U.S. Department
of Transportation
Federal Highway
Administration

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

November 12, 2015

In Reply Refer To:
HSST/CC-100B

Mr. Brian Smith
Trinity Highway Products, LLC
2525 North Stemmons Freeway
Dallas, Texas 75207

Dear Mr. Smith:

This letter updates eligibility letter CC-100B issued on December 5, 2012 in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of system: Slotted Rail Terminal (SRT) MASH
Type of system: Terminal End Section
Test Level: MASH Test Level 3 (TL-3)
Testing conducted by: Texas Transportation Institute
Task Force 13 Designator: SEW12c
Date of request: September 28, 2012
Date initially acknowledged: September 28, 2012
Date of completed package: October 16, 2012

Decision
The following device is eligible, with details provided:

- Slotted Rail Terminal (SRT) MASH

Based on a review of crash test results submitted by the manufacturer certifying the device described herein meets the crash test and evaluation criteria of the American Association of State Highway and Transportation Officials (AASHTO) "Manual for Assessing Safety Hardware" (MASH), the device is eligible for reimbursement under the Federal-aid highway program. FHWA is not revising the earlier eligibility determinations, but is updating this letter to address the statement in MASH that "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 to or rupture of the fuel tank, oil pan, or other feature that might serve as a surrogate of the fuel tank should be reported." This letter is updated to note that a test report that accompanied your request for Federal-aid reimbursement eligibility (titled *MASH TEST 3-30 on the SRT-MASH*) indicated that there was "a hole in the oil pan." Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.

Requirements
To be found eligible for Federal-aid funding, roadside safety devices should meet the crash test and evaluation criteria contained in the MASH.

Description
The device and supporting documentation are described in the attached form.

Summary and Standard Provisions
Therefore, the system described and detailed in the attached form is eligible for reimbursement and may be installed under the range of conditions previously tested.

Please note the following standard provisions that apply to FHWA eligibility letters:

- This letter provides a AASHTO/ARTBA/AGC Task Force 13 designator that should be used for the purpose of the creation of a new and/or the update of existing Task Force 13 drawing for posting on the on-line 'Guide to Standardized Highway Barrier Hardware' currently referenced in AASHTO Roadside Design Guide.
- This finding of eligibility does not cover other structural features of the systems, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may influence system conformance with MASH criteria will require a new reimbursement eligibility letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals safety problems, or that the system is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- You are expected to supply potential users with sufficient information on design and installation 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 crash test and evaluation criteria of the MASH.
- To prevent misunderstanding by others, this letter of eligibility is designated as number CC-100B and 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 at our office 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. The FHWA does not become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

Michael S. Griffith

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

Request for Federal Aid Reimbursement Eligibility Of Highway Safety Hardware

Submitter	Date of Request:	27 September 2012
	Name:	Brian Smith
	Company:	Trinity Highway Products, LLC
	Address:	2525 N. Stemmons Freeway Dallas, Texas 75207
	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.

System Type	Device Name / Variant	Testing Criterion	Test Level
'CC': Crash Cushions, Attenuators, & T	SRT-MASH TL-3	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 test / evaluation results meet the appropriate evaluation criteria in the MASH.

Identification of the individual or organization responsible for the product:

Contact Name:	Brian Smith
Company Name:	Trinity Highway Products, LLC
Address 1:	2525 N. Stemmons Freeway
Address 2:	
City/State/Zip:	Dallas, TX 75207
Country:	USA

PRODUCT DESCRIPTION

Modification to Existing Hardware Significant

The SRT-MASH is a proprietary 10-post w-beam terminal that has a linear flare with a 4-foot offset over a length of 37 feet 6 inches. The anchor post (Post 1) is a Cable Release Post (CRP) embedded 6 feet 6 inches below grade. 6 ft long Steel Yielding Terminal Posts (SYTP) are used throughout the remaining length of the terminal (Posts 2-10) and are embedded 40 inches below grade. Posts 1 and 2 are spaced 75 inches on center and connected at the ground line with a 3-inch x 3-inch x ¼-inch Angle Strut.

The spacing between Posts 2 and 3 is 56 inches to offset the rail splice from the post to midspan between Posts 3 and 4. Posts 3 through 10 are spaced at 37.5 inches. The last post spacing in the terminal between Posts 10 and 11 (the first standard line post) is 56 inches.

Two 12 ft-6 inch long 12 gauge Slotted W-beam Rails are followed by a 12 ft-6 inch standard section of 12 gauge W-Beam. The first Slotted W-beam Rail has two sets of three ½-inch wide x 27-inch long slots located between Posts 1 and 2 and Posts 2 and 3. The second Slotted W-beam Rail has two sets of three ½-inch wide x 12-inch long slots located between Posts 3 and 4 and Posts 6 and 7. Slot Guards are bolted to the rails at the downstream end of each set of slots.

Post 3 through Post 10 are offset from the rail using 6-inch x 8-inch x 14-inch routed Wood Offset Blocks. No Offset Blocks are used on Post 1 and Post 2. Posts 2 through Post 7 were not bolted to the Slotted W-Beam Rails. A Shelf Angle fabricated from ½-inch steel plate is used at Post 2 to provide vertical reaction for the Cable Anchor System. W-Beam Flange Protectors are used at Posts 2 through Post 7 to provide additional vertical support to the Slotted W-Beam Rails.

A standard SRT Cable Anchor Bracket is attached to the first Slotted W-Beam Rail between Post 1 and Post 2 using eight 5/8-inch diameter A307 Hex Bolts with Nuts and Washers. A 9¼-inch long section of 1¼-inch diameter A53 Grade B, schedule 40 pipe is positioned inside the Cable Anchor Bracket against the downstream Bearing Plate. A modified 6 ft 6-inch Cable with 12½-inch long threaded rods extending from the swaged fittings and with shorter wire rope is used.

Standard W6x8.5 steel line posts with 6-inch x 8-inch x 14-inch routed Wood Offset Blocks are used beginning at Post 11. The height of the W-Beam Rail was transitioned from 31 inches at Post 11 to 27 inches at Post 13. The Federal Highway Administration (FHWA) agreed that attaching the MASH SRT to a 27¾-inch high modified G4(1S) guardrail would be more critical than attaching the MASH SRT to a 31-inch high guardrail system. Thus, if the MASH SRT performed acceptably in this configuration, it would be accepted for use with crashworthy guardrail systems with heights ranging from 27¾ inches to 31 inches.

Required Test Number	Narrative Description	Evaluation Results
3-30 (1100C)	MASH Test Designation 3-30: An 1100C (2425 lb) passenger car impacting the terminal end-on at a nominal impact speed and angle of 62 mi/h and 0 degree, respectively, with the quarter point of the vehicle aligned with the centerline of the nose of the terminal. This test is primarily intended to evaluate occupant risk and vehicle trajectory criteria. Summary of results: The 1100C, traveling at an impact speed of 61.4 mi/h, impacted the nose of the SRT-MASH at 1.2 degrees with the left quarterpoint aligned with the center of post 1. The SRT-MASH activated as designed, slowed the 1100C vehicle, and permitted its controlled penetration behind the test article. The top portion of Post 1 was resting 12.5 feet toward the field side of Post 23. This detached element rode along with the vehicle and did not penetrate or show potential for penetrating the occupant compartment, or to present undue hazard to others in the area. The seam on the interior right side between the firewall and the door frame opened when the skin on the passenger door was peeled off. However, there was no evidence of penetration into the passenger compartment or direct contact of the terminal components with the firewall. Maximum occupant compartment deformation was 6.25 inches in the right floorpan area. Occupant risk factors were within the limits specified for MASH test 3-30.Maximum roll was 10 degrees, and maximum pitch was -10 degrees. The 1100C vehicle remained upright during and after the collision event. The vehicle subsequently came to rest adjacent to Post 14 of the test installation and 13 feet toward the field side. The SRT-MASH performed acceptably according to the evaluation criteria of MASH test 3-30.	PASS
3-31 (2270P)	MASH Test Designation 3-31: A 2270P (5000 lb) pickup truck impacting the terminal end-on at a nominal impact speed and angle of 62 mi/h and 0 degree, respectively, with the centerline of the vehicle aligned with the centerline of the nose of the terminal. This test is primarily intended to evaluate occupant risk and vehicle trajectory criteria. Summary of results: The 2270P, traveling at an impact speed of 61.0 mi/h, impacted the nose of the SRT-MASH at an impact angle of 0.6 degrees. The SRT-MASH activated as designed and permitted its controlled gating of the 2270P behind the test article. The first section of W-Beam Guardrail tore after buckling and collapsing in front to the vehicle, and came to rest adjacent to the field side of the installation between Post 14 and 15. This fragment did not penetrate or show potential for penetrating the occupant compartment, or to present undue hazard to others in the area. No occupant compartment deformation occurred. The 2270P vehicle remained upright during and after the collision event. Maximum roll was 7 degrees, and maximum pitch was 5 degrees. Occupant risk factors were within the preferred limits specified for MASH test 3-31. The SRT-MASH performed acceptably according to the evaluation criteria of MASH test 3-31.	PASS

CRASH TESTING

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-32 (1100C)	MASH Test Designation 3-32: An 1100C (2425 lb) passenger car impacting the terminal end-on at a nominal impact speed and angle of 62 mi/h and 5/15 degrees, respectively, with the centerline of the vehicle aligned with the centerline of the nose of the terminal. This test is primarily intended to evaluate occupant risk and vehicle trajectory criteria. For Test 3-32, the slot in the central portion of the upstream end (anchor end) of the first Slotted Rail was extended another 6 inches further downstream than in the previous tests for a total slot length of 13.5 inches. The additional slot length permits the CRP to rotate and activate more readily during end-on impacts. This change does not affect the anchorage capacity of the SRT-MASH during redirection impacts along the length of the terminal. Also, the blockout at post 3 was removed for 3-32. This change will not affect the outcome of the previously conducted tests. The beginning of length of need is defined as post 4, so test 3-35 is not affected by removal of the blockout on post 3. Even if the beginning of LON was post 3, the vehicle would not engage that post. In test 3-34, post 3 was contacted and pushed down by the small car. The removal of the blockout at post 3 does not increase the post strength or forces imparted to the vehicle attributable to post activation. The post is not attached to the rail and it is an SYTP. Consequently, the vehicle can readily push this post down without generating any significant snagging forces. Given that post 3 was already pushed down by the vehicle, and the force does not change with the removal of the blockout, the outcome of the test would not be affected in any way. Tests 3-30 and 3-31 will also not be affected for some of the same reasons. The posts were readily pushed over due to their design (SYTP) and the fact that the rail is not attached to the posts. Without the blockout, the post is positioned more toward the center of the impacting vehicle. Therefore, the small force that is imparted to the vehicle during the post activation is more aligned with the c.g of the vehicle and is therefore less likely to induce any yaw as the vehicle gates through the system. Summary of results: The 1100C, traveling at an impact speed of 61.5 mi/h, contacted the nose of the SRT-MASH at post 1 at an impact angle of 5.4 degrees. The SRT-MASH activated as designed and permitted controlled gating of the 1100C. The top portion of Post 1 detached from the base (as designed) and came to rest adjacent to the field side of the installation. This detached element did not penetrate or show potential for penetrating the occupant compartment, or to present undue hazard to others in the area. No occupant compartment deformation or intrusion occurred. The 1100C vehicle remained upright during and after the collision event. Maximum roll was -31 degrees, and maximum pitch was 14 degrees. Occupant risk factors were within the preferred limits specified for MASH test 3-32. Brakes were applied at 2 seconds after impact, and the vehicle subsequently came to rest 191 ft downstream of the terminal and 35 feet toward the field side. The SRT-MASH performed acceptably according to the evaluation criteria of MASH test 3-32.	PASS

3-33 (2270P)	MASH Test Designation 3-33: A 2270P (5000 lb) pickup truck impacting the terminal end-on at a nominal impact speed and angle of 62 mi/h and 5/15 degrees, respectively, with the centerline of the vehicle aligned with the centerline of the nose of the terminal. This test is primarily intended to evaluate occupant risk and vehicle trajectory criteria. Summary of results: Researchers at TTI feel that the successfully conducted Test 3-32 is a more critical test, and therefore, Test 3-33 was not conducted.	WAIVER REQUES
3-34 (1100C)	MASH Test Designation 3-34: An 1100C (2425 lb) passenger car impacting the terminal at a nominal impact speed and angle of 62 mi/h and 15 degrees, respectively, with the corner of the vehicle bumper aligned with the critical impact point (CIP) of the length of need (LON) of the terminal. This test is primarily intended to evaluate occupant risk and vehicle trajectory criteria. Summary of results: The 1100C, traveling at an impact speed of 62.2 mi/h, impacted the SRT-MASH 24 inches downstream of post 1 at an impact angle of 14.5 degrees. The SRT-MASH contained and redirected the 1100C vehicle. The vehicle did not penetrate or override the installation. Maximum dynamic deflection was 2.6 feet. Several blockouts separated from the posts and came to rest on the field side of the installation. Two were resting near the installation, and a piece of blockout was resting 52 feet toward the field side. These blockouts did not penetrate or show potential for penetrating the occupant compartment, or to present undue hazard to others in the area. No occupant compartment deformation or intrusion occurred. The 1100C vehicle remained upright during and after the collision event. Over a 2-second period, maximum roll was 10.6 degrees, and maximum pitch was 2.5 degrees. Occupant risk factors were within the limits specified for MASH test 3-32. The 1100C vehicle exited within the exit box. Brakes on the vehicle were not applied and the vehicle came to a controlled stop 15 feet from the traffic face of Post 11. The SRT-MASH performed acceptably according to the evaluation criteria of MASH test 3-34.	PASS

3-35 (2270P)	MASH Test Designation 3-35: A 2270P (5000 lb) pickup truck impacting the terminal at a nominal impact speed and angle of 62 mi/h and 25 degrees, respectively, with the corner of the vehicle bumper aligned with the beginning of the LON of the terminal. This test is primarily intended to evaluate structural adequacy and vehicle trajectory criteria. Summary of results: The 2270P, traveling at an impact speed of 62.4 mi/h, impacted the SRT-MASH 6.8 inches downstream of post 4 at an impact angle of 24.3 degrees. The SRT-MASH contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride or override the installation. Maximum dynamic deflection during the test was 3.8 feet. Some of the blockouts separated from the posts. However, these blockouts did not penetrate or show potential for penetrating the occupant compartment, or to present undue hazard to others in the area. Maximum occupant compartment deformation was 1.5 inches from kickpanel to kickpanel just above the floorpan. The 2270P vehicle remained upright during and after the collision event. During the first 1.5 seconds of the test, maximum roll was 9 degrees, and maximum pitch was -5 degrees. Occupant risk factors were within the preferred limits specified for MASH test 3-31. The 2270P vehicle exited within the exit box. Brakes on the vehicle were not applied and the vehicle came to rest against Post 14. The SRT-MASH performed acceptably according to the evaluation criteria of MASH test 3-35.	PASS
3-36 (2270P)	MASH Test Designation 3-36: A 2270P (5000 lb) pickup truck impacting the terminal at a nominal impact speed and angle of 62 mi/h and 25 degrees, respectively, with the corner of the vehicle bumper aligned with the CIP with respect to the transition to the stiff barrier or backup structure. As a w-beam guardrail terminal, the SRT-MASH will never be attached directly to a backup structure, and the transition to a stiff barrier is basically at Post 11. Therefore, researchers at TTI feel that Test 3-36 is irrelevant and was therefore not conducted.	WAIVER REQUES

3-37 (2270P)	MASH Test Designation 3-37: A 2270P (5000 lb) pickup truck impacting the terminal at a nominal impact speed and angle of 62 mi/h and 25 degrees, respectively, mid-point between the nose and the end of the terminal in the reverse direction. This test is intended to evaluate the performance of a terminal for a "reverse" hit. Summary of results: Researchers at TTI feel that test 3-37 is not a critical test for a flared, non-energy-absorbing, gating terminal system that has no impact head. In the reverse direction, the slotted rail flares away from the impacting vehicle, effectively reducing the impact angle from 25° to 18° and significantly decreasing impact severity. Other factors used to conclude that test 3-37 was unnecessary include the following: 1. The SYTP are designed to yield and bend over for impacts from either the downstream direction or the reverse direction. 2. The rail is not attached to the SYTP at post locations 2 through 7, allowing the SYTP to easily bend and lay down when impacted. 3. The rail is slotted at post location1 so that in a reverse hit, the rail offers no resistance to release of the CRP at post location 1. 4. Pendulum tests and previous tests of other terminals systems have demonstrated the ability of the CRP to release for impacts in either the downstream direction or the reverse direction. Test 3-39 of a cable barrier terminal with 820C test vehicle in TTI report entitled Crash Testing and Evaluation of a New Terminal for Cable/Wire Rope Guardrails," dated March 2002.	WAIVER REQUES
3-38 (1500A)	MASH Test Designation 3-38: A 1500A (3307 lb) passenger car impacting the terminal end-on at a nominal impact speed and angle of 62 mi/h and 0 degree, respectively, with the centerline of the vehicle aligned with the centerline of the nose of the terminal. This test is primarily intended to evaluate the performance of the staged attenuator/terminal when impacted by a mid-size vehicle. This test is not applicable. The SRT-MASH is a non-energy-absorbing terminal system and not a staged energy-absorbing device. Therefore, Test 3-38 was not conducted.	WAIVER REQUES
3-40 (1100C)	This test involves non-redirective crash cushions. The SRT-MASH is not a non-redirective crash cushion.	WAIVER REQUES
3-41 (2270P)	This test involves non-redirective crash cushions. The SRT-MASH is not a non-redirective crash cushion.	WAIVER REQUES
3-42 (1100C)	This test involves non-redirective crash cushions. The SRT-MASH is not a non-redirective crash cushion.	WAIVER REQUES
3-43 (2270P)	This test involves non-redirective crash cushions. The SRT-MASH is not a non-redirective crash cushion.	WAIVER REQUES
3-44 (2270P)	This test involves non-redirective crash cushions. The SRT-MASH is not a non-redirective crash cushion.	WAIVER REQUES
3-45 (1500A)	This test involves non-redirective crash cushions. The SRT-MASH is not a non-redirective crash cushion.	WAIVER REQUES

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 Transportation Institute
Laboratory Contact:	Dr. Roger Bligh
Address:	Texas A&M Riverside Campus Building 7091 3100 State Highway 47 Bryan, TX 77807
Country:	USA
Accreditation Certificate Number and Date:	Mechanical 2821.01 30 April 2013

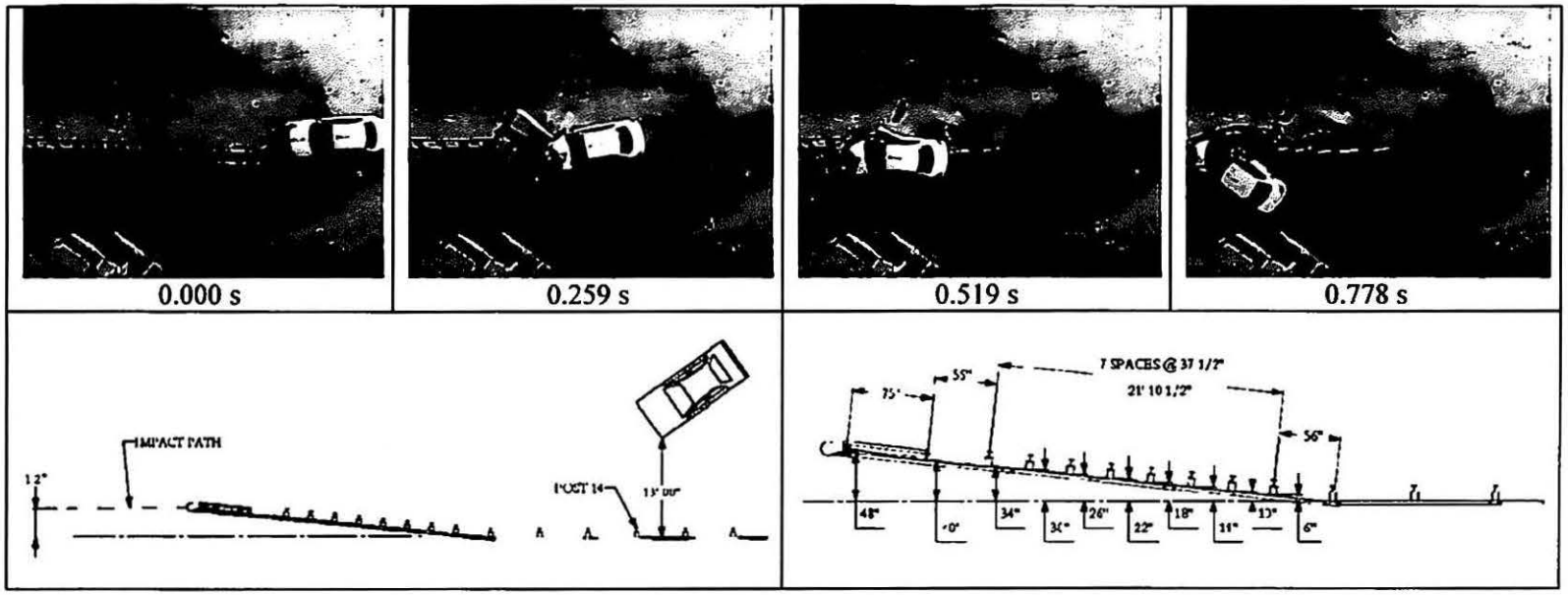
ATTACHMENTS

Attach to this form:

1) A copy of the Test Data Summary Sheet for each test conducted in support of this request.
2) 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 key to understanding the performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		AASHTO TF13	
Number	Date	Designator	Key Words
CC-100B	November 30, 2012	SEW12c	Terminal, end treatment, guardrail, roadside safety, crash testing, MASH



General Information
- Test Agency ..... Texas Transportation Institute (TTI)
- Test Standard Test No. ..... MASH Test 3-30
- TTI Test No. 400001-SRT6
- Date ..... October 29, 2010

Test Article
- Type ..... Terminal
- Name ..... SRT-MASH
- Installation Length ..... 131 ft-3 inches
- Material or Key Elements ..... Slotted rail, CRP post 1, SYTP, anchor bracket and cable

Soil Type and Condition ..... Standard Soil, Dry

Test Vehicle
- Type/Designation 1100C
- Make and Model ..... 2005 Kia Rio
- Curb ..... 2385 lb
- Test Inertial ..... 2423 lb
- Dummy ..... 178 lb
- Gross Static ..... 2601 lb

Impact Conditions
- Speed ..... 61.4 mi/h
- Angle ..... 1.2 degrees
- Location/Orientation ..... Nose

Kinetic Energy ..... 305 kip-ft (-2.6%)

Exit Conditions
- Speed ..... 12.0 mi/h
- Angle ..... 45.4 degrees

Occupant Risk Values
- Impact Velocity
  - Longitudinal ..... 24.3 ft/s
  - Lateral ..... 1.0 ft/s
- Ridedown Accelerations
  - Longitudinal ..... 10.9 G
  - Lateral ..... 6.6 G
- THIV ..... 26.9 km/h
- PHD ..... 11.4 G
- ASI 0.66
- Max. 0.050-s Average
  - Longitudinal ..... -7.6 G
  - Lateral ..... -1.9 G
  - Vertical ..... -3.1 G

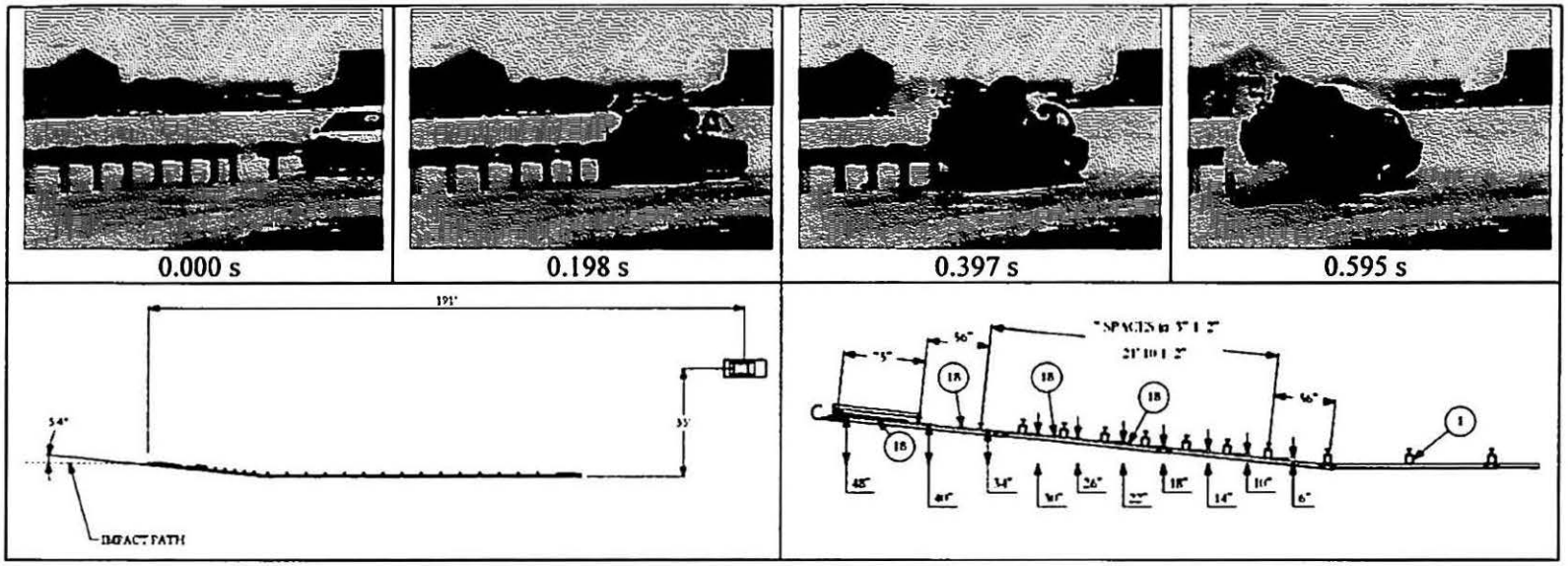
Post-Impact Trajectory
- Stopping Distance ..... 43.75 ft dwnstrm, 26.3 ft twd field side

Vehicle Stability
- Maximum Yaw Angle ..... 151 degrees
- Maximum Pitch Angle ..... -10 degrees
- Maximum Roll Angle ..... 10 degrees
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 5.3 ft
- Permanent ..... 5.3 ft

Vehicle Damage
- VDS 12RFQ6
- CDC 12FREW4
- Max. Exterior Deformation ..... 12.0 inches
- OCDI RF1000100
- Max. Occupant Compartment Deformation ..... 6.25 inches

Figure 5.7. Summary of results for *MASH* test 3-30 on the SRT-MASH.



General Information
- Test Agency ..... Texas Transportation Institute (TTI)
- Test Standard Test No. ..... MASH Test 3-32
- TTI Test No. 400001-SRT8
- Date ..... January 21, 2011

Test Article
- Type ..... Terminal
- Name ..... SRT-MASH
- Installation Length ..... 125 ft
- Material or Key Elements ..... Slotted rail, CRP post 1, SYTP, anchor bracket and cable
- Soil Type and Condition ..... Standard Soil, Dry

Test Vehicle
- Type/Designation 1100C
- Make and Model ..... 2005 Kia Rio
- Curb ..... 2385 lb
- Test Inertial ..... 2412 lb
- Dummy ..... 172 lb
- Gross Static ..... 2584 lb

Impact Conditions
- Speed ..... 61.5 mi/h
- Angle ..... 5.4 degrees
- Location/Orientation ..... Nose

Impact Severity ..... 8885 kip-ft

Exit Conditions
- Speed ..... 40.0 mi/h
- Angle ..... 2.0 degrees

Occupant Risk Values
- Impact Velocity
  - Longitudinal ..... 24.6 ft/s
  - Lateral ..... 3.3 ft/s
- Ridedown Accelerations
  - Longitudinal ..... 5.0 G
  - Lateral ..... 5.6 G
- THIV ..... 27.3 km/h
- PHD ..... 7.4 G
- ASI 0.64
- Max. 0.050-s Average
  - Longitudinal ..... -6.7 G
  - Lateral ..... 1.8 G
  - Vertical ..... -5.2 G

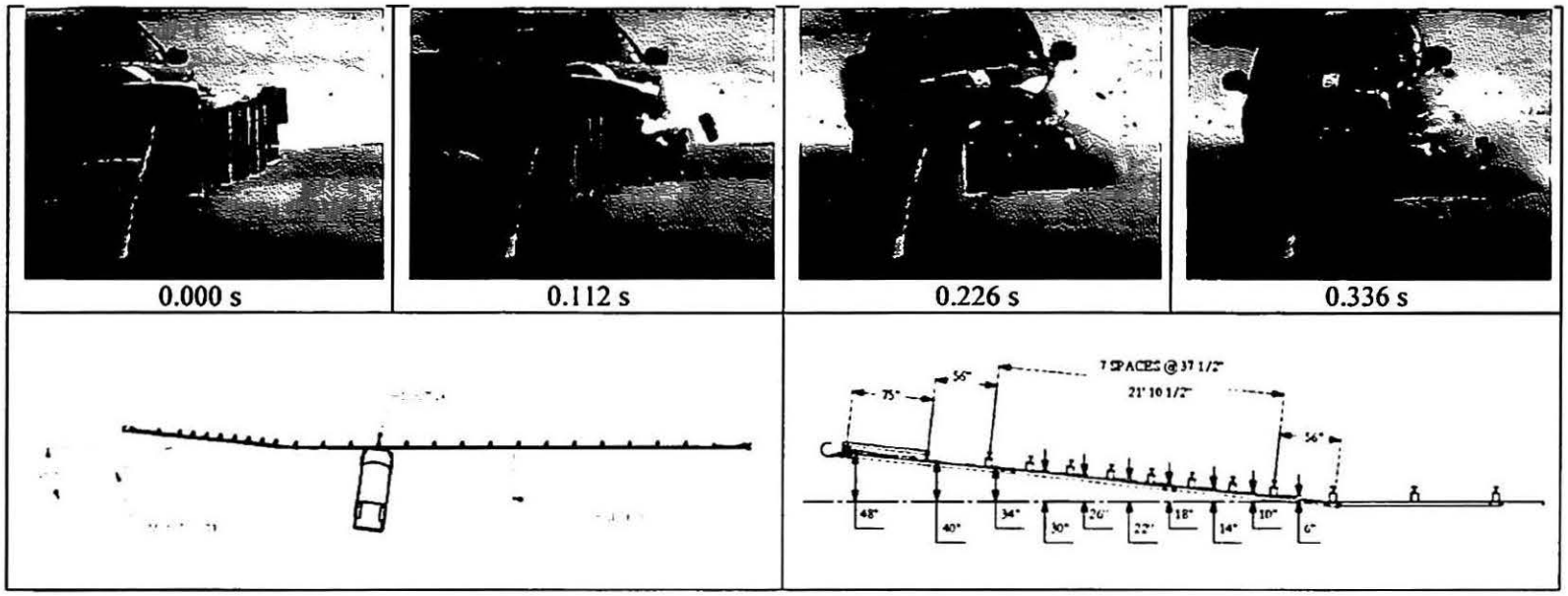
Post-Impact Trajectory
- Stopping Distance ..... 191 ft dwnstrm
  35 ft twd field side

Vehicle Stability
- Maximum Yaw Angle ..... -8 degrees
- Maximum Pitch Angle ..... 14 degrees
- Maximum Roll Angle ..... -32 degrees
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 4.0 ft
- Permanent ..... 4.0 ft
- Working Width .....

Vehicle Damage
- VDS 12FD6
- CDC 12FDEW4
- Max. Exterior Deformation ..... 7.0 inches
- OCDI FS0000000
- Max. Occupant Compartment Deformation 0

Figure 5.7. Summary of results for *MASH* test 3-32 on SRT-MASH.



General Information
- Test Agency ..... Texas Transportation Institute (TTI)
- Test Standard Test No. ..... MASH Test 3-35
- TTI Test No. 403371-SRT3
- Date 2010-10-04

Test Article
- Type ..... Terminal
- Name ..... SRT-MASH
- Installation Length ..... 137 ft-6 inches
- Material or Key Elements ..... Slotted rail, CRP post 1, SYTP, anchor bracket and cable

Soil Type and Condition ..... Standard Soil, Dry

Test Vehicle
- Type/Designation 2270P
- Make and Model ..... 2003 Dodge Ram 1500 Pickup
- Curb ..... 4712 lb
- Test Inertial ..... 4948 lb
- Dummy ..... No dummy
- Gross Static ..... 4948 lb

Impact Conditions
- Speed ..... 62.4 mi/h
- Angle ..... 24.3 degrees
- Location/Orientation ..... Post 4

Impact Severity ..... 3507 kip-ft (-4.9%)

Exit Conditions
- Speed ..... Not obtainable
- Angle ..... Not obtainable

Occupant Risk Values
- Impact Velocity
  - Longitudinal ..... 21.6 ft/s
  - Lateral ..... 16.7 ft/s
- Ridedown Accelerations
  - Longitudinal ..... 8.1 G
  - Lateral ..... 5.2 G
- THIV ..... 29.5 km/h
- PHD ..... 9.4 G
- ASI 0.77
- Max. 0.050-s Average
  - Longitudinal ..... -6.7 G
  - Lateral ..... 5.1 G
  - Vertical ..... 1.6 G

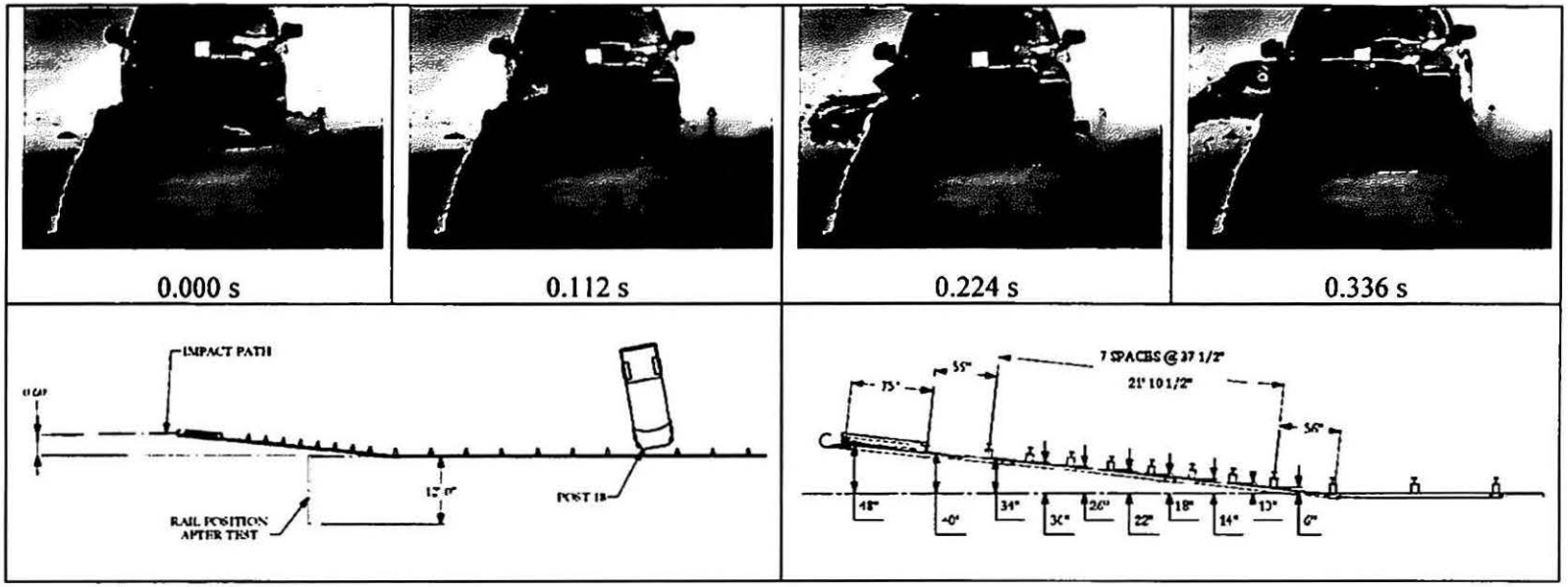
Post-Impact Trajectory
- Stopping Distance ..... 81.3 ft

Vehicle Stability
- Maximum Yaw Angle ..... -43 degrees
- Maximum Pitch Angle ..... -5 degrees
- Maximum Roll Angle ..... 9 degrees
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 3.8 ft
- Permanent ..... 3.8 ft
- Working Width ..... 4.0 ft

Vehicle Damage
- VDS 11LFQ5
- CDC 11FLEW4
- Max. Exterior Deformation ..... 16.0 inches
- OCDI LF0000000
- Max. Occupant Compartment Deformation ..... 1.5 inches

Figure 5.7. Summary of results for *MASH* test 3-35 on SRT-MASH.



General Information
- Test Agency ..... Texas Transportation Institute (TTI)
- Test Standard Test No. ..... MASH 3-31
- TTI Test No. 400001-SRT5
- Date ..... October 21, 2010

Test Article
- Type ..... Terminal
- Name ..... SRT-MASH
- Installation Length ..... 131 ft-3 inches
- Material or Key Elements ..... Slotted rail, CRP post 1, SYTP, anchor bracket and cable

Soil Type and Condition ..... Standard Soil, Dry

Test Vehicle
- Type/Designation 2270P
- Make and Model ..... 2003 Dodge Ram 1500 Pickup Truck
- Curb ..... 4774 lb
- Test Inertial ..... 5021 lb
- Dummy ..... No dummy
- Gross Static ..... 5021 lb

Impact Conditions
- Speed ..... 61.0 mi/h
- Angle ..... 0.6 degrees
- Location/Orientation ..... Nose

Impact Severity ..... 624 kip-ft (- 3.5%)

Exit Conditions
- Speed ..... Not obtainable
- Angle ..... Not obtainable

Occupant Risk Values
- Impact Velocity
  - Longitudinal ..... 18.0 ft/s
  - Lateral ..... 2.0 ft/s
- Ridedown Accelerations
  - Longitudinal ..... 11.8 G
  - Lateral ..... 7.6 G
- THIV ..... 20.0 km/h
- ASI 0.50
- Max. 0.050-s Average
  - Longitudinal ..... -4.7 G
  - Lateral ..... 1.5 G
  - Vertical ..... -3.0 G

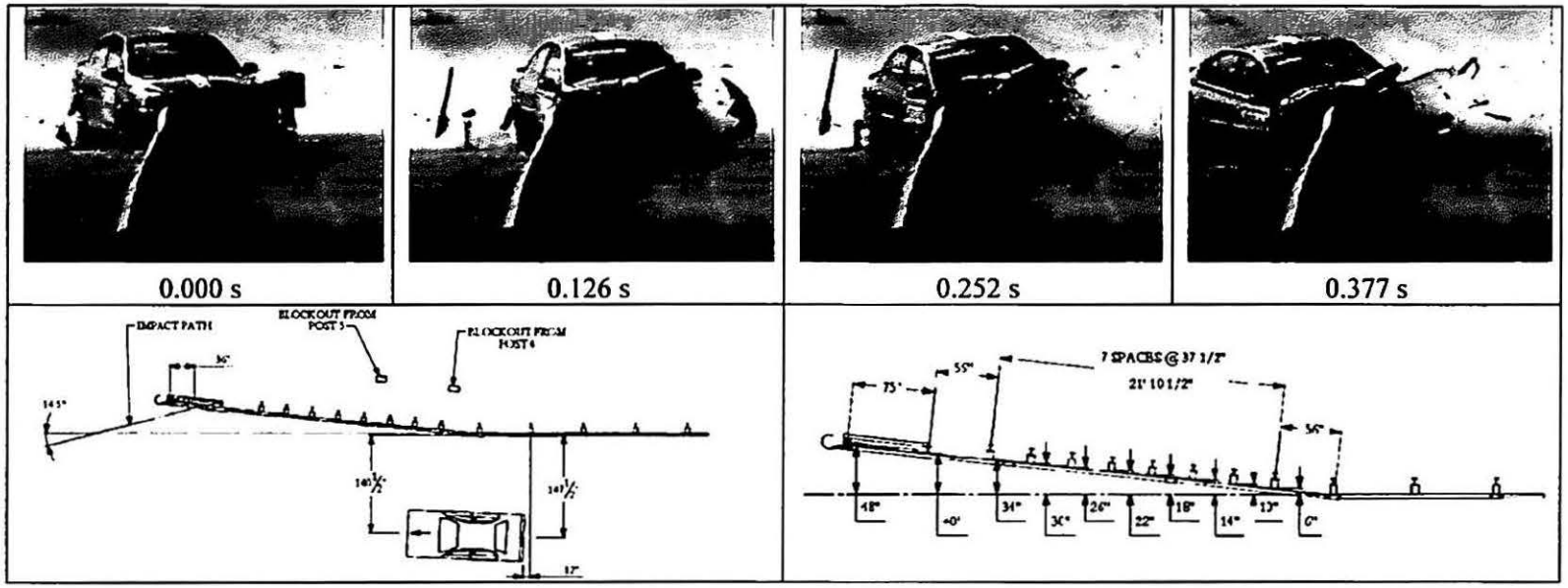
Post-Impact Trajectory
- Stopping Distance ..... 81.0 ft dwnstrm Against field side

Vehicle Stability
- Maximum Yaw Angle ..... 72 degrees
- Maximum Pitch Angle ..... 5 degrees
- Maximum Roll Angle ..... 7 degrees
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 13.3 ft
- Permanent ..... 12.5 ft
- Working Width ..... 20.25 ft

Vehicle Damage
- VDS 12FC4
- CDC 12FCEW4
- Max. Exterior Deformation ..... 17.0 inches
- OCDI FS0000000
- Max. Occupant Compartment Deformation 0

Figure 5.7. Summary of results for *MASH* test 3-31 on the SRT-MASH.



General Information
- Test Agency ..... Texas Transportation Institute (TTI)
- Test Standard Test No. ..... MASH 3-34
- TTI Test No. 400001-SRT4
- Date ..... October 19, 2010

Test Article
- Type ..... Terminal
- Name ..... SRT-MASH
- Installation Length ..... 131 ft-3 inches
- Material or Key Elements ..... Slotted rail, CRP post 1, SYTP, anchor bracket and cable

Soil Type and Condition ..... Standard Soil, Dry

Test Vehicle
- Type/Designation 1100C
- Make and Model ..... 2004 Kia Rio
- Curb ..... 2428 lb
- Test Inertial ..... 2431 lb
- Dummy ..... 174 lb
- Gross Static ..... 2605 lb

Impact Conditions
- Speed ..... 62.2 mi/h
- Angle ..... 14.5 degrees
- Location/Orientation ..... 24 inches dwnstrm post 1

Impact Severity ..... 2126 kip-ft, (-5.5%)

Exit Conditions
- Speed ..... 13.3 mi/h
- Angle ..... 64.6 degrees

Occupant Risk Values
- Impact Velocity
  - Longitudinal ..... 34.8 ft/s
  - Lateral ..... 13.4 ft/s
- Ridedown Accelerations
  - Longitudinal ..... 12.0 G
  - Lateral ..... 5.4 G
- THIV ..... 41.1 km/h
- PHD ..... 13.0 G
- ASI 1.08
- Max. 0.050-s Average
  - Longitudinal ..... -11.9 G
  - Lateral ..... 3.9 G
  - Vertical ..... 3.0 G

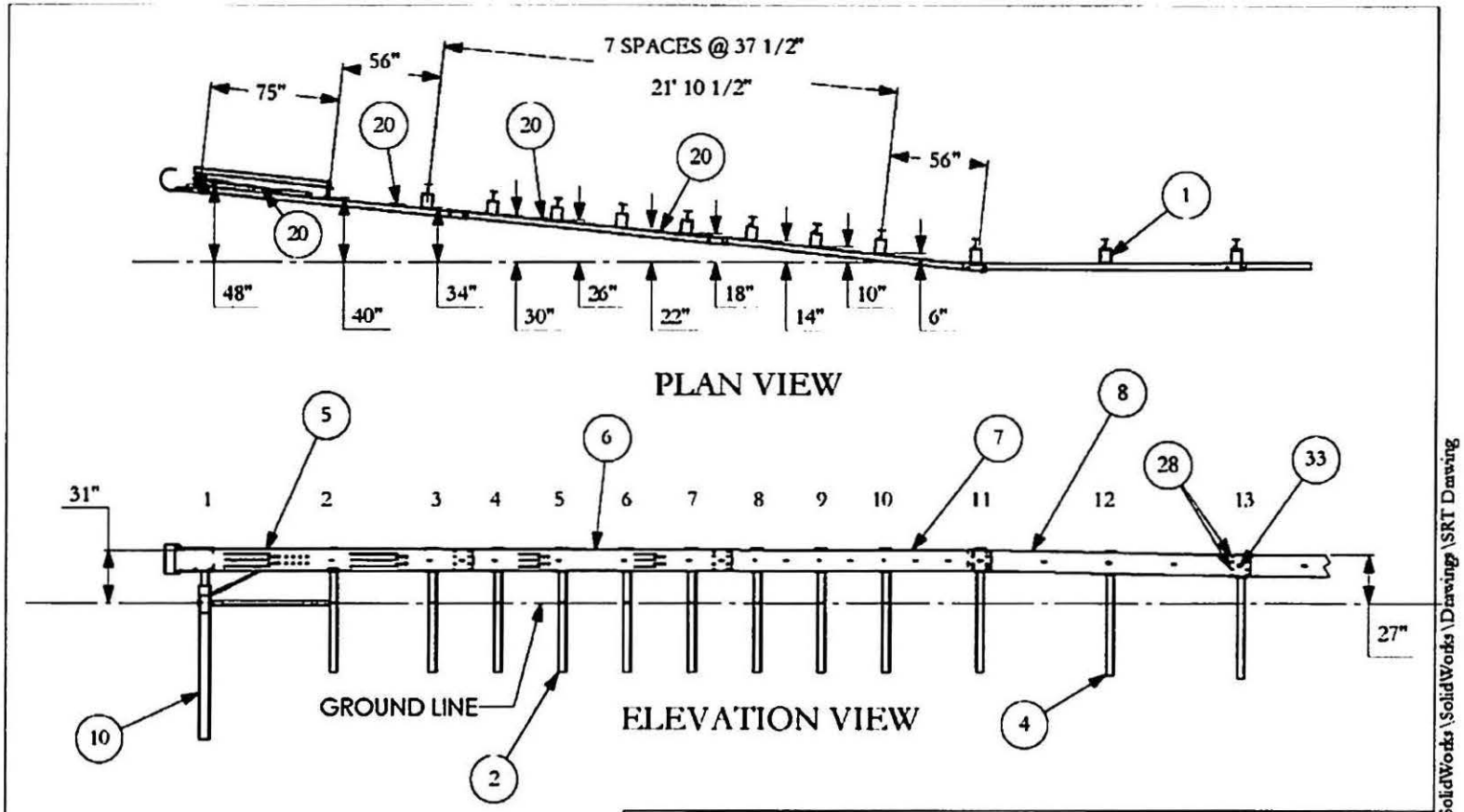
Post-Impact Trajectory
- Stopping Distance ..... 43.8 ft

Vehicle Stability
- Maximum Yaw Angle ..... -166 degrees
- Maximum Pitch Angle ..... 2 degrees
- Maximum Roll Angle ..... 11 degrees
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 2.62 ft
- Permanent ..... 2.62 ft
- Working Width ..... 2.62 ft

Vehicle Damage
- VDS 11LFQ6
- CDC 11FLEW4
- Max. Exterior Deformation ..... 15.5 inches
- OCDI FS0000000
- Max. Occupant Compartment Deformation 0

Figure 5.7. Summary of results for *MASH* test 3-34 on SRT-MASH.



1. Two Slotguards on rails 1 and 2 (Four total).
2. Flange protectors on posts 2-7.
3. Shelf angle on post 2.
4. Posts 2 - 7 not attached to rail.
5. Posts 2 - 10 SYTP, posts 11 - 25 STD line posts.

The Texas A&M University System							
Revisions:				Texas Transportation Institute College Station, Texas 77843			
No.	Date	By	Chk				
1.				Date	Drawn By	Scale	Sheet No.
2.				2010-10-12	BCJ/GES	1:80	3 of 10
3.				Project No.		Summary Rails 1-4	
4.				403371-SRT			
5.				SRT			

T:\2010-2011\403371-SRT\Test3\SolidWorks\SolidWorks\Drawings\SRT Drawing