U.S. Department of Transportation
Federal Highway Administration

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

June 21, 2011

In Reply Refer To:
HSST/CC-117

Felipe Almanza
Technical Engineering Director
TrafFix Devices, Inc.
160 Avenida La Pata
San Clemente, California 92673

Dear Mr. Almanza:

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:	SLED – Sentry Longitudinal Energy Dissipater
Type of system:	Gating Crash Cushion / Impact Attenuator
Test Level:	NCHRP Report 350 Test Level 2
Testing conducted by:	KARCO Engineering
Date of request:	November 29, 2010
Date initially acknowledged:	December 13, 2010

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.

Requirements
Roadside safety devices should meet the guidelines contained in the Report 350. The FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 24, 1997, provides further guidance on crash testing requirements of longitudinal barriers.

Decision
The following device was found acceptable, with details provided below:

- TL-2 SLED – Sentry Longitudinal Energy Dissipater

Description

The SLED End Treatment CMB is a non-redirective, gating crash cushion, tested as an end treatment for use with concrete median barriers (CMBs). For this test, three (3) F-shape concrete median barriers were used. The SLED End Treatment CMB system consists of five (5) main components: three (3) yellow SLED End Treatment sections, one (1) containment impact sled, and one (1) SLED End Treatment Transition. The length of the SLED End Treatment CMB, excluding the concrete elements, is 5.7 m (18.6 ft). The total tested array length is 15.1 m (49.5 ft.).

The yellow elements of the SLED End Treatment CMB measure 1.16 m (3.8 ft) tall, 1.93m (6.3 ft) in length from pin to pin, and weigh 72.5k9 (160 lb). The yellow element of the SLED End Treatment CMB is made of high density polyethylene (HDPE) plastic, and has a 200 mm (8 in) diameter fill hole. The front yellow element has 6 holes drilled near the base to ensure that the element cannot be filled with water. The other two yellow elements are filled with water.

Each SLED End Treatment CMB element contains eleven knuckles per side interlocked together with a vertical drop t-pin aligning a series of concentric pin holes. This provides a positive connection between the eleven knuckle sections per side. Within the four upper knuckles on each SLED End Treatment CMB element are four molded in corrosion resistant steel wire ropes.

Pinned to the front of the yellow end treatment section is the galvanized steel containment impact sled. The impact sled consists of a steel tube frame and sheet metal construction. The impact sled is approximately 0.77 m (2.54 ft) tall, 0.69 m (2.3 ft) wide, 2.25 m (7.4 ft) long, and weighs 95 kg (2001b).

Following the SLED End Treatment CMB are three (3) F-shape concrete median barriers. These three (3) elements add an additional length of 12.3 m (40.3 ft). Each F-shape concrete median barrier is approximately 1.07 m (42 in) tall, 0.66 m (26 in.) wide at the base, 3.05 m (120 in) long and weighs approximately 2650 kg (5483 lbs). The concrete median barriers were anchored to the concrete using a steel plate and drop in anchors.

The SLED End Treatment CMB connects to the F-Shape concrete median barriers with a steel SLED End Treatment Transition. The SLED End Treatment Transition is made of three main components: the steel transition frame, left transition panel, and right transition panel. The steel frame of the transition is positively connected to the last water filled SLED End Treatment with a pin. The left and right transition panels are connected to the transition frame with pins. Both transition panels are anchored to the first concrete median barrier using four (4) anchor bolts.

Crash Testing

A non-redirective gating crash cushion requires the following tests be conducted: 3-40, 3-41, 3-42, 3-43, and 3-44. Tests 3-40, 3-41, 3-43 and 3-44 were conducted on the TL-3 SLED shielding either a fixed concrete barrier or a water-filled Sentry installation. The remaining tests were waived, and the TL-3 SLED was found acceptable in FHWA Acceptance Letter CC-114 dated February 9, 2011.

All physical crash test summaries are included as enclosures to this correspondence.

Findings
Because the SLED is a non-redirecting, gating cash cushion, it should be applied to hazards that are not likely to be impacted at an angle on the side at any significant velocity. We note also that proper antifreezing agents must be used as filler when the SLED and Sentry products are used in areas where low temperatures can be anticipated. All users of this device should be made aware of the factors that contribute to its proper performance.

Therefore, the system 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 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 NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number CC-114 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 Sentry and SLED are patented products and considered proprietary. If proprietary devices 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,

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

DATA SHEET 4

SUMMARY OF RESULTS

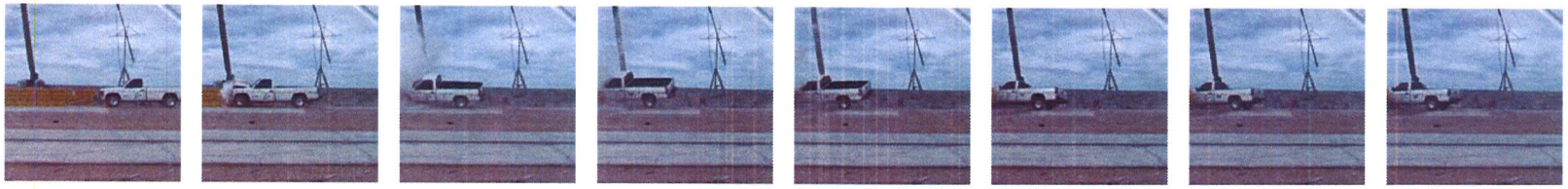
Test Article: TrafFix Devices SLED End Treatment CMB

Project No.: P30077-01

Test Program: NCHRP 350 3-44

Test Date: 06/28/10

Test Vehicle: 1996 Chevrolet Cheyenne 2500



GENERAL INFORMATION	
TEST AGENCY	KARCO Engineering, LLC
TEST NO.	2-44
DATE	9/29/2010
TEST ARTICLE	
TYPE	Crash Cushion
INSTALLATION LENGTH	15.1 m (49.5 ft)
END TREATMENT LENGTH	5.7 m (18.6 ft)
SIZE AND/OR DIMENSION OF KEY ELEMENTS	Nominal Mass 72.5 kg (160 lbs)
SOIL TYPE AND CONDITION	Concrete
TEST VEHICLE	
TYPE	Production Model
DESIGNATION	2000P
MODEL	1994 Chevrolet Cheyenne 2500
MASS (CURB)	1892.0 kg (4171 lbs)
MASS (TEST INERTIAL)	1961.0 kg (4323 lbs)
DUMMY MASS	N/A
MASS (GROSS STATIC)	1961.0 kg (4323 lbs)
IMPACT CONDITIONS	
VELOCITY (km/h)	73.8 km/h (45.9 mi/h)
ANGLE (°)	20.3
IMPACT SEVERITY (kJ)	363.9
EXIT CONDITIONS	
VELOCITY (km/h)	
ANGLE (°)	

OCCUPANT RISK VALUES	
FLAIL SPACE VELOCITY (m/sec)	
X DIRECTION	8.3
Y DIRECTION	0.9
THIV (Optional)	
RIDEDOWN ACCELERATION (g's)	
X DIRECTION	-9.1
Y DIRECTION	4.4
PHD (Optional)	
ASI (Optional)	
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	
PERMANENT	
VEHICLE DAMAGE	
EXTERIOR	
VDS	1-FR-6
CDC	01FREW4
INTERIOR	
OCDI	FS0000000
POST-IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (°)	-20.6
MAXIMUM PITCH ANGLE (°)	-10.6
MAXIMUM YAW ANGLE (°)	20.9

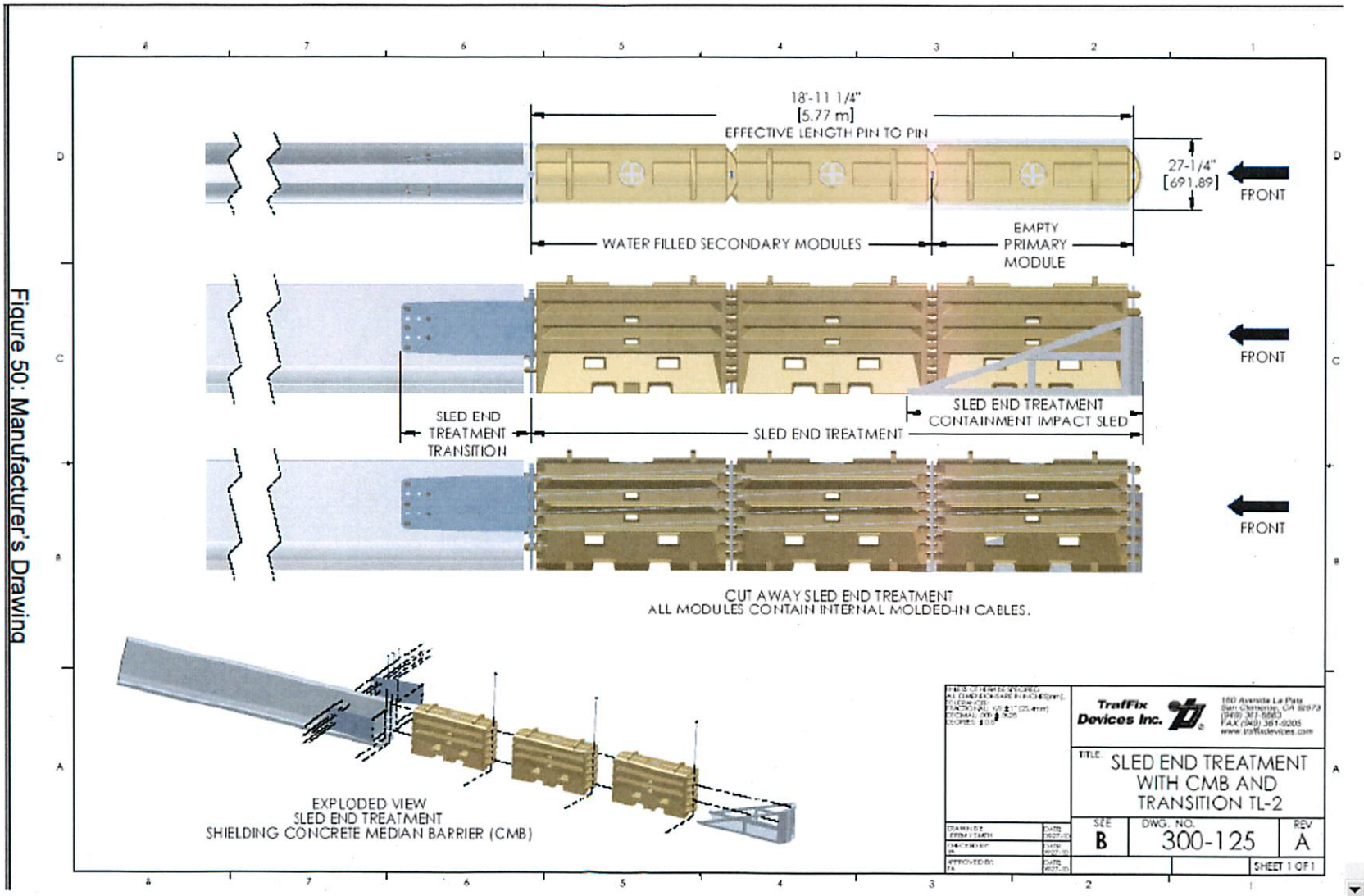


Figure 50: Manufacturer's Drawing