



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

RECEIVED FEB 18 2009

1200 New Jersey Avenue, SE.
Washington, DC 20590

February 13, 2009

In Reply Refer To: HSSD/CC-65E

Mr. Geoffrey Maus
Chief Design Engineer
TraFFix Devices, Inc.
160 Avenida La Pata
San Clemente, California 92673

Dear Mr. Maus:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system: Scorpion Attenuator Trailer (Modified)
Type of system: Truck Mounted Attenuator - Trailer
Test Level: NCHRP Report 350 Test Level 3
Testing conducted by: KARCO Engineering, LLC
Date of request: December 26, 2008
Date of completed package: January 21, 2009

You requested that we find this system acceptable for use on the NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Requirements

Roadside safety systems should meet the guidelines contained in the NCHRP Report 350. The FHWA Memorandum "Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements of longitudinal barriers.

Description

The TraFFix Devices Inc. Scorpion Trailer Attenuator is a trailer based impact attenuator. It is comprised of four sections, as illustrated in the drawings enclosed for reference: the steel tongue section, the aluminum strut section, the aluminum cartridge section, and the axle wheel assembly. The steel tongue section incorporates a Telescoping Anti-Rotation System (TARS). The modified Scorpion Trailer Attenuator covered by this acceptance letter has an overall length of 5.323 m (209.6 in.), an overall width of 2.410 m (94.9 in.), and weighs a total 701.0 kg (1545 lbs).

**MOVING THE
AMERICAN
ECONOMY**



Description of modifications:

To reduce the weight of the original Scorpion Trailer Attenuator (FHWA acceptance letter CC-65B, dated March 16, 2007), material thicknesses were optimized and in applicable locations, aluminum was used in place of steel. Changes were limited to three components: the tongue, center connecting angles, and the rear diaphragm.

- 1) Reduced Trailer Tongue weight. The tongue section which incorporates the Telescoping Anti-Rotation System (TARS) was tested using thinner steel wall tubing and plate. The original heavier 3-53 tongue tested on September 27, 2006, weighed approximately 731 lbs (283 kg). The lighter 3-53 tongue tested on September 26, 2008, weighed 455 lbs (206 kg).
- 2) Reduced connecting center angle weight. The set of connecting angles attach the strut and cartridge together. The original 3-53 heavier steel connecting angles tested on September 27, 2006, weighed 40 lbs (18.14 kg). The lighter 3-53 aluminum connecting angles tested on September 26, 2008, weighed 13 lbs (5.9 kg).
- 3) Reduced rear diaphragm weight. The rear diaphragm consists of the attachment elements for the axle assembly and Impact Absorber Boxes A and B. The original heavier 3-53 rear diaphragm support tested on September 27, 2006, was a steel weldment and weighed approximately 170 lbs (77 kg). The lighter 3-53 rear diaphragm support tested on September 26, 2008, is an aluminum weldment and weighs approximately 65 lbs (29 kg).

The total weight reduction resulting from the three design changes is 435 lbs (162 kg).

Crash Testing

Test 3-53 was selected as a “worst case scenario” test as a result of the extreme load and stress conditions that the Trailer Attenuator components must undergo during the offset angled impact test. Test 3-53 places the modified TARS design in severe compressive and tensile stress conditions while exerting a large bending moment on the entire attenuator system about the pintle attachment point.

In comparison, a Report 350 3-52 test would impart a similar peak compression load to the favored impact side, but with significantly less angled shear load on the attenuator. A Report 350 3-51 test would impart the most total load into the attenuator, but the load would be distributed over the entire attenuator, reducing the force on each load path. The Report 3-51 test would have a minimal lateral load imparted into the attenuator.

Post crash test analysis showed that each of the modified elements – tongue, center angles, and rear diaphragm – performed in a functionally identical manner to their heavier counterparts. The modified components caused no alteration in safety performance of the trailer attenuator.

You noted that the TARS tubes did not undergo any buckling or deformation upon impact into the truck frame plate. The connecting angles and axle diaphragm contained all of their attached components. In addition, the test results for Ride-down Acceleration and Occupant Velocity were well below the maximum allowable values and nearly equal to the original 3-53 tested values.

Findings

Therefore, the modified Scorpion Trailer Attenuator described above and detailed in the enclosed drawings is acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency.

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

- This acceptance is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the system will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number CC-65E 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.
- The Scorpion Attenuators are patented products and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS 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.
- This acceptance 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 acceptance letter is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

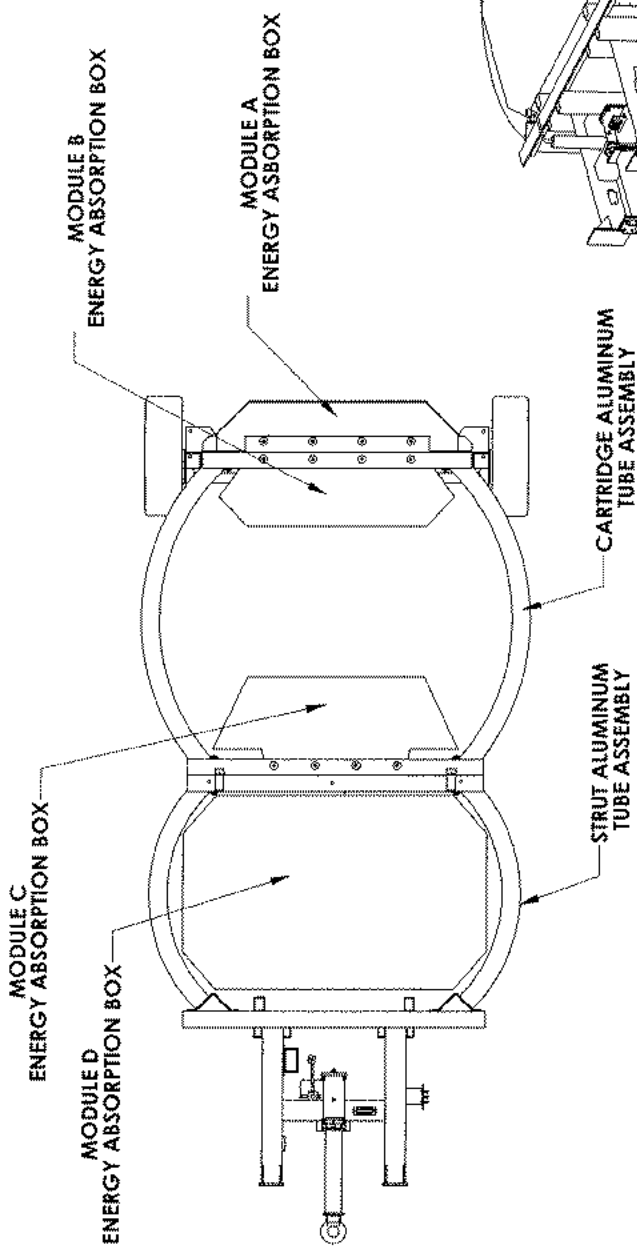
Sincerely yours,



David A. Nicol
Director, Office of Safety Design
Office of Safety

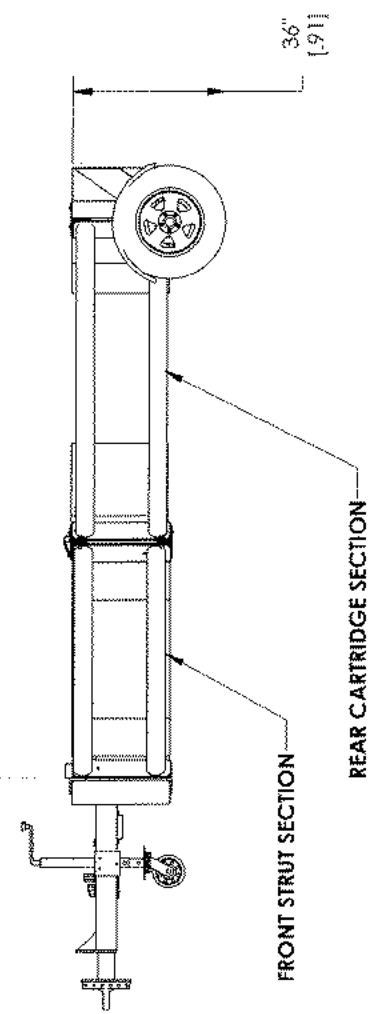
Enclosures

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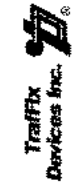
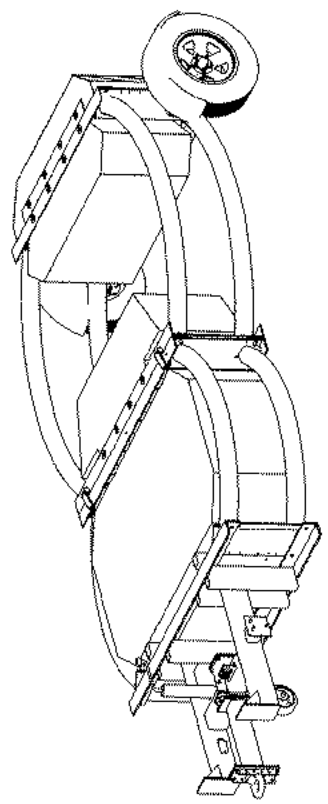
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1.446



FRONT STRUT SECTION

REAR CARTRIDGE SECTION

36"
[.91]



2201 Calle Pinedero
San Clemente, CA 92672
(949) 381-5665
Fax: (949) 381-5666
www.traffixdevices.com

TITLE:

**TRAFFIX DEVICES
TRAILER ATTENUATOR**

SIZE: **B** DWG. NO. **904** REV **A**

DESIGNED BY
CHECKED BY
APPROVED BY

DATE
DATE
DATE

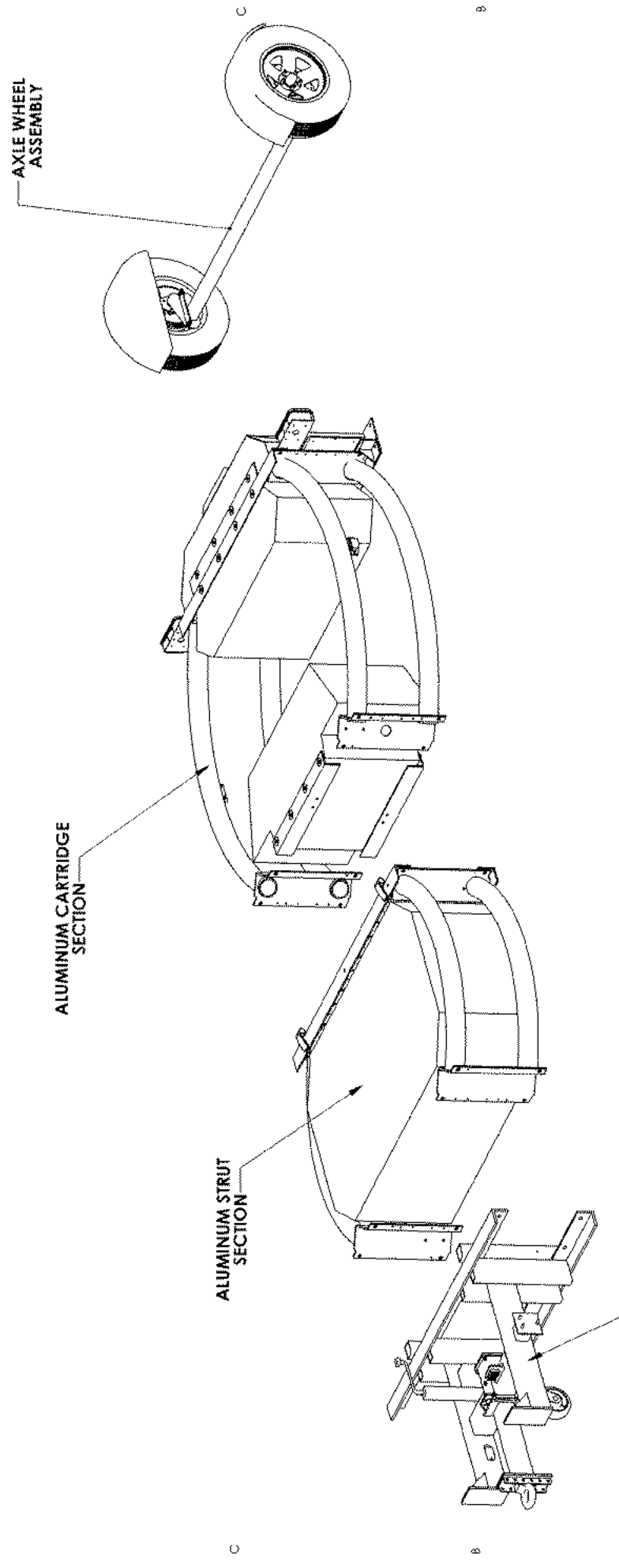
SHEET 1 OF 1

1: DIMENSIONS: INCHES [METERS]
UNLESS OTHERWISE SPECIFIED

8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

D D



B B

A A

Traffix Devices Inc.
 220 Calle Pinobesera
 San Clemente, CA 92672
 (949) 261-5800
 Fax: (949) 261-5805
 www.traffixdevices.com

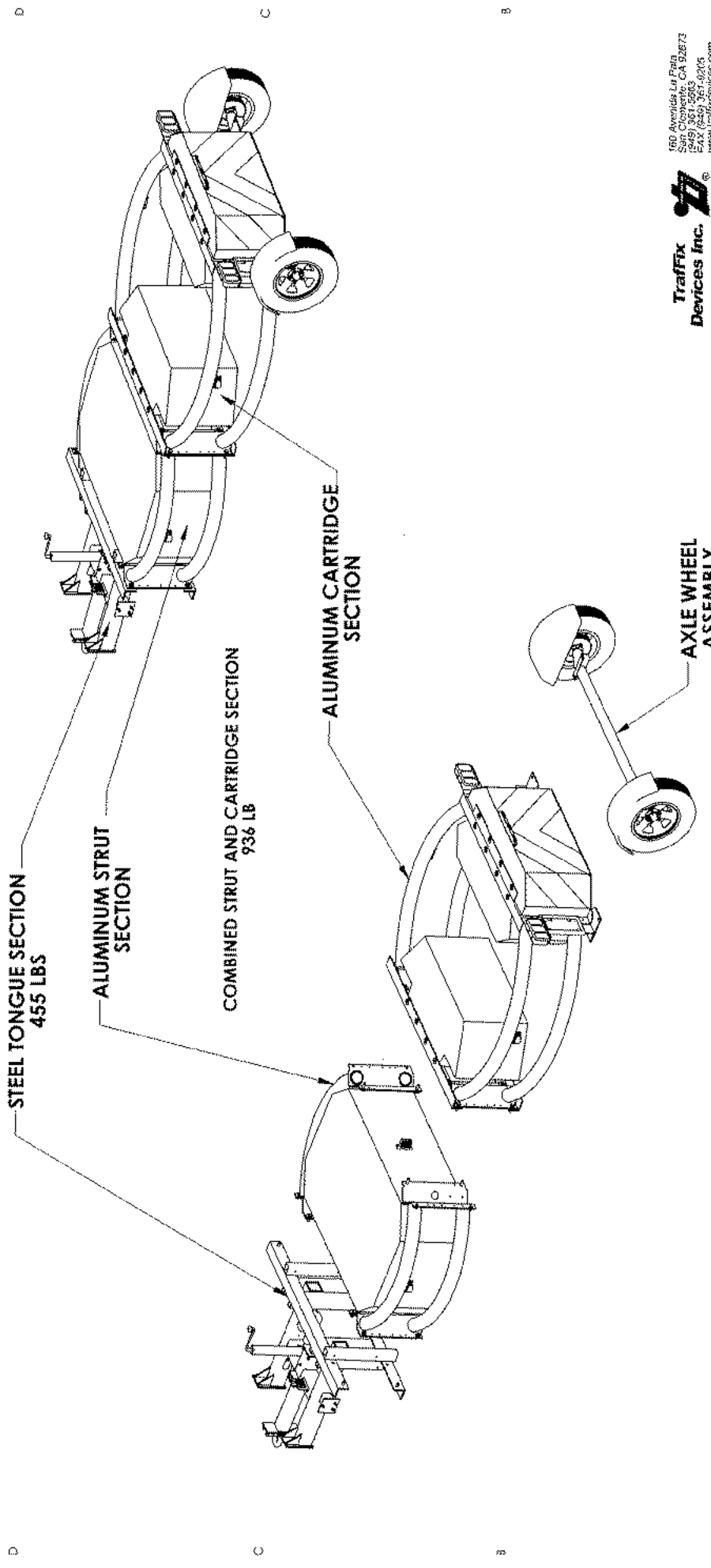
TITLE:
TRAFFIX DEVICES
TRAILER ATTENUATOR

SIZE B **DWG. NO. 905** **REV A**

DATE: _____ **DATE:** _____
DESIGNED BY: _____ **CHECKED BY:** _____
APPROVED BY: _____

SHEET 1 OF 1

8 7 6 5 4 3 2 1



Traffix Devices Inc.
 166 Avenida La Plata
 San Clemente, CA 92673
 TEL: (949) 761-9275
 FAX: (949) 761-9276
 www.traffixdevices.com

TITLE: **TRAFFIX DEVICES TRAILER ATTENUATOR**

DATE: 12/28/06
 DRAWN BY: DAVE
 CHECKED BY: DAVE
 APPROVED BY: DAVE

SIZE: **B** DWG. NO.: **987** REV: **B**

SHEET 2 OF 3

D C B A 8 7 6 5 4 3 2 1

DATA SHEET 5

SUMMARY OF RESULTS

Test Article: TraFFix Devices Scorpion Trailer Attenuator Project No.: P28149-01
 Test Program: NCHRP 350 3-53 Test Date: 09/26/08
 Test Vehicle: 2000 Chevrolet 2500



GENERAL INFORMATION		OCCUPANT RISK VALUES	
TEST AGENCY	KARCO Engineering, LLC	FLAIL SPACE VELOCITY (m/sec)	
TEST NO.	3-53	X DIRECTION	9.0
DATE	9/26/2008	Y DIRECTION	1.5
TEST ARTICLE		THIV (Optional)	N/A
TYPE	TMA	RIDEDOWN ACCELERATION (g's)	
INSTALLATION LENGTH	N/A	X DIRECTION	-15.7
SIZE AND/OR DIMENSION OF KEY ELEMENTS	701.0 kg (1545.4 lbs)	Y DIRECTION	-7.6
SOIL TYPE AND CONDITION	Concrete	PHD (Optional)	N/A
TEST VEHICLE		ASI (Optional)	N/A
TYPE	Production Model	TEST ARTICLE DEFLECTIONS (m)	
DESIGNATION	2000P	DYNAMIC	N/A
MODEL	2000 Chevrolet 2500	PERMANENT	N/A
MASS (CURB)	2159.0 (4760 lbs)	VEHICLE DAMAGE	
MASS (TEST INERTIAL)	2008.5 (4429 lbs)	EXTERIOR	
DUMMY MASS	0 kg (0 lbs)	VDS	1-FR-4
MASS (GROSS STATIC)	2008.5 (4429 lbs)	CDC	01FRMW3
IMPACT CONDITIONS		INTERIOR	
VELOCITY (km/h)	101.1 (62.8 mph)	OCDI	FS1011000
ANGLE (°)	9.0		
IMPACT SEVERITY (kJ)	762.6	POST-IMPACT VEHICULAR BEHAVIOR	
EXIT CONDITIONS		MAXIMUM ROLL ANGLE (°)	
VELOCITY (km/h)		-9.8	
ANGLE (°)		MAXIMUM PITCH ANGLE (°)	
		-3.1	
		MAXIMUM YAW ANGLE (°)	
		-51.6	