



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

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

May 17, 2018

In Reply Refer To:
HSST-1 / B-305

Ms. Melissa Batula, Chief
Highway Delivery Division
Pennsylvania Department of Transportation
Bureau of Design
400 North Street, 7th Floor
Harrisburg, PA. 17120

Dear Melissa Batula:

This letter is in response to your April 23, 2018 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-305 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:

- G2 Weak Post W-Beam Guardrail System

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: G2 Weak Post W-Beam Guardrail System

Type of system: Longitudinal Barrier

Test Level: MASH Test Level 3 (TL3)

Testing conducted by: Texas A&M Transportation Institute

Date of request: April 25, 2018

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.

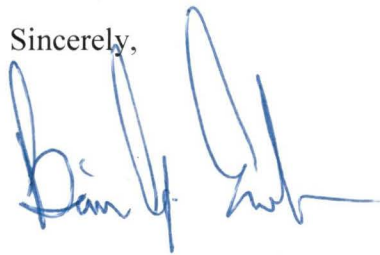
You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the test and evaluation criteria of AASHTO's MASH.

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-305 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.
- If the subject device is a patented product it may be considered to be 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,



(H)

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:	April 23, 2018	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Melissa Batula	
	Company:	Pennsylvania Department of Transportation	
	Address:	Keystone Building, 7th Floor 400 North St, Harrisburg, Pennsylvania 17106-7100	
	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

1-1-1

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	G2 Weak Post W-Beam Guardrail System	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 checked="" type="checkbox"/>
Company Name:	Pennsylvania Dept of Transportation	Same as Submitter <input checked="" type="checkbox"/>
Address:	Keystone Building, 7th Floor 400 North St, Harrisburg, Pennsylvania 17106-7100	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.

There are no shared financial interests in the G2 Weak Post W-Beam Guardrail System between the Pennsylvania Department of Transportation (PennDOT), and Texas A&M Transportation Institute (TTI), other than the costs involved in the actual crash testing and the reports thereof for this submission to FHWA. Trinity Highway Products (THP) provided the 3-10 test article materials, and THP and TTI have testing and royalty-bearing license agreements between them.

PRODUCT DESCRIPTION

- New Hardware or Significant Modification
- Modification to Existing Hardware

Construct #1 (May 2009)

For the 3-11, 2270P test, the PennDOT G2 Weak Post W-Beam Guardrail System was comprised of a 32-inch tall W-beam guardrail system utilizing PennDOT Type 2-W S3x5.7 guardrail posts, each 63 inches in length with a 1/4-inch x 8-inch x 24-inch soil plate (PLS01) on posts 7-26, and a 31 ft-3 inch long ET-Plus guardrail terminal on each end. Posts 7 to 26 were equally spaced at 12 ft-6 inches, and with terminal posts spaced at 6 ft-3 inches, resulted in a total installation length of 325 ft-00 inches. Standard 12-gauge W-beam guardrail (type RWM02a) was used in the system, and guardrail splices were located mid-span between every post except within the ET-Plus terminal lengths. Each ET-Plus end terminal was 31 inches tall, and the 32-inch tall guardrail transitioned to the 31-inch tall ET-Plus terminals over a 12 ft-6 inch long section adjacent to each terminal.

The guardrail and a RWB01a back-up plate were secured to each post with an ASTM F568, Class 4.6, 5/16-inch diameter x 2 3/8-inch long hex bolt, two 1 3/4-inch x 1/8-inch thick square plate washers on the traffic face of the rail, a 5/16-inch flat washer, and two ASTM A563M hex nuts. The first nut was hand tightened plus one turn, and then secured with the second nut. The bottom edge of the W-beam guardrail was supported on each post by an ASTM F568, Class 4.6, 9/16-inch diameter x 1-5/8-inch long shelf hex bolt with two ASTM A563M hex nuts.

The posts were embedded 30 inches in 2-ft diameter drilled holes that were backfilled with standard soil meeting AASHTO specifications for "Materials for Aggregate and Soil Aggregate Subbase, Base, and Surface Courses), designated M147-65(2004), Grading B crushed limestone road base, compacted to 95% standard proctor density.

Construct #2 (July 2017)

For the 3-10, 1100C test, the PennDOT G2 Weak Post W-Beam Guardrail System was comprised of a 32-inch tall W-beam guardrail system utilizing PennDOT Type 2-W S3x5.7 guardrail posts, each 65 inches in length with a 1/4-inch x 8-inch x 24-inch soil plate (PLS01) on posts 3-23, and a 9 ft-4 1/2 inch long Texas Department of Transportation (TxDOT) Downstream Anchor Terminal (DAT-14) on each end. Posts 3 to 23 were equally spaced at 12 ft-6 inches, and with the terminals, resulted in a total installation length of 281 ft -3 inches. Standard 12-gauge W-beam guardrail (type RWM02a) was used in the system, and guardrail splices were located mid-span between every post. Each DAT-14 end terminal was 31 inches tall and the 32-inch tall guardrail transitioned to the 31-inch tall DAT terminals over a 25-ft long section adjacent to each terminal.

The guardrail and a RWB01a back-up plate were secured to each post with a ASTM A307 5/16-inch diameter x 2 3/8-inch long hex bolt, two 1 3/4-inch x 1/8-inch thick square plate washers on the traffic side of the rail, a 5/16-inch flat washer, and two heavy hex nuts. The first nut was hand tightened plus one turn, and then secured with the second nut. The bottom edge of the W-beam guardrail was supported on each post by a ASTM A307 1/2-inch diameter x 1 1/2-inch long shelf hex bolt and two heavy hex nuts.

The posts were embedded 32 inches in 2-ft diameter drilled holes drilled that were backfilled with standard soil meeting AASHTO specifications for "Materials for Aggregate and Soil Aggregate Subbase, Base, and Surface Courses), designated M147-65(2004), Grading B crushed limestone road base, compacted to 95% standard proctor density.

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: 2018.03.21 16:22:43 -05'00'
Address:	3135 TAMU, College Station, Texas 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	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)	<p>The results of the test conducted on July 14, 2017, and installed as described in "Construct #2" above, are found in TTI Test Report No. 608221-1.</p> <p>The G2 Weak Post W-beam guardrail system contained and redirected the 1100C vehicle. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection of the guardrail was 71.8 inches. A few of the W-beam backup plates separated from the installation, however, these did not penetrate, or show potential for penetrating, the occupant compartment, or present undue hazard for others in the area. Maximum occupant compartment deformation was 0.5 inch in the floor pan/toe pan area. No intrusion of the occupant compartment occurred. The 1100C vehicle remained upright during and after the collision period. Maximum roll and pitch angles were 12 degrees and 6 degrees, respectively. Occupant risk factors were within the preferred limits of MASH.</p>	PASS
3-11 (2270P)	<p>The results of the test conducted on May 5, 2009, and installed as described in "Construct #1" above, are found in TTI Test Report No. 476460-1-7 and NCHRP Project No 22-14(3), Appendix J.</p> <p>The Modified G2 Weak Post W-beam guardrail system contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the weak post guardrail. Maximum dynamic deflection of the rail during the test was 8.6 ft. The rail element detached from several posts, however, did not penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area. Maximum occupant compartment deformation was 0.25 inch in the lateral area across the cab at the driver's side hip area. The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were -12 degrees and -4 degrees, respectively. Occupant risk factors were within the limits specified in MASH. The 2270P vehicle remained within the exit box.</p>	PASS
3-20 (1100C)	Test 3-20 is not applicable for this type of system. (i.e. not a Transition)	Non-Relevant Test, not conducted
3-21 (2270P)	Test 3-21 is not applicable for this type of system. (i.e. not a Transition)	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:	Darrell L. Kuhn	Digitally signed by Darrell L. Kuhn Date: 2018.03.21 16:26:42 -05'00'
Address:	3135 TAMU, College Station, Texas 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	ISO 17025 Laboratory, A2LA Testing Certification No. 2821.01 Expires April 30, 2019	

Submitter Signature*:



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		Key Words
Number	Date	

INTENDED USE

Weak-post W-beam guardrails are commonly used where dynamic deflections of at least 87 inches [2200 mm] are acceptable. This system must be anchored with a suitable terminal system; crashworthy W-beam terminals can be transitioned to and used with this guardrail system. SGR-02b is a Test Level 3 barrier.

COMPONENTS

Unit length = 150 inches [3810 mm]

Designator	Component	Number
FBB01	Splice bolts and nuts	8
FBX08a	Rail-post bolt (1.5 [40]) and nut	1
FBX14a	Rail support bolt (1.5 [40]) and nut	1
FWR01	Guardrail washer	1
PSE03	Post	1
RWB01a	W-beam back-up plate	1
RWM02a	W-beam rail	1

APPROVALS

FHWA Acceptance Letter B-64A.

REFERENCES

M.H. Ray, K. Engstrand, C.A. Plaxico, and R.G. McGinnis, "Improvements to the Weak-Post W-Beam Guardrail," *Transportation Research Record 1743*, pp. 88-96, 2001.

M.E. Bronstad, J.E. Michie and J.D. Mayer, Jr., *Performance of Longitudinal Traffic Barriers*, National Cooperative Highway Research Program Report Number 289, Transportation Research Board, June, 1987.

J.D. Michie, L.R. Calcote, and M.E. Bronstad, *Guardrail Performance and Design*, National Cooperative Highway Research Program Report Number 115, Highway Research Board, 1971.

CONTACT INFORMATION

Federal Highway Administration
Office of Safety
400 Seventh Street, SW
Washington, DC 20590
202-366-2288

WEAK-POST W-BEAM GUARDRAIL

SGR02b

SHEET NO.

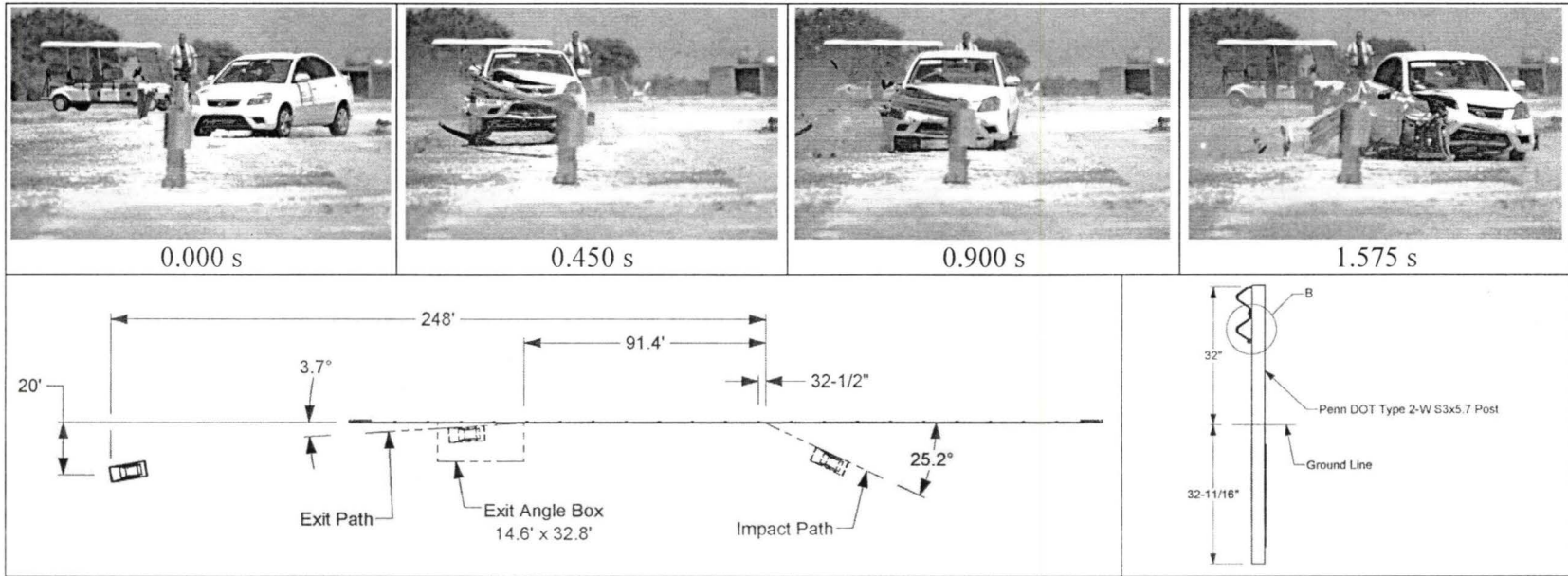
DATE

2 of 2

07/20/2005



ARIBA



General Information

Test Agency Texas A&M Transportation Institute (TTI)
 Test Standard Test No. MASH Test 3-10
 TTI Test No. 608221-1
 Test Date 2017-07-14

Test Article

Type Longitudinal Barrier - Guardrail
 Name G2 Weak Post W-Beam Guardrail
 Installation Length..... 281 ft 3 inches
 Material or Key Elements... 32-inch tall W-beam guardrail system with PennDOT Type 2-W S3x5.7 posts with soil plates, and TxDOT DAT-14 terminals

Soil Type and Condition

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

Test Vehicle

Type/Designation..... 1100C
 Make and Model 2011 Kia Rio
 Curb..... 2495 lb
 Test Inertial..... 2443 lb
 Dummy 165 lb
 Gross Static..... 2608 lb

Impact Conditions

Speed 62.0 mi/h
 Angle 25.2 degrees
 Location/Orientation 32.5 inches upstrm of Post 12

Impact Severity

..... 57 kip-ft

Exit Conditions

Speed 45.6 mi/h
 Angle 3.7 degrees

Occupant Risk Values

Longitudinal OIV 13.4 ft/s
 Lateral OIV..... 13.8 ft/s
 Longitudinal Ridedown 4.8 g
 Lateral Ridedown 5.9 g
 THIV 20.4 km/h
 PHD..... 6.0 g
 ASI..... 0.45
 Max. 0.050-s Average
 Longitudinal -3.6 g
 Lateral..... -3.6 g
 Vertical..... -2.4 g

Post-Impact Trajectory

Stopping Distance..... 248 ft downstream
 20 ft twd traffic

Vehicle Stability

Maximum Yaw Angle 36 degrees
 Maximum Pitch Angle 6 degrees
 Maximum Roll Angle 12 degrees
 Vehicle Snagging No
 Vehicle Pocketing No

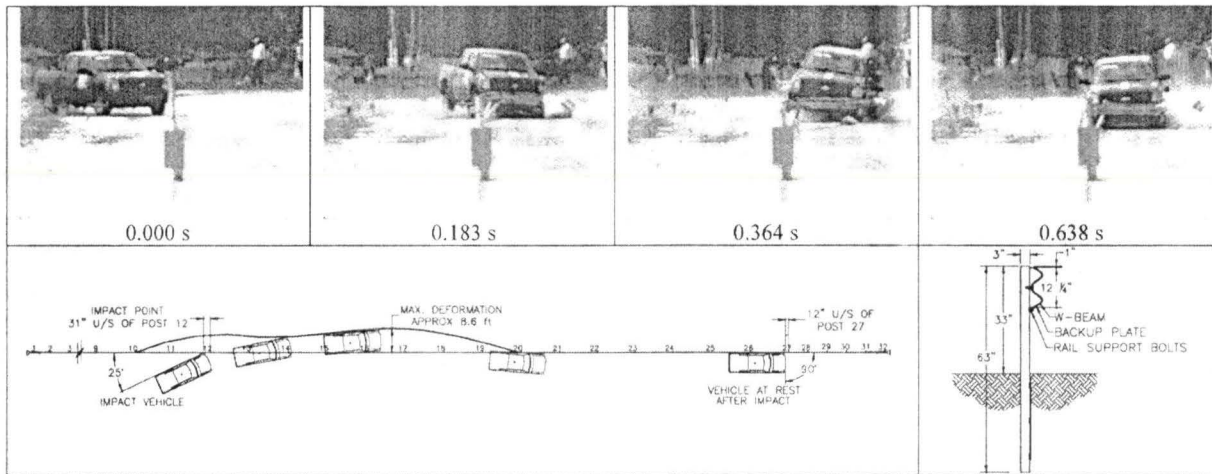
Test Article Deflections

Dynamic..... 71.8 inches
 Permanent 28.0 inches
 Working Width..... 92.0 inches
 Height of Working Width 35.6 inches

Vehicle Damage

VDS 01RFQ4
 CDC..... 01FREW4
 Max. Exterior Deformation..... 9.25 inches
 OCDI..... RF0001000
 Max. Occupant Compartment Deformation..... 0.5 inches

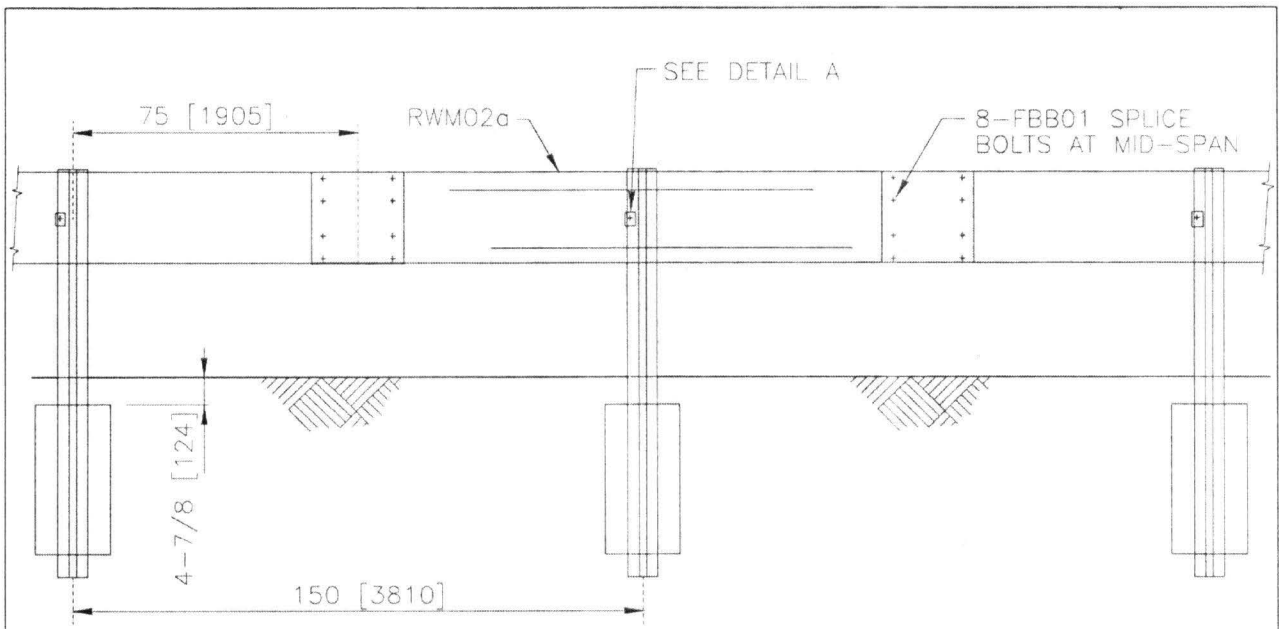
Figure 5.11. Summary of Results for MASH Test 3-10 on G2 Weak Post W-Beam Guardrail System.



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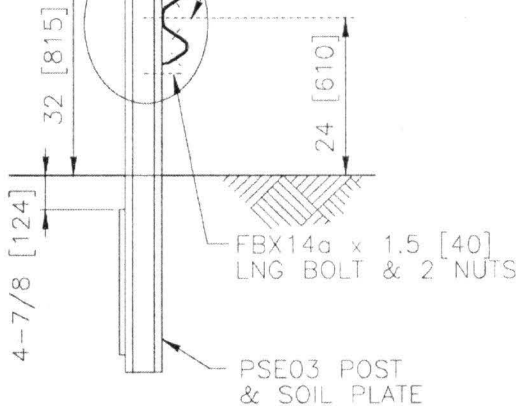
<p>General Information</p> <p>Test Agency..... Texas Transportation Institute</p> <p>Test No. RF476460-1-7</p> <p>Date 2009-05-01</p> <p>Test Article</p> <p>Type..... Longitudinal Barrier</p> <p>Name Modified G2 Weak Post W-Beam guardrail</p> <p>Installation Length 325 ft</p> <p>Material or Key Elements .. W-beam rail element on S3x5.7 posts spaced 12 ft apart</p> <p>Soil Type and Condition.... Crushed Limestone, Dry</p> <p>Test Vehicle</p> <p>Type/Designation..... 2270P</p> <p>Make and Model 2007 Chevrolet Silverado Pickup</p> <p>Mass</p> <p>Curb 4868 lb</p> <p>Test Inertial..... 5004 lb</p> <p>Gross Static..... 5004 lb</p>	<p>Impact Conditions</p> <p>Speed 62.4 mi/h</p> <p>Angle 24.6 degrees</p> <p>Exit Conditions</p> <p>Speed Stopped</p> <p>Angle 0 degrees</p> <p>Occupant Risk Values</p> <p>Impact Velocity</p> <p>Longitudinal..... 9.5 ft/s</p> <p>Lateral 10.5 ft/s</p> <p>Ridedown Accelerations</p> <p>Longitudinal..... -3.4 G</p> <p>Lateral 4.5 G</p> <p>THIV 13.9 km/h</p> <p>PHD 4.6 G</p> <p>Max. 0.050-s Average</p> <p>Longitudinal..... -2.2 G</p> <p>Lateral 3.1 G</p> <p>Vertical 1.6 G</p>	<p>Post-Impact Trajectory</p> <p>Stopping Distance 83.5 ft downstream, Adjacent traffic face</p> <p>Vehicle Stability</p> <p>Maximum Yaw Angle..... 43 degrees</p> <p>Maximum Pitch Angle..... -4 degrees</p> <p>Maximum Roll Angle..... -12 degrees</p> <p>Vehicle Snagging..... No</p> <p>Vehicle Pocketing..... No</p> <p>Test Article Deflections</p> <p>Dynamic..... 8.6 ft</p> <p>Permanent 5.8 ft</p> <p>Working Width..... 9.0 ft</p> <p>Vehicle Damage</p> <p>VDS..... 11LFQ3</p> <p>CDC..... 11FLEW3</p> <p>Max. Exterior Vehicle Crush..... 5.5 inches</p> <p>Max. Occupant Compartment Deformation..... 0.25 inches</p>
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Figure 81. Summary of Results for MASH Test 3-11 on the Modified G2 Weak Post W-Beam Guardrail.

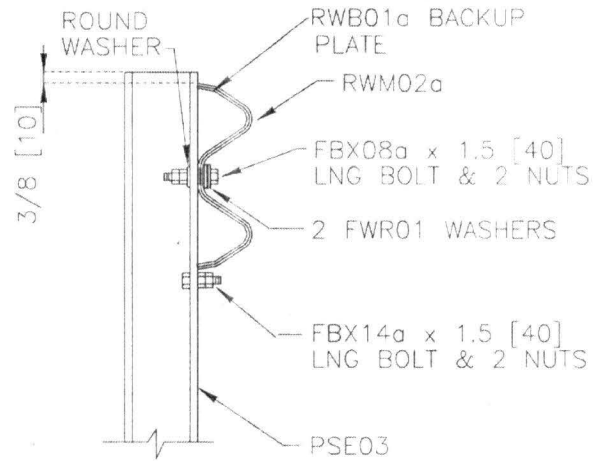


ELEVATION

SEE DETAIL A
 RWM02a w/ RWB01a BACKUP PLATE
 FBX08a x 1.5 [40] LNG BOLT & 2 NUTS w/ 2 FWR01 WASHERS & 1 ROUND WASHER



SECTION



DETAIL A: RAIL-POST ATTACHMENT

2005

WEAK-POST W-BEAM GUARDRAIL



ARIBA

SGR02b

SHEET NO.

DATE:

1 of 2

7/20/2005