U.S. Department of Transportation
Federal Highway Administration

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

July 8, 2011

In Reply Refer To:
HSST/CC-90B

Rick Mauer
World Wide TTMA Manager
Gregory Industries, Inc.
4100 13th Street, SW
Canton, Ohio 44710

Dear Mr. Mauer:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of a modified trailer-mounted attenuator for use on the National Highway System (NHS).

Name of system: TTMA-100
Type of system: Trailer-Mounted Attenuator (TMA)
Test Level: NCHRP Report 350 TL-3
Testing conducted by: Safe Technologies, Inc.
Date of request: December 23, 2010
Request initially acknowledged: January 4, 2011

You requested that we find a modified version of your previously-accepted trailer attenuator 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." To support your request, you supplied a copy of the January 2011 Safe Technologies, Inc. test report TTMA-01 "TTMA Trailer-Mounted Attenuator".

Requirements

Roadside safety devices should meet the guidelines contained in NCHRP Report 350 if tested prior to January 1, 2011, and the guidelines in AASHTO's Manual for Assessing Safety Hardware if tested after that date. The FHWA memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 24, 1997, provides further guidance on crash testing requirements of longitudinal barriers and crash cushions.

Decision

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

- TTMA-100 Trailer-Mounted Attenuator

Description

The basic TTMA-100 design as previously accepted is based on the bursting tube technology originally developed for the energy-absorbing box-beam guardrail terminal and subsequently adopted for use on trailer-mounted changeable message signs/arrow boards. The TTMA-100 includes four major components: an impact head assembly, a trailer frame, a hitch assembly, and a breakaway axle assembly. Specific modifications made to the design were:

- An optional trailer hitch extension was added to the A-frame
- The lunette ring on the hitch was placed in its uppermost position
- A breakaway disconnect braking system was added to the trailer
- An arrow board and stand were added to the trailer
- A backup guidance system was incorporated into the trailer design

The first three modifications were expected to have no measureable effect on crash performance. The trailer hitch extension is intended for use on support trucks having a recessed pintle hitch, thus preventing the arrow board from contacting the truck bed during sharp turns. The adjustable lunette ring is designed to maintain the trailer in a level position, based on the mounting height of the support vehicle hitch. The disconnect brakes are designed to stop the trailer should it become loose from the support vehicle during transit. The brakes are not activated in a crash and the battery which activates them is mounted in a box on the side of the A-frame where it cannot interfere with the proper functioning of the energy-absorbing tubes.

The last two modifications could potentially change the crash performance of the TTMA-100 and are described separately under the next section.

The general design of the Trailer TMA, as tested, is shown in Enclosure 1. I am assuming that users may obtain detailed drawings directly from you and that such drawings will accurately depict the device that was tested.

Testing

The two modifications to your original design likely to affect the crash performance include the addition of an arrow board/support and the incorporation of a backup guidance system. The arrow board stand was located near the front of the TTMA-100 in an area not generally reached by an impacting vehicle. The backup guidance system is designed to prevent the trailer from articulating when the support vehicle is driven in reverse. Consequently, the trailer is retained from articulation when struck off-center by an impacting vehicle. Based on your reviewing the results of the five certification tests originally conducted, you concluded that Report 350 test 3-52 would represent the “worst case” scenario with the added backup guidance system. FHWA concurs.

In test 3-52, a 2008-kilogram (4427-pound) pickup truck impacted the attenuator at 101 km/r (63 mph) and at 0 degrees, offset1/3 the width of the truck. Occupant impact velocity was 9 meters/second (29.7 feet/second) and the ridedown acceleration was 17 G's. The TTMA-100 did not articulate and there was no structural damage to the arrow board/support. For this test, the 4770-kilogram (10,516-pound) support vehicle was unblocked and was pushed ahead 9.7 meters (31.5 feet) after impact. Enclosure 2 is the test summary sheet.

Findings

The TTMA-100 trailer TMA, which was previously accepted as a TL-3 design in FHWA letters CC-90 and CC-90A, was modified as described below, and subjected to one additional crash test.

Based upon the successful completion of NCHRP Report 350 test 3-52, the FHWA agrees that your TTMA-100, as modified, remains acceptable as an NCHRP Report 350 TL-3 attenuator.

In previous testing, the trailer support vehicle was restrained from forward and lateral movement so there is no upper limit to the weight of the support vehicle. As noted above, the support vehicle was unblocked and rolled ahead 9.7 meters (31.5 feet) after impact. You will be expected to advise users of the TTMA-100 of expected roll-ahead distances based on the weights of both the support vehicle and of potential impacting vehicle(s).

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

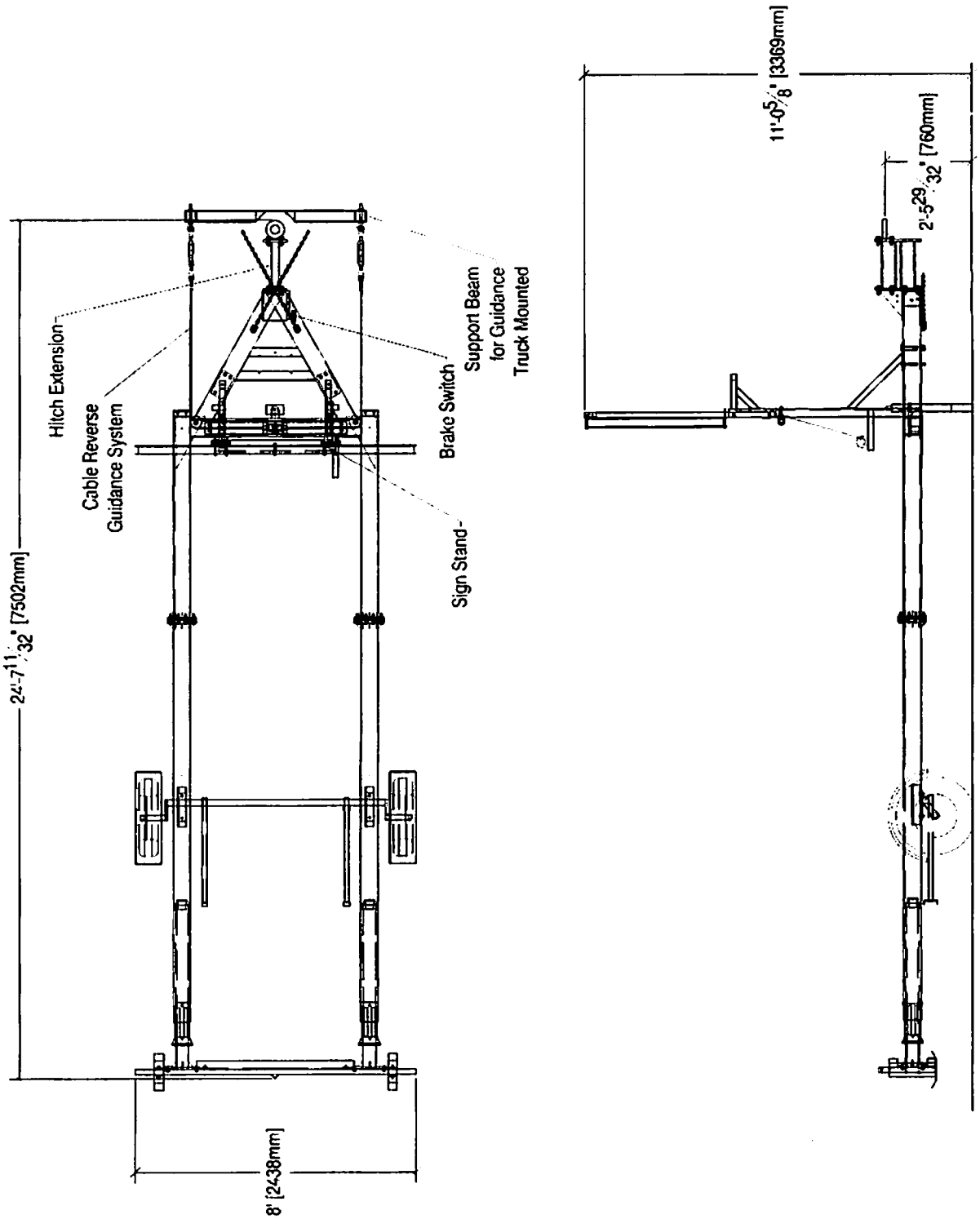
- This acceptance letter provides an AASHTO/ARTBA/AGC Task Force 13 designator that should be used to identify any new or updated Task Force 13 drawings for this product.
- This acceptance is limited to the crashworthiness characteristics of the device and does not cover its structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any design 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, the in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its 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 NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number CC-90B shall not be reproduced except in full. This letter, and test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The TTMA-100 is a patented product and is considered proprietary. If proprietary devices are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, they: (a) 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.

Sincerely yours,

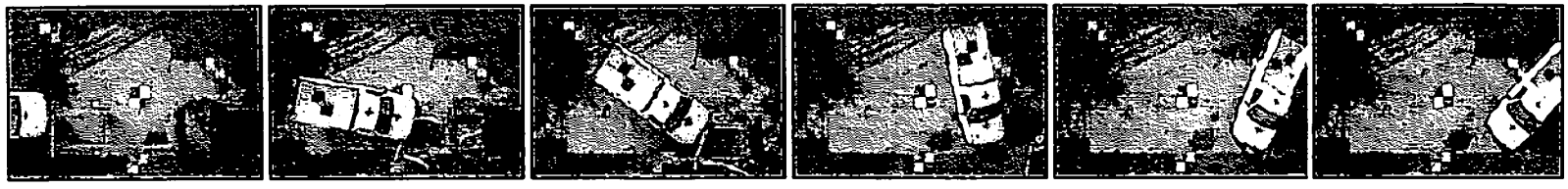
Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

Enclosures


Hitch Extension
Cable Reverse Guidance System
Brake Switch
Support Beam for Guidance Truck Mounted
Sign Stand
24'-7 11/32" [7502mm]
8' [2438mm]
11'-0 5/8" [3369mm]
2'-5 29/32" [760mm]

Enclosure 1

Enclosure 2



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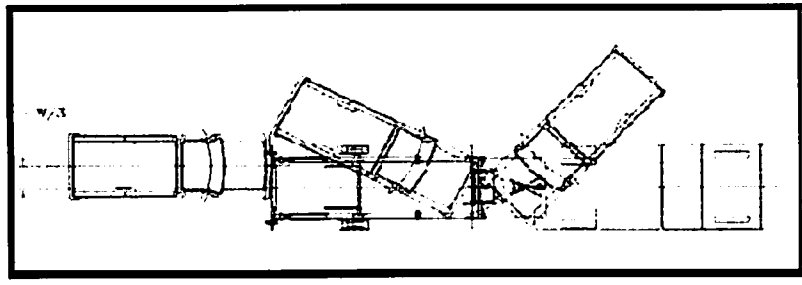

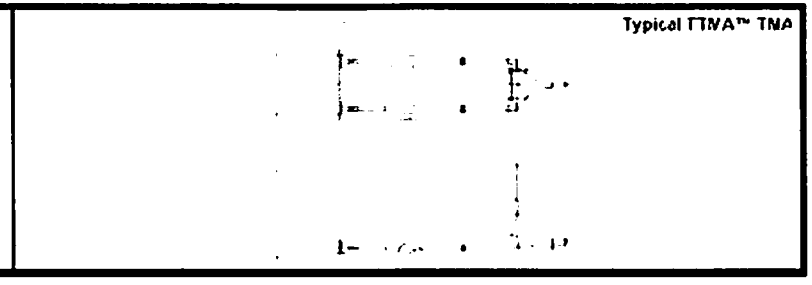

General Information

Test Agency	SAFE TECHNOLOGIES, INC.
Test Designation	NCHRP Report 350 3-52
Test No.	STI Test # TTMA01
Date	12/5/2001

Test Article

Type	Trailer Mounted Attenuator
Name	TTMA
Dimensions	Length: 7.5 m (24.6 ft)
Size and/or dimension and material of key elements	Height: 3.1 m (11.1 ft) Width: 2.4 m (8.0 ft)

Test Vehicle

Type	Production Model
Designation	2000P
Make	2004 Chevrolet 3/4 Ton Pickup
Mass, kg	
Curb	2233
Test Inertial	2009
Dummy(s)	N/A
Gross Static	2009

Impact Conditions

Speed (kph)	101
Angle (deg)	0
Impact Severity (kJ)	790.1

Exit Conditions

Speed (kph)	N/A
Angle (deg)	N/A

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	9
y-direction	3
Ridedown Accelerations (g's)	
x-direction	17
y-direction	6

Test Article Deflection (mm)

Dynamic	N/A
Permanent	N/A

Vehicle Damage

Exterior	
VDS	12-FD-1
CDC	12FZEW1
Interior	
OCDI	FS0000000

Post-Impact Vehicular Behavior (deg - gy @ sec)

Maximum Roll Angle	10
Maximum Pitch Angle	3
Maximum Yaw Angle	77