



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

November 30, 2012

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

In Reply Refer To:
HSST/B-232A

Mr. Brian Smith
Trinity Highway Products, LLC
2525 North Stemmons Freeway
Dallas, Texas 75207

Dear Mr. Smith:

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: CASS S3 MASH
Type of system: Longitudinal Cable Barrier System
Test Level: MASH TL4
Testing conducted by: Texas A&M Transportation Institute
Task Force 13 Designator: SGM36b
Date of request: August 28, 2012
Date initially acknowledged: August 30, 2012
Date of completed package: August 30, 2012

Decision:

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

- CASS S3 MASH

A caveat to as-submitted form is this system is eligible when installed on the as-crash tested flat terrain under AASHTO MASH Test Level 4 criteria and excludes 1V:6H or flatter slopes as requested on the attached form under Project Development.

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

CASS S3 MASH as a Test Level 4 roadside or median barrier on flat terrain only; or, as previously tested:

- MASH Test Level 3 roadside barrier on sloped terrain up to 1V:4H
- MASH Test Level 3 median barrier on sloped terrain up to 1V:4H

A caveat is this eligibility will be subject to additional testing as per AASHTO Technical Committee on Roadside Safety, considering additional testing requirements for median barriers in a 1V:4H sloped median, based upon a 4 feet offset from slope break point.

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-232A 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.

- The CASS S3 MASH are patented products 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.
- Although the barrier performed well under ideal test impact conditions with the two test vehicles, the likelihood of passenger car underrides of any cable system may increase as the post spacing increases, particularly when the barrier is installed on non-level or slightly irregular terrain and the cables are not restrained from lifting at each post. Consequently, some transportation agencies have limited post spacing to approximately 6m (20 feet) for cable barriers. The dynamic deflection of the barrier is likely to increase when it is installed along the convex sides of horizontal curves, and when distances between anchorages exceed the 195m (640-foot) test length.

Sincerely yours,

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

Enclosures



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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.

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Sincerely yours,



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:	August 28, 2012
	Name:	Brian Smith
	Company:	Trinity Highway Products, LLC
	Address:	2525 N. Stemmons Freeway Dallas, Texas 75207
	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.

System Type	Device Name / Variant	Testing Criterion	Test Level
'B': Barriers (Roadside, Median, Bridge	CASS S3 MASH	AASHTO MASH	TL4

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 test / evaluation results meet the appropriate evaluation criteria in the MASH.

Identification of the individual or organization responsible for the product:

Contact Name:	Brian Smith
Company Name:	Trinity Highway Products, LLC
Address 1:	2525 N. Stemmons Freeway
Address 2:	
City/State/Zip:	Dallas, TX 75207
Country:	USA

PRODUCT DESCRIPTION

Modification to Existing Hardware null
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In its HSST/B-232 letter of May 4, 2012, the Federal Highway Administration (FHWA) confirmed that the CASS S3 MASH System is eligible for reimbursement under the Federal-aid highway program under AASHTO MASH Test Level 3 criteria.

Successful full-scale MASH Test Level 4 crash testing was recently conducted by the Texas Transportation Institute (TTI) on Trinity's CASS S3 MASH installed on flat terrain. Trinity Highway Products, LLC is seeking eligibility reimbursement status under the Federal-aid highway program for CASS S3 MASH on 1V:6H slopes or flatter under AASHTO MASH Test Level 4 criteria.

CASS S3 MASH is a tensioned, four-cable barrier system that was tested with standard (non-prestretched) cables. The top two cables are positioned within a wave-shaped slot in the web of S75x8 (S3x5.7#) structural I-beam posts. The bottom two cables are supported on flanges of the I-beam post by 8mm (5/16 inch) hook bolts having the open end down, with the lowest cable located on the median-side flange and the next lowest cable located on the traffic-side flange.

The proprietary S75x8 (S3x5.7#) posts were installed in steel tube sleeves set in 305mm (12 inch) diameter x 762mm (30 inch) deep concrete footings at 3.2 meters (10-foot 6-inch) spacings. The cables within the wave-shaped slot are separated by a plastic spacer. A stainless steel strap is mounted on the outside of the post above the top cable.

The 19mm (3/4 inch) diameter standard (non-prestretched) cables were set at heights of 450mm, 755mm, 960 and 1070mm (17.75, 29.75, 37.875, and 42.125 inches) above the ground surface, measured to the center of each cable. Tension of the cables was set at 18.7 to 18.9 kN (4,200 to 4,260 pounds force) for the tests.

Although testing was conducted with standard (non-prestretched) cables, Trinity also requests eligibility reimbursement under the Federal-aid highway program under AASHTO MASH Test Level 4 criteria of CASS S3 MASH with prestretched cables.

The 195m (640 foot) test installations were anchored by TTI Breakaway Cable Anchor Terminals, accepted by FHWA on August 29, 2002 (CC-76) and April 23, 2007 (B-157).

CRASH TESTING

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
4-10 (1100C)	<p>In its HSST/B-232 letter of May 4, 2012, the Federal Highway Administration (FHWA) confirmed that the CASS S3 MASH System is eligible for reimbursement under the Federal-aid highway program under AASHTO MASH Test Level 3 criteria. This was based on full-scale crash test with the 1100C in 3-10 backslope testing installed in a 9.1m (30 foot 0 inch) wide depressed median with 4H:1V side slopes on 3.2m (10 foot 6 inch) post spacing.</p> <p>Additionally, in its HSSD/B-141F letter, FHWA accepted CASS barrier systems described above as acceptable for use on the designated 1V:4H or flatter slopes under NCHRP Report 350 Test Level 3 or 4 conditions. This was based on full-scale crash test with the 820C in 3-10 foreslope testing installed in a 9.1m (30 foot 0 inch) wide depressed median with 4H:1V side slopes on 3.2m (10 foot 6 inch) post spacing.</p>	WAIVER REQUES
4-11 (2270P)	<p>In its HSST/B-232 letter of May 4, 2012, the Federal Highway Administration (FHWA) confirmed that the CASS S3 MASH System is eligible for reimbursement under the Federal-aid highway program under AASHTO MASH Test Level 3 criteria. This was based on full-scale crash test with the 2270P in 3-11 foreslope testing installed in a 9.1m (30 foot 0 inch) wide depressed median with 4H:1V side slopes on 3.2m (10 foot 6 inch) post spacing.</p>	WAIVER REQUES

Required Test Number	Narrative Description	Evaluation Results
4-12 (10000S)	<p>MASH Test 4-12 involves a 10000S single-unit box-van weighing 22,000 lb impacting the CIP of the LON at an impact speed an angle of 90 km/h (56 mi/h) and 15 degrees, respectively. This test is intended to evaluate the strength of the LON in containing and redirecting the heavy test vehicle.</p> <p>Summary of Results: Trinity CASS S3 MASH TL-4 contained and captured the 10000S SUT. The SUT rode over the lower two cables, however, the top two cables contained the vehicle. Maximum dynamic deflection of Trinity CASS S3 TL-4 during the test was 4.9m (16.1 ft). No detached elements, fragments, or other debris were present to penetrate the occupant compartment, or present undue hazard to others in the area. No occupant compartment deformation was noted. The SUT remained upright during and after the collision event. Maximum roll angle was 0 degrees. The 10000S SUT remained within the system.</p>	PASS
4-20 (1100C)	Transition testing was not addressed with this longitudinal barrier	WAIVER REQUES
4-21 (2270P)	Transition testing was not addressed with this longitudinal barrier	WAIVER REQUES
4-22 (10000S)	Transition testing was not addressed with this longitudinal barrier	WAIVER REQUES

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 Transportation Institute
Laboratory Contact:	Dean Alberson
Address:	Texas A&M Riverside Campus Building 7091 3100 State Highway 47 Bryan, TX 77807
Country:	USA
Accreditation Certificate Number and Date:	Mechanical 2821.01 30 April 2013

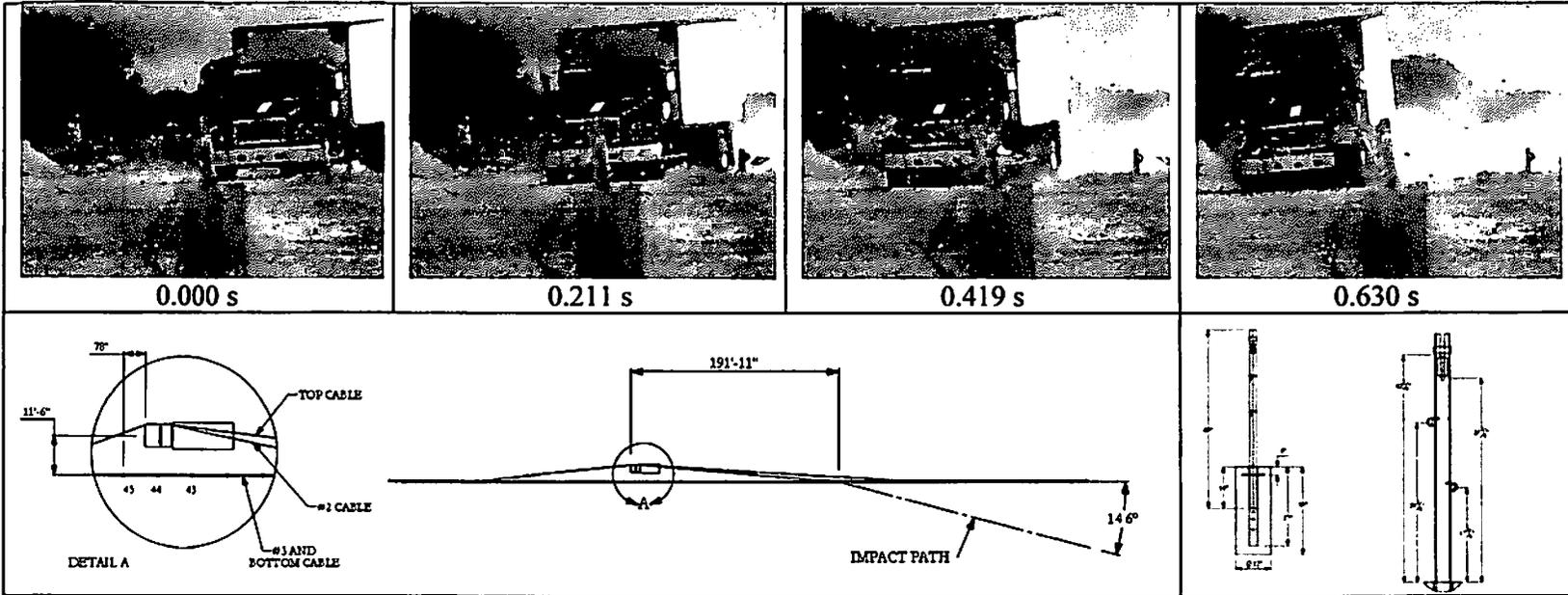
ATTACHMENTS

Attach to this form:

- 1) A copy of the 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
B-232A	October 11, 2012	SGM36b	TL4 Median & Roadside Barrier on Flat Terrain, Tensioned Four-Cable Barrier, Non-prestretched Cables, Structural I-beam Posts, Steel Tube Sleeves, Concrete Footings, Plastic Cable Spacer.



General Information

Test Agency..... Texas Transportation Institute (TTI)
 Test Standard Test No. MASH Test 4-12
 TTI Test No. 400001-TCR42
 Date 2010-06-25

Test Article

Type..... Longitudinal Barrier
 Name..... Trinity Cable Safety System (CASS)
 Installation Length 640 ft
 Material or Key Elements

Soil Type and Condition..... Concrete footing in crush limestone, dry

Test Vehicle

Type/Designation..... 10000S
 Make and Model..... 1995 Freightliner F160
 Curb 12820
 Test Inertial..... 22,550
 Dummy No dummy
 Gross Static 22,500

Impact Conditions

Speed57.8 mi/h
 Angle14.6 degrees
 Location/Orientation

Exit Conditions

SpeedRemained in
 Angle system

Occupant Risk Values

Impact Velocity
 Longitudinal3.0 ft/s
 Lateral5.2 ft/s
 Ridedown Accelerations
 Longitudinal-2.0 G
 Lateral 1.7 G
 THIV6.4 km/h
 PHD2.1 G
 ASI.....0.15

Max. 0.050-s Average

Longitudinal-1.3 G
 Lateral 1.3 G
 Vertical 1.2 G

Post-Impact Trajectory

Stopping Distance 195 ft downstrm
 Within cables

Vehicle Stability

Maximum Yaw Angle.....23 degrees
 Maximum Pitch Angle.....-2 degrees
 Maximum Roll Angle.....10 degrees
 Vehicle Snagging.....No
 Vehicle Pocketing.....No

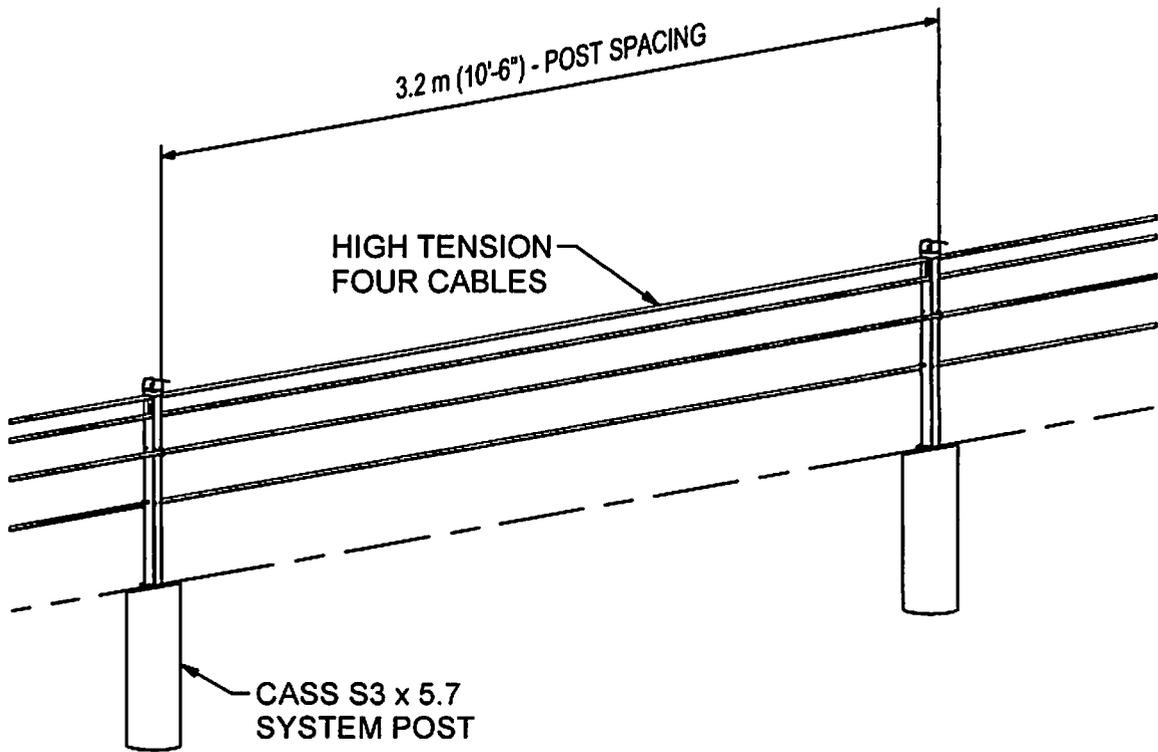
Test Article Deflections

Dynamic..... 16.2 ft
 Permanent..... 14.5 ft
 Working Width 17.2 ft

Vehicle Damage

VDS01RFQ2
 CDC.....01FREN2
 Max. Exterior Deformation.....6.0 inches
 Max. Occupant Compartment
 Deformation.....0

Figure 5.7. Summary of results for MASH test 4-12 on the Trinity Cable Safety System (CASS).



CASS S3 MASH SYSTEM



**TRINITY HIGHWAY
PRODUCTS, LLC**

SHEET NO.

DATE

1 OF 1

7/12/2012