U.S. Department of Transportation
Federal Highway Administration

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

July 14, 2025

In Reply Refer To:
HSST-1/CC-180

Christopher Jaime
TrafFix Devices, Inc.
160 Avenida La Pata
San Clemente, CA 92673
USA

Dear Mr. Jaime:

We received your initial correspondence on November 21, 2023 requesting issuance of a Federal-aid reimbursement eligibility letter under the Federal-aid highway program for the roadside safety system, device, design, product, or hardware (collectively "device") described below. On September 12, 2024, we received a complete set of files needed to complete our review. We write to inform you that the device Delta Crash Cushion is eligible for Federal-aid reimbursement. This letter is assigned Federal Highway Administration (FHWA) control number CC-180.

ELIGIBILITY LETTERS

The FHWA issues Federal-aid reimbursement eligibility letters for new roadside safety devices that are crash tested in accordance with the industry standard of the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH).

FHWA, the Department of Transportation, and the United States (government) do not regulate roadside safety devices, crash test facilities, or the manufacturing industry. Issuance of eligibility letters is discretionary and provided only as a service to the states. FHWA may, at its discretion, decline to issue, revise, or rescind an eligibility letter. Eligibility letters are only issued by the FHWA headquarters Office of Safety.

Eligibility letters are issued only as notice to the states that a device is eligible for reimbursement under the Federal-aid highway program. They do not establish approval or certification for any other purpose. Issuance of an eligibility letter is not a prerequisite or requirement for state transportation agencies seeking to use Federal-aid funds for roadside safety devices. State agencies may use a device for which an eligibility letter has not been issued and seek Federal-aid reimbursement.

FEDERAL-AID REIMBURSEMENT

The request for issuance of this letter certified the device was crash tested in accordance with the industry standard of AASHTO's MASH. This eligibility letter is based on that certification and

the material offered in support of its issuance. The device described below is eligible for reimbursement under the Federal-aid highway program.

Name of system: Delta Crash Cushion
Type of system: Crash Cushion
Test Level: Test Level 2
Testing conducted by: Applus IDIADA KARCO Engineering LLC
Date of request: November 21, 2023

Information about the device, including material such as the eligibility request, crash test reports, drawings, or images are included in one or more attachment(s) to this letter.

Eligibility letter CC-180 is inapplicable to devices, optional equipment, alternate materials, or other features that were not crash tested in accordance with AASHTO's MASH.

This letter is issued only for the subject device as crash tested under AASHTO's MASH. Later modification(s) of the device are not eligible for Federal-aid reimbursement under this letter. Notice of later modification(s) should be given to transportation agencies, facility owners, and operators (collectively "agencies").

Agencies should be provided appropriate information about the device's design, installation, maintenance, materials, and mechanical properties.

Issuance of this letter is discretionary, and it may be revised or rescinded at FHWA's discretion. This letter is not a determination of compliance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) or ownership of any intellectual property rights.

This eligibility letter is not a determination by the government that a crash involving the subject device will result in any particular outcome. It is limited to only the device's eligibility for Federal-aid reimbursement.

INTELLECTUAL PROPERTY

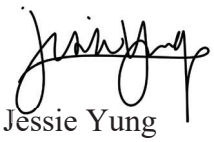
Issuance of this eligibility letter does not convey property rights of any sort nor any exclusive privilege. This letter is not authorization or consent by the government for the use, manufacture, or sale of any patented or proprietary system, device, design, product, or hardware for which the requester is not the patent owner. Eligibility letters are not an expression of any view, position, or determination by the government as to the validity, scope, or ownership of any intellectual property rights to a specific device. These letters do not grant, impute, suggest, or otherwise establish any ownership, distribution, or licensing rights to the requester. The government expresses no opinion about the intellectual property rights relating to any device for which this or any other eligibility letter is issued.

PUBLIC DISCLOSURE

To prevent any misunderstanding, and as discussed above, this Federal-aid eligibility letter is assigned FHWA control number CC-180. It should only be reproduced in full with its attachment(s). This Federal-aid eligibility letter and the material offered by the requester supporting its issuance is public information. All eligibility letters and supporting material are subject to public disclosure under the Freedom of Information Act (FOIA). Eligibility letters are available to the public at https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/.

If you have any questions please contact Paul LaFleur at Paul.LaFleur@dot.gov.

Sincerely,



Jessie Yung
Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	11/21/2023	◉ New ○ Resubmission
	Name:	Christopher Jaime	
	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

! - ! - !

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'CC': Crash Cushions, Attenuators, & Terminals	◉ Physical Crash Testing ○ Engineering Analysis	Delta Crash Cushion	AASHTO MASH	TL2

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:	Christopher Jaime	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 KARCO Engineering 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 a TL-2 (50mph) 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 to be attached to the object it is shielding. The surface used for testing was asphalt. The Delta is delivered assembled, with only the front Module needing to be bolted in place after anchoring the to the road surface. There are 27 anchor bolts required for the installation to the road surface.

The Delta Crash Cushion consists of 1 track weldment, 5 internal diaphragms, 6 energy attenuation fender panels, 1 front impact head, and 1 energy attenuation module. The Delta has overall dims. of 14 ft. (4.3m) 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 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 45N to designate its attenuation and position order within the crash cushion with 1N front position, 3N central position, and 45N at the rear of the device. The Thrie beam panels use 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 3/4"-10 male thread allows the fender panels to be bolted directly to 2 of the 5 internal diaphragms. The two diaphragms at these positions remain attached to the fender panel during the impact event. The remaining three internal diaphragms use 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:	Alex Beltran	
Engineer Signature:	 Digitally signed by Alex Beltran DN: cn=Alex Beltran, o=Applus IDIADA, ou, email=Alex.Beltran@idiada.com, c=US Date: 2025.02.06 09:06:41 -08'00'	
Address:	9270 Holly Rd. Adelanto, CA 92301	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
2-30 (1100C)	Applus IDIADA KARCO Project# P43080-01 conducted on 06/12/2023. Test 2-30 involves an 1100C test vehicle impacting the Delta Crash Cushion end-on at a nominal impact speed and angle of 50 mph (80 km/h) and 0°, respectively, with the quarter point of the vehicle aligned with the center of the attenuator. Test 2-30 is designed to examine vehicle trajectory and occupant risk. The test vehicle, a 2017 Kia Rio with a test inertial weight of 2,460.3 lbs (1,116.0 kg), impacted the Delta at a speed and angle of 52.69 mph (84.80 km/h) and 0.5°, respectively. Upon impact the test vehicle crushed the attenuation box and collapsed the first two 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 occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-30.	PASS

Required Test Number	Narrative Description	Evaluation Results
2-31 (2270P)	Applus IDIADA KARCO Project# P43081-01 conducted on 05/23/2023. Test 2-31 involves an 2270P test vehicle impacting the Delta Crash Cushion end-on at a nominal impact speed and angle of 50 mph (80 km/h) and 0°, respectively, with the centerline line of the Delta aligned with the centerline of the vehicle. Test 2-31 is a capacity test designed to examine occupant risk and vehicle trajectory during high energy, head-on impacts. The test vehicle, a 2017 RAM 1500 with a test inertia weight of 5,019.8 lbs (2,277.0 kg), impacted the Delta at a speed and angle of 50.13 mph (80.68 km/h) and 0.4°, respectively. Upon impact, the test vehicle crushed the attenuation box and collapsed all three 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 occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-31.	PASS

2-32 (1100C)	Applus IDIADA KARCO Project# P43082-01 conducted on 06/05/2023. Test 2-32 involves an 1100C test vehicle impacting the Delta Crash Cushion end-on at a nominal impact speed and angle of 50 mph (80 km/h) and 15°, respectively, with the centerline of the vehicle aligned with the nose of the system. Test 2-32 is designed to examine vehicle trajectory and occupant risk. The test vehicle, a 2017 Kia Rio with a test inertial weight of 2,473.5 lbs (1,122.0 kg), impacted the Delta at a speed and angle of 51.59 mph (83.03 km/h) and 15.0°, respectively. Upon impact the test vehicle crushed the attenuation box and collapsed the first two 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 occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-32.	PASS
2-33 (2270P)	Applus IDIADA KARCO Project# P43083-01 conducted on 06/08/2023. Test 2-33 involves a 2270P test vehicle impacting the Delta Crash Cushion end-on at a nominal impact speed and angle of 50 mph (80 km/h) and 15°, respectively, with the centerline of the vehicle aligned with the nose of the system. Test 2-33 is designed to examine vehicle trajectory and occupant risk. The test vehicle, a 2017 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 51.23 mph (82.45 km/h) and 14.2°, respectively. Upon impact the test vehicle crushed the attenuation box and collapsed all 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 occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-33.	PASS

2-34 (1100C)	Applus IDIADA KARCO Project# P45015-01 conducted on 01/27/2025. Test 2-34 involves an 1100C test vehicle impacting the Delta Crash Cushion at the CIP at a nominal impact speed and angle of 50 mph (80 km/h) and 15°, respectively. The CIP was determined to be 12 in. (305 mm) downstream from the impact head. Test 2-34 is designed to examine vehicle trajectory, stability, and occupant risk. The test vehicle, a 2020 Kia Rio with a test inertial weight of 2,398.5 lbs (1,088.0 kg), impacted the Delta TL-2 PLUS at a speed and angle of 51.18 mph (82.36 km/h) and 14.5°, 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 risk of occupant compartment penetration and occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-34.	PASS
2-35 (2270P)	Applus IDIADA KARCO Project# P43085-01 conducted on 05/25/2023. Test 2-35 involves an 2270P test vehicle impacting the Delta Crash Cushion at the CIP at a nominal impact speed and angle of 50 mph (80 km/h) and 25°, respectively. The CIP was determined to be 12 in. (305 mm) downstream from the impact head. Test 2-35 is designed to examine vehicle trajectory, stability, and occupant risk. The test vehicle, a 2018 RAM 1500 with a test inertial weight of 5,013.2 lbs (2,274.0 kg), impacted the Delta at a speed and angle of 50.12 mph (80.66 km/h) and 24.89°, 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 risk of occupant compartment penetration and occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-35.	PASS

2-36 (2270P)	Applus IDIADA KARCO Project# P43086-01 conducted on 06/16/2023. Test 2-36 involves an 2270P test vehicle impacting the Delta Crash Cushion at the CIP at a nominal impact speed and angle of 50 mph (80 km/h) and 25°, respectively. The CIP was determined to be 7 ft. (2.1 m) upstream from the rigid backup structure. Test 2-36 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 2018 RAM 1500 with a test inertial weight of 5,017.6 lbs (2,276.0 kg), impacted the Delta at a speed and angle of 50.27 mph (80.90 km/h) and 25.3°, 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 risk of occupant compartment penetration and occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-36.	PASS

2-37 (2270P)	Applus IDIADA KARCO Project# P43087-03 conducted on 07/26/2023. Test 2-37a involves an 2270P test vehicle impacting the Delta Crash Cushion at the CIP at a nominal impact speed and angle of 50 mph (80 km/h) and 25°, respectively. The CIP was determined to be 19.20 in. (488 mm) upstream from the rigid backup structure. Test 2-37a is designed to examine the snagging of the rear of the device. The primary concern is occupant compartment deformation and vehicle stability. The test vehicle, a 2019 RAM 1500 with a test inertial weight of 5,020.9 lbs (2,277.5 kg), impacted the Delta at a speed and angle of 52.18 mph (83.97 km/h) and 25.5°, 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 risk of occupant compartment penetration and occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-37a.	PASS

2-38 (1500A)	Applus IDIADA KARCO Project# P43088-02 conducted on 06/28/2023. Test 2-38 involves an 1500A test vehicle impacting the Delta Crash Cushion end-on at a nominal impact speed and angle of 50 mph (80 km/h) and 0°, respectively, with the centerline line of the Delta aligned with the centerline of the vehicle. Test 2-38 is designed to examine occupant risk and vehicle trajectory during an impact with a mid-sized vehicle. The test vehicle, a 2018 Chevrolet Malibu with a test inertia weight of 3,326.7 lbs (1,509.0 kg), impacted the Delta at a speed and angle of 50.24 mph (80.85 km/h) and 0.4°, respectively. Upon impact, the test vehicle crushed the attenuation box and collapsed the majority of the system. The vehicle remained stable throughout the entire impact even 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 occupant compartment deformation was within the MASH allowable limits. The Delta Crash Cushion met all the requirements of MASH Test 2-38.	PASS
2-40 (1100C)	Test designed for non-redirective crash cushion, not applicable for re-directive crash cushions.	Non-Relevant Test, not conducted
2-41 (2270P)	Test designed for non-redirective crash cushion, not applicable for re-directive crash cushions.	Non-Relevant Test, not conducted
2-42 (1100C)	Test designed for non-redirective crash cushion, not applicable for re-directive crash cushions.	Non-Relevant Test, not conducted
2-43 (2270P)	Test designed for non-redirective crash cushion, not applicable for re-directive crash cushions.	Non-Relevant Test, not conducted
2-44 (2270P)	Test designed for non-redirective crash cushion, not applicable for re-directive crash cushions.	Non-Relevant Test, not conducted
2-45 (1500A)	Test designed for non-redirective crash cushion, not applicable for re-directive 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:	Digitally signed by Alex Beltran DN: cn=Alex Beltran, o=Applus IDIADA, ou, email=Alex.Beltran@idiada.com, c=US Date: 2025.02.06 09:08:15 -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 :	TL-371, November 2024 - November 2026	

Submitter Signature*: Christopher Jaime
Digitally signed by Christopher Jaime
Date: 2025.02.06 14:14:22 -08'00'

Submit Form

ATTACHMENTS

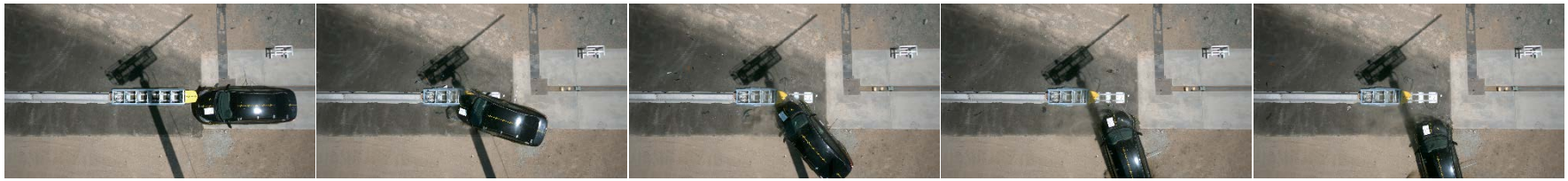
Attach to this form:

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

MASH 2016 Test 2-30 Summary



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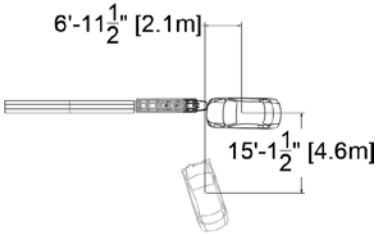

GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test Number	P43080-01
Test Designation	2-30
Test Date	06/12/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	1100C
Year, Make, and Model	2017 Kia Rio
Curb Mass	2,539.7 lbs (1,152.0 kg)
Test Inertial Mass	2,460.3 lbs (1,116.0 kg)
Gross Static Mass	2,627.9 lbs (1,192.0 kg)

Impact Conditions

Impact Velocity	52.69 mph (84.80 km/h)
Target Velocity	50.0 mph (80.5 km/h)
Impact Angle	0.5°
Target Angle	0.0°
Location / Orientation	17.8 in. (452 mm) toward the passenger side
Target Location	Quarter vehicle width aligned with center of barrier
Kinetic Energy	228.4 kip-ft (309.6 KiloJoules)
Minimum Kinetic Energy	141.0 kip-ft (191.0 KiloJoules)

Exit Conditions

Exit Velocity	8.16 mph (13.13 km/h)
Exit Angle	45.3°
Final Vehicle Position	15.1 ft. (4.6 m) toward the driver side 7.0 ft. (2.1 m) downstream
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	17.3°
Maximum Pitch Angle	-36.4°
Maximum Yaw Angle	75.7°

Occupant Risk

Longitudinal OIV	38.7 ft/s (11.8 m/s)
Lateral OIV	2.0 ft/s (0.6 m/s)
Longitudinal RA	-18.7 g
Lateral RA	3.6 g
THIV	38.7 ft/s (11.8 m/s)
PHD	18.7 g
ASI	1.23

Test Article Deflections

Static	4.9 ft. (1.5 m)
Dynamic	4.9 ft. (1.5 m)
Working Width	2.6 ft. (0.8 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	12-FD-3
CDC	12FDAW2
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-30

MASH 2016 Test 2-31 Summary

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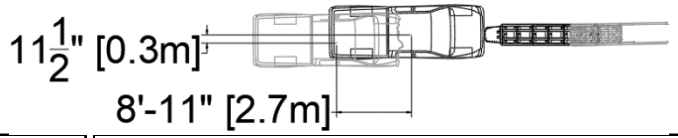


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test Number	P43081-01
Test Designation	2-31
Test Date	05/23/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.2 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2017 Ram 1500
Curb Mass	5,511.5 lbs (2,500.0 kg)
Test Inertial Mass	5,019.8 lbs (2,277.0 kg)
Gross Static Mass	5,019.8 lbs (2,277.0 kg)

Impact Conditions

Impact Velocity	50.13 mph (80.68 km/h)
Target Velocity	50.0 mph (80.5 km/h)
Impact Angle	0.4°
Target Angle	0.0°
Location / Orientation	0.4 in. (11 mm) toward the passenger side
Target Location	Center of vehicle aligned with center of barrier
Kinetic Energy	421.7 kip-ft (571.8 KiloJoules)
Minimum Kinetic Energy	291.0 kip-ft (395.0 KiloJoules)

Exit Conditions

Exit Velocity	2.40 mph (3.86 km/h)
Exit Angle	1.4°
Final Vehicle Position	8.9 ft. (2.7 m) upstream 1.0 ft. (0.3 m) toward the
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	7.4°
Maximum Pitch Angle	-3.4°
Maximum Yaw Angle	2.5°

Occupant Risk

Longitudinal OIV	27.6 ft/s (8.4 m/s)
Lateral OIV	-3.3 ft/s (-1.0 m/s)
Longitudinal RA	-18.9 g
Lateral RA	2.1 g
THIV	27.9 ft/s (8.5 m/s)
PHD	18.9 g
ASI	1.20

Test Article Deflections

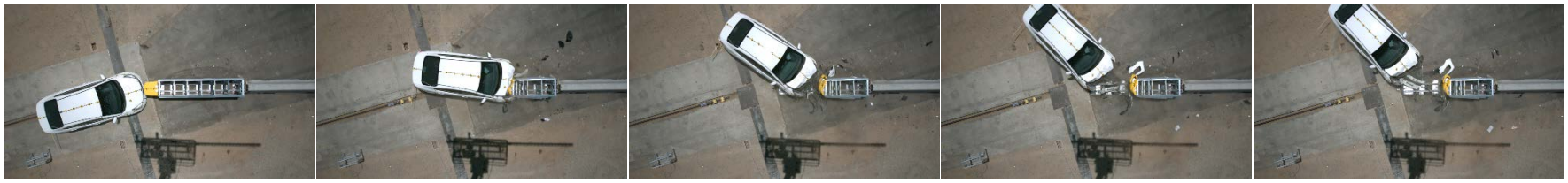
Static	9.1 ft. (2.8 m)
Dynamic	9.1 ft. (2.8 m)
Working Width	2.4 ft. (0.7 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	12-FD-5
CDC	12FDEW3
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-31

MASH 2016 Test 2-32 Summary



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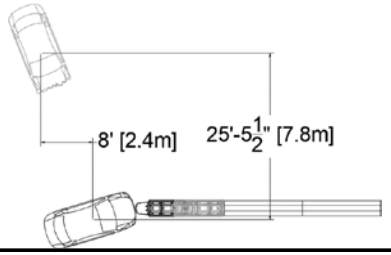


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test No	P43082-01
Test Designation	2-32
Test Date	06/05/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	1100C
Year, Make, and Model	2017 Kia Rio
Curb Mass	2,550.7 lbs (1,157.0 kg)
Test Inertial Mass	2,473.5 lbs (1,122.0 kg)
Gross Static Mass	2,629.0 lbs (1,192.5 kg)

Impact Conditions

Impact Velocity	51.59 mph (83.03 km/h)
Target Velocity	50.0 mph (80.5 km/h)
Impact Angle	15.0°
Target Angle	0.0°
Location / Orientation	0.1 in. (2 mm) Toward the Driver Side
Target Location	Center of vehicle aligned with center of barrier
Kinetic Energy	220.1 kip-ft (298.4 kJ)
Minimum Kinetic Energy	141.0 kip-ft (191.0 kJ)

Exit Conditions

Exit Velocity	7.71 mph (12.4 km/h)
Exit Angle	97.3°
Final Vehicle Position	8.0 ft. (2.4 m) Upstream 25.5 ft. (7.8 m) Toward the Driver Side
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	-7.8°
Maximum Pitch Angle	-16.2°
Maximum Yaw Angle	57.7°

Occupant Risk

Longitudinal OIV	39.0 ft/s (11.9 m/s)
Lateral OIV	-2.0 ft/s (-0.6 m/s)
Longitudinal RA	-16.0 g
Lateral RA	-3.4 g
THIV	39.0 ft/s (11.9 m/s)
PHD	16.0 g
ASI	1.22

Test Article Deflections

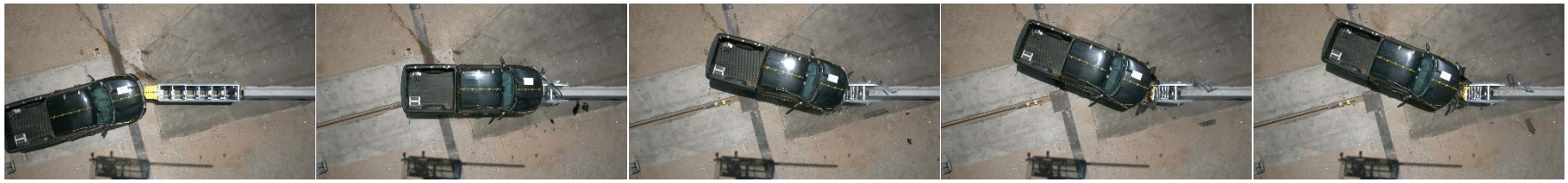
Static	6.6 ft. (2.0 m)
Dynamic	6.6 ft. (2.0 m)
Working Width	2.9 ft. (0.9 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	12-FD-6
CDC	12FDEW4
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-32

MASH 2016 Test 2-33 Summary



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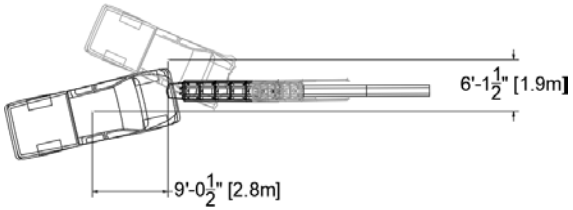


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test No	P43083-01
Test Designation	2-33
Test Date	06/08/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2017 Ram 1500
Curb Mass	4,975.7 lbs (2,257.0 kg)
Test Inertial Mass	5,019.8 lbs (2,277.0 kg)
Gross Static Mass	5,019.8 lbs (2,277.0 kg)

Impact Conditions

Impact Velocity	51.23 mph (82.45 km/h)
Target Velocity	50.0 mph (80.5 km/h)
Impact Angle	14.2°
Target Angle	15.0°
Location / Orientation	1.00 in. (25 mm) toward the passenger side
Target Location	Center of vehicle aligned with center of barrier
Kinetic Energy	440.5 kip-ft (597.2 kJ)
Minimum Kinetic Energy	291.0 kip-ft (395.0 kJ)

Exit Conditions

Exit Velocity	3.21 mph (5.17 km/h)
Exit Angle	35.9°
Final Vehicle Position	9.0 ft. (2.8 m) downstream 6.1 ft. (1.9 m) toward the driver side
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	-5.7°
Maximum Pitch Angle	-4.3°
Maximum Yaw Angle	36.8°

Occupant Risk

Longitudinal OIV	30.2 ft/s (9.2 m/s)
Lateral OIV	-7.5 ft/s (-2.3 m/s)
Longitudinal RA	-13.9g
Lateral RA	-2.6 g
THIV	31.5 ft/s (9.6 m/s)
PHD	13.9 g
ASI	0.91

Test Article Deflections

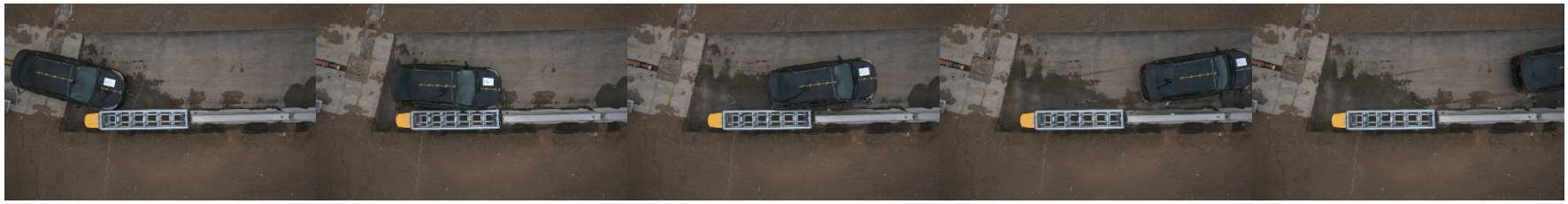
Static	9.5 ft. (2.9 m)
Dynamic	9.5 ft. (2.9 m)
Working Width	34.2 ft. (10.4 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	12-FD-5
CDC	12FDEW1
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-33

MASH 2016 Test 2-34 Summary



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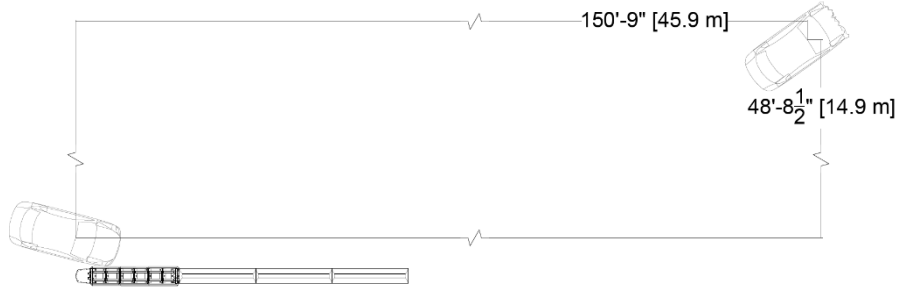

GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test No	P45015-01
Test Designation	2-34
Test Date	01/27/25

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	1100C
Year, Make, and Model	2020 Kia Rio LX
Curb Mass	2,541.9 lbs (1,153.0 kg)
Test Inertial Mass	2,398.5 lbs (1,088.0 kg)
Gross Static Mass	2,561.7 lbs (1,162.0 kg)

Impact Conditions

Impact Velocity (Target)	50.00 mph (80.47 km/h)
Impact Velocity (Actual)	51.18 mph (82.36 km/h)
Impact Angle (Target)	15.0°
Impact Angle (Actual)	14.5°
Location / Orientation (Target)	12.0 in. (305 mm) downstream from the first panel
Location / Orientation (Actualt)	11.5 in. (292 mm) downstream from the first panel
Impact Severity	13.2 kip-ft (17.8 kJ)
Minimum IS Required	9.0 kip-ft (12.8 kJ)

Exit Conditions

Exit Velocity	45.50 mph (73.23 km/h)
Exit Angle	6.5°
Final Vehicle Position	150.7 ft. (45.9 m) Downstream 48.8 ft. (14.9 m) Driver side
Exit Box Criteria Met	N/A
Vehicle Snagging	Satisfactory
Vehicle Pocketing	Satisfactory
Vehicle Stability	Satisfactory
Maximum Roll Angle	2.5°
Maximum Pitch Angle	3.1°
Maximum Yaw Angle	-30.1°

Occupant Risk

Longitudinal OIV	8.9 ft/s (2.7 m/s)
Lateral OIV	18.4 ft/s (5.6 m/s)
Longitudinal RA	-1.8 g
Lateral RA	-9.1 g
THIV	20.7 ft/s (6.3 m/s)
PHD	9.1 g
ASI	1.12

Test Article Deflections

Static	0.0 ft. (0.0 m)
Dynamic	0.1 ft. (0.0 m)
Working Width	2.5 ft. (0.8 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	12-FD-6
CDC	12FDEW9
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-34

MASH 2016 Test 2-35 Summary

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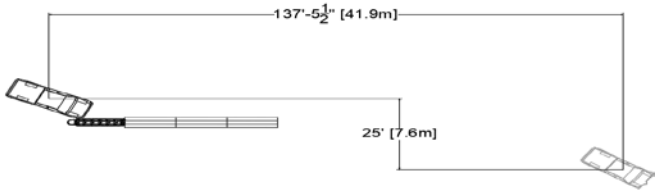

GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test No	P43085-01
Test Designation	2-35
Test Date	05/25/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2018 Ram 1500
Curb Mass	5,116.8 lbs (2,321.0 kg)
Test Inertial Mass	5,013.2 lbs (2,274.0 kg)
Gross Static Mass	5,013.2 lbs (2,274.0 kg)

Impact Conditions

Impact Velocity	50.12 mph (80.66 km/h)
Target Impact Velocity	50.0 mph (80.5 km/h)
Impact Angle	24.9°
Target Impact Angle	25.0°
Location / Orientation	15.84 in. (402 mm) from the beginning of the first panel.
Target Location	12.00 in. (305 mm) from the beginning of the first panel.
Impact Severity	74.6 kip-ft (101.1 kJ)
Minimum Impact Severity	52.0 kip-ft (70.5 kJ)

Exit Conditions

Exit Velocity	38.03 mph (61.20 km/h)
Exit Angle	148.3°
Final Vehicle Position	25.0 ft. (7.6 m) toward the driver side 137.5 ft. (41.9 m) Downstream
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	20.4°
Maximum Pitch Angle	11.5°
Maximum Yaw Angle	-31.4°

Occupant Risk

Longitudinal OIV	18.0 ft/s (5.5 m/s)
Lateral OIV	19.4 ft/s (5.9 m/s)
Longitudinal RA	-4.0 g
Lateral RA	-6.3 g
THIV	26.6 ft/s (8.1 m/s)
PHD	6.7 g
ASI	1.11

Test Article Deflections

Static	0.23 ft. (66.0 mm)
Dynamic	0.28 ft. (86.4 mm)
Working Width	2.78 ft. (0.85 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	1-FL-3
CDC	01RRWW1
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-35

MASH 2016 Test 2-36 Summary

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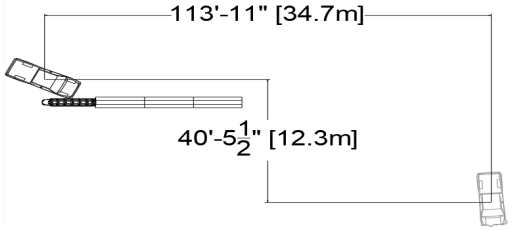

GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test No	P43086-01
Test Designation	2-36
Test Date	06/16/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2018 Ram 1500
Curb Mass	5,025.4 lbs (2,279.5 kg)
Test Inertial Mass	5,017.6 lbs (2,276.0 kg)
Gross Static Mass	5,017.6 lbs (2,276.0 kg)

Impact Conditions

Impact Velocity	50.27 mph (80.90 km/h)
Target Velocity	50.0 mph (80.5 km/h)
Impact Angle	25.3°
Target impact Angle	25.0°
Location / Orientation	7.68 ft. from backup structure
Target Location	7.3 ft. from backup structure
Impact Severity	77.40 kip-ft (105.0 kJ)
Minimum Impact Severity	52.0 kip-ft (70.5 kJ)

Exit Conditions

Exit Velocity	38.03 mph (61.20 km/h)
Exit Angle	148.3°
Final Vehicle Position	113.9 ft. (34.7 m) downstream 40.5 ft. (12.3 m) toward dr side
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	11.2°
Maximum Pitch Angle	-7.6°
Maximum Yaw Angle	-31.8°

Occupant Risk

Longitudinal OIV	20.7 ft/s (6.3 m/s)
Lateral OIV	18.7 ft/s (5.7 m/s)
Longitudinal RA	-4.0 g
Lateral RA	-6.6 g
THIV	26.9 ft/s (8.2 m/s)
PHD	6.9 g
ASI	1.31

Test Article Deflections

Static	0.13 ft. (40.6 mm)
Dynamic	0.3 ft. (91.4 mm)
Working Width	2.8 ft. (0.85 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	12-FD-4
CDC	12FDEW1
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-36

MASH 2016 Test 2-37a Summary

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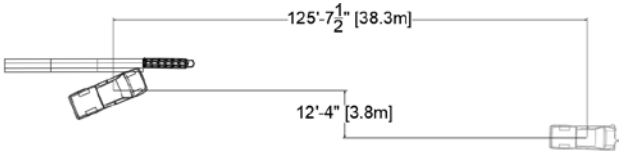


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test Number	P43087-03
Test Designation	2-37a
Test Date	07/26/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	2270P
Year, Make, and Model	2019 Ram 1500
Curb Mass	5,167.5 lbs (2,344.0 kg)
Test Inertial Mass	5,020.9 lbs (2,277.5 kg)
Gross Static Mass	5,020.9 lbs (2,277.5 kg)

Impact Conditions

Impact Velocity	52.18 mph (83.97 km/h)
Target Impact Velocity	50.0 mph (80.5 km/h)
Impact Angle	25.5°
Target Impact Angle	25.0°
Location / Orientation	19.2 in. (488 mm) upstream from backup structure
Target Location	19.32 in. (491 mm) upstream from backup structure
Impact Severity	84.4 kip-ft (114.5 KiloJoules)
Minimum Impact Severity	52.0 kip-ft (70.5 KiloJoules)

Exit Conditions

Exit Velocity	41.64 mph (67.01 km/h)
Exit Angle	5.4°
Final Vehicle Position	12.3 ft. (3.8 m) toward the passenger side 125.6 ft. (38.3 m) downstream
Exit Box Criteria Met	Satisfactory
Vehicle Snagging	Satisfactory
Vehicle Pocketing	Satisfactory
Vehicle Stability	Satisfactory
Maximum Roll Angle	-13.8°
Maximum Pitch Angle	-5.9°
Maximum Yaw Angle	38.8°

Occupant Risk

Longitudinal OIV	17.1 ft/s (5.2 m/s)
Lateral OIV	-21.7 ft/s (-6.6 m/s)
Longitudinal RA	-6.8 g
Lateral RA	6.9 g
THIV	27.9 ft/s (8.5 m/s)
PHD	7.0 g
ASI	1.48

Test Article Deflections

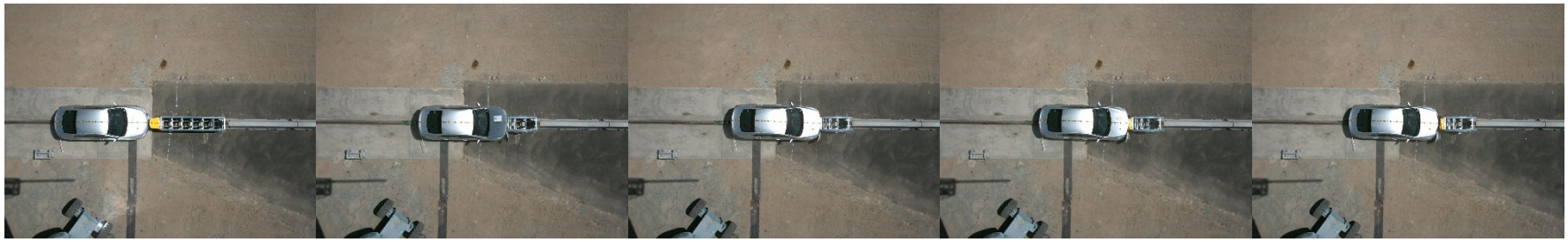
Static	0.0 ft. (0.0 m)
Dynamic	0.1 ft. (0.0 m)
Working Width	2.6 ft. (0.8 m)
Debris Field	None

Vehicle Damage

Vehicle Damage Scale	11-FL-5
CDC	11FLEE4
Maximum Deformation	6.6 in. (167 mm) Driver Side Toe Pan

Figure 2 Summary of Test 2-37a

MASH 2016 Test 2-38 Summary



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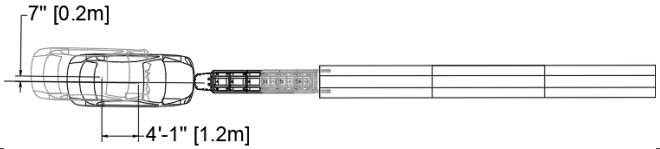


GENERAL INFORMATION

Test Agency	Applus IDIADA KARCO
Test Number	P43088-02
Test Designation	2-38
Test Date	06/28/23

TEST ARTICLE

Name / Model	Delta Crash Cushion
Type	Crash Cushion
Crash Cushion Length	13.6 ft. (4.1 m)
Road Surface	Clean, Dry, Asphalt

TEST VEHICLE

Type / Designation	1500A
Year, Make, and Model	2018 Chevrolet Malibu
Curb Mass	3,018.1 lbs (1,369.0 kg)
Test Inertial Mass	3,326.7 lbs (1,509.0 kg)
Gross Static Mass	3,326.7 lbs (1,509.0 kg)

Impact Conditions

Impact Velocity	50.24 mph (80.85 km/h)
Target Velocity	50.0 mph (80.5 km/h)
Impact Angle	0.4°
Target Angle	0.0°
Location / Orientation	0.5 in. (13 mm) toward the passenger side
Target Location	Center of vehicle aligned with center of barrier
Kinetic Energy	280.7 kip-ft (380.6 KiloJoules)
Minimum Kinetic Energy	141.0 kip-ft (191.0 KiloJoules)

Exit Conditions

Exit Velocity	N/A
Exit Angle	N/A
Final Vehicle Position	0.6 ft. (0.2 m) toward the driver side 4.1 ft. (1.2 m) upstream
Exit Box Criteria Met	N/A
Vehicle Snagging	None
Vehicle Pocketing	None
Vehicle Stability	Satisfactory
Maximum Roll Angle	5.9°
Maximum Pitch Angle	-2.3°
Maximum Yaw Angle	8.1°

Occupant Risk

Longitudinal OIV	33.1 ft/s (10.1 m/s)
Lateral OIV	-1.0 ft/s (-0.3 m/s)
Longitudinal RA	-16.0 g
Lateral RA	-2.2 g
THIV	33.1 ft/s (10.1 m/s)
PHD	16.0 g
ASI	0.98

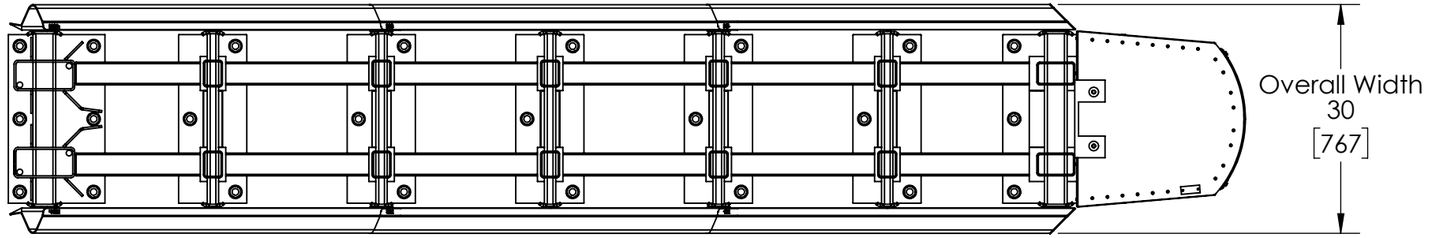
Test Article Deflections

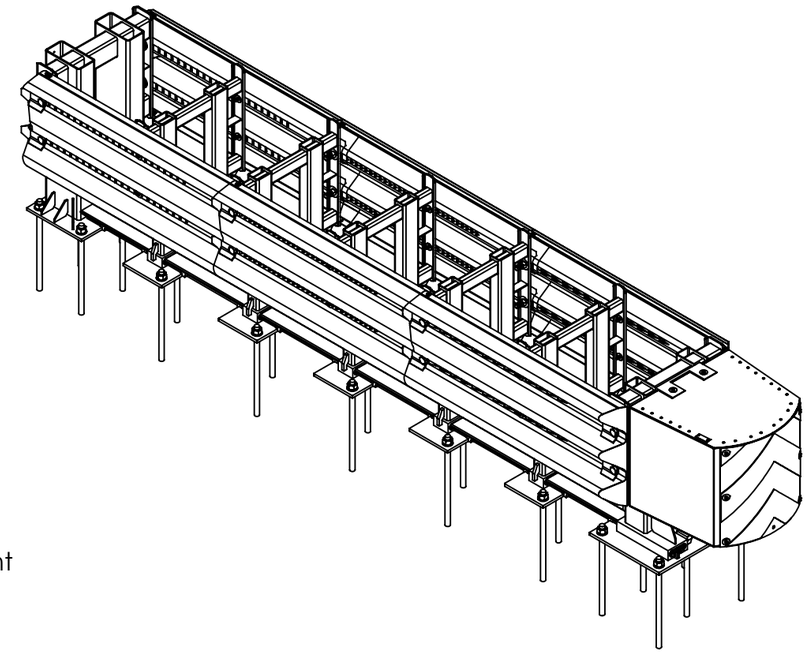
Static	6.2 ft. (1.9 m)
Dynamic	6.2 ft. (1.9 m)
Working Width	2.8 ft. (0.9 m)
Debris Field	None

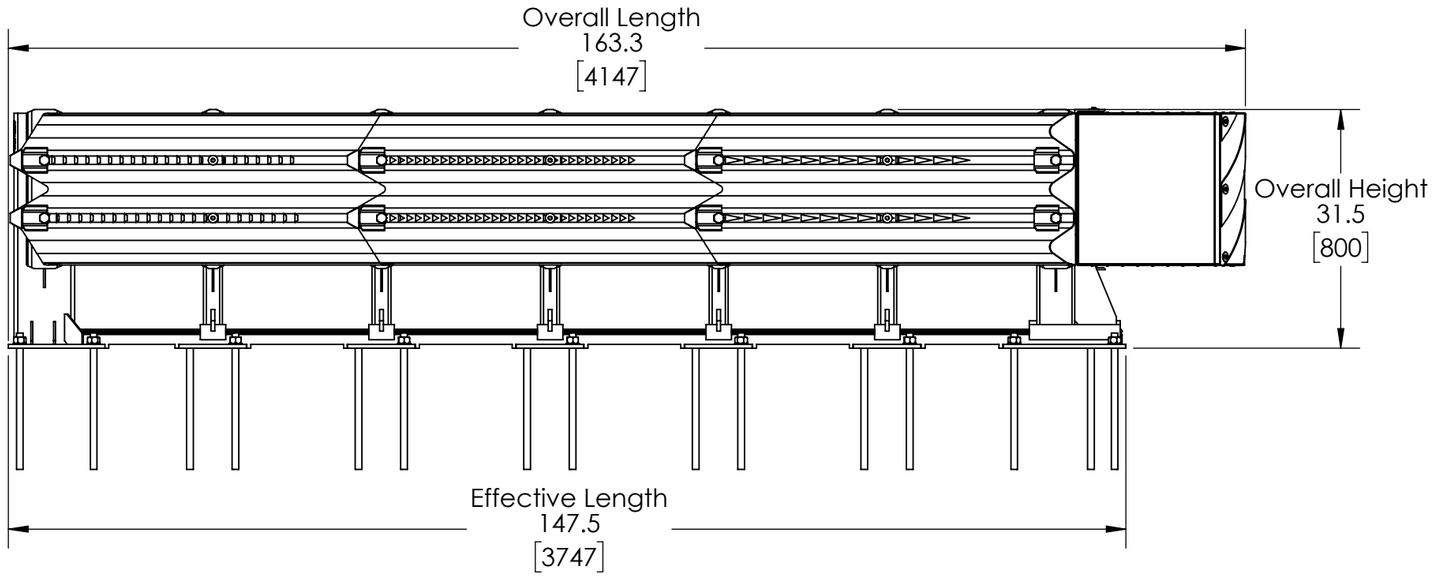
Vehicle Damage

Vehicle Damage Scale	12-FC-2
CDC	12FCEN2
Maximum Deformation	0.0 in. (0 mm)

Figure 2 Summary of Test 2-38







2. Units: Inches [mm]
1. Finish: Galvanized
NOTES: Unless Otherwise Specified

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES[mm].
TOLERANCES:
FRACTIONAL: X/X ± 1/16" [1.6mm]
DECIMAL: X.X ± .0625"
X.XX ± .032"
X.XXX ± .010"
DEGREES: X ± 0.5°
X.X ± 0.1°

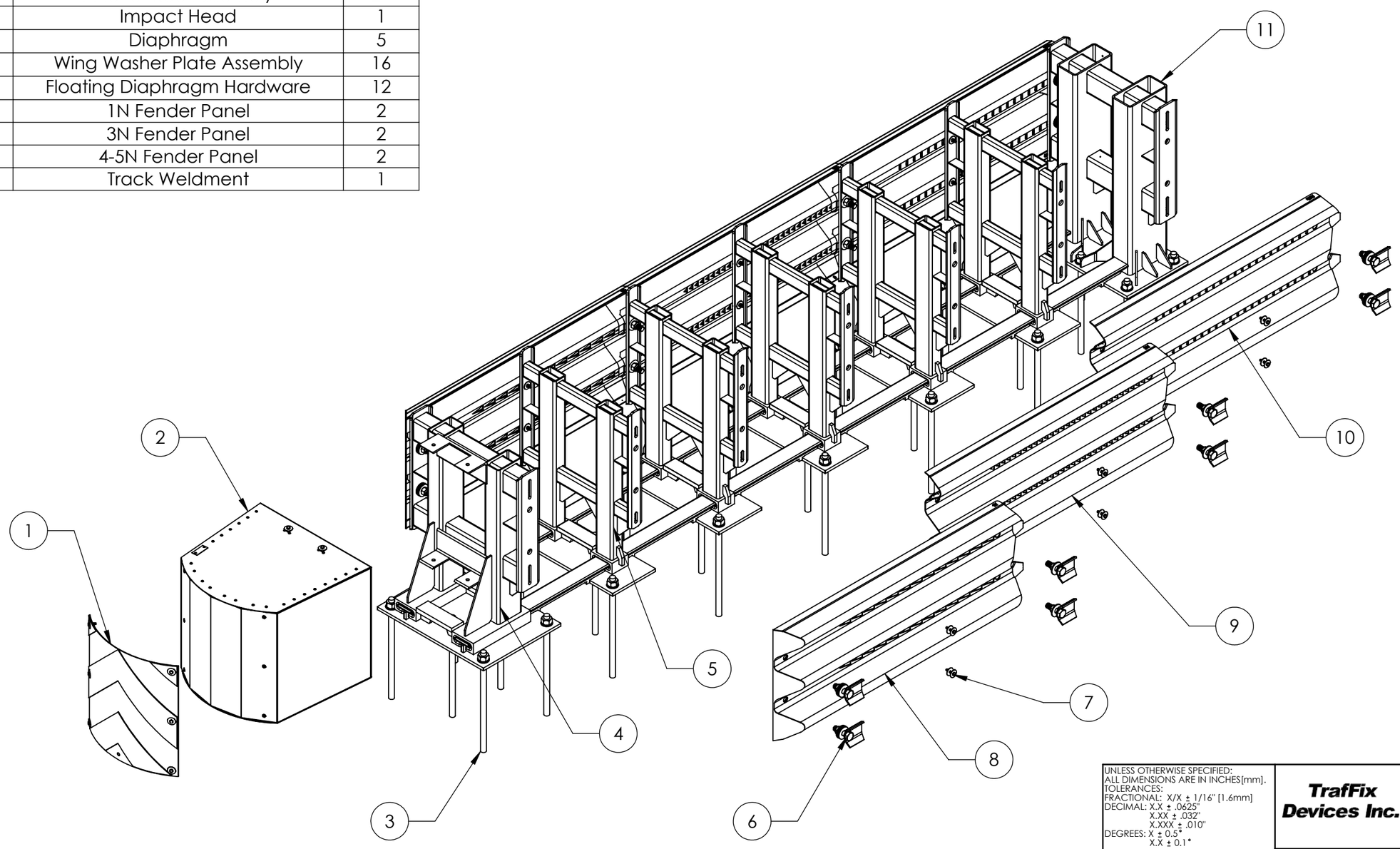
TrafFix Devices Inc.
160 Avenida La Pata
San Clemente, CA 92673
(949) 361-5663
FAX (949) 361-9205
www.traffixdevices.com

TITLE:

Delta Crash Cushion TL2 Narrow

DRAWN BY: CD	DATE: 6/26/23	SIZE B	DRAWING NO. 1127
CHECKED BY: CJ	DATE: 6/26/23		REV A
APPROVED BY: CJ	DATE: 6/26/23		SHEET 1 OF 2

Item No.	Descripion	QTY.
1	Sheeting Panel	1
2	Energy Attenuation Module	1
3	Anchor Rod Assembly	27
4	Impact Head	1
5	Diaphragm	5
6	Wing Washer Plate Assembly	16
7	Floating Diaphragm Hardware	12
8	1N Fender Panel	2
9	3N Fender Panel	2
10	4-5N Fender Panel	2
11	Track Weldment	1



UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES[mm].
TOLERANCES:
FRACTIONAL: X/X ± 1/16" [1.6mm]
DECIMAL: X.X ± .0625"
X.XX ± .032"
X.XXX ± .010"
DEGREES: X ± 0.5°
X.X ± 0.1°

TrafFix Devices Inc.
160 Avenida La Pata
San Clemente, CA 92673
(949) 361-5663
FAX (949) 361-9205
www.traffixdevices.com

TITLE:

Delta Crash Cushion TL2 Narrow

DRAWN BY: CD	DATE: 6/26/23	
CHECKED BY: CJ	DATE: 6/26/23	
APPROVED BY: CJ	DATE: 6/26/23	

SIZE	DRAWING NO.	REV
B	1127	A