

Refer to: HSA-10/WZ-107

Mr. Leo J. Yodock, III
Yodock Wall Co., Inc.
3000 S.W. 4th Avenue
Ft. Lauderdale, FL 33315

Dear Mr. Yodock:

Thank you for your letters of September 4, 2001, requesting Federal Highway Administration (FHWA) acceptance of your company's **Energy Dispersement Cell Barricade (EDCB)** as a crashworthy traffic control device for use in work zones on the National Highway System (NHS). Accompanying your letter was a report of crash testing conducted by the Texas Transportation Institute and videos of the tests. You requested that we find this device acceptable as a Test Level 3 (TL-3) devices, respectively, 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."

On December 13, 2001, you met with members of the Office of Safety Design staff to discuss the crash-testing program, the results, and the proposed uses associated with these devices. On January 9, 2002, you submitted additional information as discussed at our meeting.

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 were those lightweight devices which could be self-certified by the vendor, Category II devices were other lightweight devices which needed individual crash testing, Category III devices were barriers and other fixed or massive devices also needing crash testing, and Category IV devices were trailer mounted lighted signs, arrow panels, etc. 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 device follows:

Energy Dispersement Cell Barricade - TL-3

The Yodock Barrier Model 2001 EDCB units are rotomolded, low-density polyethylene, water-filled containers. Overall dimensions on these units are 1830 mm long, 1170 mm tall, 610 mm width at the base, and 280 mm wide at the top. There are two forklift holes at 530 mm above ground level that nominally measure 150 mm x 280 mm. The bottom vertical face of the

device is 230 mm in height. For this test, water ballast was placed in the units to the maximum capacity. The approximate full mass of each unit is 1025 kg (1650 pounds.) A total of three units were placed adjacent to each other and coupled with Polyethylene couplers. The total length of the installation was 5.5 m (18 ft.)

The Type III barricade atop each water filled unit was fabricated with two 50 mm (2 inch) schedule 80 PVC pipes, 2.59 m long (102 inch) supports. The center of the support pipes are placed 330 mm (13 in) from each end of the units. Hollow plastic lumber measuring 20 mm (3/4 inch) thick, 195 mm (7.7 inches) tall, by 1840 mm (72.4 inches) long was attached to the PVC pipe with 6 mm (1/4 inch) “U” bolts. The top of the middle horizontal panel was 1940 mm (76.4 inches) above the ground. The top of the upper horizontal panel was mounted 2440 mm (96 inches) above grade. In addition, a 1220 mm x 1220 mm x 12 mm (4 foot x 4 foot x 7/6 inch) plywood sign panel was bolted to the middle Type III barricade. The top of the sign panel was 3250 mm (128 inches) above grade. Four battery powered warning lights were attached to the top of the pipe supports.

This device was evaluated as a road-closure system to be placed perpendicular to the centerline of the roadway. A similar Yodock system was successfully crash tested earlier and accepted by FHWA Acceptance Letter WZ-34 dated March 23, 2000. It consisted of a single unit with type III apparatus with no water ballast added. Because the vehicle velocity change for that device was 3.9 m/s it was known that an impact into a similar barricade system filled with water would cause unacceptable decelerations. It was decided to run such a test anyway to determine the worst possible performance of this system. One reason for this ultimate test was the proposed use for such a system: it is intended to be placed at right angles to the roadway to deter vehicles from proceeding beyond that point. It was expected that the water-filled barricade would keep vehicles from filtering through, be very difficult for unauthorized persons to move, yet still be somewhat forgiving in the event of a crash. Please note that, as a result of this testing, it has been determined that these units may not be completely filled with water when deployed.

For this device, a single Report 350 test 3-71 was conducted with an 820 kg passenger car impacting the center barricade of the array head-on at a speed of 100 km/hr.

Testing

Full-scale automobile testing was conducted on your company’s devices. The test results are summarized in the following table.

Test Number	400001-YWC2
NCHRP Report 350 Test #	3-71
Test Article	Type III Barricade
Height to Bottom of Sign	1535 mm
Height to Top of Sign	3260 mm
Flags or lights	4 Type A/C Beacons
Test Article Mass (one cell)	1056 kg

Vehicle Inertial Mass	820 kg
Impact Speed	96.3 km/hr
Occupant Risk Values:	
Occupant Impact Velocity	8.5 m/s
Ridedown x-direction	-2.0 g's
Ridedown y-direction	2.0 g's
Max 0.050-s accel x-dir	-16.2 g's
Max 0.050-s accel y-dir	-1.4 g's
Max 0.050-s accel z-dir	-3.2 g's
Vehicle crush	280 mm max
Occupant Compartment Intrusion	95 mm (crush)
Windshield Damage	Hole caused by hood

The mass of the middle cell was 60 kg (cell unit) + 965 kg (water) + 20 kg (barricade posts and panels) + 11 kg (sign on middle cell only)

In the **EDCB** test, the vehicle broke through the middle barricade, pulling those to the right and to the left along with it for a short distance. The impact forced the hood back into the windshield, causing a hole in the glass. Even though the test resulted in a hole in the windshield, parts of the device itself did not show potential for penetrating the occupant compartment. Because of the mass of the water in the filled cells, Occupant Impact Velocity exceeded that for a breakaway work zone traffic control device. However, it was within the desirable limit for a crash cushion impact and is considered survivable.

Findings

The Model 2001 Type III **EDCB** tested full of water, exceeded the velocity change requirements for a work zone traffic control device. However, its intended use is to hinder access to an area and be difficult to move. The researchers calculated that the occupant impact velocity of 5 meters per second would not be exceeded if the volume of water was reduced by half in these units. Therefore, we conclude that the Model 2001 Type III barricade will be acceptable for road closures in if the cell units are used half filled with water (482 kg of water). The fill mark or other method of regulating the maximum water line must be permanently incorporated into the EDCB units. An additional condition is that they not be placed in a location where traffic running perpendicular to the closed road cannot impact the end of a EDCB installation as they have not been crash tested at the 90 degree orientation.

Because this device has been tested and met the unique requirements that had been set for them, the device described above and shown in the enclosed drawings for reference is acceptable for use on the NHS under the range of conditions tested and the additional conditions discussed above, when proposed by a State. In addition, the Model 2001m EDCB, the base unit of which is 812 mm tall, will also be acceptable subject to the same conditions and restrictions as the crash-tested Model 2001 EDCB.

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 MUTCD.
- 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 it will meet the crashworthiness requirements of FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number WZ-107 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 Yodock Wall plastic safety shape units are patented and 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 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 existing highway facilities or that no equally suitable alternative exists

or: (c) they must be used for research or for a distinctive types 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, a copy of which is enclosed.

Sincerely yours,

Michael L. Halladay
Acting Program Manager, Safety

Enclosure

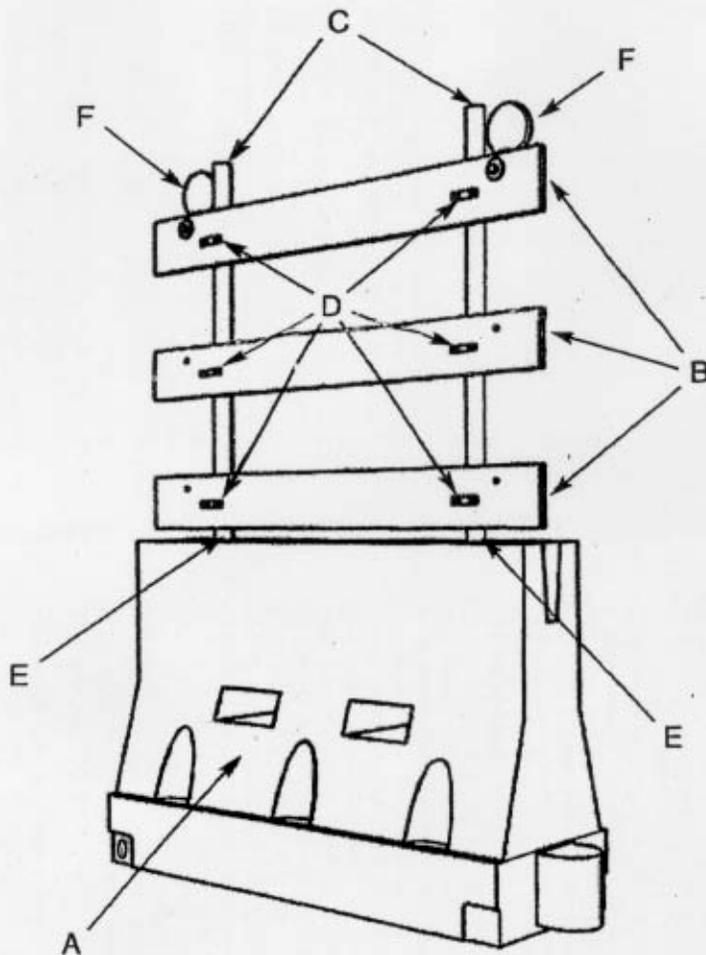
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N. Artimovich, HSA-10)

T3 PARTS LIST

FRONT VIEW



- A - Yodock Barrier Model 2001
- B - Horizontal Barricade Panels
- C - 2" Schedule 80 PVC Posts
- D - U-bolt with Bracket and Nuts
- E - Rubber Post Stabilizer
- F - Barricade Light (optional)
- G - P-Bracket (optional, shown in rear view)

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 reference 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.

ENCLOSURE 2