U.S. Department of Transportation
Federal Highway Administration

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

June 17, 2021

In Reply Refer To:
HSST-1/CC-167

Geoff Maus
TrafFix Devices, Inc.
160 Avenida La Pata
San Clemente
CA 92673
USA

Dear Mr. Maus:

This letter is in response to your January 8, 2021 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-167 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:

- Delta Crash Cushion

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: Delta
Type of system: Crash Cushion
Test Level: TL3
Testing conducted by: Applus IDIADA KARCO Engineering, LLC
Date of request: January 8, 2021

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-167 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:	January 08, 2021	◉ New ○ Resubmission
	Name:	Geoff Maus	
	Company:	TrafFix Devices, Inc.	
	Address:	160 Avenida La Pata San Clemente, CA 92673	
	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

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System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'CC': Crash Cushions, Attenuators, & Terminals	◉ Physical Crash Testing ○ Engineering Analysis	Delta	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:	Geoff Maus	Same as Submitter ☒
Company Name:	TrafFix Devices, Inc.	Same as Submitter ☒
Address:	160 Avenida La Pata San Clemente, CA 92673	Same as Submitter ☒
Country:	USA	Same as Submitter ☒
Enter below all disclosures of financial interests as required by the FHWA `Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.		
TrafFix Devices Inc. and Applus IDIADA KARCOEngineering LLC share no financial interests between the two organizations. This includes no shared financial interest but not limited to: i. Compensation including wages,salaries,commissions,professional fees,or fees for business referrals ii. Consulting relationships iii. Research funding or other forms of research support; iv. Patents,copyrights, licenses,and other intellectual property interests; v. Business ownership and investment interests.		

PRODUCT DESCRIPTION

(●) New Hardware or Significant Modification ( ) Modification to Existing Hardware

The Delta Crash Cushion is TL-3 narrow re-directive, non-gating crash cushion designed to shield road side hazards in permanent and temporary installations/applications in both Uni- and Bi-directional traffic flow conditions. The Delta is free standing and does not require that it is attached to the object it is shielding and can be installed on concrete, asphalt, or a hybrid concrete/asphalt road surfaces. The surface used for testing was concrete. The Delta is delivered assembled, with only the front Module needing to be bolted in place after anchoring the system to the road surface. There are 39 anchor bolts required for the installation to the road surface. The Delta was tested to MASH TL-3 and can be used in TL-2 and TL-1 applications.
The Delta Crash Cushion was co-developed by TrafFix Devices Inc. (TDI) based in San Clemente California and the University of Nebraska-Lincoln Midwest Roadside Safety Facility (MwRSF). The MASH crashworthy testing was conducted at the independent test laboratory IDIADA KARCO Engineering LLC in Adelanto California.
The Delta consists of 1 track weldment, 9 internal diaphragms, 10 energy attenuation fender panels, 1 front impact head, and 1 energy attenuation module. The Delta has overall dims. of 21 ft. (6.4 m) X 30.1 in. (765 mm) X 31.5 in. (800 mm). The Delta attenuates the impacting vehicles kinetic energy by tearing/shearing through a series of attenuation stages that are achieved by different shaped cutout patterns within the valleys of the Thrie beam fender panels. The attenuation is not effected by extreme cold, hot, wet, or dry conditions on the roadway. The Delta's open design reduces/minimizes debris build up in and around the device. The attenuation stages progressively increase in resistance to attenuate more kinetic energy as the impacting vehicle collapses the device. Each panel is sequentially marked from 1N to 4-5N to designate its attenuation and position order within the crash cushion with 1N front position, 2N & 3N central positions and 4-5N at the rear of the device. The Thrie beam panels utilize the AASHTO M180 profile. The panels are bolted to the front impact head, internal diaphragms, and track weldment backup structure. The fender panels splice/overlap at their leading and trailing edges. A bent washer assembly which incorporates a ¾"-10 male thread allows the fender panels to be bolted directly to 4 of the nine internal diaphragms. The four diaphragms at these positions remain attached to the fender panel during the impact event. The remaining five internal diaphragms utilize a sacrificial fastener to restrain them to the fender panels at the mid-span location between the fender panels trailing and leading edges. The sacrificial fasteners are designed to shear upon impact and release the intermediate diaphragm from the panel. The Impact Head acts as a mounting surface for the energy attenuation module. The energy attenuation front module is 22 in. (559 mm) X 23.25 in. (591 mm) X 20 in. (508 mm) and is filled with aluminum honeycomb. The Impact Head is guided down the track by dual 12 in. (305 mm) long sliders. An object marker sheeting panel bolts to the energy attenuation module and contains 3 directional sheeting patterns gore, left, and right. The object marker panel is 19 in. (483 mm) X 19 in. (483 mm) and can accommodate different patterns and colors as requested. The track weldment consists of 2 parallel longitudinal "T" shaped tracks that are welded to ground level lateral anchoring plates. At the rear of the track weldment is a 31.0 in. (787 mm) tall backup structure that is made from 4.0 in. (203 mm) X 8.0 in. (102 mm) steel tubing and is reinforced with steel tubing and gussets.

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:	Steven Matsusaka Digitally signed by Steven Matsusaka DN: cn=Steven Matsusaka, email=steven.matsusaka@idiada.com, c=US Date: 2021.01.08 22:42:49 -08'00'	
Address:	9270 Holly Rd, Adelanto, CA	Same as Submitter ☐
Country:	USA	Same as Submitter ☒

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-30 (1100C)	Applus IDIADA KARCO Engineering Project# P40224-01 conducted on August 12, 2020. Test 3-30 involves an 1100C test vehicle impacting the Delta end-on at a nominal impact speed and angle of 62 mph (100 km/h) and 0°, respectively, with the vehicle offset one quarter of its width.Test 3-30 is designed to examine vehicle trajectory and occupant risk. The test vehicle, a 2016 Hyundai Accent with a test inertial weight of 2,427.2 lbs (1,101.0 kg), impacted the Delta at a speed and angle of 63.22 mph (101.74 km/h) and 0.5°, respectively. Upon impact the test vehicle crushed the front attenuation module and collapsed the first three attenuation stages of the Delta. The vehicle came to a controlled stop remained stable throughout the impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and minimal occupant compartment deformation. The Delta met all the requirements of MASH Test 3-30.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-31 (2270P)	Applus IDIADA KARCO Engineering Project# P40225-01 conducted on August 17, 2020. Test 3-31 involves an 2270P test vehicle impacting the Delta end-on at a nominal impact speed and angle of 62 mph (100 km/h) and 0°, respectively, with the centerline line of the Delta aligned with the centerline of the vehicle. Test 3-31 is a capacity test designed to examine occupant risk and vehicle trajectory during high energy, head-on impacts. The test vehicle, a 2015 RAM 1500 with a test inertia weight of 5,014.3 lbs (2,274.5 kg), impacted the Delta at a speed and angle of 62.16 mph (100.03 km/h) and 0.4°, respectively. The vehicle crushed the nose box and collapsed the majority of the system. The rearmost attenuation stage still had reserve capacitance after the impact. The vehicle remained stable throughout the impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and there was minimal occupant compartment deformation. The Delta met all the requirements of MASH Test 3-31.	PASS

3-32 (1100C)	Applus IDIADA KARCO Engineering Project# P40196-01 conducted on July 21, 2020. Test 3-32 involves an 1100C test vehicle impacting the Delta end-on at a nominal impact speed and angle of 62 mph (100 km/h) and 15°, respectively, with the centerline of the vehicle aligned with the nose of the system. Test 3-32 is designed to examine vehicle trajectory and occupant risk. The test vehicle, a 2016 Hyundai Accent with a test inertial weight of 2,453.7 lbs (1,113.0 kg), impacted the Delta at a speed and angle of 62.70 mph (100.90 km/h) and 15.2°, respectively. Upon impact the test vehicle crushed the attenuation box and collapsed the first three attenuation stages of the Delta. The vehicle remained stable throughout the entire impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no risk of occupant compartment penetration and there was minimal occupant compartment deformation. The Delta met all the requirements of MASH Test 3-32.	PASS
3-33 (2270P)	Applus IDIADA KARCO Engineering Project# P40197-01 conducted on July 22, 2020. Test 3-33 involves an 2270P test vehicle impacting the Delta end-on at a nominal impact speed and angle of 62 mph (100 km/h) and 15°, respectively, with the centerline of the vehicle aligned with the nose of the system. Test 3-33 is designed to examine vehicle trajectory and occupant risk. The test vehicle, a 2015 RAM 1500 with a test inertial weight of 5,037.5 lbs (2,285.0 kg), impacted the Delta at a speed and angle of 59.96 mph (96.50 km/h) and 15.4°, respectively. Upon impact the test vehicle crushed the attenuation box and fully collapsed the first four attenuation stages of the Delta. The fifth attenuation stage still had reserve capacity. The vehicle remained stable throughout the entire impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and there was minimal occupant compartment deformation. The Delta met all the requirements of MASH Test 3-33.	PASS

3-34 (1100C)	Applus IDIADA KARCO Engineering Project# P40226-01 conducted on August 24, 2020. Test 3-34 involves an 1100C test vehicle impacting the Delta the CIP at a nominal speed and angle of 62 mph (100 km/h) and 15°, respectively. The CIP was determined to be 12 in. (305 mm) downstream from the impact head. Test 3-34 is designed to examine vehicle trajectory, stability, and occupant risk. The test vehicle, a 2016 Hyundai Accent with a test inertial weight of 2,437.2 lbs (1,105.5 kg), impacted the Delta at a speed and angle of 62.51 mph (100.60 km/h) and 15.2°, respectively. Upon impact the vehicle was smoothly redirected and exited withing the bounds of the exit box. The vehicle remained stable throughout the impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and there was minimal occupant compartment deformation. The Delta met all the requirements of MASH Test 3-34.	PASS
3-35 (2270P)	Applus IDIADA KARCO Engineering Project# P40195-01 conducted on July 15, 2020. Test 3-35 involves a 2270P test vehicle impacting the Delta the CIP at a nominal speed and angle of 62 mph (100 km/h) and 25°, respectively. The CIP was determined to be 12 in. (305 mm) downstream from the impact head. Test 3-35 is designed to examine the capacity of the Delta to contain and redirect heavy passenger vehicles. The primary concern is vehicle trajectory, stability, and occupant risk. The test vehicle, a 2014 RAM 1500 with a test inertial weight of 5,055.1 lbs (2,293.0 kg), impacted the Delta at a speed and angle of 62.75 mph (100.98 km/h) and 25.4°, respectively. Upon impact the vehicle was smoothly redirected and exited withing the bounds of the exit box. The vehicle remained stable throughout the impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and the occupant compartment deformation limits were not exceeded. The Delta met all the requirements of MASH Test 3-35.	PASS

3-36 (2270P)	Applus IDIADA KARCO Engineering Project# P40198-01 conducted on July 23, 2020. Test 3-36 involves a 2270P test vehicle impacting the Delta the CIP at a nominal speed and angle of 62 mph (100 km/h) and 25°, respectively. The CIP was determined to be 7 ft. (2.1m) upstream from the rigid backup structure. Test 3-36 is designed to examine the capacity of the Delta to provide sufficient rigidity to prevent severe wheel snag or pocketing at the rigid end of the system. The primary concern is vehicle trajectory, stability, and occupant risk. The test vehicle, a 2015 RAM 1500 with a test inertial weight of 5,019.8 lbs (2,277.0 kg), impacted the Delta at a speed and angle of 60.14 mph (96.78 km/h) and 24.8°, respectively. Upon impact the vehicle was smoothly redirected and exited withing the bounds of the exit box. The vehicle remained stable throughout the impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and the occupant compartment deformation limits were not exceeded. The Delta met all the requirements of MASH Test 3-36.	PASS

3-37 (2270P)	Applus IDIADA KARCO Engineering Project# P40369-01 conducted on November 25, 2020. Test 3-37a involves a 2270P test vehicle impacting the Delta transition in the reverse direction at a nominal speed and angle of 62 mph (100 km/h) and 25°, respectively. The CIP was determined to be 4.3 ft. (1.3m) upstream from the rigid backup structure as recommended in MASH. Test 3-37a is designed to examine the snagging on the rear of the device. The primary concern is occupant compartment deformation and vehicle stability. The test vehicle, a 2017 RAM 1500 with a test inertial weight of 5,023.1 lbs (2,278.5 kg), impacted the Delta at a speed and angle of 63.04 mph (101.46 km/h) and 25.2°, respectively. Upon impact the vehicle was smoothly redirected and exited within the bounds of the exit box. The vehicle remained stable throughout the impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and the occupant compartment deformation limits were not exceeded. The Delta met all the requirements of MASH Test 3-37a.	PASS

3-38 (1500A)	Applus IDIADA KARCO Project# P40237-01 conducted on August 18, 2020. Test 3-38 involves an 1500A test vehicle impacting the Delta end-on at a nominal impact speed and angle of 62 mph (100 km/h) and 0°, respectively, with the centerline line of the Delta aligned with the centerline of the vehicle. Test 3-38 is designed to examine occupant risk and vehicle trajectory during an impact with a mid-sized vehicle. The test vehicle, a 2015 Chevrolet Malibu with a test inertia weight of 3,306.9lbs (1,500.0 kg), impacted the Delta at a speed and angle of 61.97 mph (99.73 km/h) and 0.0°, respectively. The vehicle crushed the nose box and collapsed the majority of the system. The two rearmost attenuation stage still had reserve capacitance after the impact. The vehicle remained stable throughout the impact event and did not exceed Roll or Pitch angles of 75°. The Occupant Impact Velocities and Ride Down Acceleration were within the acceptable range per MASH. There was no occupant compartment penetration and there was minimal occupant compartment deformation. The Delta met all the requirements of MASH Test 3-38.	PASS
3-40 (1100C)	Test designed for non-redirective crash cushion, not applicable for redirective crash cushions.	Non-Relevant Test, not conducted
3-41 (2270P)	Test designed for non-redirective crash cushion, not applicable for redirective crash cushions.	Non-Relevant Test, not conducted
3-42 (1100C)	Test designed for non-redirective crash cushion, not applicable for redirective crash cushions.	Non-Relevant Test, not conducted
3-43 (2270P)	Test designed for non-redirective crash cushion, not applicable for redirective crash cushions.	Non-Relevant Test, not conducted
3-44 (2270P)	Test designed for non-redirective crash cushion, not applicable for redirective crash cushions.	Non-Relevant Test, not conducted
3-45 (1500A)	Test designed for non-redirective crash cushion, not applicable for redirective crash cushions.	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:	Applus IDIADA KARCO Engineering, LLC	
Laboratory Signature:	Steven Matsusaka Digitally signed by Steven Matsusaka DN: cn=Steven Matsusaka, email=steven.matsusaka@idiada.com, c=US Date: 2021.01.08 22:42:58 -08'00'	
Address:	9270 Holly Rd, Adelanto, CA 92301	Same as Submitter ☐
Country:	USA	Same as Submitter ☒
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*: Geoff Maus Digitally signed by Geoff Maus Date: 2021.01.14 11:57:54 -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		
Number	Date	Key Words