



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

November 16, 2010

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

In Reply Refer To:
HSSI/CC-110

Mr. Barry D. Stephens, P.E.
Sr. Vice President Engineering
Energy Absorption Systems, Inc.
3617 Cincinnati Avenue
Rocklin, CA 95678

Dear Mr. Stephens:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of a roadside safety device for use on the National Highway System (NHS) under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 testing guidelines.

Name of device:	Test Level (TL-2) ACZ 350™ System
Type of device:	Impact Attenuator and Transitions
Test Level:	NCHRP Report 350 TL-2
Testing conducted by:	E-Tech Testing Services, Inc.
Date of request:	July 15, 2010
Task Force 13 Designator:	SCI24

Decision:

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

- ACZ 350 System meeting TL-2 conditions for a Report 350 non-redirective, gating crash cushion where impact speeds are not expected to exceed 70 km/h (44 mph).

Requirements

Roadside safety devices should meet the guidelines contained in NCHRP 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.

Description:

As per the submitted crash test report, the ACZ-350 System is designed to perform as a narrow, non-redirecting, gating crash cushion to shield the blunt ends of both permanent and variable length portable concrete median barriers (P/CMB), as well as steel barrier such as the Vulcan Barrier. The TL-3 ACZ 350 System was accepted by the FHWA on February 13, 2009,



(reference HSSD/CC-47D). The 2-segment ACZ 350™ System consists of a sheet metal nose, two water-filled barrier segments, and a steel transition pinned together to act as an end treatment.

The nose is constructed of light gauge steel and connects directly to the front-most water filled barrier segment. Each of the two water filled barrier segments is equipped with an external top-mounted steel stiffener which is rigidly fixed to each respective segment and an internal steel frame as well as external side-mounted steel laminated straps. A heavy duty non-crushable steel transition completes the system by connecting the last water filled segment to the blunt end of the downstream barrier, be it P/CMB or Vulcan Barrier. The ACZ 350™ System has an overall length of 5.6 meters (18 feet, 4inches). The overall height is 815 mm (32 inches).

Crash Testing

As per the submitted crash test report, the following physical crash testing was conducted:

- A. **Test 2-40 (820C/ 70kph/ 0 degree/ w/4 offset):** Impact speed = 70.3 km/h, ridedown = -9.6 g's, Longitudinal $\Delta V = 10.2$ m/s.
- B. **Test 2-41 (2000P/ 70kph/ 0 degree):** Impact speed = 71.3 km/h, ridedown = -8.6 g's, Longitudinal $\Delta V = 9.2$ m/s.

The crash test summaries are enclosed for reference. In addition, the following tests are requested to be waived as per the following comparisons:

Test Number	Test Level	Requested Comparison
1-40	TL1	Not necessary since Test 2-40 passed
1-41	TL1	Not necessary since Test 2-41 passed
1-42	TL1	Not necessary since Test 2-40 is worst case
1-43	TL1	Not necessary since Test 2-41 is worst case
1-44	TL1	Not necessary since this test is similar to the previous successful Test 3-44 as per Acceptance Letter CC-47D.
2-42	TL2	Not necessary as Test 2-40 (see above) is worst case
2-43	TL2	Not necessary as Test 2-41 (see above) is worst case
2-44	TL2	Not necessary since this test is similar to the previous successful Test 3-44 as per Acceptance Letter CC-47D.

Findings

The FHWA concurs to the submitted physical crash testing and to requested comparisons relating to the proposed TL-2 2-segment ACZ 350™ System only. Therefore, the ACZ 350 Crash Cushion System meets the TL-2 impact conditions and evaluation criteria for a Report 350 non-redirective, gating crash cushion and is acceptable for use on the NHS. However, it is critical this system be used only when such use is acceptable to the contracting authority and only in locations where impact speeds are not expected to exceed 70 km/h (44 mph). Regarding the TL-1 1-segment ACZ-350™ System, the submitted crash test report did not address this particular system. Therefore, FHWA does not concur with the requested

comparisons relating to the proposed 1-segment ACZ 350™ System. Additional physical crash testing on the proposed 1-segment ACZ 350™ System is strongly recommended.

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

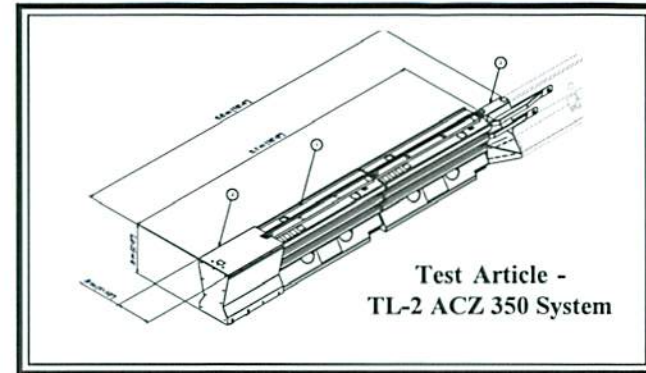
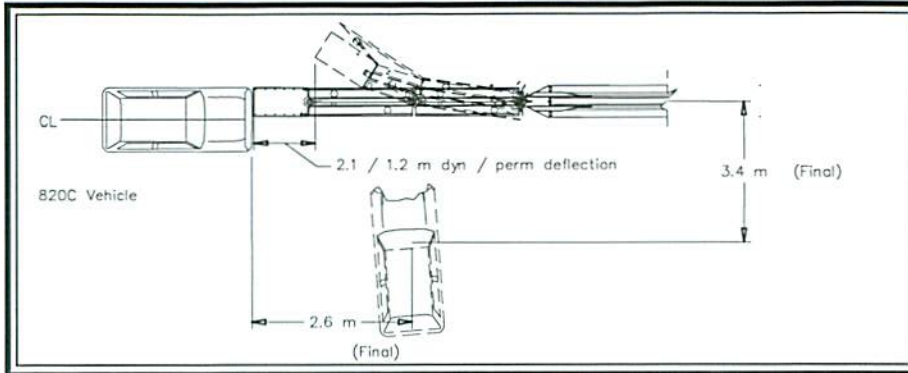
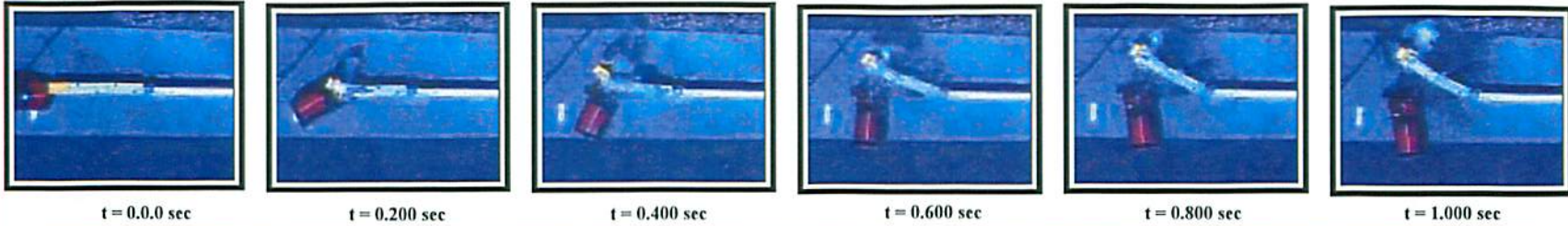
- This acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance 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 Manual for Assessing Safety Hardware.
- To prevent misunderstanding by others, this letter of acceptance is designated as number CC-110 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 TL-2 ACZ 350™ System crash cushions are patented products and considered proprietary. If proprietary devices are specified by 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,



Michael S. Griffith
Director, Office of Safety Technologies

2 Enclosures



E-TECH Testing Services, Inc.

TL-2 ACZ 350 System Crash Test Results - 10 of 48

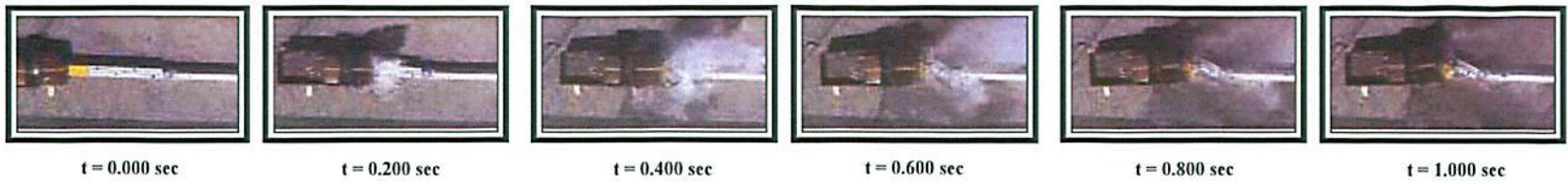
General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 2-40
Test No.	01-4317-004
Date	6/14/10
Test Article	
Type	Energy Absorption System
.....	TL-2 ACZ 350 System
Installation Length,	5.6 m - (2) segment total,
.....	pinned and freestanding
.....	w/ steel nose
Material and key elements	Polyethylene plastic segments
.....	Water filled with frame and
.....	steel side straps, 14 ga
.....	hollow steel nose, transition to (2) 3 m
.....	anchored PCMB
.....	Segment Length x Width x Height:
.....	(2021 mm x 533 mm x 813 mm)
Foundation Type and Condition	Portland Cement Concrete,
.....	clean and dry, unanchored
Test Vehicle	
Type	Production Model
Designation	820C
Model.....	1990 Ford Festiva
.....	
Mass (kg)	
Curb	873
Test inertial	828
Dummy	75
Gross Static	903

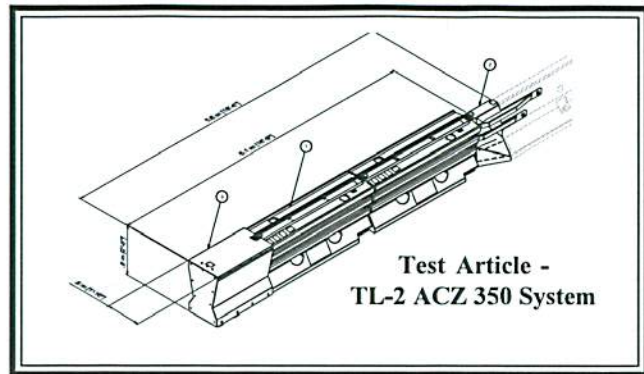
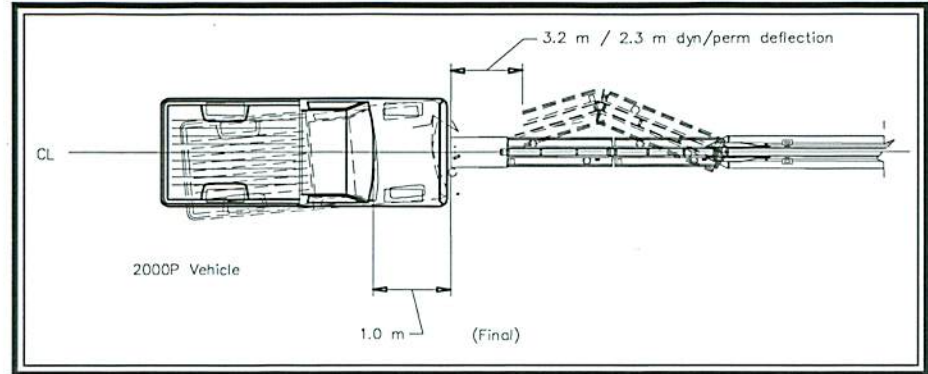
Impact Conditions

Speed (km/h)	70.3
Angle (deg)	0
Impact Severity (kJ)	157.9
Exit conditions	
Speed (km/h)	N/A
Angle (deg - veh. c.g.)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	10.2
y-direction	-0.1
Ridedown Acceleration (g's)	
x-direction	-9.6
y-direction	-3.2
European Committee for Normalization (CEN) Values	
THIV (km/h)	36.9
PHD (g's)	9.7
ASI	0.8
Post-Impact Vehicular Behavior (deg - rate gyro)	
Maximum Roll Angle	-5.8
Maximum Pitch Angle	16.7
Maximum Yaw Angle	-93.3
Test Article Deflections (m)	
Dynamic	2.1
Permanent	1.2
Vehicle Damage (Primary Impact)	
Exterior	
VDS	FD-
CDC	12FDAW2
Interior	
VCDI	AS0000000
Maximum Deformation (mm)	Negligible

Figure 1. Summary of Results - TL-2 ACZ 350 System Test 01-4317-004



E-TECH Testing Services, Inc.



TL-2 ACZ 350 System Crash Test Results - 16 of 48

General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 2-41
Test No.	01-4317-005
Date	6/18/10

Test Article

Type	Energy Absorption System
.....	TL-2 ACZ 350 System
Installation Length,	5.6 m - (2) segment total,
.....	pinned and freestanding
.....	w/ steel nose
Material and key elements	Polyethylene plastic segments
.....	Water filled with frame and
.....	steel side straps, 14 ga
.....	hollow steel nose, transition to (2) 3 m
.....	anchored PCMB
.....	Segment Length x Width x Height:
.....	(2021 mm x 533 mm x 813 mm)
Foundation Type and Condition	Portland Cement Concrete,
.....	clean and dry, unanchored

Test Vehicle

Type	Production Model
Designation	2000P
Model	1989 Chevrolet C2500 Pickup
.....	
Mass (kg)	
Curb	1927
Test inertial	2007
Dummy	N/A
Gross Static	2007

Impact Conditions

Speed (km/h)	71.3
Angle (deg)	0
Impact Severity (kJ)	394.0

Exit conditions

Speed (km/h)	N/A
Angle (deg - veh. c.g.)	N/A

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	9.2
y-direction	-0.7
Ridedown Acceleration (g's)	
x-direction	-8.6
y-direction	5.9

European Committee for Normalization (CEN) Values

THIV (km/h)	33.2
PHD (g's)	8.6
ASI	0.8

Post-Impact Vehicular Behavior (deg - rate gyro)

Maximum Roll Angle	7.2
Maximum Pitch Angle	31.9
Maximum Yaw Angle	8.4

Test Article Deflections (m)

Dynamic	3.2
Permanent	2.3

Vehicle Damage (Primary Impact)

Exterior	
VDS	FD-2
CDC	12FDEW2
Interior	
VCDI	AS0000000
Maximum Deformation (mm)	Negligible

Figure 6. Summary of Results - TL-2 ACZ 350 System Test 01-4317-005