



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

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

April 1, 2020

In Reply Refer To:
HSST-1/CC-159

Mr. Michael J. Buehler
Trinity Highway Products, LLC
3617 Cincinnati Ave.
Rocklin, California 95765

Dear Mr. Buehler:

This letter is in response to your December 12, 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 CC-159 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

Decision

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

- SS180[®]M

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: SS180®M
Type of system: Truck-Trailer Mounted Attenuator (TTMA)
Test Level: MASH Test Level 3 (TL3)
Testing conducted by: KARCO
Date of request: December 12, 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 CC-159 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 12, 2019	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Bret R. Eckert, P.E.	
	Company:	Trinity Highway Products, LLC	
	Address:	3617 Cincinnati Ave., Rocklin CA 95765	
	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
Truck-Mounted Attenuators (TMA)	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	SS180@M	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:	Michael J. Buehler, P.E.	Same as Submitter <input type="checkbox"/>
Company Name:	Trinity Highway Products, LLC	Same as Submitter <input checked="" type="checkbox"/>
Address:	3617 Cincinnati Ave., Rocklin CA 95765	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.

The SS180@M Truck Mounted Attenuator ("SS180@MTMA") system technology is the commercial embodiment of intellectual property that is protected by patents owned by Trinity Highway Products, LLC ("THP"). THP does not pay royalties for sales of the SS180@MTMA. The SS180@MTMA system was designed and developed by engineers and employees at THP. The patent holders of record for the SS180@MTMA system are Michael J. Buehler, P.E., Patrick A. Leonhardt, P.E., and Sean Thompson; and all are employed by THP. The associated United States patent, number 9,399,845 (Dated Sept. 11, 2013), is assigned to Trinity Highway Products, LLC.

Applus IDIADA Karco Engineering, LLC (KARCO) conducted the certification tests of the SS180@MTMA System. KARCO is an internationally accredited third party crash testing laboratory. Full-scale crash testing on the SS180@MTMA system was performed in accordance with testing criteria, set forth by the American Association of State Highway and Transportation Officials (AASHTO) in the Manual for Assessing Safety Hardware ("MASH") (2016). Other than fees paid to KARCO to conduct the tests and then analyze and report the test results, KARCO and THP do not share financial interests.

PRODUCT DESCRIPTION

Help

- New Hardware or Significant Modification

 Modification to Existing Hardware

The SS180M is a mobile crash cushion attached to the rear of a support vehicle. It may be used on shadow or advanced warning vehicles upstream of moving operations or as a barrier vehicle for stationary work zones. The SS180M is designed to be used on support vehicles with a minimum weight of 13,500 lb. and a maximum weight of 25,000 lb.

The SS180M consists of a frame, hydraulics and controls system, energy absorbing cartridges, lighting, face plate, and optional arrow board / message board. The frame is a structural tube steel space frame that is bolted together in sections consisting of an Impact Frame, Rear Arms, Mid-Frame, Forward Arms, and Support frame. The frame is powder coated and has factory installed decals and name-plate. The frame hinges in the middle and the back half can be rotated approximately 180° to shorten the length of the system when traveling. The frame mounts to a support vehicle in a variety of ways. Typical mounts include; Socket Hitch Receivers, which come in various lengths to accommodate the specific geometry of the support vehicle, and Bolt and Weld-on systems.

The SS180M is 176.5" long by 82" wide. When the system is fully extended, it is 52" high, including the nominal height above the ground of 12" ± 1" at the rear of the system. When folded in the travel configuration, the system is 94" long and 77" high. A system without arrow board weighs approximately 2030 lbs.

The hydraulics and controls consist of a single 3-1/2" cylinder operated by a controls system that folds the system into a condensed state for transporting to and from the work zone. The hydraulics system is controlled either locally at the support frame or remotely with a cabled controller. Electro-mechanical switches are designed to automatically de-energize the hydraulics when the system is fully folded or unfolded.

There are two energy absorbing cartridges, the rear cartridge "Cartridge A" and the forward cartridge "Cartridge B". Both cartridges consist of aluminum cells separated by aluminum sheet diaphragms. The sides, top and bottom, and end are aluminum sheet. The rear of each cartridge is a steel sheet "strong-back" that contains features for attachment to the Mid or Support Frames. Standard lighting consists of LED stop, turn, tail, and clearance lights. The lighting may be LED or incandescent and can be manufactured by different lighting supply vendors. The aluminum face plate is a light-weight assembly designed to cover the rear of the system and improve driver visibility. It is a 0.040" thick aluminum sheet with fabricated bends to fit the Impact Frame.

The energy absorbing and structural portions of the SS180M consist of the frame, frame arms, and cartridges. The other ancillary portions of the system, such as hydraulics, controls, and electrical lighting do not absorb appreciable amounts of impact energy therefore changes to these components will not affect the performance of the SS180M during an impact event. For instance, various vendors may supply hydraulic cylinders, hoses, pumps, electronic controls and electrical lighting components that perform the same function as the components that were present during testing. The arrow board was present during testing, however, this item is not required for proper performance of the SS180M. The impact face plate may be any color and striped with any reflective or non-reflective tape of any color, depending on customer requirements.

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:	Steven Matsusaka	
Engineer Signature:		DN: cn=Steven Matsusaka, email=steven.matsusaka@jciada.com, c=US Digitally signed by Steven Matsusaka Date: 2019.12.02 11:45:44 -08'00'
Address:	9270 Holly Road, Adelanto, CA. 92301	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
3-50 (1100C)	<p>Applus IDIADA KARCOTest No. P39045-05. Test Date July 01, 2019. Crash Test Report No. TR-P39045-05_D for MASH Test 3-50 Crash Test of Trinity Highway Products SS180M.</p> <p>The TMA was impacted by a 2013 Kia Rio 4-door sedan. The test vehicle impacted the SS180M at a velocity of 61.60 mph (99.14 km/h) and an impact angle of 0.1°. The SS180M brought the vehicle to a controlled stop. The maximum measured dynamic deformation of the TMA was 7.8 ft (2.4 m). The support vehicle rolled ahead a distance of 2.8 ft. (0.9 m) as a result of the impact. The test vehicle sustained damage to its front end. The engine was pushed rearward toward the firewall, the hood deformed rearward and upward, and the front bumper fascia detached from the vehicle. The occupant compartment was not penetrated and the deformation limits were not exceeded. The Trinity Highway Products SS180M met all the requirements for MASH 2016 Test 3-50.</p>	PASS
3-51 (2270P)	<p>Applus IDIADA KARCOTest No. P39046-01. Test Date July 03, 2019. Crash Test Report No. TR-P39046-01_C for MASH Test 3-51 Crash Test of Trinity Highway Products SS180M.</p> <p>The TMA was impacted by a 2013 RAM 1500 4-door pickup truck. The test vehicle impacted the SS180M at a velocity of 61.75 mph (99.38 km/h) and an impact angle of 0.3°. The SS180M brought the vehicle to a controlled stop. The maximum measured dynamic deflection was 12.3 ft. (3.7 m). The impact head, both cartridges, and side arms were damaged. The roll ahead distance of the support truck was 9.2 ft (2.8 m). The test vehicle sustained damage to its front end. The bumper fascia was deformed, the grill and hood were both crushed, and the engine compartment was damaged. The occupant compartment was not penetrated and the deformation limits were not exceeded. The Trinity Highway Products SS180M met all the requirements for MASH 2016 Test 3-51.</p>	PASS

Required Test Number	Narrative Description	Evaluation Results
3-52 (2270P)	<p>Applus IDIADA KARCOTest No. P39047-01. Test Date July 02, 2019. Crash Test Report No. TR-P39047-01_C for MASH Test 3-52 Crash Test of Trinity Highway Products SS180M.</p> <p>The TMA was impacted by a 2014 RAM 1500 4-door pickup truck. The test vehicle impacted the SS180M at a velocity of 63.24 mph (101.77 km/h) and an offset of 27.4 in (697 mm) left of TMA centerline. The SS180M brought the vehicle to a controlled stop. The maximum measured dynamic deflection of the system was 12.2 ft. (3.7 m). The support vehicle rolled ahead a distance of 9.1 ft (2.8 m) as a result of the impact. The test vehicle sustained damage to its front end. The bumper fascia and grill were torn off. The bumper beam was pushed towards the engine compartment. The right front wheel was punctured. The occupant compartment was not penetrated and the deformation limits were not exceeded. The Trinity Highway Products SS180M met all the requirements for MASH 2016 Test 3-52.</p>	PASS
3-53 (2270P)	<p>Applus IDIADA KARCOTest No. P39048-01. Test Date July 05, 2019. Crash Test Report No. TR-P39048-01_C for MASH Test 3-53 Crash Test of Trinity Highway Products SS180M.</p> <p>The TMA was impacted by a 2014 RAM 1500 4-door pickup truck. The test vehicle impacted the SS180M at a velocity of 62.44 mph (100.49 km/h) and an impact angle of 9.6°. The SS180M absorbed the vehicle's energy and deflected its trajectory, causing the vehicle to spin about its yaw axis before coming to rest 54.5 ft. (16.6 m) forward and 22.9 ft. (7.0 m) left of its position at its initial point of contact with the TMA. The support truck rolled ahead 21.0 ft. (6.4 m) as a result of the impact. The test vehicle sustained damage to its right front end. The front bumper and right front quarter panel were pushed rearward into the engine compartment and the right front wheel pushed toward the wheel well. The occupant compartment was not penetrated and the deformation limits were not exceeded. The Trinity Highway Products SS180M met all the requirements for MASH 2016 Test 3-53.</p>	PASS
3-54 (1500A)	Per MASH, this test is optional.	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:	KARCOEngineering, INC	
Laboratory Signature:	Steven Matsusaka	DN: cn=StevenMatsusaka, email=steven.matsusaka@idiada.com, c=US Digitally signed by Steven Matsusaka Date: 2019.12.02 11:54:42 -08'00'
Address:	9270 Holly Road, Adelanto, CA. 92301	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	International Accreditation Services (IAS) ISO 17025 Accreditation Certificate #TL-371 Expires July 1, 2022	

Submitter Signature*: **Bret Eckert, P.E.**

Digitally signed by Bret Eckert, P.E.
DN: cn=Bret Eckert, P.E., o=Trinity Highway Products,
email=bret.eckert@trh.net, c=US
Date: 2019.12.02 12:25:01 -08'00'

Submit Form

ATTACHMENTS

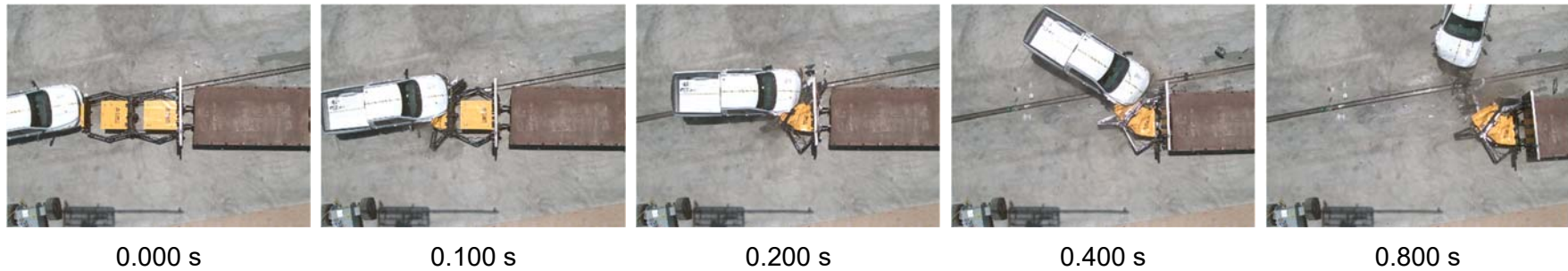
Attach to this form:

- 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:

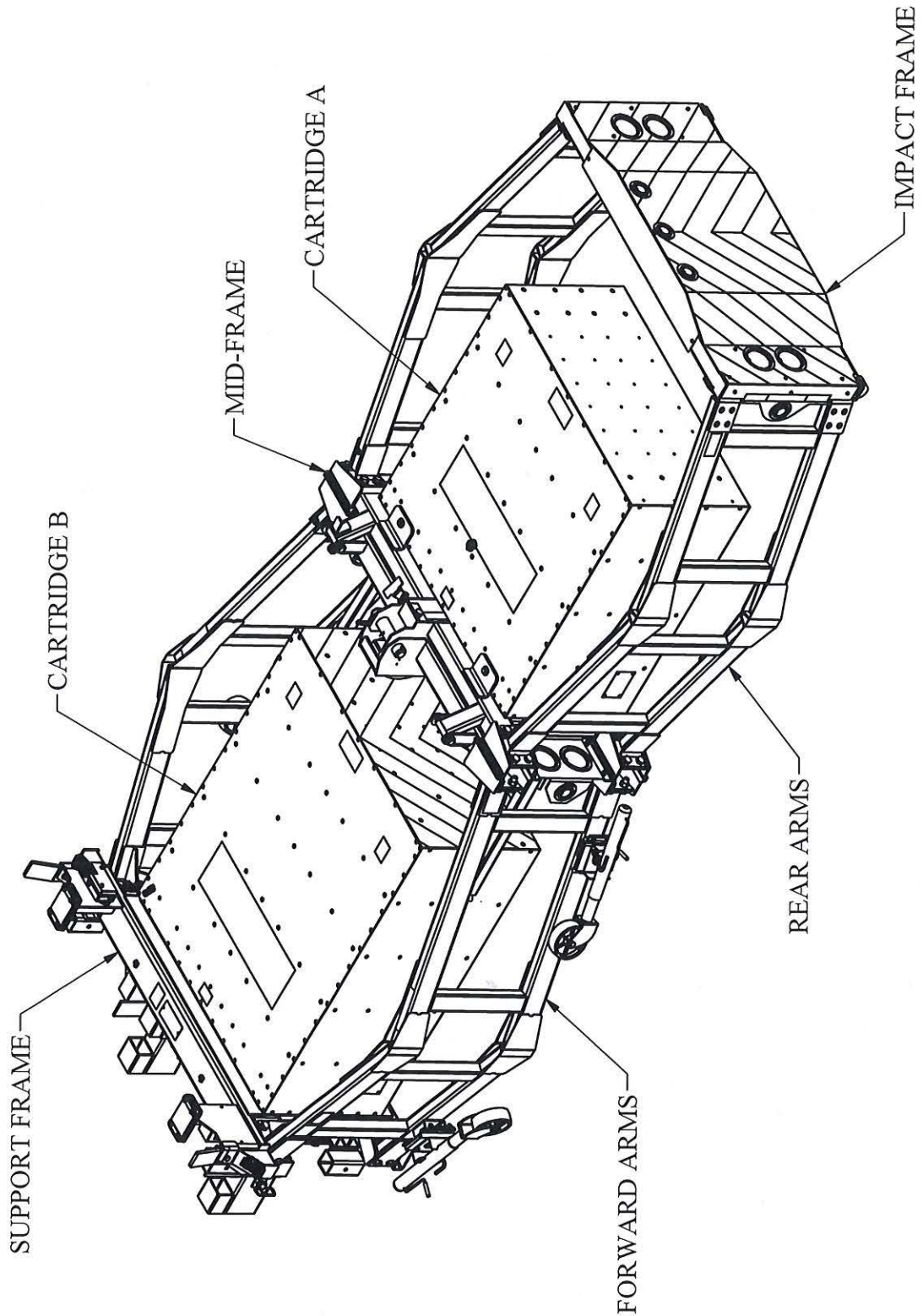
Eligibility Letter		Key Words
Number	Date	

MASH 2016 Test 3-53 Summary



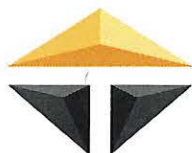
<p>GENERAL INFORMATION</p> <p>Test Agency..... Applus IDIADA KARCO IDIADA KARCO Test No..... P39048-01 Test Designation..... 3-53 Test Date..... 07/05/19</p> <p>TEST ARTICLE</p> <p>Name / Model..... SS180 M Type..... Truck Mounted Attenuator TMA Length..... 14.6 ft. (4.5 m) Road Surface..... Concrete Support Vehicle Restraint.... 2nd gear, Parking Brake Engaged</p> <p>TEST VEHICLE</p> <p>Type / Designation..... 2270P Year, Make, and Model.... 2014 RAM 1500 Curb Mass..... 4,985.7 lbs (2,261.5 kg) Test Inertial Mass..... 5,025.4 lbs (2,279.5 kg) Gross Static Mass..... 5,025.4 lbs (2,279.5 kg)</p>	<p>Impact Conditions</p> <p>Impact Velocity..... 62.44mph (100.49 km/h) Impact Angle..... 9.6° CCW Location / Orientation..... 20.5 in (520 mm) Offset Left of TMA CL Kinetic Energy..... 654.4 kip-ft (887.3 kJ)</p> <p>Exit Conditions</p> <p>Exit Velocity..... N/A Exit Angle..... N/A Final Vehicle Position..... 54.5 ft. (16.6 m) Downstream 22.9 ft. (7.0 m) Left</p> <p>Exit Box Criteria Met..... N/A Vehicle Snagging..... None Vehicle Pocketing..... None Vehicle Stability..... Satisfactory Maximum Roll Angle..... -7.2 ° Maximum Pitch Angle..... -9.8 ° Maximum Yaw Angle..... -148.3 °</p>	<p>Occupant Risk</p> <p>Longitudinal OIV..... 31.2 ft/s (9.5 m/s) Lateral OIV..... 2.3 ft/s (0.7 m/s) Longitudinal RA..... -12.6 g Lateral RA..... -4.4 g THIV..... 31.5 ft/s (9.6 m/s) PHD..... 13.0 g ASI..... 0.90</p> <p>Test Article Deflections</p> <p>Static..... 10.2 ft. (3.1 m) Dynamic..... 11.9 ft. (3.6 m) Working Width..... N/A Debris Field..... 159.0 ft. (48.5 m) Downstream 23.9 ft. (7.3 m) Left</p> <p>Vehicle Damage</p> <p>Vehicle Damage Scale..... 1-FR-6 CDC..... 01FZEW2 Maximum Intrusion..... 17.8 in. (451 mm) at Front Bumper</p>
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Figure 4 Summary of Test 3-53



2019

SS180M TRUCK MOUNTED ATTENUATOR



TRINITY
HIGHWAY

SWT##

SHEET NO.

DATE

1 of 2

12/4/2019

INTENDED USE

The SS180[®]M is a mobile crash cushion attached to the rear of a support vehicle. It may be used on shadow or advanced warning vehicles upstream of moving operations or as a barrier vehicle for stationary work zones. The SS180[®]M is designed to be used on support vehicles with a minimum weight of 13,500 lb. and a maximum weight of 25,000 lb.

FEATURES

The SS180[®]M consists of a frame, hydraulics and controls system, energy absorbing cartridges, lighting, face plate, and optional arrow board / message board. The frame is a structural tube steel space frame that is bolted together in sections consisting of an Impact Frame, Rear Arms, Mid-Frame, Forward Arms, and Support frame. The frame hinges in the middle and the back half can be rotated approximately 180° to shorten the length of the system when traveling.

SPECIFICATIONS

- The SS180[®]M is 176.5" long.
- Width is 82".
- When the system is fully extended, it is 52" high, including the nominal height above the ground of 12" ± 1" at the rear of the system.
- When folded in the travel configuration, the system is 94" long and 77" high.
- A system without arrow board weighs approximately 2030 lbs.

ELIGIBILITY

The SMT[™] TMA has been fully tested in conformance to MASH 2016 Test Level 3 and is determined eligible for Federal reimbursement by FHWA.

FHWA Eligibility Letter(s): CC-#### dated _____ for MASH 2016 Test Level 3

REFERENCES

Manual for Assessing Safety Hardware (MASH), American Association of State Highway and Transportation Officials (AASHTO), 2016

CONTACT INFORMATION

2525 North Stemmons Freeway
Dallas, TX 75207
Telephone: (888) 323-6374
Fax: (800) 770-6755
<http://www.trinityhighway.com>

SS180M TRUCK MOUNTED ATTENUATOR

SWT##

SHEET NO.

DATE

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12/4/2019



TRINITY
HIGHWAY