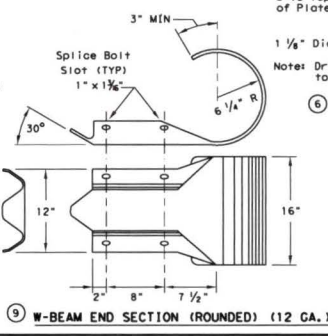
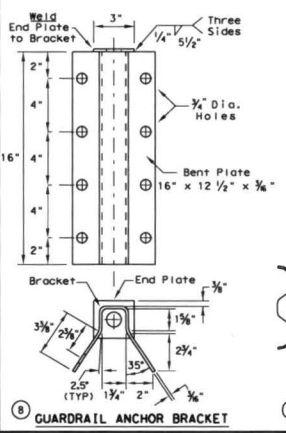
GENERAL NOTES

1. The detail shown is the minimum length of Need (LON) for a DAT connected to a concrete rail.
2. The rail section at the end post is supported by the Shelf Angle Bracket. The rail element is not attached to the end post.
3. The foundation tubes shall not project more than 3 3/4\"/>

MOW STRIP INSTALLATION

If a mow strip is required with the DAT installation the leave-out area around the steel foundation tubes and the two channel struts may be omitted. This will require a full pour at the foundation tubes.

#	(DAT) PARTS LIST	QTY
1	Steel Foundation Tube	2
2	DAT Terminal Post	2
3	Channel Strut	2
4	Terminal Rail Element	1
5	Shelf Angle Bracket	1
6	BCT Bearing Plate	1
7	BCT Post Sleeve	1
8	Guardrail Anchor Bracket	1
9	(Rounded) W-Beam End Section	1
10	BCT Cable Anchor	1
11	Recessed Nut, Guardrail	20
12	1/4\"/>	



Design Division Standard

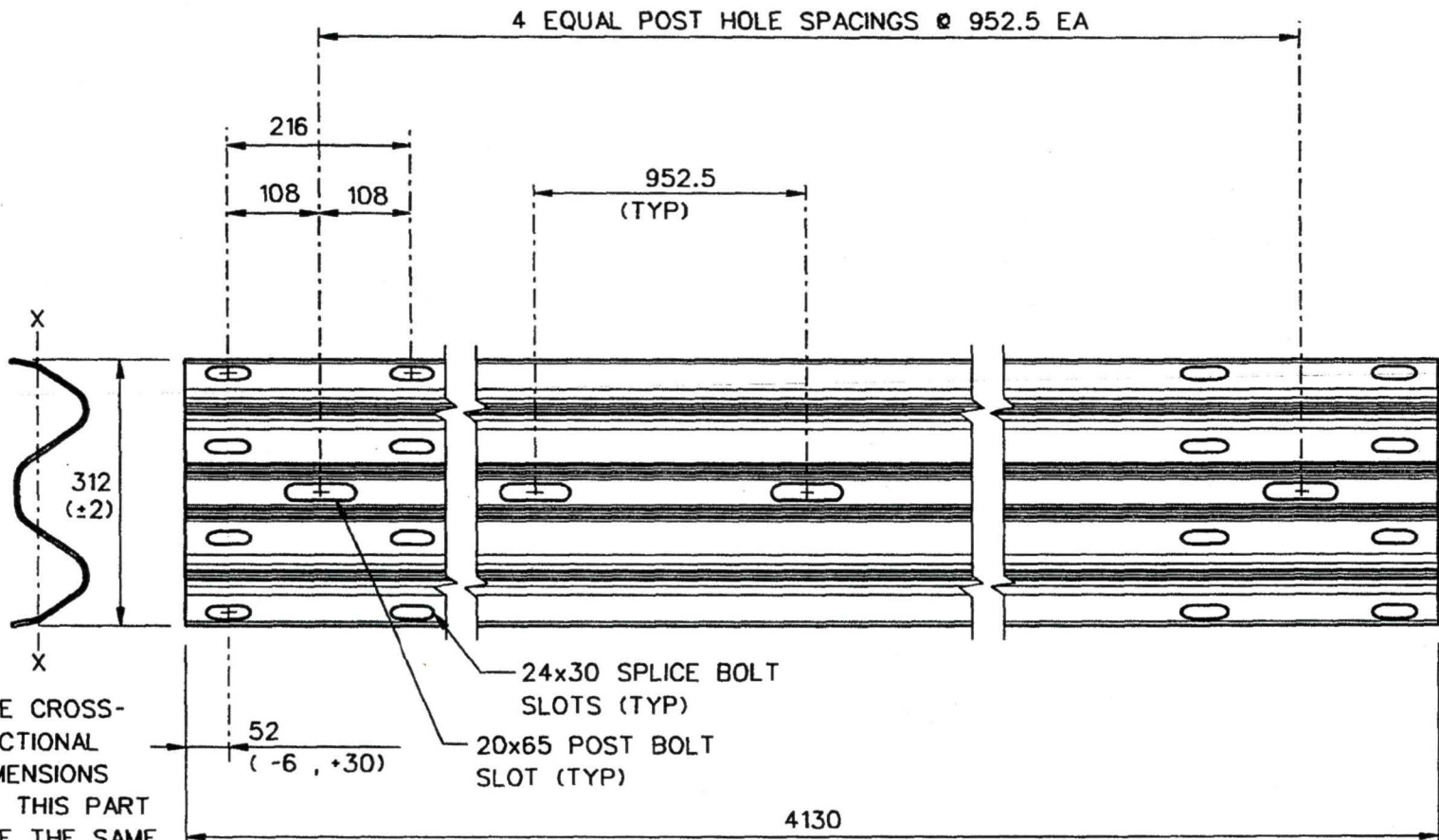
METAL BEAM GUARD FENCE
(Downstream Anchor Terminal)
GF(31)DAT-14

FILE: gf31dt14.dgn	REV: TX001	CHK: AM	DWG: VP	CHK: CGL
CONT: 1	SECT: 1	JOB: 1	HIGHWAY: 1	
REVISIONS				
DIST: 1	COUNTY: 1			SHEET NO. 1

1994

DESIGNATOR	BASE METAL THICKNESS
RWM04a	2.67
RWM04b	3.43

4-SPACE W-BEAM GUARDRAIL



THE CROSS-SECTIONAL DIMENSIONS OF THIS PART ARE THE SAME AS PART RWM02a (SHT 3 of 4).



RWM04a-b

SHEET NO. REF. NO.

1 of 2

RE-3-73

SPECIFICATIONS

Corrugated sheet steel beams shall conform to the current requirements of AASHTO M180. The section shall be manufactured from sheets with a nominal width of 483 mm. Guardrail RWM04a shall conform to AASHTO M180 Class A and RWM04b shall conform to Class B. Corrosion protection may be either Type II (zinc-coated) or Type IV (corrosion resistant steel). Corrosion resistant steel should conform to ASTM A606 for Type IV material and shall not be zinc-coated, painted or otherwise treated. Inertial properties are calculated for the whole cross-section without a reduction for the splice bolt holes.

Designator	Area (10 ³ mm ²)	I _x (10 ⁶ mm ⁴)	I _y (10 ⁶ mm ⁴)	S _x (10 ³ mm ³)	S _y (10 ³ mm ³)
RWM04a-b	1.3	1.0	--	23	--

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This corrugated sheet steel beam is used as a rail element in transition systems STB02 and STB03 or when a reduced post spacing is desired in the SGR02, SGR04a-b, SGM02, and SGM04a-b.

4-SPACE W-BEAM GUARDRAIL

RWM04a-b

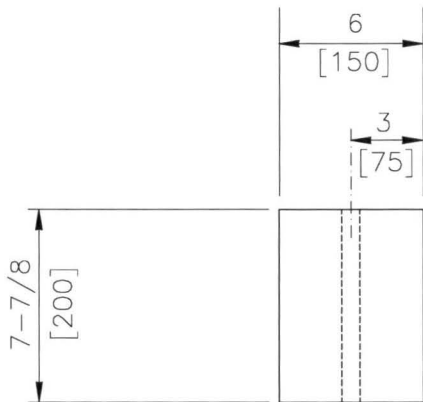
SHEET NO.

DATE

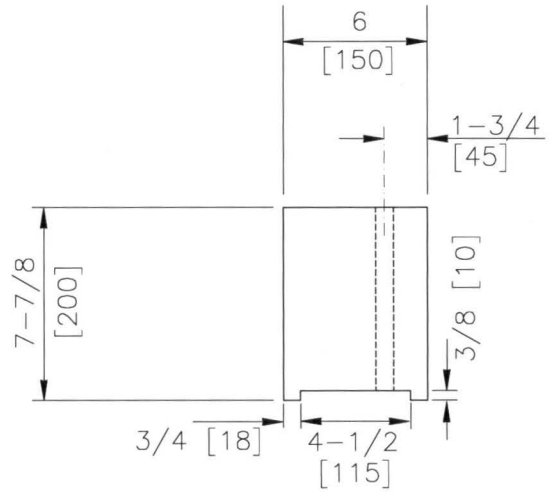
2 of 2

04-01-95

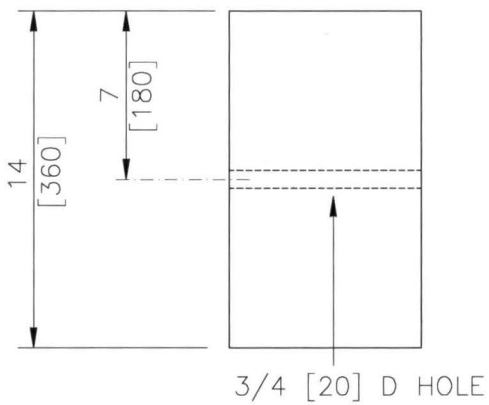




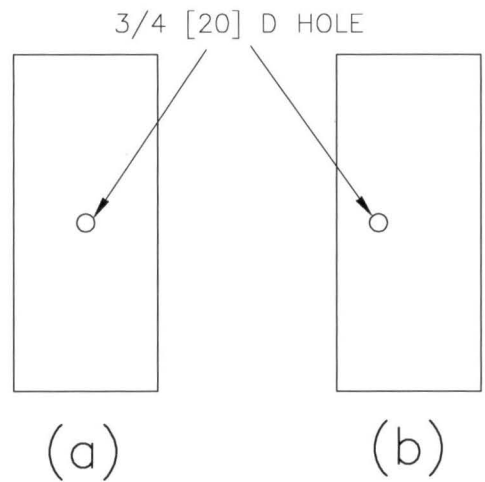
PLAN (a)



PLAN (b)



SIDE



FRONT

1994

W-BEAM TIMBER BLOCKOUT

PDB01a-b

SHEET NO.

DATE:

1 of 2

6/30/2005

SPECIFICATIONS

Blockouts shall be made of timber with a stress grade of at least 1160 psi [8 MPa]. Grading shall be in accordance with the rules of the West Coast Lumber Inspection Bureau, Southern Pine Inspection Bureau, or other appropriate timber association. Timber for blockouts shall be either rough-sawn (unplaned) or S4S (surfaced four sides) with nominal dimensions indicated. The variation in size of blockouts in the direction parallel to the axis of the bolt holes shall not be more than $\pm \frac{1}{4}$ inch [6 mm]. Only one type of surface finish shall be used for posts and blockouts in any one continuous length of guardrail.

All timber shall receive a preservation treatment in accordance with AASHTO M 133 after all end cuts are made and holes are drilled.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

Blockout PDB01a is used with wood post PDE01 or PDE02 in the SGR04b strong-post W-beam guardrail and the SGM04b median barrier. Blockout PDB01b is routed to be used with steel post PWE01 or PWE02 in the SGR04c guardrail and the SGM04a median barrier.

W-BEAM TIMBER BLOCKOUT

PDB01a-b

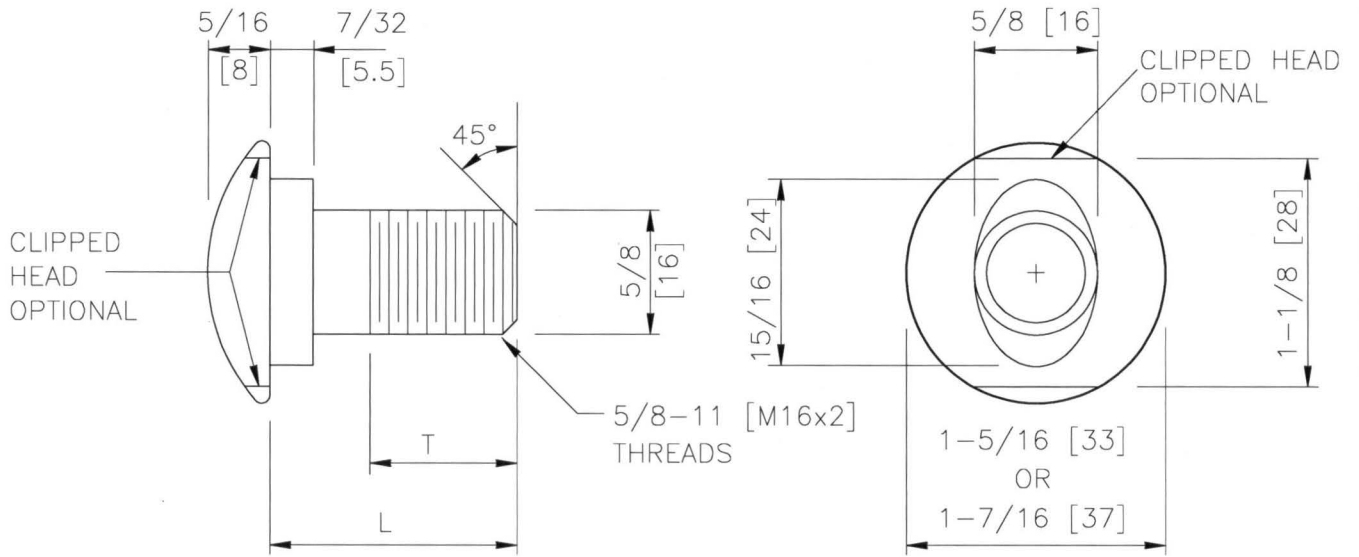
SHEET NO.

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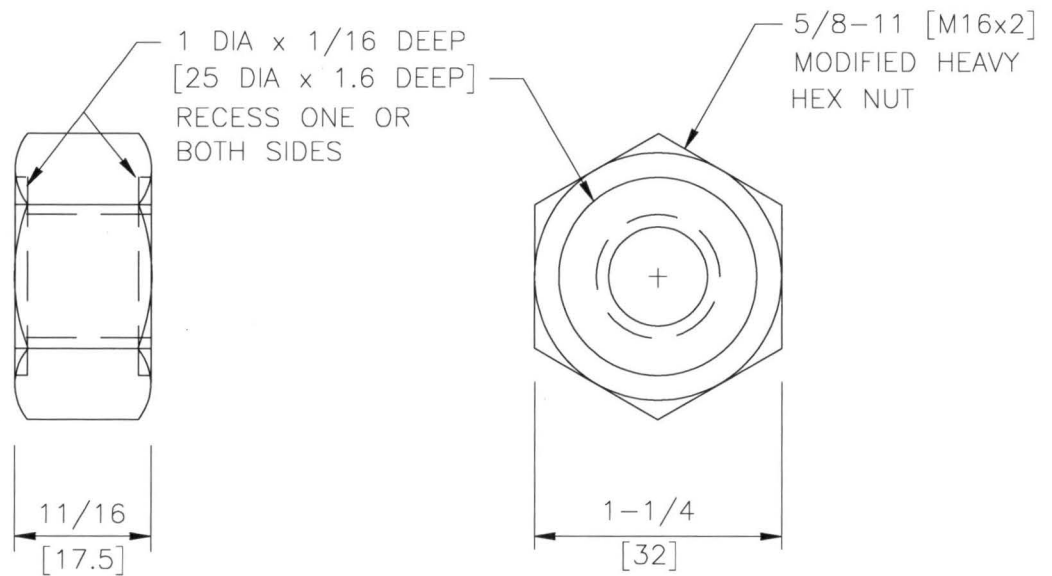
2 of 2

7/06/2005

- NOTES:** 1. ALL FILLETS SHALL HAVE A MINIMUM RADIUS OF 1/16 [2].
 2. IF THE BOLT EXTENDS MORE THAN 1/4 [6] FROM THE NUT THE BOLT SHOULD BE TRIMMED BACK.



DESIGNATOR	L	T (MIN)
FBB01	1-1/4 [32]	1-1/8 [28]
FBB02	2 [51]	1-3/4 [44]
FBB03	10 [254]	4 [102]
FBB04	18 [457]	4 [102]
FBB05	25 [635]	4 [102]



GUARDRAIL BOLT AND RECESSED NUT



FBB01-05

SHEET NO.	DATE:
1 of 2	5/2/2018

SPECIFICATIONS

The geometry and material specifications for this oval shoulder button-headed bolt and hex nut are found in AASHTO M 180. The bolt shall have 5/8-11 [M16x2] threads as defined in ANSI B1.1 [ANSI B1.13M] for Class 2A [6g] tolerances. Bolt material shall conform to ASTM A307 Grade A [ASTM F 568M Class 4.6], with a tensile strength of 60 ksi [400 MPa] and yield strength of 36 ksi [240 MPa]. Material for corrosion-resistant bolts shall conform to ASTM A325 Type 3 [ASTM F 568M Class 8.8.3], with tensile strength of 120 ksi [830 MPa] and yield strength of 92 ksi [660 MPa]. This bolt material has corrosion resistance comparable to ASTM A588 steels. Metric zinc-coated bolt heads shall be marked as specified in ASTM F 568 Section 9 with the symbol "4.6."

Nuts shall have ANSI B1.1 Class 2B [ANSI B1.13M Class 6h] 5/8-11 [M16x2] threads. The geometry of the nuts, with the exception of the recess shown in the drawing, shall conform to ANSI B18.2.2 [ANSI B18.2.4.1M Style 1] for zinc-coated hex nuts (shown in drawing) and ANSI B18.2.2 [ANSI B18.2.4.6M] for heavy hex corrosion-resistant nuts (not shown in drawing). Material for zinc-coated nuts shall conform to the requirements of AASHTO M 291 (ASTM A 563) Grade A [AASHTO M 291M (ASTM A 563M) Class 5], and material for corrosion-resistant nuts shall conform to the requirements of AASHTO M 291 (ASTM A 563) Grade C3 [AASHTO M 291M (ASTM A 563M) Class 8S3].

When zinc-coated bolts and nuts are required, the coating shall conform to either AASHTO M 232 (ASTM A 153/A 153M) for Class C or AASHTO M 298 (ASTM B 695) for Class 50. Zinc-coated nuts shall be tapped over-size as specified in AASHTO M 291 (ASTM A 563) [AASHTO M 291M (ASTM A 563M)], except that a diametrical allowance of 0.020 inch [0.510 mm] shall be used instead of 0.016 inches [0.420 mm].

Designator	Stress Area of Threaded Bolt Shank (in ² [mm ²])	Min. Bolt Tensile Strength (kips [kN])
FBB01-05	0.226 [157.0]	13.6 [62.8]

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

These bolts and nuts are used in numerous guardrail and median barrier designs.

GUARDRAIL BOLT AND RECESSED NUT

FBB01-05



SHEET NO.

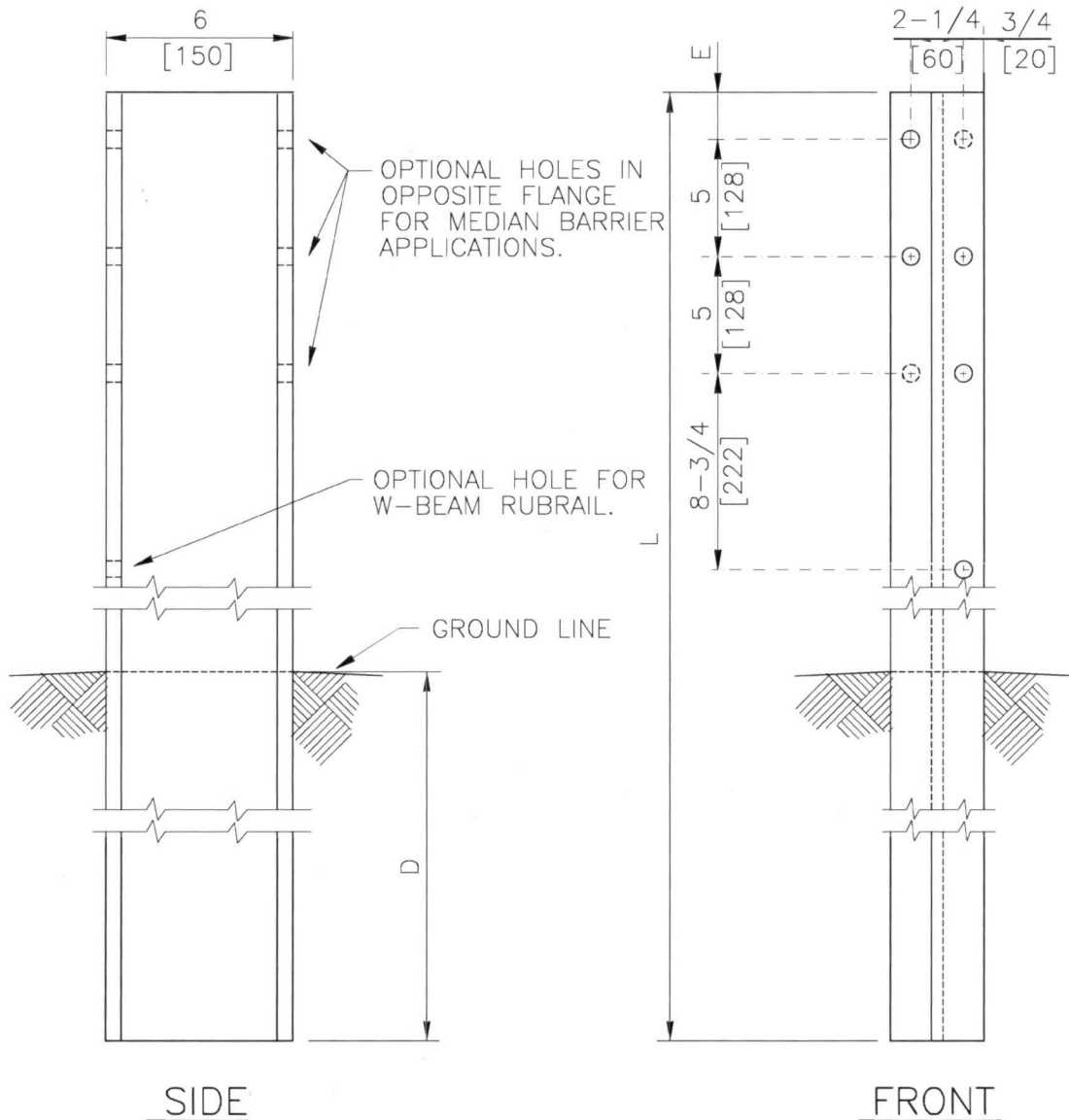
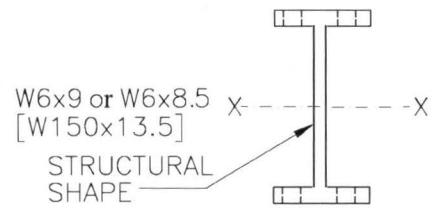
DATE

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5/2/2018

DESIGNATOR	L	D	E
PWE01	72 [1830]	43-1/4 [1100]	2 [52]
PWE02	78 [1980]	49-1/4 [1250]	2 [52]
PWE03	78 [1980]	45-3/8 [1153]	5-7/8 [149]
PWE04	81 [2060]	46-1/8 [1173]	5-7/8 [149]

NOTE: ALL HOLES ARE 3/4 [20] D.



1994

WIDE-FLANGE GUARDRAIL POST

PWE01-04

SHEET NO.

DATE:

1 of 2

7/27/2005

SPECIFICATIONS

W-beam and thrie-beam guardrail posts shall be manufactured using AASHTO M 270 / M 270M (ASTM A 709 / A 709M) Grade 36 [250] steel unless corrosion-resistant steel is required, in which case the post shall be manufactured from AASHTO M 270 / M 270M (ASTM A 709 / A 709M) Grade 50W [345W] steel. The dimensions of the cross-section shall conform to a W6x9 [W150x13.5] section as defined in AASHTO M 160 / M 160M (ASTM A 6 / A 6M). [W150x12.6] wide flange posts are an acceptable alternative that is considered equivalent to the [W150x13.5].

After the section is cut and all holes are drilled or punched, the component should be zinc-coated according to AASHTO M 111 (ASTM A 123) unless corrosion-resistant steel is used. When corrosion-resistant steel is used, the portion of the post to be embedded in soil shall be zinc-coated according to AASHTO M 111 (ASTM A 123) and the portion above the soil shall not be zinc-coated, painted or otherwise treated.

Designator	Area in ² [10 ³ mm ²]	I _x in ⁴ [10 ⁶ mm ⁴]	I _y in ⁴ [10 ⁶ mm ⁴]	S _x in ³ [10 ³ mm ³]	S _y in ³ [10 ³ mm ³]
PWE01-04	2.63 [1.7]	16.43 [6.84]	2.19 [0.91]	5.57 [91.2]	1.11 [18.2]

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

Posts PWE01 and PWE02 are used with the SGR04a and SGR04c guardrails and the SGM04a median barrier. Blockouts like PWB01 (steel) or PDB01 (wood) are attached to each post.

Post PWE03 is used with the SGR09a guardrail and the SGM09a median barrier. Wood or plastic blockouts like the PWB02 are attached to each post with FBB03 bolts and FWC16a washers under the nuts.

Post PWE04 is used with the SGR09b guardrail and the SGM09b median barrier. A modified steel blockout PWB03 is attached to each post with at least two 1.5-inch [40 mm] long FBX16a bolts and nuts.

WIDE-FLANGE GUARDRAIL POST

PWE01-04

SHEET NO.

DATE

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7/06/2005