U.S. Department of Transportation
Federal Highway Administration

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

May 20, 2014

In Reply Refer To:
HSST/B-250

Ms. Sydney D. Chase
XavierC, LLC
1220 Pennell Drive
Glendora California 91740

Dear Ms. Chase:

This letter is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of system:	Non Blocked BMS2-TL3 Single Steel Guardrail
Type of system:	31-inch Tall High Strength W-beam Guardrail on C posts.
Test Level:	MASH Test Level 3
Testing conducted by:	CIDAUT of Spain
Task Force 13 Designator:	SGR51
Date of request:	March 8, 2014
Date of completed package:	April 13, 2014

Decision:
The following device is eligible, with details provided in the form which is attached as an integral part of this letter. This letter applies to the Length of Need of the BMS2-TL3 guardrail. Complete barrier systems need crashworthy terminals to anchor the barrier, and transitions to rigid barriers or bridge rails. The sloped anchors used in the crash tests and shown in the attached drawings adequately anchored the barrier length of need but were not of a crashworthy design.

- Non Blocked BMS2-TL3 Single Steel Guardrail, 31 inch height, W-beam of Grade 70 steel per ASTM A 607, mounted on “C” posts.

Based on a review of crash test results submitted by the manufacturer certifying the device described herein meets the crash test and evaluation criteria of the American Association of State Highway and Transportation Officials’ Manual for Assessing Safety Hardware (MASH), the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.

Requirements
To be found eligible for Federal-aid funding, roadside safety devices should meet the crash test and evaluation criteria contained in the American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (MASH).

Description
The device and supporting documentation are described in the attached form.

Summary and Standard Provisions
Therefore, the system described and detailed in the attached form is eligible for reimbursement and may be installed under the range of conditions tested.

Please note the following standard provisions that apply to FHWA eligibility letters:

- This letter provides a AASHTO/ARTBA/AGC Task Force 13 designator that should be used for the purpose of the creation of a new and/or the update of existing Task Force 13 drawing for posting on the on-line 'Guide to Standardized Highway Barrier Hardware' currently referenced in AASHTO Roadside Design Guide.
- This finding of eligibility does not cover other structural features of the systems, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may influence system conformance with MASH will require a new reimbursement eligibility letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals safety problems, or that the system is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- You are expected to supply potential users with sufficient information on design and installation 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 the MASH.
- To prevent misunderstanding by others, this letter of eligibility is designated as number B-250 and 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 at our office 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. The FHWA does not become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.
- Steel used in guardrail is a material subject to the Buy America requirements. These requirements, including waiver provisions, are found in Title 23 of the Code of Federal Regulations, Section 635.410. Please note that all manufacturing processes of

steel and iron materials, including the application of coatings for these materials, must occur in the United States.

- The XavierC, LLC, W-beam guardrail system is a patented product and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects: (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.

Sincerely yours,

Michael S. Griffith

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:	3-8-2014	◉ New ○ Resubmission
	Name:	Sydney D. Chase	Signature:
	Company:	XavierC, LLC	
	Address:	1220 Pennell Drive Glendora, CA	
	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.

Help

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'B': Barriers (Roadside, Median, Bridge Railings)	◉ Physical Crash Testing ○ FEA & V&V Analysis	BMS2-TL3 Single Steel 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.

Identification of the individual or organization responsible for the product:

Contact Name:	Sydney D. Chase	Same as Submitter ☒
Company Name:	XavierC, LLC	Same as Submitter ☒
Address:	1220 Pennell Drive Glendora, CA	Same as Submitter ☒
Country:	USA	Same as Submitter ☒

PRODUCT DESCRIPTION

◉ New Hardware	○ Modification to Existing Hardware	

The non-blocked BMS2-TL3 Single Steel Guardrail (BMS2-TL3-161213-I-004) consists of W-beam sections made from hot rolled steel sheet with the following characteristics: Class 2 Grade 70 to base steel per ASTM A 607; Class A to base metal, nominal thickness according to standard AASHTO M 180. W-beam is installed at a nominal height of 31" at the top of the embedded post. The posts are are made from hot rolled steel sheets with characteristics per ASTM A 36; Class A base metal nominal thickness per AASHTO M 180. The W-Beam end shoe is made from hot rolled steel sheet per Class 33 to base steel, per ASTM A 570. Guardrail is hot dip galvanized per ASTM A 123 (AASHTO M 111) in addition must comply with Type I of Standard Specification AASHTO M 180.

The rail is mounted on C125 posts that are 67" long, and set at 6'3" centers. The posts are embedded 36" into the ground. The splice of the W-Beams are bolted to the face of every other post at 12' 6". The bolts to join splice are M16X30 round head bolts; the bolts used to join W-beam to posts are M16X40 all made of steel per ASTM A 307 Grade A. The hex nuts, M16 per ASTM A 563 for Class 5. The W-Beam splices shall use round steel washers according to ISO 7091 minimum hardness of 100 Hv. A rectangular plate washer (located under the neck and over the W-beam and squared washer, located just under the nut inside the post) are both made of hot rolled steel sheet of Grade 33 per ASTM A 570. Bolts fastening W-Beam to the post shall be tightened with a torque between 30 N.m. and 50 N.m. All remaining joints shall be tightened with a torque from 60 N.m. to 80 N.m., except W-beam joints, which are joined with a torque from between 130 N.m. to 150 N.m.

Required Test Number	Narrative Description	Evaluation Results
3-10 (1100C)	The results of Test No. E14-0001 (MASH 3-10) conducted January 8, 2014 are found in Report No.0109-131031/ 01_ENG. A small car (2420 lbs), with a simulated occupant in the left front seat, impacted the non-blocked BMS2-TL3 Single Steel Guardrail, installed at a height of 31", at a speed of 62.5 MPH at an angle of 25.5 degrees. The impact severity was 5.4% greater than the target. At .044 s after impact the left front corner of vehicle contacted between post no. 15 and 16. Vehicle began to redirect and run parallel to system at post no. 18 at .260 s. At .564 s the vehicle lost contact with rail traveling at an exit speed of 35.1 MPH at 10 degrees coming to rest 282.9' downstream toward traffic face of the guardrail at 32.8'. Damage to vehicle was moderate. Minimal occupant deformations occurred to the left side floor pan. A maximum transversal deflection of 1.60". Damage to the barrier was moderate and consisted of deformed and disengaged posts, contact marks on post and guardrail, and deformed W-beam rail. Maximum dynamic deflection of rail was 3.17' and maximum permanent deformation was 2.42'; working width 3.93'. All occupant risk measures were well below recommended values, and the test vehicle showed no tendency to roll over. The system comfortably met the criterion of MASH 3-10.	PASS
3-11 (2270P)	The results of Test No. E13-3032 (MASH 3-11) conducted December 30, 2013 are found in Report No.0109-131031/01_ENG. A pickup truck (5,000 lbs), with a simulated occupant in the left front seat and installed at a height of 31", traveling at an impact speed of 62.6 MPH impacted the non-blocked BMS2-TL3 Single Steel Guardrail 15.5' at an impact angle of 25.4 degrees. The left side of the front bumper impacted between post 14 and 15. At 0.040 s after impact, the left front tire contacted post no. 15, the vehicle began to redirect. The left front wheel of the vehicle contacted post no. 16 at 0.124 s. The left front corner of the bumper of the vehicle contacted post no. 17 at 0.166 s, and it contacted post no. 18 at 0.242 s. The vehicle began traveling parallel with the BMS2-TL3 Single Steel Guardrail at 0.270 s. At 0.370 s after impact, the left front tire contacted the post no. 19; it contacted the post no. 20 at 0.485 s. At 0.614 s, the vehicle lost contact with the rail while traveling at an exit speed and angle of 39.9 MPH and 4.3 degrees. The vehicle came to rest 128.0' downstream of impact and 0.0' toward the traffic face of the rail. Damage to vehicle was moderate. Minimal occupant deformations occurred to the left side floor pan A maximum transversal deflection of .55". Damage to the barrier was moderate and consisted of deformed and disengaged posts, contact marks on post and guardrail, and deformed W-beam rail. Maximum dynamic deflection of rail was 4.06' and maximum permanent deformation was 2.80'; working width 4.75'. All occupant risk measures were well below recommended values, and the test vehicle showed no tendency to roll over. The system comfortably met the criterion of MASH 3-11.	PASS
3-20 (1100C)		WAIVER REQUESTED

CRASH TESTING

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-21 (2270P)		WAIVER REQUESTED

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:	CIDAUT	
Laboratory Contact:	Oscar Blanco Salgado & Jose Alberto De Prado Rodriguez	Same as Submitter ☐
Address:	Parque Technologico de Boecillo P-209 47151 Boecillo. Valladolid	Same as Submitter ☐
Country:	SPAIN	Same as Submitter ☐
Accreditation Certificate Number and Date:	ISO 17025 ENAC Accreditiation No 412/LE858	

ATTACHMENTS

Attach to this form:

1) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
2) 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 key to understanding the performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		AASHTO TF13	
Number	Date	Designator	Key Words

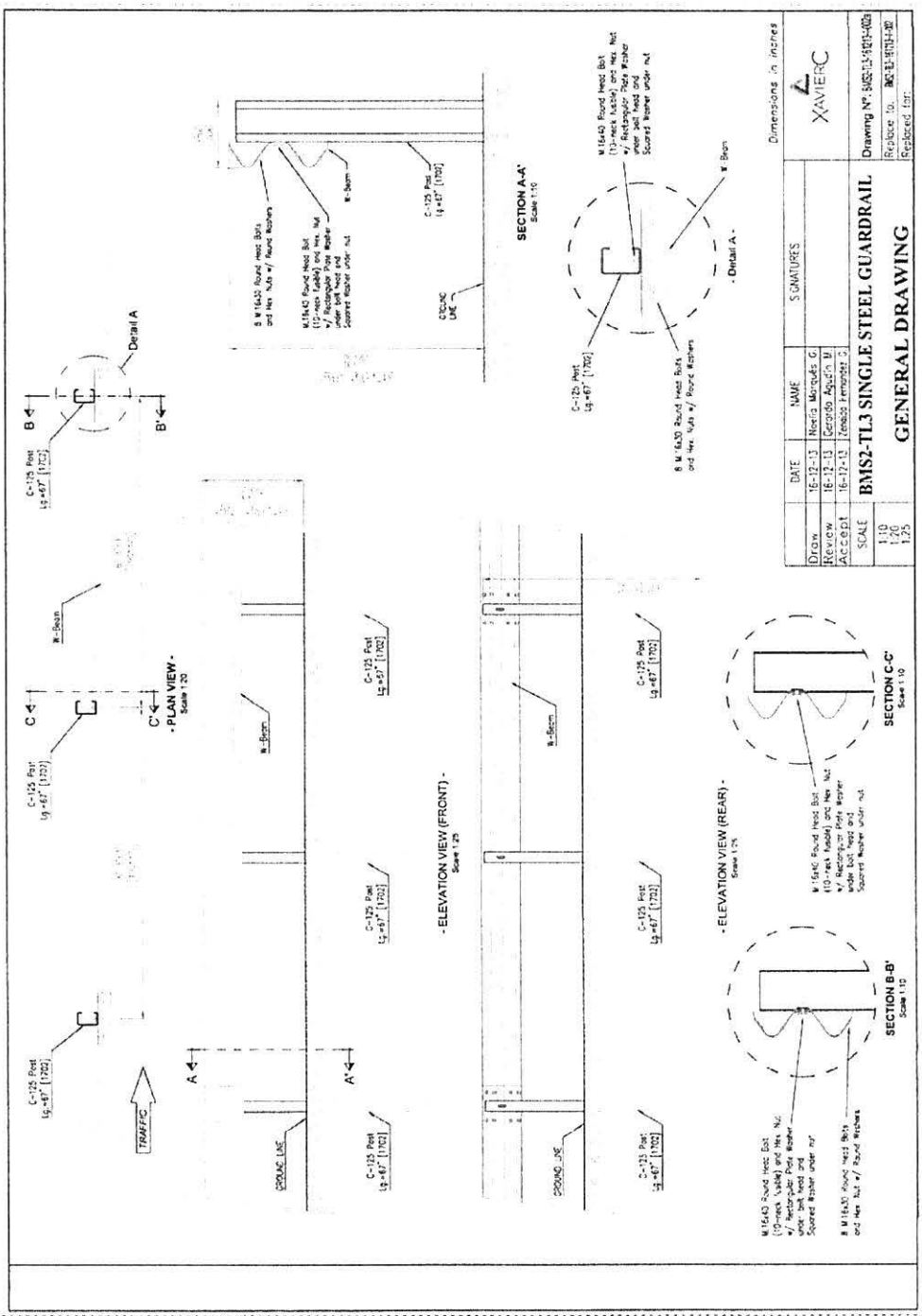


Figure 2.3 Details of the BMS2-TL3 SINGLE STEEL GUARDRAIL

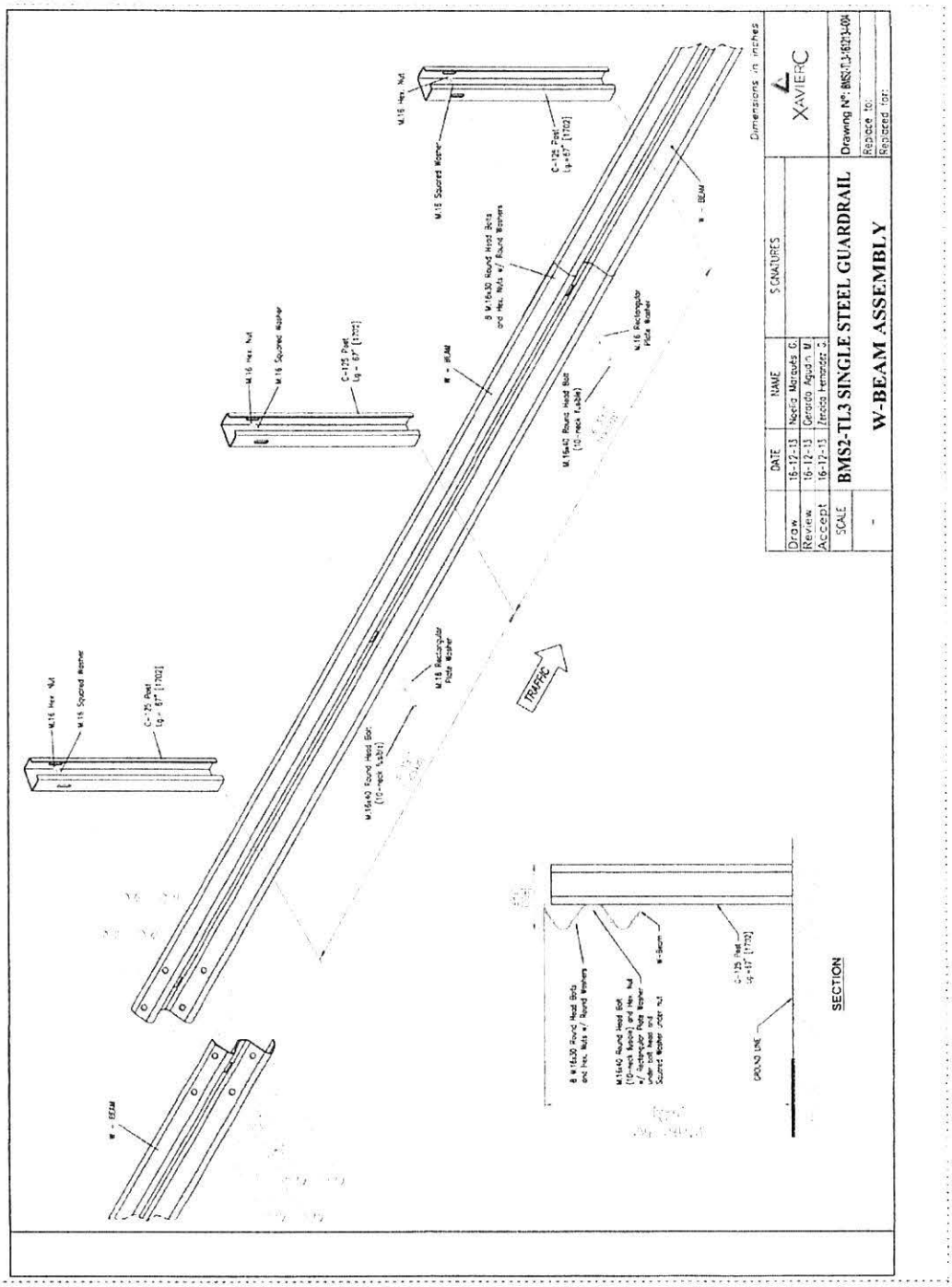


Figure 2.2 Details of the BMS2-TL3 SINGLE STEEL GUARDRAIL

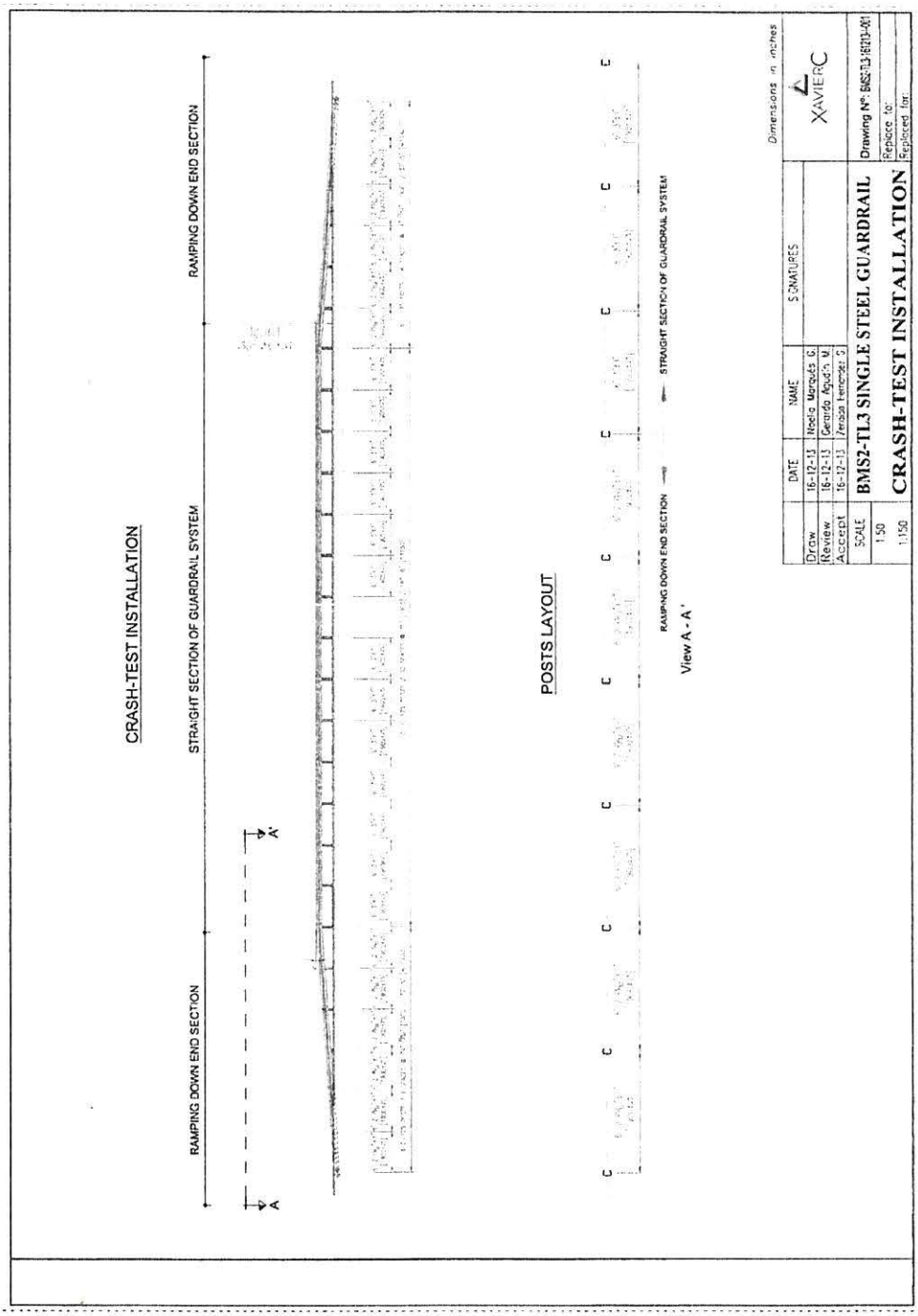
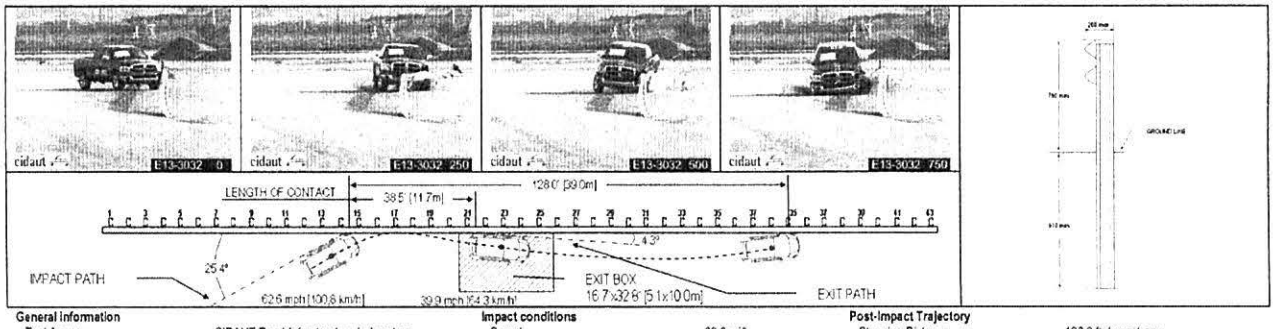


Figure 2.1 Details of the BMS2-TL3 SINGLE STEEL GUARDRAIL

Test Report	0109-131031 / 01_ENG	Date: mm/dd/yyyy	02 / 26 / 2014	Test Level	TL-3 / *MASH*:2009



General Information

Test Agency	CIDAUT Road Infrastructure Laboratory
Test Standard Test No.	*MASH* Test 3-11
Test No.	E13-3032
Test Date (mm-dd-yyy)	12-30-2013

Test Article

Type	Longitudinal barrier
Name	BMS2-TL3 SINGLE STEEL GUARDRAIL
Installation Length	188 ft (without terminals)
Material or Key Elements	W-beam S500MC, 2.67mm thickness C-125 steel post S235JR, 4.5 mm thickness W-beam – post frangible bolt joint

Soil

Soil type and condition	Standard soil, dry
Type of soil	Grading B – AASHTO M 147-65 (2004)
Description of Placement	6-inch lifts tamped with compactor

Test Vehicle

Type/Designation	2270P
Make and Model	2008 Dodge Ram 1500
Curb	5011 lb
Test Inertial	5002 lb
Dummy	No dummy
Gross Static	5002 lb

Impact conditions

Speed	62.6 mi/h
Angle	25.4 degrees
Location/Orientation	15.5 ft upstream of post 17

Exit Conditions

Speed	39.9 mi/h
Angle	4.3 degrees
Exit Box criterion	PASS

Occupant Risk Values

Impact Velocity	
Longitudinal	15.7 ft/s
Lateral	-15.7 ft/s
Ridedown Accelerations	
Longitudinal	-5.4 G
Lateral	7.6 G
THIV	22.1 km/h
PHD	7.8 G
ASI	0.68
Max. 0.050-s Average	
Longitudinal	-4.3 G
Lateral	6.0 G
Vertical	-2.2 G

Post-Impact Trajectory

Stopping Distance	128.0 ft downstream 0.0 ft twd traffic face

Vehicle Stability

Maximum Yaw Angle	35 degrees
Maximum Pitch Angle	-11 degrees
Maximum Roll Angle	-16 degrees
Vehicle Snagging	No
Vehicle Pocketing	No

Test Article Deflections

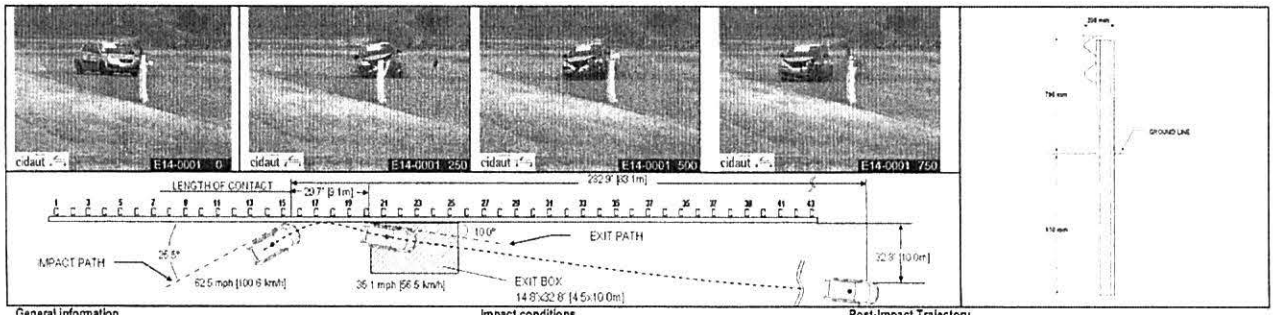
Dynamic	4.06 ft
Permanent	2.60 ft
Working Width	4.75 ft

Vehicle damage

VDS	11FL2
CDC	11FLEW1
Max. Exterior Deformation	11.93 inches
OCDI	LF0000000
Max. Occupant Compartment Deformation	0.55 inches

Figure 5.9 Summary of Result for *MASH* Test 3-11 on BMS2-TL3 SINGLE STEEL GUARDRAIL

Test Report	0109-131031 / 01_ENG	Date: (mm/dd/yyyy)	02 / 26 / 2014	Test Level	TL-3 / *MASH*:2009



General Information

Test Agency	CIDAUT Road Infrastructure Laboratory
Test Standard Test No.	*MASH* Test 3-10
Test No.	E14-0001
Test Date (mm-dd-yyy)	01-08-2014

Test Article

Type	Longitudinal barrier
Name	BMS2-TL3 SINGLE STEEL GUARDRAIL
Installation Length	188 ft (without terminals)
Material or Key Elements	W-beam S500MC, 2.67mm thickness C-125 steel post S235JR, 4.5 mm thickness W-beam – post frangible bolt joint

Soil

Soil type and condition	Standard soil, dry
Type of soil	Grading B – AASHTO M 147-65 (2004)
Description of Placement	6-inch lifts tamped with compactor

Test Vehicle

Type/Designation	1100C
Make and Model	2008 Kia Rio Sedan
Curb	2376 lb
Test Inertial	2434 lb
Dummy	172 lb
Gross Static	2606 lb

Impact conditions

Speed	62.5 mi/h
Angle	25.5 degrees
Location/Orientation	10.3 ft upstream of post 17

Exit Conditions

Speed	35.1 mi/h
Angle	10.0 degrees
Exit Box criterion	PASS

Occupant Risk Values

Impact Velocity	
Longitudinal	22.0 ft/s
Lateral	-16.1 ft/s
Ridedown Accelerations	
Longitudinal	-6.9 G
Lateral	8.3 G
THIV	26.2 km/h
PHD	10.2 G
ASI	0.76
Max. 0.050-s Average	
Longitudinal	-6.5 G
Lateral	5.6 G
Vertical	-3.1 G

Post-Impact Trajectory

Stopping Distance	282.9 ft downstream 32.8 ft twd traffic face

Vehicle Stability

Maximum Yaw Angle	35 degrees
Maximum Pitch Angle	-2 degrees
Maximum Roll Angle	10 degrees
Vehicle Snagging	No
Vehicle Pocketing	No

Test Article Deflections

Dynamic	3.17 ft
Permanent	2.42 ft
Working Width	3.93 ft

Vehicle damage

VDS	11FL4
CDC	11LFEW2
Max. Exterior Deformation	6.97 inches
OCDI	LF0001000
Max. Occupant Compartment Deformation	1.60 inches

Figure 6.10 Summary of Result for *MASH* Test 3-10 on BMS2-TL3 SINGLE STEEL GUARDRAIL