October 6, 2004

Refer to: HSA-10/WZ-191

Mr. Barry D. Stephens
Senior Vice President, Engineering
Energy Absorption Systems, Incorporated
3617 Cincinnati Avenue
Rocklin, California 95765

Dear Mr. Stephens:

Thank you for your letter of June 28, 2004, requesting Federal Highway Administration (FHWA) acceptance of your company's Safe-Hit Barracuda^{tm} Longitudinal Channelizing Barricade as a Test Level 2 (TL-2) crashworthy traffic control device for use in work zones on National Highway System (NHS). Accompanying your letter were reports of crash testing conducted by E-TECH Testing Services and video of the tests. 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."

Introduction

The FHWA guidance on crash testing of work zone traffic control devices is contained in two memoranda. The first, dated July 25, 1997, titled "INFORMATION: Identifying Acceptable Highway Safety Features," established four categories of work zone devices: Category I devices are those lightweight devices which are to be self-certified by the vendor, Category II devices are other lightweight devices which need individual crash testing but with reduced instrumentation, Category III devices are barriers and other fixed or heavy devices also needing crash testing with normal instrumentation, and Category IV devices are trailer mounted lighted signs, arrow panels, etc., for which crash testing requirements have not yet been established. The second guidance memorandum was issued on August 28, 1998, and is titled "INFORMATION: Crash Tested Work Zone Traffic Control Devices." This later memorandum lists devices that are acceptable under Categories I, II, and III.

A brief description of the devices follows:

The Safe-Hit Barracuda^{tm} Longitudinal Channelizing Barricade (LCB) is a rotation molded hollow, low-density polyethylene plastic section which can accept water ballast. From the outside, the segments are identical to your company's existing TRITON$^{®}$ Barrier, but the Barracuda segments are fabricated without an internal steel framework.

The Safe-Hit Barracuda[tm] LCB is modular and can be used in various lengths for specific applications. A dimensioned drawing and material specifications are enclosed for reference. The height of each section is 828 mm, the length is 1984 mm, and the wall thickness is nominally
5 mm. The section shape is tapered from a base width of 495 mm to a top width of 546 mm. The test articles were installed according to the instructions supplied by the manufacturer. A total of 18 yellow colored sections were aligned end to end and interconnected with ABS connector pins to form the LCB installation. The installation was freestanding and unanchored on a flat, clean, and dry asphalt surface. Water ballast was added to bring the mass of each section to 586 kg.

Testing

Full-scale automobile testing was conducted on your company's LCB. Because LCBs are a unique category of barricade, the FHWA has recommended that they be tested with the 820 C vehicle at an impact angle of 20 degrees just like a redirective barrier. However, since LCBs are not designed to redirect the vehicle, controlled penetration is allowed. All other criteria, including occupant impact speed, ridedown acceleration, and occupant compartment penetration/intrusion, must be evaluated as if the device were a longitudinal barrier. The test is summarized in the table below.

Test Number	01-4019-001 (TL-2)
Device Tested	Safe-Hit Barracuda[tm] Longitudinal Channelizing Barricade
Weight of Ballasted Unit	584 kg
Flags? Lights?	None
Mass of Test Vehicle	833 kg
Impact Speed	70.3 kmh
Occupant Risk Values:	
Impact Velocity	
x-direction	7.1 m/s
y-direction	0.2 m/s
Ridedown Acceleration	
x-direction	-7.4 g's
y-direction	-4.2 g's

Findings

The vehicle penetrated directly through the installation losing most of its velocity and experiencing relatively minor roll and pitch. The vehicle then yawed clockwise traveling roughly parallel to the back side of the installation and came to rest 14.6 m downstream from the point of impact and 1.8 m behind the original face of the installation. The maximum dynamic and permanent lateral deflection of the test article was 3.0 m.

Damage was limited to minor deformation of the grill and hood. The headlights were broken out. The seatbelt broke loose during the impact and the dummy's head cracked the windshield. There was no measurable deformation of the vehicle interior.

The results of the testing met the FHWA requirements and, therefore, the device described above and detailed in the enclosed drawings and specifications are acceptable for use on the NHS under the range of conditions tested, when proposed by a State.

You also had two additional requests:

1) that we accept the TRITON barrier as a LCB, and
2) that TRITON barrier can be used with the BARRACUDA devices.

We concur in request 1), the TRITON barrier may be used in lieu of a row of channelizing devices or a LCB.

We also concur in request 2), but recommend that TRITON barrier follow the BARRACUDA LCB and that the respective units be ballasted so that they are the same approximate weight, considering the steel structure inside the TRITON units add weight.

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

- Our 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, 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 they will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number WZ-191 shall not be reproduced except in full. This letter, and the 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 Safe-Hit Barracuda[tm] Longitudinal Channelizing Barricade is a patented device and is considered "proprietary." The use of proprietary work zone traffic control devices in Federal-aid projects is generally of a temporary nature. They are *selected by the contractor* for use as needed and removed upon completion of the project. Under such conditions they can be presumed to meet requirement "a" given below for the use of proprietary products on Federal-aid projects. On the other hand, if proprietary devices are

specified by a highway agency for use on Federal-aid 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 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. These provisions do not apply to exempt non-NHS projects. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is enclosed.

- 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,

/***Original Signed by***/

John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

FHWA:HSA-10:NArtimovich:tb:x61331:10/4/04
File: h://directory folder/nartimovich/WZ191-BarracudaFIN
cc: HSA-10 (Reader, HSA-1; Chron File, HSA-10;
N. Artimovich, HSA-10)

Sec. 635.411 Material or product selection.

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless

(1) Such patented or proprietary item is purchased or obtained through competitive bidding with equally suitable unpatented items, or

(2) The State highway agency certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by refetence the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State highway agency wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

(c) A State highway agency may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must be set forth in the specifications for various types of drainage installations.

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.

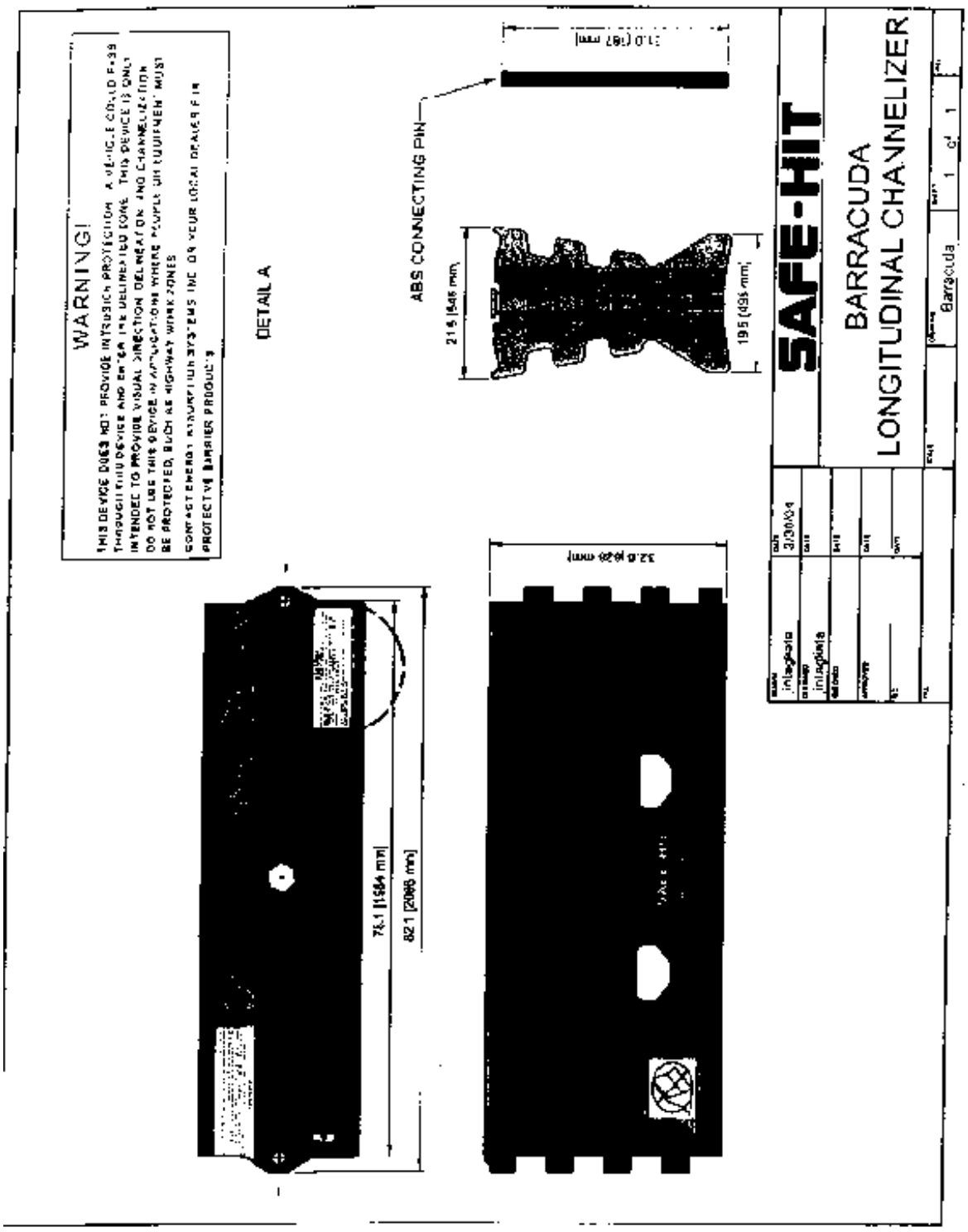

Illustration D-2. BARRACUDA Drawing

BARRACUDA Longitudinal Channelizer Specifications

Material: LLDPE

Physical Properties:

Density	ASTM D-1505	0.939-0.940 g/ml
Melt Index (190° C, 2.16 kg)	ASTM D-1238	3.3-3.5 g/10 min
ESCR (100% Igepal CO-630, F_{50}) (min.)	ASTM D-1693(B)	1000 hrs.
(10% Igepal CO-630, F_{50})	ASTM D-1693(B)	480 hrs. (min.)
Tensile Strength at Yield (2"/min)	ASTM D-638	2560-2900 psi
Elongation at Break	ASTM D-638	600-765 %
Flexural Modulus (1% Secant)	ASTM D-790	121,000 psi
Heat Distortion Temperature (66 psi)	ASTM D-648	64° C
Low Temperature Impact (1/8" thick)	ARM -40° C	51-52 ft-lbs
(1/4" thick)	ARM -40° C	175-198 ft-lbs

Illustration D-3. BARRACUDA Material Specification