



March 26, 2009

1200 New Jersey Avenue, SE.  
Washington, DC 20590

In Reply Refer To: HSSD/CC-97A

Mr. Chuck Mettler  
Engineering Manager  
Plastic Safety Systems  
2444 Baldwin Road  
Cleveland, Ohio 44104

Dear Mr. Mettler:

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).

Name of device: Crash Guard Sand Barrel System - Interchangeability  
Type of device: Crash Cushion/Impact Attenuator  
Test Level: NCHRP Report 350 TL-3  
Simulations conducted by: Battelle Memorial Institute  
Dates of request: June 20, 2008, revised November 17, 2008  
Date complete information received: November 30, 2008

You requested that we find modules of 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" when used to repair installations of sand barrels manufactured by others.

### **Requirements**

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

### **Description and Analysis**

The FHWA Technical Advisory T5040.20 dated September 22, 1982, states that sand-filled modules of certain manufacturers were considered interchangeable within an array. The focus of the Advisory is repair and maintenance of sand-barrel crash cushions but we do emphasize that new installations should always start out with barrels from the same manufacturer. When faced with repairing a partially damaged attenuator the Advisory says repairs of a Fitch system may be done using Energite barrels, for example.



You asked the FHWA to accept the use of Crash Guard sand barrels as interchangeable with other barrels mentioned in the Advisory. We noted that Crash Guard barrels perform in a different manner than the Energite or Fitch systems in that Crash Guard barrels are designed to break apart at seams rather than allowed to fracture anywhere on the module. Because the barrels perform differently, we asked for additional information on the interaction between the types of barrels.

In the development of the Crash Guard barrels you had them modeled using finite element analysis. You agreed to ask Battelle Memorial Institute to evaluate the crash performance of a mixed array system of the CrashGuard and the Energite barrels using finite element analysis. There were many possible barrel arrangements for such a system, however, only selected cases were evaluated. The intent was to select cases considered to be representative of ‘worse’ case scenarios for the mixed array system and these were selected under the direction of the FHWA.

- The initial cases were evaluated with identical sand mass layout as shown in the enclosed drawing for reference. They consisted of:
  - Case 1: The first five rows were composed of the CrashGuard system and the remaining three rows were composed of the ENERGITE system - (e.g., six barrels of each system).
  - Case 2: The first four rows were composed of the CrashGuard system and the remaining four rows were composed of the ENERGITE system - (e.g., four barrels of CrashGuard and eight barrels of Energite)
  - Case 3: The first three rows were composed of the CrashGuard system and the remaining five rows were composed of the ENERGITE system - (e.g., three barrels of CrashGuard and nine barrels of Energite)

Based on the results of those three cases, it was concluded that, when the CrashGuard barrels are used in combination with other FHWA accepted frangible sand barrel systems, the occupant risk and structural performance criteria of NCHRP Report 350 for Test 3-41 would be met. The occupant risk assessment for Case 2 is enclosed for reference.

### **Findings**

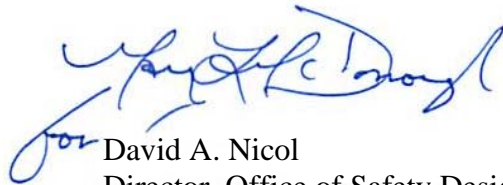
Therefore, CrashGuard sand barrels may be used in the same crash cushion installations with frangible barrel systems such as Energite III, Fitch, and Big Sandy sand barrel systems when replacing damaged barrels.

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 NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number CC-97A 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.
- CrashGard sand barrel crash cushions 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,



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

Enclosures

Test 3-41 Case 2 Analysis Result – Occupant Risk Assessment:

Impact Velocity (m/s)	at 0.1574 seconds on front of interior	
x-direction	<u>8.7</u>	
y-direction	-0.0	
THIV (km/hr):	31.3	at 0.1574 seconds on front of interior
THIV (m/s):	8.7	
Ridedown Accelerations (g's)		
x-direction	<u>-14.3</u>	(0.1947 - 0.2047 seconds)
y-direction	-1.5	(0.1804 - 0.1904 seconds)
PHD (g's):	14.3	(0.1947 - 0.2047 seconds)
ASI:	0.63	(0.1527 - 0.2027 seconds)
Max. 50msec Moving Avg. Accelerations (g's)		
x-direction	-7.5	(0.1525 - 0.2025 seconds)
y-direction	-0.5	(0.0540 - 0.1040 seconds)
z-direction	1.4	(0.1069 - 0.1569 seconds)
Max Roll, Pitch, and Yaw Angles (degrees)		
Roll	-2.7	(0.5812 seconds)
Pitch	<u>-3.3</u>	(0.2323 seconds)
Yaw	-0.9	(0.9998 seconds)

