



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

June 19, 2020

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

In Reply Refer To:
HSST-1/B-232B

Greg Neece
Trinity Highway Products, LLC
2525 North Stemmons Freeway
Dallas, Texas 75207

Dear Mr. Neece:

On May 4, 2012, the Federal Highway Administration's Office of Safety issued eligibility letter B-232 for the CASS S3 on 4H:1V Slopes. The Office of Safety has recently made updates to its eligibility letter website to be more consistent with the 2nd Edition of American Association of State Highway and Transportation Officials' (AASHTO) Manual for Assessing Safety Hardware (MASH) and the additional test matrices for cable barriers therein. These updates have necessitated the modification of certain eligibility letters including B-232. The modification for B-232 consists of adding the phrase "30 foot-wide median on backslope 11 feet from bottom of median and 26 feet from slope break point" after the original description of the device to indicate the as-tested conditions for the device. Additionally, the language of this letter has been updated to be consistent with current Office of Safety policy for the issuance of eligibility letters.

Please note that this modification to letter B-232 will in no way affect the eligibility for the associated device as was determined on May 4, 2012. This FHWA letter of eligibility is assigned FHWA control number B-232B and is valid until a subsequent letter is issued by FHWA that expressly references this device. This letter will supersede the original B-232 letter in full.

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:

- CASS S3 on 4H:1V Slopes, 30 foot-wide median on backslope 11 feet from bottom of median and 26 feet from slope break point

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: CASS S3 on 4H:1V Slopes, 30 foot-wide median on backslope 11feet from bottom of median and 26 feet from slope break point

Type of system: Longitudinal Barrier

Test Level: MASH Test Level 3 (TL3)

Testing conducted by: Texas Transportation Institute

Date of request: July 14, 2011

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-232B 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



TRINITY HIGHWAY PRODUCTS, LLC

July 14, 2011

Mr. Nicholas Artimovich, II
Highway Engineer, Office of Safety Design
Federal Highway Administration HSSD
1200 New Jersey Avenue SE, Room E-71-322
Washington, DC 20590
Tel: 202-366-1331
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e-mail: nick.artimovich@fhwa.dot.gov

Re: Request for FHWA Acceptance of CASS S3 MASH on 4H:1V Slopes per MASH Test Level 3.

Dear Mr. Artimovich:

Attached for your review are the test reports and videos of successful full-scale crash tests recently conducted by the Texas Transportation Institute (TTI) on Trinity's Cable Safety System (CASS S3 MASH) 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. Trinity Highway Products, LLC is seeking FHWA acceptance of CASS S3 MASH for use on the National Highway System (NHS).

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. 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 17.4 to 17.7 kN (3,914 to 3,985 pounds force) for the tests.

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).

According to MASH, two crash tests are recommended to evaluate longitudinal barriers to TL-3. In the safety performance evaluation of CASS S3 MASH, and as per your March 15, 2010 e-mail concurrence, two full-scale crash tests were conducted. Trinity feels that safety performance verification of the proposed CASS S3 MASH can be concluded, as summarized below.

MASH Test Designation 3-10: An 1100C (2425 lb) passenger car impacting the critical impact point (CIP) of the length of need (LON) of the barrier at a nominal impact speed and angle of 100 km/h (62 mi/h) and 25 degrees, respectively. This test investigates the barrier's ability to successfully contain and redirect a small passenger vehicle. CASS S3 MASH was installed on the backslope of the 9.1m (30 foot 0 inch) wide depressed median with 4H:1V side slopes at 3.35m (11 feet 0 inch) from the median bottom.

Summary of results: CASS S3 MASH on the 4H:1V backslope contained and redirected the 1100C vehicle. The vehicle did not penetrate or underride the barrier. Both wheels on the left side overrode the lower cable of the installation. Maximum dynamic deflection of the cable barrier was 2.29 meters (7.5 feet). Although the cables separated from some of the posts, there were no detached elements, fragments or other debris to penetrate or show potential for penetrating the occupant compartment or to present undue hazard to others in the area.

Maximum occupant compartment deformation was 25mm (1.0 inch) in the driver's side instrument panel area. The 1100C vehicle remained upright during and after the collision event. Maximum roll was 22 degrees, and maximum pitch was 16 degrees. Occupant risk factors were within the limits specified for MASH test 3-10. The 1100C vehicle remained within the cable system. CASS S3 MASH performed acceptably according to the evaluation criteria of MASH test 3-10.

MASH Test Designation 3-11: A 2270P (5000 lb) pickup truck impacting the critical impact point (CIP) of the length of need (LON) of the barrier at a nominal impact speed and angle of 100 km/h (62 mi/h) and 25 degrees, respectively. This is a strength test for test levels 1 through 3 to verify a barrier's performance for impacts involving light trucks and SUVs for all test levels. CASS S3 MASH was installed on the foreslope of a 9.1m (30 foot 0 inch) wide depressed median with 4H:1V side slopes at 1.22m (4 foot 0 inch) from the break point.

Summary of results: CASS S3 MASH on the 4H:1V foreslope contained and redirected the 2270P vehicle. The vehicle did not penetrate or underride. Only the left rear wheel overrode the two lower cables of the installation. Maximum dynamic deflection of the cable barrier was 2.9 meters (9.6 feet). Although the cables separated from some of the posts, there were no detached elements, fragments or other debris to penetrate or show potential for penetrating the occupant compartment or to present undue hazard to others in the area.

Maximum occupant compartment deformation was 25mm (0.25 inch) in the left lower kickpanel area. The 2270P vehicle remained upright during and after the collision event. Maximum roll was -4 degrees, and maximum pitch was 18 degrees. Occupant risk factors were within the limits specified for MASH test 3-11. The vehicle remained within the installation and did not exit the barrier, thus remaining within the exit box. CASS S3 MASH performed acceptably according to the evaluation criteria of MASH test 3-11.

Trinity respectfully requests FHWA acceptance of the CASS S3 MASH cable barrier for use on the National Highway System (NHS) as a MASH Test Level 3 compliant roadside or median barrier on the designated 4H:1V or flatter slopes when such use is acceptable to the contracting agency.

Although testing was conducted with standard (non-prestretched) cables, Trinity also requests FHWA acceptance of CASS S3 MASH with prestretched cables.

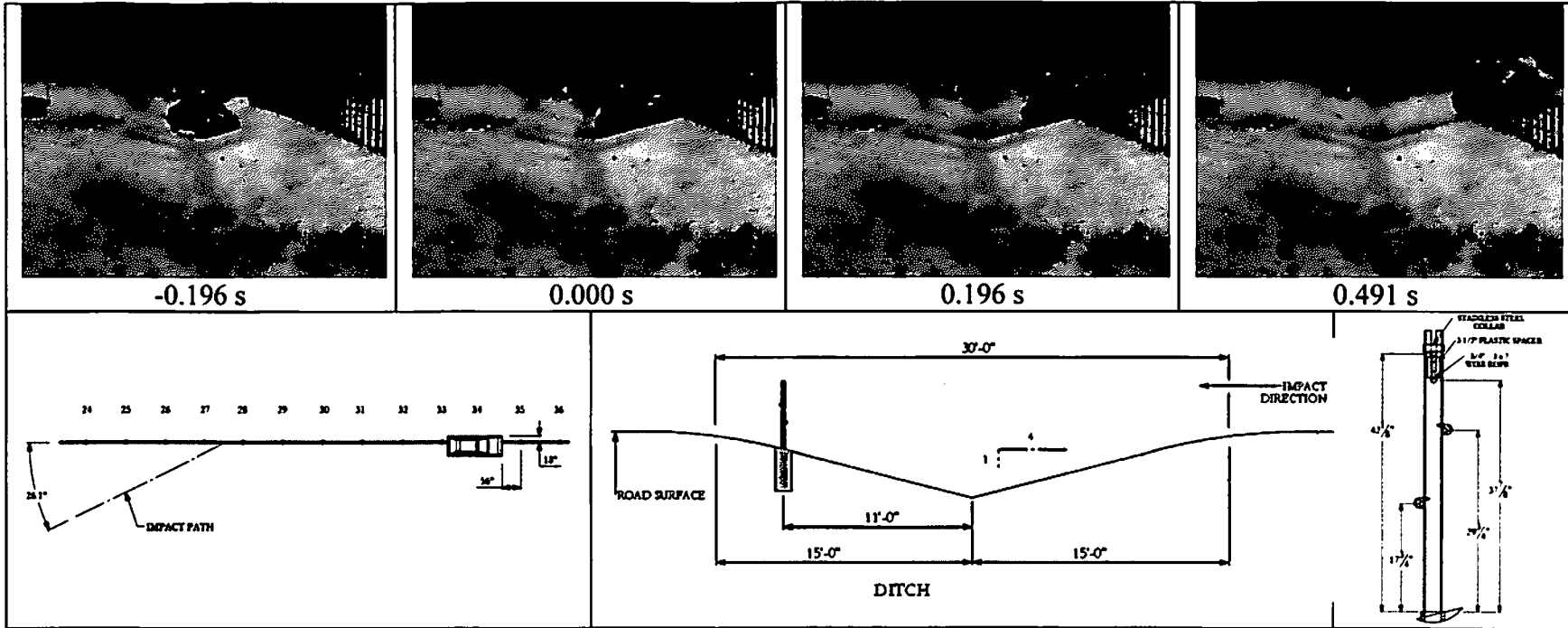
Thank you for your consideration. Should you have questions, we will be pleased to furnish or secure answers promptly.

Sincerely,
Brian Smith

A handwritten signature in black ink, appearing to read "Brian Smith", written in a cursive style.

Trinity Highway Products, LLC.

Enclosures: 4



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General Information

Test Agency..... Texas Transportation Institute
 Test Standard Test No. MASH 3-10
 TTI Test No. 400001-TCR41
 Date 2010-06-02

Test Article

Type..... Cable Barrier
 Name Trinity CASS on 4H:1V Backslope
 Installation Length 640 ft
 Material or Key Elements 4 wire ropes supported by slotted S3x5.7 support posts

Soil Type and Condition..... MASH Standard Soil, dry

Test Vehicle

Type/Designation..... 1100C
 Make and Model..... 2004 Kia Rio
 Curb 2394 lb
 Test Inertial..... 2406 lb
 Dummy 176 lb
 Gross Static..... 2582 lb

Impact Conditions

Speed entering ditch.....61.5 mi/h
 Angle entering ditch.....26.1 degrees
 Speed at wire rope46.2 mi/h
 Angle at wire rope.....26.1 degrees
 Location/Orientation Midspan 27-28

Exit Conditions

Speed Not obtainable
 Angle Not obtainable

Occupant Risk Values

Impact Velocity
 Longitudinal.....17.4 ft/s
 Lateral 0.3 ft/s
Ridedown Accelerations
 Longitudinal.....-5.0 G
 Lateral 3.7 G
 THIV19.1 km/h
 PHD5.0 G
 ASI0.72
Max. 0.050-s Average
 Longitudinal.....-6.8 G
 Lateral 1.4 G
 Vertical-4.6 G

Post-Impact Trajectory

Stopping Distance 66.6 ft downstream

Vehicle Stability

Maximum Yaw Angle.....22 degrees
 Maximum Pitch Angle..... 16 degrees
 Maximum Roll Angle.....22 degrees
 Vehicle Snagging.....No
 Vehicle Pocketing.....No

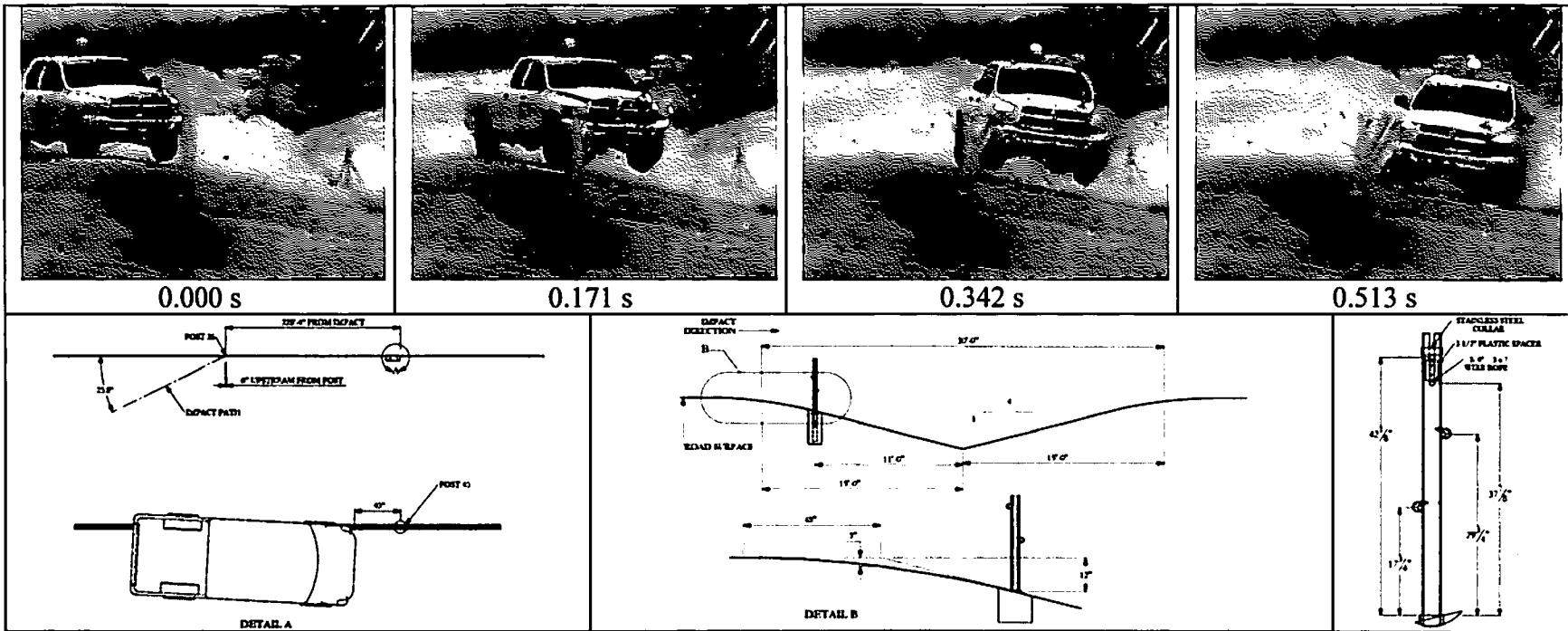
Test Article Deflections

Dynamic.....7.5 ft
 Permanent.....2.4 ft
 Working Width.....8.1 ft

Vehicle Damage

VDS 11LFQ4
 CDC..... 11FLEW4
 Max. Exterior Deformation.....8.0 inches
 OCDI.....LF0000000
 Max. Occupant Compartment Deformation.....1.0 inch

Figure 5.7. Summary of results for MASH test 3-10 on the Trinity CASS on 4H:1V backslope.



General Information

Test Agency..... Texas Transportation Institute
 Test Standard Test No. *MASH 3-11*
 TTI Test No. 400001-TCR40
 Date 2010-05-13
Test Article
 Type..... Cable Barrier
 Name Trinity CASS on 4H:1V Foreslope
 Installation Length 640 ft
 Material or Key Elements 4 wire ropes supported by slotted S3x5.7 support posts

Soil Type and Condition..... MASH Standard Soil, dry

Test Vehicle

Type/Designation..... 2270P
 Make and Model 2005 Dodge Ram 1500 pickup
 Curb 4724 lb
 Test Inertial..... 5044 lb
 Dummy No dummy
 Gross Static..... 5044 lb

Impact Conditions

Speed62.5 mi/h
 Angle25.8 degrees
 Location/Orientation

Exit Conditions

Speed Did not exit
 Angle Did not exit

Occupant Risk Values

Impact Velocity
 Longitudinal.....10.8 ft/s
 Lateral11.4 ft/s
 Ridedown Accelerations
 Longitudinal.....-4.8 G
 Lateral 4.5 G
 THIV 15.7 km/h
 PHD 6.0 G
 ASI.....0.36
 Max. 0.050-s Average
 Longitudinal.....-3.1 G
 Lateral 2.9 G
 Vertical-2.1 G

Post-Impact Trajectory

Stopping Distance 231 ft

Vehicle Stability

Maximum Yaw Angle..... 32 degrees
 Maximum Pitch Angle.....-4 degrees
 Maximum Roll Angle..... 18 degrees
 Vehicle Snagging..... No
 Vehicle Pocketing..... No

Test Article Deflections

Dynamic..... 9.6 ft
 Permanent 1.1 ft
 Working Width 10.3 ft

Vehicle Damage

VDS 11LFQ1
 CDC..... 11FLEW2
 Max. Exterior Deformation..... 6.0 inches
 Max. Occupant Compartment Deformation..... 0.25 inch

Figure 5.7. Summary of results for *MASH* test 3-11 on the Trinity CASS on 4H:1V foreslope.