



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

December 20, 2024

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

In Reply Refer To:
HSST-1/CC-179

Gerrit Dyke
Lindsay Corporation
18135 Burke St
Elkhorn, NE 68022
USA

Dear Mr. Dyke:

We received your initial correspondence on November 16, 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 16, 2024, we received a complete set of files needed to complete our review. We write to inform you that the device Tau-XR is eligible for Federal-aid reimbursement. This letter is assigned Federal Highway Administration (FHWA) control number CC-179.

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: Tau-XR
Type of system: Crash Cushion
Test Level: Test Level 3
Testing conducted by: Holmes Solutions LP
Date of request: November 16, 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.

In accordance with FHWA's Memo "Federal-aid Reimbursement Eligibility Process for Safety Hardware Devices" dated November 12, 2015, FHWA will make note of any reported damage to a test vehicle's fuel tank, oil pan, or other feature that might serve as a surrogate of the fuel tank. AASHTO's MASH states "Although not a specific factor in assessing test results, integrity of a test vehicle's fuel tank is a potential concern. It is preferable that the fuel tank remains intact and not be punctured. Damage or rupture of the fuel tank, oil pan, or other feature that might serve as a surrogate of the fuel tank should be reported". The test report included in this submittal states the oil pan suffered minor damage causing a leak during tests 3-30 and 3-32.

Eligibility letter CC-179 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.

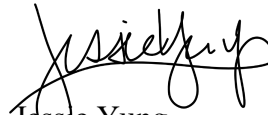
PUBLIC DISCLOSURE

To prevent any misunderstanding, and as discussed above, this Federal-aid eligibility letter is assigned FHWA control number CC-179. 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. 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 Aimee Zhang at Aimee.Zhang@dot.gov.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jessie Yung', written over a horizontal line.

Jessie Yung
Director, Office of Safety Technologies
FHWA Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	November 16, 2023	☐ New ☐ Resubmission
	Name:	Gerrit Dyke	
	Company:	Lindsay Corporation	
	Address:	18135 Burke St, Elkhorn, NE 68022	
	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	Tau-XR	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:	Gerrit Dyke	Same as Submitter ☐
Company Name	Lindsay Corporation	Same As Submitter ☐
Address:	18135 Burke St, Elkhorn, NE 68022	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.		
Neither Holmes Solutions LP, the test facility, or any of its employees have any financial interest in Lindsay Corporation.		

PRODUCT DESCRIPTION

- ☒ New Hardware or Significant Modification
 ☐ Modification to Existing Hardware

The TAU-XR™ is a low maintenance fully redirective, non-gating crash cushion designed to meet the latest test standards defined in the Manual for Assessing Safety Hardware (MASH), Second Edition, 2016 for Test Level 3 impacts. The TAU-XR system utilizes a rigid rail anchoring system, a backstop, a front support, 6 mid-supports and 14 telescoping three-beam side panels to form 7 collapsible bays. The bays are equipped with varying arrays of crushable aluminum tubes designed to absorb the kinetic energy and safely contain vehicles during head on impacts while the side panels safely redirect vehicles during side impacts. The system has a nominal 32 1/4" height, a 34 3/16" width except at the front nose, which is 36" wide, and a length of 282 3/4". The system was designed and tested to safely shield hazards up to 30" wide.

The TAU-XR is comprised of a dual rail weldment; a compact backstop assembly; a front support; six mid-supports; 16 rail sliders; two front side panels; 15 sliding panels; two end panels; two rubber bumpers; a cross brace; 28 sets of panel sliders and various sets of hardware such as nuts, bolts, springs, and washers. The seven collapsible bays contain 32 aluminum tubes distributed among the bays and nested into designated pockets to ensure correct placement. A retaining bar is installed across each end to maintain the position of the tubes.

The TAU-XR rail and backstop weldments are anchored to a concrete foundation using threaded rods secured in place with epoxy.

The TAU-XR utilizes standard corrugated three-beam panels which enable the application of standard transition methods to various roadside hardware and barrier systems. Proprietary transitions using nested angled and standard end panels were tested and are available.

The TAU-XR was tested with a delineation decal, delineation may be placed on the delineation plate which is part of the front support.

The TAU-XR was tested with an identification decal for product identification, component tracking and quality control.

The TAU-XR WAS TESTED WITH AN ImpactAlert device, developed by Lindsay, to monitor and detect vehicle impacts and send notifications via SMS text or e-mail to designated repair crew or DOTs. The impact alert was affixed to the downstream side of the backstop. The ImpactAlert is an optional device that does not affect the capacity, function, or performance of the TAU-XR.

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:	Mathew McNeil	
Engineer Signature:	Mathew McNeil	Digitally signed by Mathew McNeil Date: 2023.11.13 15:09:57 -07'00'
Address:	7 Canterbury St, Hornby, Christchurch, 8042	Same as Submitter ☐
Country:	New Zealand	Same as Submitter ☐

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-30 (1100C)	MASH 2016 Test 3-30 of Tau-XR. Holmes Solutions test number 144040.05.3-30. Test date August 3, 2023. Holmes Solutions report number 144040.05RP08.23(V1.3). The Tau-XR was impacted by a 2017 Hyundai Accent (1100C) traveling at a velocity of 62.3 mph (100.2 km/h), impacting the test article with the vehicle offset 1/4 of its width, at an angle of 0 degrees on the nose of the crash cushion. Upon impact the vehicle pushed the front support weldment toward the backstop, collapsing the aluminum tubes as the bays compressed. The crash cushion brought the vehicle to a controlled stop. There was no significant deformation or penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 35.8 ft/s (10.9 m/s) and a maximum ridedown acceleration of 18.3 g. The maximum roll angle was 6.1 degrees and maximum pitch angle was 9.8 degrees. The working width of the Tau-XR was 37.8 in. (960 mm). The Tau-XR meet all the requirements for MASH 2016 test 3-30.	PASS
3-31 (2270P)	MASH 2016 Test 3-31 of Tau-XR. Holmes Solutions test number 144040.05.3-31. Test date July 28, 2023. Holmes Solutions report number 144040.05RP0823(V1.3). The Tau-XR was impacted by a 2018 Dodge Ram 1500 (2270P) traveling at a velocity of 63.2 mph (101.7 km/h), impacting the test article at 0.3 degrees on the nose of the crash cushion. Upon impact the vehicle pushed the front support weldment toward the backstop, collapsing the aluminum tubes as the bays compressed. The crash cushion brought the vehicle to a controlled stop. There was no significant deformation or penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 28.7 ft/s (8.7 m/s) and a maximum ridedown acceleration of 16.3 g. The maximum roll angle was 2.6 degrees and maximum pitch angle was 4.8 degrees. The working width of the Tau-XR was 39 in (995 mm). The Tau-XR meet all the requirements for MASH 2016 test 3-31.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-32 (1100C)	MASH 2016 Test 3-32 of Tau-XR. Holmes Solutions text number 144040.05.3-32. Test date August 30, 2023. Holmes Solutions report number 144040.05RP0823(V1.3). The Tau-XR was impacted by a 2017 Hyundai Accent (1100C) traveling at a velocity of 61.6 mph (99.1 km/h), impacting the test article at 14.7 degrees on the nose of the crash cushion. Upon impact the vehicle pushed the front support weldment toward the backstop, collapsing the aluminum tubes as the bays compressed. Throughout the test the vehicle is rotating clockwise. The crash cushion brought the vehicle to a controlled stop. There was no significant deformation or penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 38.3 ft/s (11.7 m/s) and a maximum ridedown acceleration of 16.0 g. The maximum roll angle was 4.8 degrees and maximum pitch angle was 17.1 degrees. The working width of the Tau-XR was 38 in. (967 mm). The Tau-XR meet all the requirements for MASH 2016 test 3-32.	PASS
3-33 (2270P)	MASH 2016 Test 3-33 of Tau-XR. Holmes Solutions test number 144040.05.3-33. Test date July 26, 2023. Holmes Solutions report number 144050.05RP0823(V1.3). The Tau-XR was impacted by a 2017 Dodge Ram 1500 (2270P) traveling at a velocity of 62.6 mph (100.8 km/h), impacting the test article at 14.7 degrees on the nose of the crash cushion. Upon impact the vehicle pushed the front support weldment toward the backstop, collapsing the aluminum tubes as the bays compressed. Throughout the test the vehicle is rotating clockwise. The crash cushion brought the vehicle to a controlled stop. There was no significant deformation or penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 30.5 ft/s (9.3 m/s) and a maximum ridedown acceleration of 15.9 g. The maximum roll angle was 12.8 degrees and maximum pitch angle was 3.9 degrees. The working width of the Tau-XR was 38.7 in. (983 mm). The Tau-XR meet all the requirements for MASH 2016 test 3-33.	PASS

3-34 (1100C)	MASH 2016 Test 3-34 of Tau-XR. Holmes Solutions test number 144040.05.3-34. Test date September 5, 2023. Holmes Solutions report number 144040.05RP0823(V1.3). The Tau-XR was impacted by a 2017 Kia Rio (1100C) traveling at a velocity of 61.0 mph (98.1 km/h), impacting the test article at 15 degrees on the side of the system 20 in. (508 mm) downstream from the front face of the support weldment. Upon impact the side panels of the system redirected the vehicle. The vehicle exited at a velocity of 52.6 mph (84.6 km/h) and at an angle of 8.7 degrees. The crash cushion contained and redirected the test vehicle. There was no significant deformation or penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 13.1 ft/s (4.0 m/s) and a maximum ridedown acceleration of 7.3 g. The maximum roll angle was 5.7 degrees and maximum pitch angle was 3.1 degrees. The working width of the Tau-XR was 36 in. (914 mm). The Tau-XR meet all the requirements for MASH 2016 test 3-34.	PASS
3-35 (2270P)	MASH 2016 Test 3-35 of Tau-XR. Holmes Solutions test number 144040.05.3-35. Test date August 22, 2023. Holmes Solutions report number 144040.05RP0823(V1.3). The Tau-XR was impacted by a 2017 Dodge Ram 1500 (2270P) traveling at a velocity of 61.4 mph (98.8 km/h), impacting the test article at 24.9 degrees on the side of the system 11.8 in. (300 mm) downstream from the front corner of the front support weldment. Upon impact the side panels of the system redirected the vehicle. The vehicle exited at a velocity of 44.7 mph (72.0 km/h) and at an angle of 15.4 degrees. The crash cushion contained and redirected the test vehicle. The front right of the vehicle along with the right side body panels were damaged. The occupant compartment deformations were within allowable limits. There was no penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 25.3 ft/2 (7.7 m/s) and a maximum ridedown acceleration of 8.6 g. The maximum roll angle was 26.7 degrees and maximum pitch angle was 8.1 degrees. The working width of the Tau-XR was 38 in. (969 mm). The Tau-XR meet all the requirements for MASH 2016 test 3-35.	PASS

3-36 (2270P)	MASH 2016 Test 3-36 of Tau-XR. Holmes Solutions test number 144040.05.3-36. Test date August 15, 2023. Holmes Solutions report number 144040.05RP0823(V1.3). The Tau-XR was impacted by a 2017 Dodge Ram 1500 (2270P) traveling at a velocity of 62.6 mph (100.7 km/h), impacting the test article at 25.0 degrees with the centerline of the test vehicle aligned with the corner of the rigid backstop structure and the center of the 30 in (762 mm) hazard set 11 in. (279 mm) downstream from the back of the backstop anchor plate. Upon impact the side panels of the system redirected the vehicle. The vehicle existed at a velocity of 47.0 mph (75.6 km/h) and at an angle of 16.0 degrees. The crash cushion contained and redirected the test vehicle. The left front of the vehicle along with the left side body panels were damaged. The occupant compartment deformations were within allowable limits. There was no penetration into the vehicles occupant compartment. The vehicle experiences a maximum ooccupant impact velocity of 27.6 ft/s (8.4 m/s) and a maximum ridedown acceleration of 11.0 g. The maximum roll angle was 31.8 degrees and maximum pitch angle was 10.7 degrees. The working width of the Tau-XR was 37.25 in. (946 mm). The Tau-XR meet all the requirements for MASH 2016 text 3-36.	PASS
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3-37 (2270P)	MASH 2016 Test 3-37a of Tau-XR. Holmes Solutions test number 144040.05.3-37a. Test date September 19, 2023. Holmes Solutions report number 144040.05RP0823(V1.3). The Tau-XR was impacted by a 2017 Dodge Ram 1500 (2270P) traveling at a velocity of 62.0 mph (99.8 km/h), impacting the side of the test article at 25.0 degrees in the reverse orientation, approximately 108 in. (2.7 m) upstream of the backstop weldment. Upon impact the side panels of the system redirected the vehicle. The vehicle exited at a velocity of 42.5 mph (68.4 km/h) and at an angle of 20.4 degrees. The crash cushion contained and redirected the test vehicle. The front left side of the vehicle along with the left side body panels were damaged. The occupant compartment deformations were within allowable limits. There was no penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 27.4 ft/s (8.3 m/s) and a maximum ridedown acceleration of 9.1 g. The maximum roll angle was 35.2 degrees and maximum pitch angle was 15.2 degrees. The working width of the Tau-XR was 36 in. (914 mm). The Tau-XR meet all the requirements for MAXH 2016 test 3-37a.	PASS
3-38 (1500A)	MASH 2016 Test 3-38 of Tau-XR. Holmes Solutions test number 144040.05.3-38. Test date August 7, 2023. Holmes Solutions report number 144040.05RP0823(V1.3). The Tau-XR was impacted by a 2017 Chevrolet Malibu (1500A) traveling at a velocity of 62.8 mph (101.1 km/h), impacting the test article at 0 degrees on the nose of the crash cushion. Upon impact the vehicle pushed the front support weldment toward the backstop, collapsing the aluminum tubes as the bays compressed. The crash cushion brought the vehicle to a controlled stop. There was no significant deformation or penetration into the vehicles occupant compartment. The vehicle experiences a maximum occupant impact velocity of 34.5 ft/s (10.5 m/s) and a maximum ridedown acceleration of 18.8 g. The maximum roll angle was 4.1 degrees and maximum pitch angle was 6.7 degrees. The working width of the Tau-XR was 39.3 in. (1000 mm). The Tau-XR meet all the requirements for MAXH 2016 test 3-38.	PASS
3-40 (1100C)	Test for non-redirective crash cushion, Not applicable	Non-Relevant Test, not conducted
3-41 (2270P)	Test for non-redirective crash cushion, Not applicable	Non-Relevant Test, not conducted

3-42 (1100C)	Test for non-redirective crash cushion, Not applicable	Non-Relevant Test, not conducted
3-43 (2270P)	Test for non-redirective crash cushion, Not applicable	Non-Relevant Test, not conducted
3-44 (2270P)	Test for non-redirective crash cushion, Not applicable	Non-Relevant Test, not conducted
3-45 (1500A)	Test for non-redirective crash cushion, Not applicable	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:	Holmes Solutions LP	
Laboratory Signature:	Mathew McNeil  Digitally signed by Mathew McNeil Date: 2023.11.13 15:17:57 -07'00'	
Address:	7 Canterbury St, Hornby, Christchurch, 8042	Same as Submitter ☐
Country:	New Zealand	Same as Submitter ☐
Accreditation Certificate Number and Dates of current Accreditation period :	1022 ISO/IEC 17025:2017 Client Number 7559 April 2023 to April 2024	

Submitter Signature*:



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