U.S.Department
of Transportation
Federal Highway
Administration

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

January 21, 2010

In Reply Refer To:
HSSD/CC-89A

Mr. Brian Smith
Trinity Highway Products, LLC
2525 N. Stemmons Freeway
Dallas, TX 75207

Dear Mr. Smith:

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

Name of device:	70 mph HEART
Type of device:	Crash Cushion
Test Level (TL):	NCHRP Report 350 TL-3
Testing conducted by:	Texas Transportation Institute
Date of request:	May 28, 2009
Date of completed package:	October 28, 2009
Task Force 13 Designator:	SCI21

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

Requirements
Roadside safety devices should meet the guidelines contained in the NCHRP Report 350 or the AASHTO Manual for Assessing Safety Hardware. The FHWA Memorandum "Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements of longitudinal barriers.

Description
The 70 mph Hybrid Energy Absorbing Reusable Terminal (HEART) attenuator consists of deformed (hinged) High Molecular Weight/High Density Polyethylene panels along each side connected to steel diaphragms mounted on tubular steel tracks. The assembled unit is approximately 28 feet, 9 inches long when a concrete barrier is used as the backup

structure, 32 inches high in the front two-thirds and 34 inches high for the rear third, and 25 inches wide at the diaphragms with a maximum width of 39 inches between diaphragms 3 and 4. The front anchorage consists of a W8 x 13 upper release post mounted to a 1/2-inch thick base plate. There are two slots at the slip plane between the upper and lower post through which tensioning cables are anchored.

When the upper release post is impacted, the tensioned cables connected to diaphragm 2 are released and the side panels and steel diaphragms are pushed rearward along the base track. This track consists of a pair of 2-inch x 5-inch x 1/4-inch structural tubes stitch-welded above two C3 x 4.1 standard channels. The channels serve as spacers allowing the diaphragms to move longitudinally along the structural tubing during frontal impacts. Anchor bolts, 3/4-inch diameter x 7 1/2-inches long, are placed through the front anchorage base plate and anchor bolts, 3/4-inch diameter x 10-inches long, are placed through the structural tubing and channel at locations that can be accessed without removal of the plastic side panels or diaphragms and into 6-inch reinforced or 8-inch thick non-reinforced concrete, or anchor bolts, 5/8-inch x 18-inches long, are placed through the front anchorage base plate and structural tubing and channel and into 8-inch thick asphalt.

The rear backup structure can be either concrete barrier or an 8-inch x 12-inch x 1/2-inch structural tube welded to a 3/4-inch thick base plate. The last diaphragm is either bolted to brackets that are anchored to the concrete barrier or bolted to the structural tube. A second set of tensioning cables, attached to diaphragm 2, terminate on the rear side of diaphragm #12. The enclosed drawing shows the general layout of the unit and selected components.

Crash Testing

The original TL-3 HEART was crash tested and found acceptable in our FHWA Acceptance Letter CC-89 dated March 15, 2005. Your present request is for a modified version of the HEART (described above) that was crash tested at 70 mph in an NCHRP Report 350 Test 3-31 Modified. In this modified test the impact speed was established to be 70 mph instead of the 62.5 mph required by NCHRP Report 350. The test data summary sheet for that impact is enclosed for reference.

You noted that the longitudinal ridedown acceleration was 20.4 g. NCHRP Report 350 recommends a maximum 20 g (two significant digits) for this occupant risk factor. Because the recorded acceleration can be rounded down to 20 g, FHWA has accepted longitudinal ridedown acceleration up to 20.4 g in the past.

Findings

The tested unit met Report 350 evaluation criteria for a TL-3 crash cushion for the test 3-31 head-on impact with the 2000P truck at a nominal speed of 70 mph. The device is acceptable for use on the NHS as a TL-3 device when acceptable to a highway agency in uni-directional traffic flow applications as well as in bi-directional traffic flow applications provided the plastic side panels are lapped in the direction of traffic flow and an acceptable transition is used.

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

- This acceptance is limited to the crashworthiness characteristics of the devices 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 device 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 device 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-89A 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 HEART attenuators 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 device for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate device, 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, P.E.
Director, Office of Safety Design
Office of Safety

Enclosures

FHWA:HSSD:NArtimovich:tb:x61331:1/11/10
File: s://directory folder/nartimovich/CC89A_70mphHEART_11110
cc: HSSD (Reader, HSA; Chron File, HSSD; N.Artimovich, HSSD; DNicol, HSSD)

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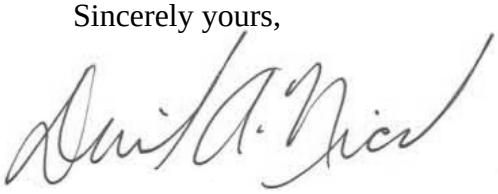
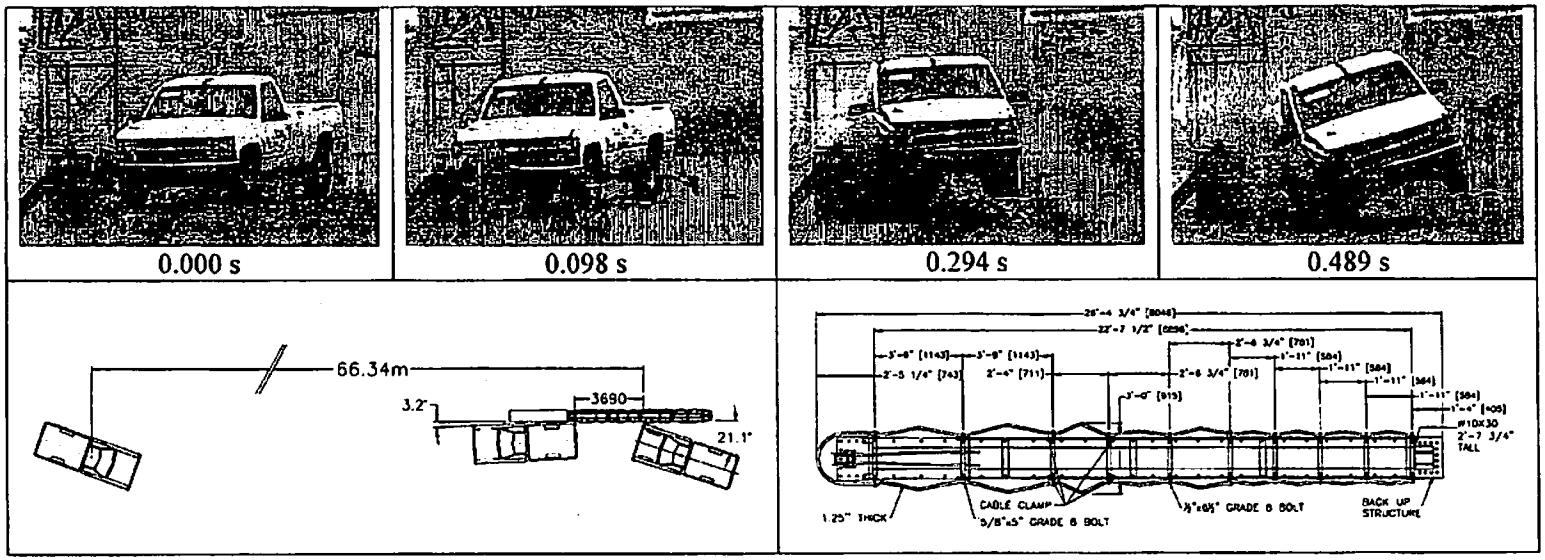


David A. Nicol, P.E.
Director, Office of Safety Design
Office of Safety

Enclosures



General Information	
Test Agency	Texas Transportation Institute
Test No.	220581-1
Date	01-23-2002
Test Article	
Type	Crash Cushion
Name	HEART
Installation Length (m)	8.0
Material or Key Elements	High Molecular Weight/High Density Polyethylene Sheeting and Steel
Soil Type and Condition	Concrete Pavement, Dry
Test Vehicle	
Type	Production
Designation	2000P
Model	1995 Chevrolet 2500 Pickup
Mass (kg)	
Curb	2103
Test Inertial	2019
Dummy	N/A
Gross Static	2019

Impact Conditions	
Speed (km/h)	99.1
Angle (deg)	21.1
Exit Conditions	
Speed (km/h)	73.5
Angle (deg)	3.2
Occupant Risk Values	
Impact Velocity (m/s)	
Longitudinal	6.5
Lateral	5.2
THIV (km/h)	29.4
Ridedown Accelerations (g's)	
Longitudinal	-8.3
Lateral	-8.4
PHD (g's)	10.8
ASI	1.30
Max. 0.050-s Average (g's)	
Longitudinal	-9.1
Lateral	-9.7
Vertical	-6.0

Test Article Deflections (m)	
Dynamic	0.17
Permanent	0.03
Working Width	0.92
Vehicle Damage	
Exterior	
VDS	01RFQ5
CDC	01FREW2
Maximum Exterior Vehicle Crush (mm)	435
Interior	
OCDI	RF0102000
Maximum Occupant Compart. Deformation (mm)	85
Post-Impact Behavior (during 1.0 sec after impact)	
Max. Yaw Angel (deg)	-28.0
Max. Pitch Angle (deg)	-2.7
Max. Roll Angle (deg)	21.6

Figure 13. Summary of results for *NCHRP Report 350* test 3-38 on the HEART.

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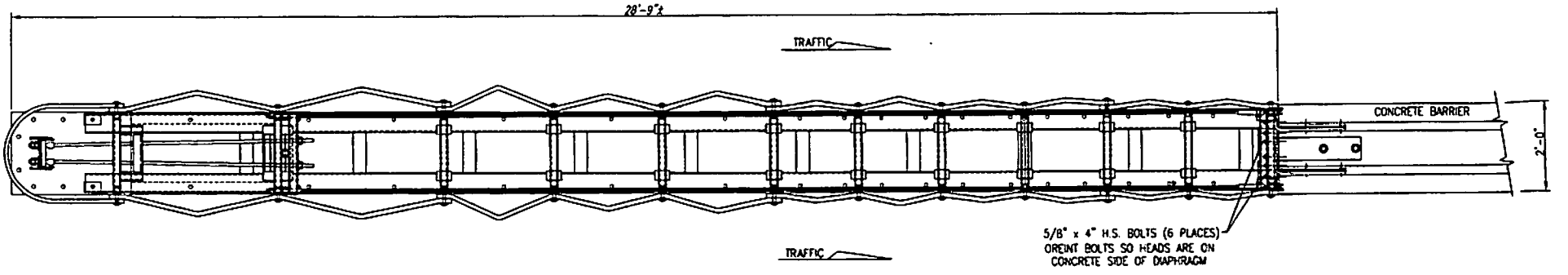

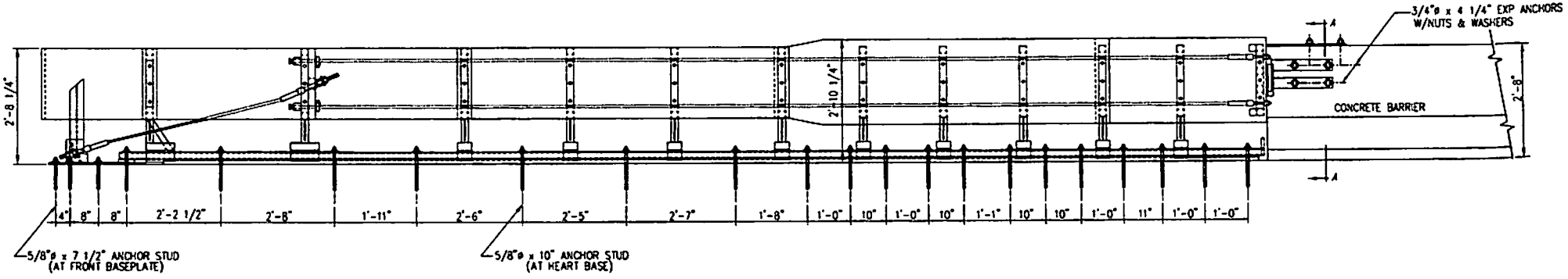

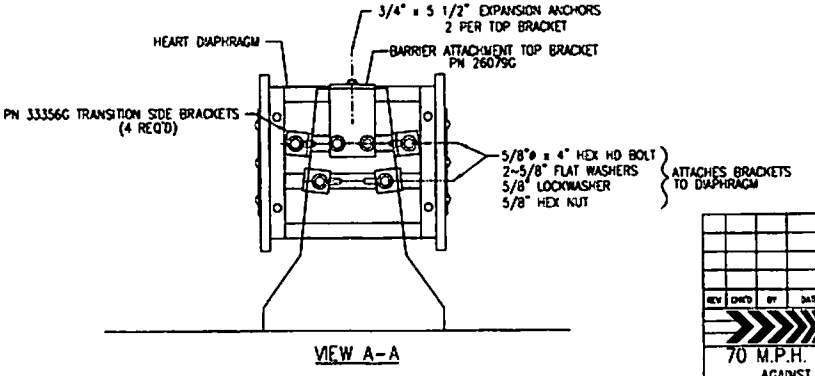

VIEW A-A

70 M.P.H. HEART BILL OF MATERIAL		
PART NUMBER	QTY	DESCRIPTION
26089A	1	HEART UNIT (FULLY ASSEMBLED)
ANCHOR HARDWARE (FULL CONCRETE BASE)		
6945G	38	5/8" x 10" ANCHOR STUD
6352G	6	5/8" x 7 1/2" ANCHOR STUD
5445B	5	ADHESIVE HY 150 MAX (CARTRIDGE)
3310G	44	5/8" LOCKWASHER
3300G	44	5/8" WASHER
3361G	44	5/8" HEX NUT

BARRIER ATTACHMENT BILL OF MATERIAL		
PART NUMBER	QTY	DESCRIPTION
26079G	1	BARRIER ATTACHMENT TOP BRACKET
33356G	4	TRANSITION SIDE BRACKET
HARDWARE		
3300G	12	5/8" WASHER (FB44)
3310G	6	5/8" LOCKWASHER
3361G	6	5/8" HEX NUT (A563 DH)
3440G	6	5/8"ø x 4" HEX HD BOLT (A325)
3701G	10	3/4" WASHER
3704G	10	3/4" HEX NUT
4709G	8	3/4"ø x 4 1/4" EXPANSION ANCHOR
4711G	2	3/4"ø x 5 1/2" EXP. ANCHOR

REV	CHK'D	BY	DATE

HEART

70 M.P.H. HEART CRASH CUSHION
AGAINST CONCRETE MEDIAN BARRIER
PLAN, ELEVATION & SECTIONS
AS TESTED

TRINITY HIGHWAY PRODUCTS, LLC.
2525 STEMMONS FREEWAY
DALLAS, TX 75207

DRAWN	LH
CHECKED	BT
SCALE	N.T.S.
DATE	10/22/08
DWG. FILE #	SS1512E TEST
DATUM	E1 OF 1
DRAWING NO.	SS 1512 TEST
REV.	0