U.S. Department of Transportation
Federal Highway Administration

August 15, 2023

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

In Reply Refer To:
HSST-1/B-374

Mr. Manar Nashif
Illinois State Toll Highway Authority
2700 Ogden Avenue
Downers Grove, IL 60515
USA

Dear Mr. Nashif:

We received your correspondence of April 28, 2021 requesting issuance of a reimbursement eligibility letter under the Federal-aid highway program for the roadside safety system, device, design, product, or hardware (collectively "device") described below. This letter is assigned Federal Highway Administration (FHWA) control number B-374.

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: Free Standing Temporary Concrete Barrier
Type of system: Temporary Concrete Barrier
Test Level: Test Level 3
Testing conducted by: Texas A&M Transportation Institute (TTI)
Date of request: April 28, 2021

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 B-374 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 eligibility letter is assigned FHWA control number B-374. It should only be reproduced in full with its attachment(s). This 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 Aimee Zhang at Aimee.Zhang@dot.gov.

Sincerely,

Robert Ritter
Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	December 01, 2022	◉ New ○ Resubmission
	Name:	Manar Nashif, P.E. Acting Chief Engineer	
	Company:	Illinois State Toll Highway Authority	
	Address:	2700 Ogden Avenue, Downers Grove, IL 60515	
	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
'B': Rigid/Semi-Rigid Barriers (Roadside, Median, Bridge Railings)	◉ Physical Crash Testing ○ Engineering Analysis	Free Standing Temporary Concrete Barrier	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:	Ahmad Hammad, PhD, PE, SE	Same as Submitter ☐
Company Name:	WSP USA Inc.	Same as Submitter ☐
Address:	2200 Western Court, Suite 120, Lisle, IL 60532	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.

Texas A&M Transportation Institute (TTI) was contracted by WSP USA Inc. (WSP) to perform full-scale crash testing of the Free Standing Temporary Concrete Barrier. There are no shared financial interests in the Free Standing Temporary Concrete Barrier by TTI, or between WSP and TTI, other than costs involved in the actual crash tests and reports for this submission to FHWA.

690900-WSP 1-2A

PRODUCT DESCRIPTION

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

The installation consisted of 16 reinforced concrete barriers, each 12.5 ft long, for a total installation length of approximately 200 ft. Two ⅞-inch diameter B7 threaded rods, with a plate washer, hardened washer, and heavy hex nut on each end, connected adjoining barriers to each other in an "X-pattern" with recesses cast into each end of each barrier. The barriers were 9½ inches wide at top, 24 inches wide at bottom, and 32 inches tall. Each barrier had two 3-inch tall × 22-inch long scuppers at bottom, and three slotted holes on each side to receive anchor pins. However, anchor pins were not used for this test installation, as all barriers were unrestrained to the road surface.

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:		
Engineer Signature:	D. Lance Bullard, Jr. Digitally signed by D. Lance Bullard, Jr. Date: 2022.12.01 15:54:18 -06'00'	
Address:	1254 Avenue A, Bldg 7091, Bryan, Texas 77807	Same as Submitter ☐
Country:	USA	Same as Submitter ☒

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-10 (1100C)	Test 3-10 (WSP-1) involves an 1100C vehicle impacting the test article at a target impact speed of 62 mi/h ±2.5 mi/h and a target impact angle of 25° ±1.5°. The target CIP was determined using the information provided in MASH Section 2.2.1, Section 2.3.2, and Table 2-7 and was for the right corner of the front bumper to impact at 3.6 ft upstream of the centerline of the joint between barriers 6 and 7. The results of the test conducted on January 15, 2020, are found in TTI Test Report number 690900-WSP 1-2A. The test vehicle was traveling at an impact speed of 61.6 mi/h as it made contact with the barrier 4.1 ft upstream of the barrier joint at an impact angle of 24.9°. After loss of contact with the barrier, the vehicle came to rest 230 ft downstream of the impact point and 28 ft towards the traffic side. The barrier contained and redirected the 1100C vehicle. The vehicle did not penetrate, underride, or override the installation. The 1100C vehicle exited within the exit box criteria. Working width was 38.0 inches at the toe of the barrier. Dynamic deflection of the barrier during the test was 14.0 inches, and permanent deflection was 14.0 inches. Although small pieces of concrete spalled off of the barrier, no detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or present hazard to others in the area. Maximum exterior crush to the vehicle was 10.0 inches in the front plane at the right front corner at bumper height. Maximum occupant compartment deformation was 1.0 inches in the right front floor pan area. The 1100C vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 11° and 11°, respectively. Longitudinal OIV was 17.1 ft/s, and lateral OIV was 24.9 ft/s. Longitudinal occupant ridedown acceleration was 3.5 g, and lateral occupant ridedown acceleration 9.9 g. The occupant risk factors were within the MASH preferred limits. The Free Standing Temporary Concrete Barrier performed acceptably for MASH test 3-10.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-11 (2270P)	Test 3-11 (WSP-2A) involves a 2270P vehicle impacting the test article at a target impact speed of 62 mi/h ±2.5 mi/h and a target impact angle of 25° ±1.5°. The target CIP was determined using the information provided in MASH Section 2.2.1, Section 2.3.2, and Table 2-7 and was for the right corner of the front bumper to impact at 4.3 ft upstream of the centerline of the joint between barriers 8 and 9. The results of the test conducted on October 23, 2020 are found in TTI Test Report number 690900 WSP 1-2A. The test vehicle was traveling at an impact speed of 62.7 mi/h as it made contact with the barrier 4.2 ft upstream of the barrier joint at an angle of 24.6°. After loss of contact with the barrier, the vehicle came to rest 211 ft downstream of the impact point and 26 ft towards the field side. The barrier contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. The 2270P vehicle exited within the exit box criteria. Working width was 62.8 inches at a height of 3.0 inches. Dynamic deflection of the barrier during the test was 40.2 inches, and permanent deflection was 40.0 inches.. Although small pieces of concrete spalled off of the barrier, no detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or present hazard to others in the area. Maximum exterior crush to the vehicle was 10.0 inches in the side plane at the right front corner at bumper height. No occupant compartment deformation was observed. The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 25° and 9°, respectively. Longitudinal OIV was 15.7 ft/s, and lateral OIV was 21.0 ft/s. Longitudinal occupant ridedown acceleration was 3.9 g, and lateral occupant ridedown acceleration 11.6 g. The occupant risk factors were within the MASH preferred limits. The Free Standing Temporary Concrete Barrier performed acceptably for MASH test 3-11.	PASS

3-20 (1100C)	This product is not a transition system.	Non-Relevant Test, not conducted
3-21 (2270P)	This product is not a transition system.	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	
Laboratory Signature:	Digitally signed by Darrell L. Kuhn 'Date: 2022.12.01 15:59:39 -06'00	
Address:	1254 Avenue A, Bldg 7091, Bryan, Texas 77807	Same as Submitter ☐
Country:	USA	Same as Submitter ☒
Accreditation Certificate Number and Dates of current Accreditation period :	ISO 17025-2017 Laboratory A2LA Certificate Number: 2821.01 Valid To: April 30, 2023	

Submitter Signature*:

Submit Form

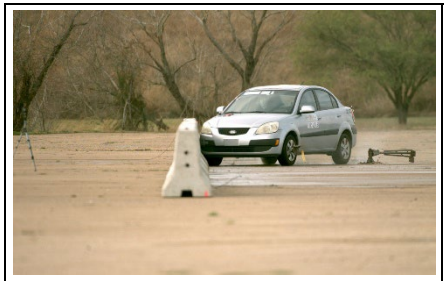
ATTACHMENTS

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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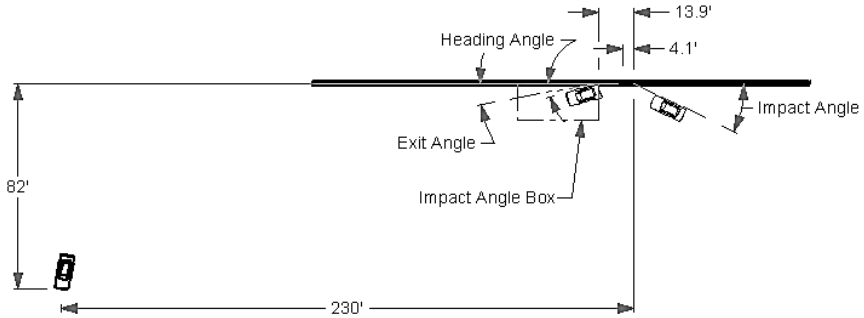

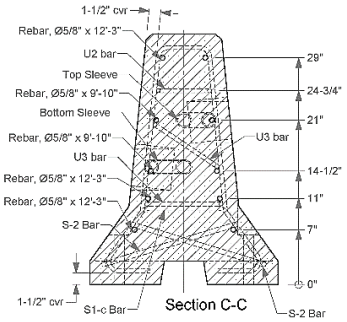

General Information
- Test Agency ..... Texas A&M Transportation Institute (TTI)
- Test Standard Test No. ..... *MASH-2016* Test 3-10
- TTI Test No. 690900-WSP1
- Test Date 2020-01-15

Test Article
- Type ..... Longitudinal Barrier – TCB
- Name ..... Illinois Tollway Free-Standing TCB
- Installation Length ..... 200 ft
- Material or Key Elements ... 9½ inches wide at top x 24 inches wide at bottom x 32 inches tall x 12½ ft long with X-bolt connection

Soil Type and Condition ..... Concrete pavement, Damp

Test Vehicle
- Type/Designation 1100C
- Make and Model ..... 2008 Kia Rio
- Curb ..... 2447 lb
- Test Inertial ..... 2420 lb
- Dummy ..... 165 lb
- Gross Static ..... 2585 lb

Impact Conditions
- Speed ..... 61.6 mi/h
- Angle ..... 24.9°
- Location/Orientation ..... 4.1 ft upstream of joint 6-7

Impact Severity ..... 54 kip-ft

Exit Conditions
- Speed ..... 52.8 mi/h
- Trajectory/Heading Angle ... 2.9° / 6.3°

Occupant Risk Values
- Longitudinal OIV ..... 17.1 ft/s
- Lateral OIV ..... 24.9 ft/s
- Longitudinal Ridedown ..... 3.5 g
- Lateral Ridedown ..... 9.9 g
- THIV ..... 9.1 g
- ASI 1.9

Max. 0.050-s Average
- Longitudinal ..... -8.6 g
- Lateral ..... -14.0 g
- Vertical ..... -3.6 g

Post-Impact Trajectory
- Stopping Distance ..... 230 ft downstream 82 ft twd traffic side

Vehicle Stability
- Maximum Yaw Angle ..... 47°
- Maximum Pitch Angle ..... 11°
- Maximum Roll Angle ..... 11°
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 14.0 inches
- Permanent ..... 14.0 inches
- Working Width ..... 38.0 inches
- Height of Working Width ..... At Toe of Barrier

Vehicle Damage
- VDS 01RFQ4
- CDC 01FREW3
- Max. Exterior Deformation ..... 10.0 inches
- OCDI FR0100000
- Max. Occupant Compartment Deformation ..... 1.0 inch in the right front floor pan

Figure 5.10. Summary of Results for *MASH-2016* Test 3-10 on Illinois Tollway Free-Standing TCB.

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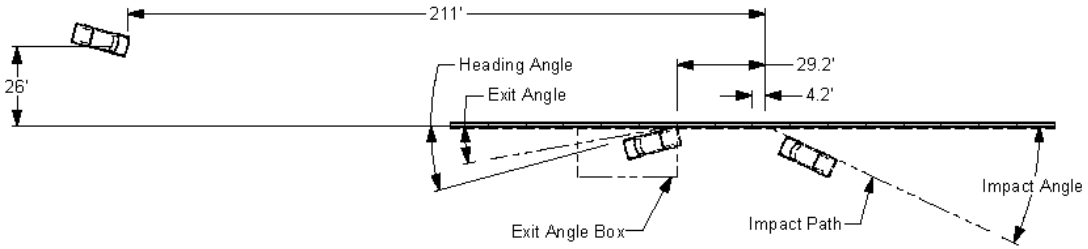
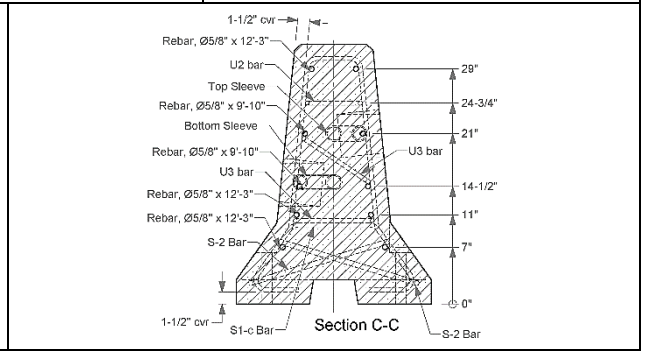




General Information
- Test Agency ..... Texas A&M Transportation Institute (TTI)
- Test Standard Test No. ..... *MASH-2016* Test 3-11
- TTI Test No. 690900-WSP2A
- Test Date 2020-10-23

Test Article
- Type ..... Longitudinal Barrier – TCB
- Name ..... Illinois Tollway Free-Standing TCB
- Installation Length ..... 200 ft
- Material or Key Elements ... 9½ inches wide at top x 24 inches wide at bottom x 32 inches tall x 12½ ft long with X-bolt connection

Soil Type and Condition ..... Concrete pavement, Damp

Test Vehicle
- Type/Designation 2270P
- Make and Model ..... 2015 RAM 1500 Pickup
- Curb ..... 4985 lb
- Test Inertial ..... 5040 lb
- Dummy ..... No dummy
- Gross Static ..... 5040 lb

Impact Conditions
- Speed ..... 62.7 mi/h
- Angle ..... 24.6°
- Location/Orientation ..... 4.2 ft upstream of joint 8-9

Impact Severity ..... 115 kip-ft

Exit Conditions
- Speed ..... 48.9 mi/h
- Trajectory/Heading Angle ... 7.0°/7.6°

Occupant Risk Values
- Longitudinal OIV ..... 15.7 ft/s
- Lateral OIV ..... 21.0 ft/s
- Longitudinal Ridedown ..... 3.9 g
- Lateral Ridedown ..... 11.6 g
- THIV ..... 8.0 m/s
- ASI 1.5

Max. 0.050-s Average
- Longitudinal ..... −7.1 g
- Lateral ..... −11.4 g
- Vertical ..... −2.7 g

Post-Impact Trajectory
- Stopping Distance ..... 211 ft downstream 26 ft twd field side

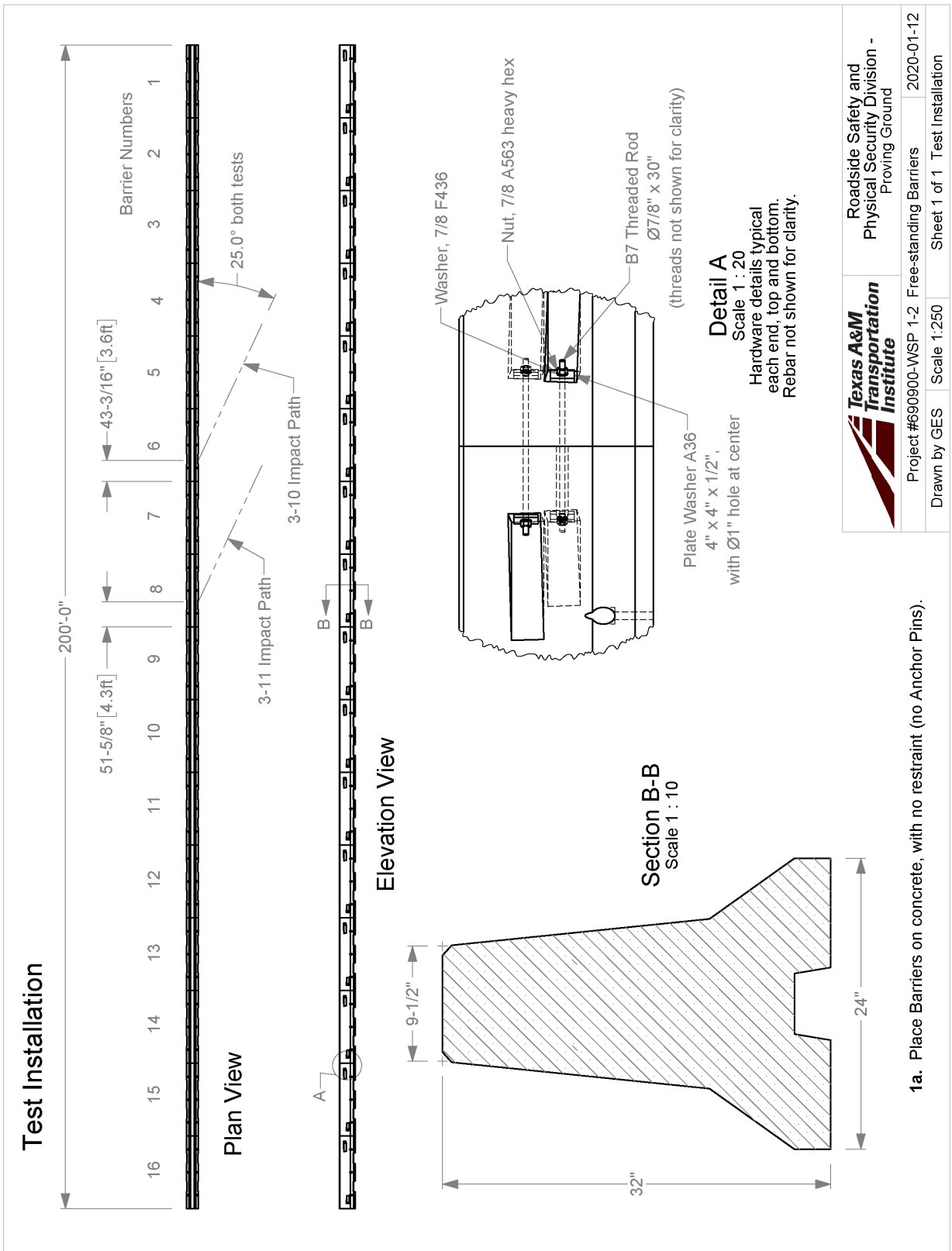
Vehicle Stability
- Maximum Yaw Angle ..... 57°
- Maximum Pitch Angle ..... 9°
- Maximum Roll Angle ..... 25°
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

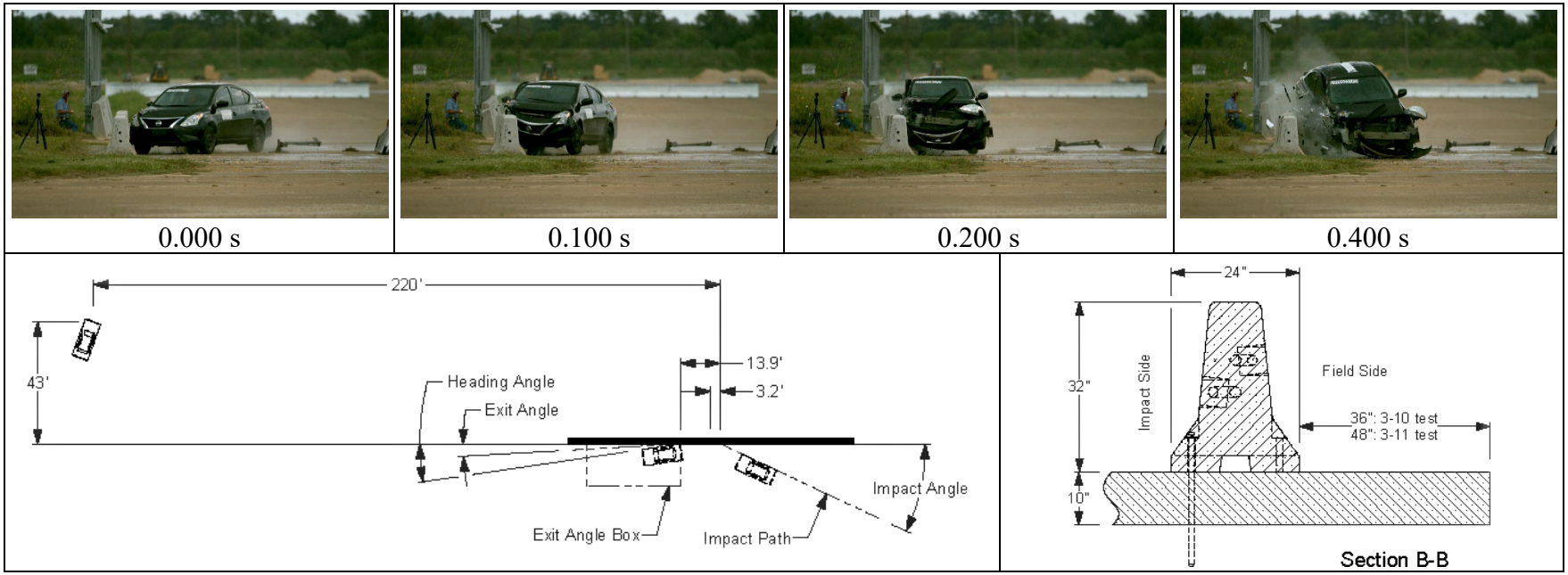
Test Article Deflections
- Dynamic ..... 40.2 inches
- Permanent ..... 40.0 inches
- Working Width ..... 62.8 inches
- Height of Working Width ..... 3.0 inches

Vehicle Damage
- VDS 01RFQ3
- CDC 01FLEW3
- Max. Exterior Deformation ..... 10.0 inches
- OCDI FR0000000
- Max. Occupant Compartment Deformation ..... None

Figure 6.10. Summary of Results for *MASH-2016* Test 3-11 on Illinois Tollway Free-Standing TCB.

APPENDIX A. DETAILS OF ILLINOIS TOLLWAY FREE-STANDING TCB





General Information
- Test Agency ..... Texas A&M Transportation Institute (TTI)
- Test Standard Test No. ..... MASH Test 3-10
- TTI Test No. 690900-WSP3
- Test Date 2020-09-14

Test Article
- Type ..... Longitudinal Barrier—Temporary Concrete Barrier
- Name ..... Pinned Temporary Concrete Barrier
- Installation Length ..... 100 ft
- Material or Key Elements ... 12 ft-6 inches long, 9½ inches wide at the top, 24 inches wide at the bottom, and 32 inches tall, X-connection; pinned to concrete slab

Soil Type and Condition ..... Concrete Pavement, Dry

Test Vehicle
- Type/Designation 1100C
- Make and Model ..... 2016 Nissan Versa
- Curb ..... 2380 lb
- Test Inertial ..... 2422 lb
- Dummy ..... 165 lb
- Gross Static ..... 2587 lb

Impact Conditions
- Speed ..... 64.5 mi/h
- Angle ..... 25.0°
- Location/Orientation ..... 3.2 ft upstream of joint 4 - 5

Impact Severity ..... 60 kip-ft

Exit Conditions
- Speed ..... 55.7 mi/h
- Trajectory/Heading Angle ... 3.2°/8.4°

Occupant Risk Values
- Longitudinal OIV ..... 20.0 ft/s
- Lateral OIV ..... 26.9 ft/s
- Longitudinal Ridedown ..... 3.4 g
- Lateral Ridedown ..... 7.9 g
- THIV ..... 10.5 m/s
- ASI 2.1

Max. 0.050-s Average
- Longitudinal ..... −11.1 g
- Lateral ..... −16.2 g
- Vertical ..... −4.5 g

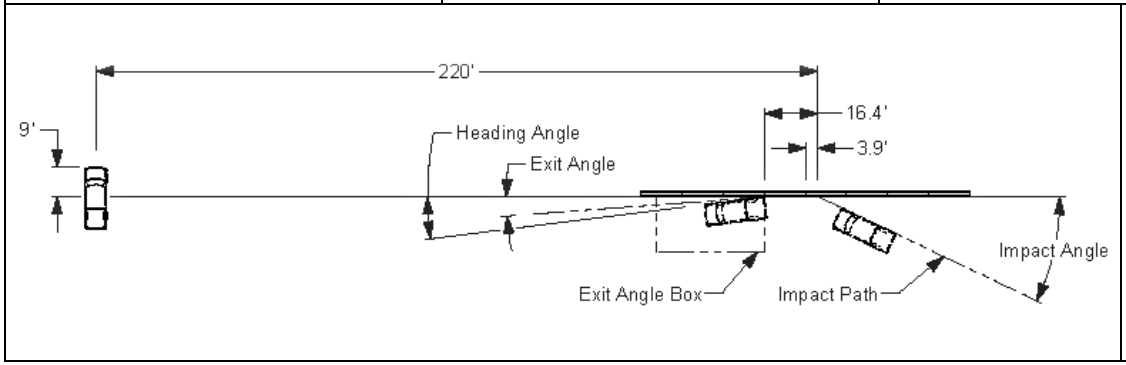
Post-Impact Trajectory
- Stopping Distance ..... 220 ft downstream 43 ft twd field side

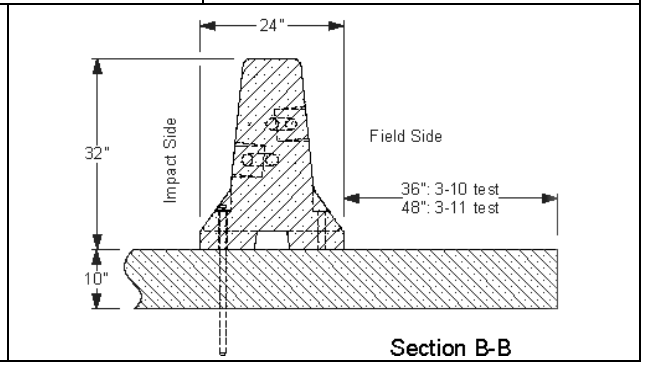
Vehicle Stability
- Maximum Yaw Angle ..... 52°
- Maximum Pitch Angle ..... 17°
- Maximum Roll Angle ..... 9°
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 8.0 inches
- Permanent ..... 4.0 inches
- Working Width ..... 28.0 inches
- Height of Working Width ..... 3.0 inches

Vehicle Damage
- VDS 01RFQ5
- CDC 01FREW4
- Max. Exterior Deformation ..... 9.0 inches
- OCDI RF0000000
- Max. Occupant Compartment Deformation ..... 1.5 inches in the right kick panel

Figure 5.10. Summary of Results for *MASH* Test 3-10 on Pinned TCB.





General Information

Test Agency	Texas A&M Transportation Institute (TTI)
Test Standard Test No.	MASH Test 3-11
TTI Test No.	690900-WSP4
Test Date	220-09-16

Test Article

Type	Longitudinal Barrier—Temporary Concrete Barrier
Name	Pinned Temporary Concrete Barrier
Installation Length	100 ft
Material or Key Elements	12 ft-6 inches long, 9½ inches wide at the top, 24 inches wide at the bottom, and 32 inches tall, X-connection; pinned to concrete slab
Soil Type and Condition	Concrete Pavement, Dry

Test Vehicle

Type/Designation	2270P
Make and Model	2014 RAM 1500 Pickup
Curb	4982 lb
Test Inertial	5009 lb
Dummy	No dummy
Gross Static	5009 lb

Impact Conditions

Speed	63.9 mi/h
Angle	25.2
Location/Orientation	3.9 ft upstream of joint 4-5
Impact Severity	124 kip-ft

Exit Conditions

Speed	54.9 mi/h
Trajectory/Heading Angle	4.2°/7.1°

Occupant Risk Values

Longitudinal OIV	14.4 ft/s
Lateral OIV	21.0 ft/s
Longitudinal Ridedown	4.1 g
Lateral Ridedown	11.4 g
THIV	7.9 m/s
ASI	1.5
Max. 0.050-s Average	
Longitudinal	−6.8 g
Lateral	−11.2 g
Vertical	−5.1 g

Post-Impact Trajectory

Stopping Distance	220 ft downstream 9 ft twd field side

Vehicle Stability

Maximum Yaw Angle	49°
Maximum Pitch Angle	20°
Maximum Roll Angle	18°
Vehicle Snagging	No
Vehicle Pocketing	No

Test Article Deflections

Dynamic	17.9 inches
Permanent	10.0 inches
Working Width	34.4 inches
Height of Working Width	3.0 inches

Vehicle Damage

VDS	01RFQ5
CDC	01FREW4
Max. Exterior Deformation	12.0 inches
OCDI	RF0010000
Max. Occupant Compartment Deformation	1.0 inches in the right front firewall

Figure 6.14. Summary of Results for *MASH* Test 3-11 on Pinned TCB.

APPENDIX A. DETAILS OF PINNED TCB