



U.S. Department  
of Transportation

Federal Highway  
Administration

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

May 17, 2018

In Reply Refer To:  
HSST-1/B-304

Mr. Gerrit Dyke, P.E.  
Lindsay Transportation Solutions  
180 River Road  
Rio Vista, CA 94571

Dear Mr. Dyke:

This letter is in response to your February 1, 2018 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 B-304 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:

- QuickChange Moveable Barrier Steel Reactive Tension System (QMBSRTS)

### **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: QuickChange Moveable Barrier Steel Reactive Tension System  
(QMBSRTS)

Type of system: Longitudinal Barrier (unanchored)

Test Level: MASH Test Level 3 (TL3)

Testing conducted by: Texas A&M Transportation Institute (TamTI)

Date of request: March 9, 2018

Date initially acknowledged: March 20, 2018

Date of completed package: March 9, 2018

FHWA concurs with the recommendation of the accredited crash testing laboratory on the attached form.

### **Full Description of the Eligible Device**

The device and supporting documentation, including reports of the crash tests or other testing done, videos of any crash testing, and/or drawings of the device, are described in the attached form.

### **Notice**

This eligibility letter is issued for the subject device as tested. Modifications made to the device are not covered by this letter. Any modifications to this device should be submitted to the user (i.e., state DOT) as per their requirements.

You are expected to supply potential users with sufficient information on design, installation and maintenance requirements to ensure proper performance.

You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the test and evaluation criteria of AASHTO's MASH.

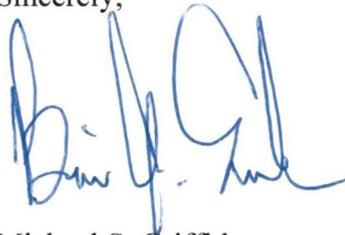
Issuance of this letter does not convey property rights of any sort or any exclusive privilege. This letter is based on the premise that information and reports submitted by you are accurate and correct. We reserve the right to modify or revoke this letter if: (1) there are any inaccuracies in the information submitted in support of your request for this letter, (2) the qualification testing was flawed, (3) in-service performance or other information reveals safety problems, (4) the system is significantly different from the version that was crash tested, or (5) any other

information indicates that the letter was issued in error or otherwise does not reflect full and complete information about the crashworthiness of the system.

### Standard Provisions

- To prevent misunderstanding by others, this letter of eligibility designated as FHWA control number B-304 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.
- If the subject device is a patented product it may be considered to be proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects: (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.

Sincerely,


Michael S. Griffith  
Director, Office of Safety Technologies  
Office of Safety

Enclosures

## Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

|                  |                  |  |   |
|------------------|------------------|--|---|
| <b>Submitter</b> | Date of Request: | February 01, 2018  | <input checked="" type="radio"/> New <input type="radio"/> Resubmission |
|                  | Name:            | Gerrit A. Dyke, P.E.   |   |
|                  | Company:         | Lindsay Transportation Solutions, Inc.                               |   |
|                  | Address:         | 180 River Road, Rio Vista, CA 95471                                  |   |
|                  | Country:         | USA  |   |
|                  | To:              | Michael S. Griffith, Director<br>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 |
|--|---|---|-------------------|------------|
| 'B': Rigid/Semi-Rigid Barriers (Roadside, Median, Bridge Railings) | <input checked="" type="radio"/> Physical Crash Testing<br><input type="radio"/> Engineering Analysis | QuickChange Moveable Barrier Steel Reactive Tension System (QMB-SRTS) | 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 A. Dyke, P.E.                   | Same as Submitter <input checked="" type="checkbox"/> |
| Company Name: | Lindsay Transportation Solutions, Inc. | Same as Submitter <input checked="" type="checkbox"/> |
| Address:      | 180 River Road, Rio Vista, CA 95471    | Same as Submitter <input checked="" type="checkbox"/> |
| Country:      | USA                                    | Same as Submitter <input checked="" type="checkbox"/> |

Enter below all disclosures of financial interests as required by the FHWA 'Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.

Texas A&M Transportation Institute (TTI) was contracted by Lindsay Transportation Solutions, Inc. (LTS) to perform full-scale crash testing of the Steel Reactive Tension Quickchange® Movable Barrier System (SRTS). There are no shared financial interests in the SRTS by TTI, or between LTS and TTI, other than the costs involved in the actual crash tests and reports for this submission to FHWA. TTI employees have, and may in the future, provided consulting services to LTS unrelated to the current testing and evaluation of this product.

## PRODUCT DESCRIPTION

- New Hardware or Significant Modification
                 
  Modification to Existing Hardware

The Steel Reactive Tension Quickchange® Movable Barrier System (SRTS) is an unanchored longitudinal barrier capable of rapid lateral transfer by a transfer vehicle. The SRTS is designed to meet the rigid requirements of deployment in movable barrier applications where positive separation is required and where lane widths and lateral space are limited.

The SRTS barrier element is fabricated out of a steel shell and filled with unreinforced concrete. The elements are connected end to end with tensioning hinge mechanisms and steel pins. Each barrier segment is approximately 39 in [1.0 m] long (pin to pin) and weighs approximately 1600 lb (725 kg). The barrier elements have an effective width of 13 in [460 mm] with a low profile 24 in [610 mm] base plate. Variable length barriers (VLB) are used in conjunction with the concrete filled segments. The system is applicable to asphalt or concrete road surfaces.

The SRTS can be utilized with or without VLBs. VLB positioning is configured in accordance with the requirements of the barrier application. Typical VLB spacing is 1 in 17 SRTS barrier segments or fewer, however, some applications may require more.

The SRTS pin used to link the barrier segments utilizes a washer and retaining clip to minimize maintenance of the connection during transfer operations. The washer and retaining clip do not effect the capacity of the joint or the function or performance of the barrier system. The SRTS can be deployed with or without the washer and retaining clip.

A series of insignificant modifications to the SRTS barrier were submitted and deemed eligible under NCHRP Report 350 including alternative retaining clips, pusher plates, and VLB hydraulic reservoir cap (Reference FHWA letter B-69E). These alternative components are integrated into the MASH tested configuration. The original components may also be applied to the SRTS eligible under MASH. In addition, alternative corrosion resistant coatings may be applied and used on SRTS and VLB hardware, including the integral tension spring, as the coatings do not effect the capacity, function, or performance of the hardware or SRTS system.

The SRTS system was tested to MASH using a 5/8" thick rubber foot. Alternative foot designs may be utilized as long as they maintain an equivalent durometer, coefficient of friction, and equal or stronger connection. An acceptable alternative foot includes the 1/2" thick rubber foot used on prior NCHRP 350 certified SRTS.

Markings may be stamped into the steel or concrete for identification, quality assurance, and tracking. The markings may be alpha numeric characters set into the top of the barrier. In some cases, a metal identification tag may be fastened to the barrier.

Applying lane striping or delineation to the barrier segments with paint or reflective tape is acceptable. Applying low profile adhesive or anchored reflectors is also acceptable. When applied to the base plate or barrier top or sides, the capacity, function, or performance of the SRTS is not effected.

Manufacturing drawings may be adjusted to ensure manufacturing capability and consistency with MASH tested and certified product.

The test installation consisted of a total of 176 SRTS barriers (Model BSI-1706058-00). The total length of the barrier installation was approximately 578-ft 6-inches (176.3 m). Two of the 176 segments (#89 and #106) were VLBs (Model BSI-1706031-00). The barriers were installed on a 6-to-7-inch (152-178 mm) thick concrete apron.

## 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:      | D. Lance Bullard, Jr.                          |  |
| Engineer Signature: | <b>D. Lance Bullard, Jr.</b>                   | Digitally signed by D. Lance Bullard, Jr.<br>Date: 2018.03.02 15:56:13 -06'00' |
| Address:            | TTI, TAMU 3135, College Station, TX 77843-3135 | Same as Submitter <input type="checkbox"/>                                     |
| Country:            | USA  | Same as Submitter <input type="checkbox"/>                                     |

A brief description of each crash test and its result:

| Required Test Number | Narrative Description  | Evaluation Results               |
|----------------------|--|----------------------------------|
| 3-10 (1100C)         | TTI Crash Test No. 690900-LTS3: The SRTS Barrier contained and redirected the 1100c vehicle. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection during the test was 27.6 inches (701 mm). No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or present a hazard to others in the area. Max occupant compartment deformation was 0.5 inches (13 mm), well within the allowable limits. Maximum roll and pitch angles were 9 degrees and 5 degrees, respectively. Occupant risk factors were within the preferred limits specified in MASH. | PASS                             |
| 3-11 (2270P)         | TTI Crash Test No. 690900-LTS4: The SRTS Barrier contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection during the test was 47.6 inches (1209 mm). No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or present a hazard to others in the area. No occupant compartment deformation or intrusion occurred. Maximum roll and pitch angles were 25 degrees and 5 degrees, respectively. Occupant risk factors were within the preferred limits specified in MASH.                                   | PASS                             |
| 3-20 (1100C)         | Test not performed. The SRTS is a stand alone barrier system that will not transition to any stiffer or more rigid barrier systems. Therefore, test 3-20 is not required.  | Non-Relevant Test, not conducted |
| 3-21 (2270P)         | Test not performed. The SRTS is a stand alone barrier system that will not transition to any stiffer or more rigid barrier systems. Therefore, test 3-21 is not required.  | 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:   | Texas A&M Transportation Institute (TTI)  |  |
| Laboratory Signature:  | <b>Darrell L. Kuhn</b>  | Digitally signed by Darrell L. Kuhn<br>Date: 2018.03.02 16:01:29 -06'00' |
| Address:   | TTI, TAMU 3135, College Station, TX 77843-3135                                  | Same as Submitter <input type="checkbox"/>                               |
| Country:   | USA   | Same as Submitter <input type="checkbox"/>                               |
| Accreditation Certificate Number and Dates of current Accreditation period : | ISO 17025 Laboratory<br>Certificate Number: 2821.01<br>Valid To: April 30, 2019 |  |

Submitter Signature\*: **Gerrit Dyke** Digitally signed by Gerrit Dyke  
Date: 2018.03.05 14:12:21  
-08'00'

**Submit Form**

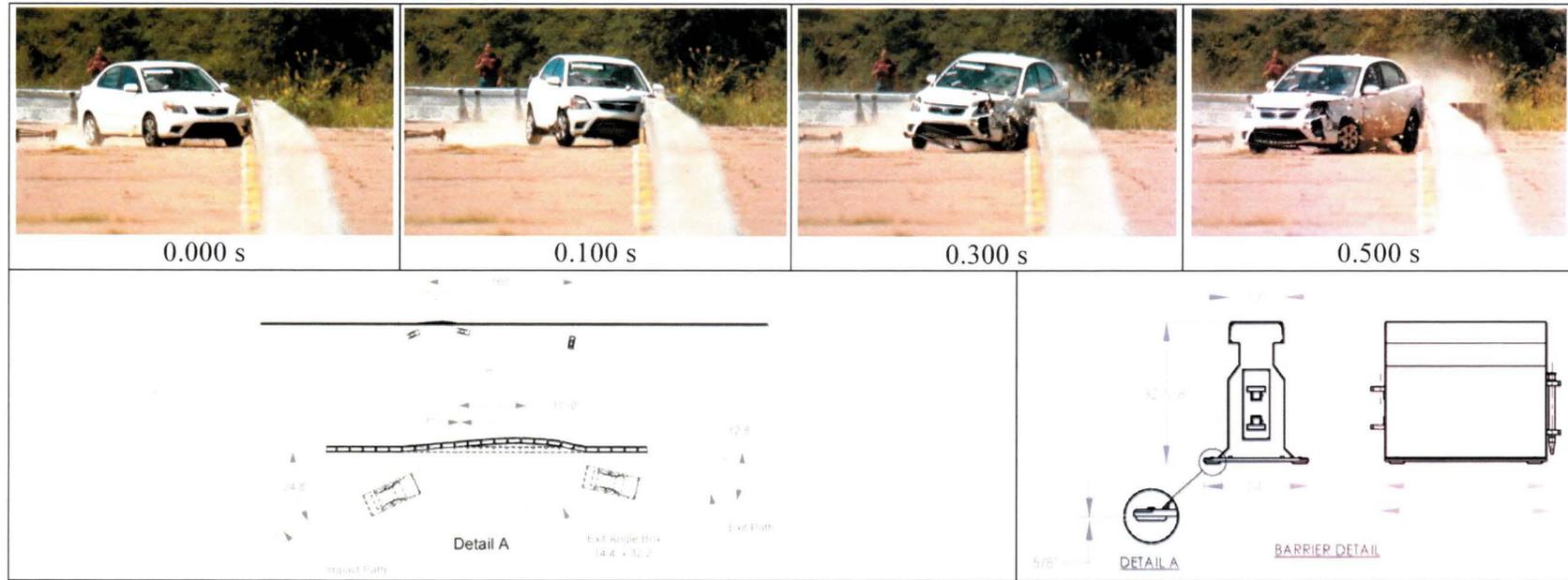
## ATTACHMENTS

Attach to this form:

- 1) Additional disclosures of related financial interest as indicated above.
- 2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
- 3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [[Hardware Guide Drawing Standards](#)]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

| Eligibility Letter |      | Key Words |
|--------------------|------|-----------|
| Number             | Date |           |
|                    |      |           |



**General Information**

Test Agency ..... Texas A&M Transportation Institute (TTI)  
 Test Standard Test No. .... MASH Test 3-10  
 TTI Test No. .... 690900-LTS3  
 Test Date ..... 2017-07-18

**Test Article**

Type ..... Portable Concrete Barrier  
 Name ..... Steel RTS Barrier  
 Installation Length ..... 578 ft 5 inches  
 Material or Key Elements .... 174 concrete filled steel barrier segments  
 37 inches (940 mm) long x 32 3/4 inches  
 (822 mm) tall plus two variable length  
 barriers (VLB)

**Soil Type and Condition**

..... Concrete surface, damp

**Test Vehicle**

Type/Designation ..... 1100C  
 Make and Model ..... 2011 Kia Rio  
 Curb ..... 2448 lb (1110 kg)  
 Test Inertial ..... 2421 lb (1098 kg)  
 Dummy ..... 165 lb (75 kg)  
 Gross Static ..... 2586 lb (1173 kg)

**Impact Conditions**

Speed ..... 62.4 mi/h (100.4 km/h)  
 Angle ..... 24.8 degrees  
 Location/Orientation ..... 7.0 inches (178 mm)  
 up of cntr 58 (bumper)

**Impact Severity**

..... 55 kip-ft (75 kJ)

**Exit Conditions**

Speed ..... 43.3 mi/h  
 Angle ..... 12.8 degrees

**Occupant Risk Values**

Longitudinal OIV ..... 18.0 ft/s (5.5 m/s)  
 Lateral OIV ..... 24.6 ft/s (7.5 m/s)  
 Longitudinal Ridedown ..... 6.8 g  
 Lateral Ridedown ..... 9.6 g  
 THIV ..... 33.7 km/h  
 PHD ..... 11.4 g  
 ASI ..... 1.94

**Max. 0.050-s Average**

Longitudinal ..... -10.1 g  
 Lateral ..... 15.1 g  
 Vertical ..... -2.6 g

**Post-Impact Trajectory**

Stopping Distance ..... 160 ft (49 m) dwnstrm  
 13 ft (4 m) twd traffic

**Vehicle Stability**

Maximum Yaw Angle ..... 53 degrees  
 Maximum Pitch Angle ..... 5 degrees  
 Maximum Roll Angle ..... 9 degrees  
 Vehicle Snagging ..... No  
 Vehicle Pocketing ..... No

**Test Article Deflections**

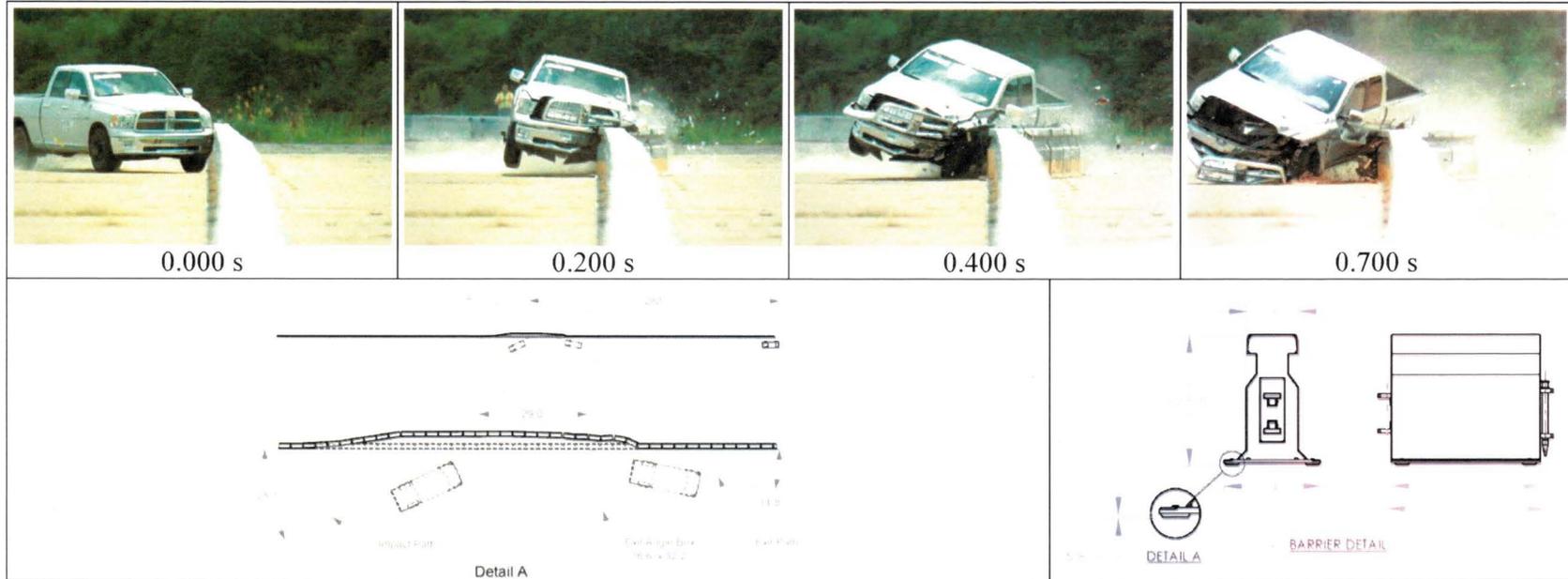
Dynamic ..... 27.6 inches (701 mm)  
 Permanent ..... 26.5 inches (673 mm)  
 Working Width\* ..... 39.5 inches (1003 mm)  
 Height of Working Width ..... 32.6 inches (882 mm)

**Vehicle Damage**

VDS ..... 11LFQ3  
 CDC ..... 11FLEW3  
 Max. Exterior Deformation ..... 10.0 inches  
 OCDI ..... LF0010000  
 Max. Occupant Compart.  
 Deformation ..... 0.5 inches (13 mm)

**Figure 5.8. Summary of Results for MASH Test 3-10 on Steel RTS Barriers.**

\* Does not include 5.5-inch toe flange



**General Information**

Test Agency..... Texas A&M Transportation Institute (TTI)  
 Test Standard Test No..... MASH Test 3-11  
 TTI Test No. .... 690900-LTS4  
 Test Date ..... 2017-07-17

**Test Article**

Type ..... Portable Concrete Barrier  
 Name ..... Steel RTS Barrier  
 Installation Length..... 578 ft 5 inches  
 Material or Key Elements... 174 concrete filled steel barrier segments  
 37 inches (940 mm) long x 32 3/4 inches  
 (822 mm) tall plus two variable length  
 barriers (VLB)

**Soil Type and Condition**

..... Concrete surface, damp

**Test Vehicle**

Type/Designation..... 2270P  
 Make and Model ..... 2011 Dodge RAM 1500 Pickup  
 Curb ..... 4938 lb (2240 kg)  
 Test Inertial..... 5030 lb (2282 kg)  
 Dummy ..... No dummy  
 Gross Static ..... 5030 lb (2282 kg)

**Impact Conditions**

Speed ..... 62.3 mi/h (100.3 km/h)  
 Angle..... 25.1 degrees  
 Location/Orientation..... 11.5 inches (292 mm)  
 upstrm of CL of  
 segment 87(bumper)

**Impact Severity**

..... 117 kip-ft (159 kJ)

**Exit Conditions**

Speed ..... 45.7 mi/h  
 Angle ..... 11.8 degrees

**Occupant Risk Values**

Longitudinal OIV ..... 14.1 ft/s (4.3 m/s)  
 Lateral OIV ..... 18.7 ft/s (5.7 m/s)  
 Longitudinal Ridedown ..... 4.8 g  
 Lateral Ridedown ..... 9.4 g  
 THIV ..... 25.2 km/h  
 PHD ..... 10.0 g  
 ASI ..... 1.19  
 Max. 0.050-s Average  
 Longitudinal ..... -6.1 g  
 Lateral ..... 9.5 g  
 Vertical ..... 2.9 g

**Post-Impact Trajectory**

Stopping Distance ..... 270 ft (82 m) dwnstrm  
 67 ft (20 m) twd traffic

**Vehicle Stability**

Maximum Yaw Angle..... 50 degrees  
 Maximum Pitch Angle..... 5 degrees  
 Maximum Roll Angle ..... 25 degrees  
 Vehicle Snagging ..... No  
 Vehicle Pocketing ..... No

**Test Article Deflections**

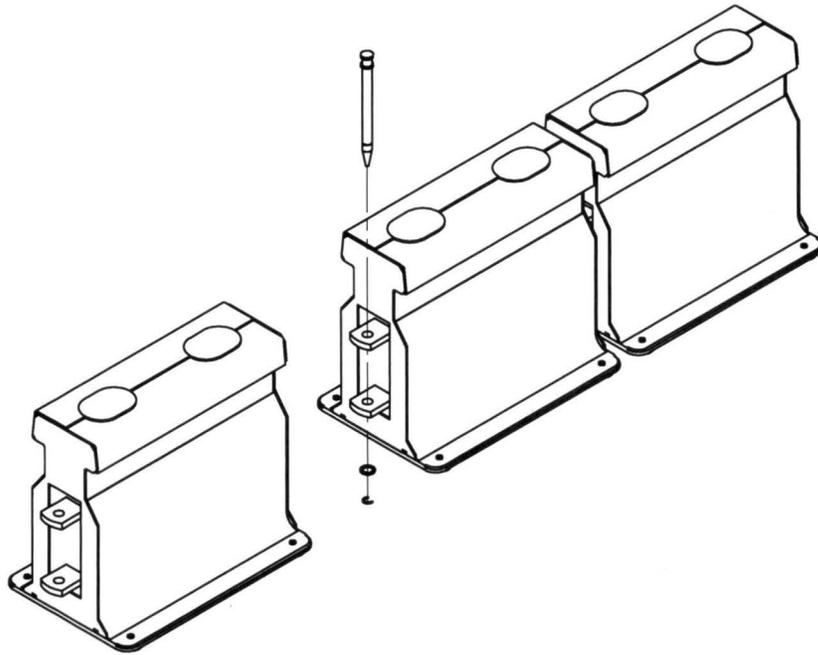
Dynamic ..... 47.6 inches (1209 mm)  
 Permanent..... 46.5 inches (1181 mm)  
 Working Width\* ..... 59.6 inches (1514 mm)  
 Vehicle Intrusion..... 32.6 inches (828 mm)

**Vehicle Damage**

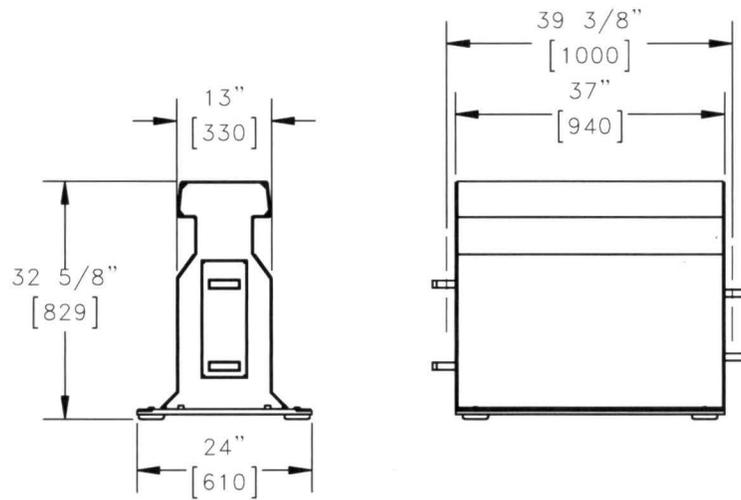
VDS ..... 11LFQ4  
 CDC ..... 11FLEW4  
 Max. Exterior Deformation..... 14.0 inches (356 mm)  
 OCDI ..... LF0000000  
 Max. Occupant Compart.  
 Deformation..... None

**Figure 6.9. Summary of Results for MASH Test 3-11 on Steel RTS Barriers.**

\* Does not include 5.5-inch toe flange



STEEL REACTIVE TENSION ® BARRIER



STEEL REACTIVE TENSION® MOVEABLE BARRIER, MASH TL-3



XXX

Lindsay Transportation Solutions, 180 River Rd., Rio Vista CA. 94571, 888-800-3691  
[www.theroadzipper.com](http://www.theroadzipper.com)

SHEET NO.

DATE:

1 OF 2

01/29/18

## INTENDED USE

The Steel Reactive Tension® QuickChange® Moveable Barrier System (SRTS) is a MASH TL-3 longitudinal barrier capable of rapid lateral transfer by a transfer vehicle. SRTS is designed to meet the rigid requirements of deployment in moveable barrier applications where positive separation is required and where lane widths and lateral space are limited. The SRTS system is unanchored and has low deflection during vehicle impacts.

SRTS MASH TL-3 is a steel shelled barrier filled with high strength concrete, connected end to end with tensioning hinge mechanisms and steel pins. Each barrier segment is approximately 39 in [1.0 m] in length and weighs approximately 1600 lb [725 kg]. The barrier has a 24 in [610 mm] wide base and a 13 in [330 mm] effective barrier width.

Specially constructed transfer machines are used to lift, move, and reposition the barrier laterally on the roadway. Transfer vehicles are capable of moving the barrier wall up to 24 ft [7.5 m] at up to 10 mph [16 kph] on a permanent system and up to 5 mph [8 kph] for a temporary or construction system.

SRTS is used as median barrier on congested roadways to open and close lanes of traffic to adapt to changing traffic volumes during commuting hours or special events. It is also used to open and close construction zones on a periodic basis to increase safety, workspace, reduce congestion, and improve construction worker productivity.

The SRTS barrier is compatible with the ABSORB 350® Crash Cushion (SC11).

## APPROVALS

The Steel Reactive Tension® QuickChange® Moveable Barrier System has been fully tested in conformance with MASH Test Level 3 and determined eligible for federal reimbursement by the FHWA.

FHWA Eligibility Letter: TBD

## CONTACT INFORMATION

Lindsay Transportation Solutions  
180 River Rd.  
Rio Vista, CA 94571  
www.barriersystemsinc.com  
Phone: 888-800-3691 or 707-374-6800  
Fax: 707-374-6801  
Email: info@barriersystemsinc.com

STEEL REACTIVE TENSION® MOVEABLE BARRIER, MASH TL-3

XXX

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