

Refer to: HSA-10/WZ-102

Mr. Chuck Bailey  
Plastic Safety Systems, Inc.  
2444 Baldwin Road  
Cleveland, OH 44104

Dear Mr. Bailey:

Thank you for your letter of February 19, 2002, requesting Federal Highway Administration (FHWA) acceptance of a number of your company's work zone traffic control device. We also appreciate receiving additional information as provided in your letters of February 4, 2002, January 21, 2002, October 1, 2001, and August 9, 2001 (items 1-4 below):

(Item 1) PSS - Type III barricade with a lightweight light attachment, and with a variation in the panel spacing;

(Item 2) the Navigator lighted vertical panel channelizer;

(Item 3) a Type II barricade with A-frame legs and with lights; also with material variations;

(Item 4) "Life Vest™" version of a directional barricade, consisting of an attachment to a conventional plastic drum. A video of informal crash testing accompanied this request

You requested that these be found acceptable as crashworthy traffic control devices for use in work zones on the National Highway System (NHS). Accompanying your October 1, 2001, letter was a report of crash testing conducted by the Midwest Roadside Safety Facility and a CD video of the tests. You requested that we review these devices and variations under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

The Type III barricade (item 1) without lights was initially found acceptable in our letter WZ-61 dated December 13, 2000. In your October 1, 2001, letter you requested that lightweight warning lights be acceptable with this barricade. In your February 4, 2002, letter you requested a variation in the spacing of the horizontal rails.

In your February 19, 2002, letter you requested that our review of your Type II barricade (item 3) be extended to cover a variety of materials and sizes that could be considered acceptable based on your testing of the "worst case" scenario.

## **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 devices follows:

### (1) PSS Type III Barricade with Lights

The horizontal rails, or “legs,” are 1217-mm (48 in) long and are placed 1225 mm (48 in) apart. Underneath each end of the legs rubber pads are attached to increase friction with the pavement. On the top center of each leg is bolted a 127 mm x 76 mm (5 x 3 in) steel plate, to which is welded a 72 mm diameter x 3.06 mm wall x 200 mm long (2.8 x 1/8 x 8 in) steel tube. These steel tubes support the vertical upright masts which are 88 mm square x 5.08 mm wall x 1521 mm long (3.5 x 0.2 x 60 in) High Density Polyethelene (HDPE) plastic. To these vertical masts are bolted (with 1/4 - 20 bolts and nuts with washers) three 205 mm wide x 22.75 mm thick x 2435 mm long (8 in x 0.9 in x 8 ft) HDPE honeycomb extrusions. A “ballast board” was also used to connect the legs. This 130 mm wide x 29.83 mm thick x 1225 mm long (1/2 in x 1 1/8 in x 4 ft) HDPE extrusion with a wall thickness of 6.1 mm (1/4 in) was installed as a safer location to place sandbags. To the top of each vertical uprights is bolted a lightweight warning light, or a detachable head warning light having the battery at the base.

### (2) “Navigator” Plastic Vertical Panel, with light

This device consists of a 1118 mm (44 in) tall cone with a 152 mm (6 in) tall handle to which is attached a “TrafLite” warning light (mass of 1.8 kg, or 4 pounds, with batteries). To the face of the cone is 914 mm long and 311 mm wide (36 x 12 in) panel of reflective sheeting. It was tested with a 13.6 kg (30 lb) rubber ballast. A drawing of the tested device is enclosed for reference.

In your February 19, 2002, letter you requested that this device be considered acceptable with a 7.25 kg (16 lb) rubber ballast, and 305 x 610 mm, 203 x 915 mm, and 203 x 610 (12x24 in, 8x36 in, and 8x24 in) panels.

### (3) Plastic Type II Barricade with lights

This type II barricade consists of two plastic “A-frame” supports that are 708 mm (28 inches) wide at the base and measure 1133 mm (44.6 inches) along the side. When deployed, the top of these supports are at an elevation of 1126 mm (44.3 inches) above the pavement. Inserted between the two A-frame supports are two 210-mm (8 1/4 inch) wide plastic panels that are 3667 mm (12 feet) long. Bolted atop each support was a “TrafLite” warning light. A drawing of the tested device is enclosed for reference.

In your February 19, 2002, letter you requested that this device be considered acceptable in the following variations:

1. With or without the 11.3 kg (25 lb) of sand ballast in the legs.
2. Using 3660 mm, 3050 mm, 2440 mm, 1830 mm, 1220 mm (12 ft, 10 ft, 8 ft, 6 ft, and 4 ft) extruded HDPE (1x8 in) boards.
3. Use of other extruded HDPE boards. The weight of the tested board is 1 kg/m (0.66 lbs per foot). The other boards weigh 1.12 kg/m (0.75 lbs per foot) and 1.39 kg/m (0.93 lbs per foot) and are shown in the enclosure for reference.
4. Attachment of signs. (The Type II barricades with signs were only tested with a bogie vehicle. Because the signs and/or barricade panels impacted the bogie at the location where we would expect the windshield would be, we cannot determine with certainty what would have happened to the windshield. Therefore, we recommend full-scale crash testing at both zero and 90 degrees.)

### (4) Plastic Drum with “Life Vest™” Type II attachment

This attachment consists of a LDPE band with a quick-release ratcheting buckle. Two molded HDPE sign mounts are permanently attached to the band. Sign panels (arrow or diagonal stripe panels) are bolted to the mounts using 6.5 mm (1/4 inch) diameter bolts. The weight of the belt assembly is (2 pounds). A drawing of the Type II attachment is enclosed for reference.

### **Testing**

Full-scale automobile testing was conducted on your company’s (Item 2) Navigator Vertical Panel and the (Item 3) F&A-Frame Type II barricade. Informal testing was conducted on the (Item 4) “Life Vest™” attachment on a drum. As mentioned earlier, the (Item 1) Type III barricade was tested previously. In the current test program two stand-alone examples of your vertical panel and your Type II barricade were tested in tandem, one head-on and the next placed six meters downstream turned at 90 degrees, as called for in our guidance memoranda. The crash tests are summarized in the table below:

Test Number	PSS-2 (Item (2))	PSS-3 (Item 3))
Test Article	Navigator Vertical Panel	F&A-Frame Type II Barricade
Height to Top of Panel	1118 mm (44 in)	921 mm (36 1/4 in)
Height to Top of Light	1448 mm (57 in)	1365 mm (53 3/4 in)

Flags or lights	1 TrafLite	2 TrafLites
Test Article Mass (each)	4.69 kg (10.4 lbs)	11.4 kg (25 lbs)
Ballast Mass	13.61 kg (30 lbs) base	22.6 kg (50 lbs) sand in legs
Vehicle Inertial Mass	821 kg (1810 lbs)	812 kg (1790 lbs)
Impact Speed, Head-on	105.6 km/hr (65.6 mph)	103.6 km/hr (64.3 mph)
Impact Speed, 90 Deg.	102.5 km/hr (63.4 mph)	95.0 km/hr (59.0 mph) **
Velocity Change, Head-on*	0.89 m/sec (2.92 fps)	2.4 m/sec (7.87 fps) **
Velocity Change, 90 deg.	N/A	N/A
Vehicle crush	Minor dents and scrapes	Dents and scrapes
Occupant Compart. Intrusion	None	None
Windshield Damage	Localized cracking	No damage

\* The vehicle's velocity change was only measured between impacts. The velocity change while impacting the second device would have been comparable to the first impact.

\*\* The test vehicle's brakes were activated accidentally between impacts exacerbating the vehicle velocity change. Even so the delta V was acceptable.

Informal bogie testing was also conducted on the A-frame type II barricade with 1220 mm x 1220 mm (48x48 in) plywood and Endurance sign panels affixed to the two rails.

### Findings

Items (2) and (3). Windshield damage was limited to localized spider cracking during the test of the vertical panel. The results of the testing met the FHWA requirements and, therefore, the Navigator Vertical Panel and the F&A-Frame Type II Barricade described above and shown in the enclosed drawings for reference are acceptable for use on the NHS under the range of conditions tested, when proposed by a State.

Item (1) We also note that the use of warning lights on the PSS Type III barricade is covered by our Acceptance Letter WZ-85 (copy enclosed.) This memorandum states:

The Type III barricades discussed above may be used with one or two lightweight warning lights [mass of "lightweight" warning lights is 1.5 kg maximum]. The lights should be attached atop the backside of the upright supports. As an alternative, removable head warning lights may be mounted on the supports, with the battery pack located at the base.

Although this section applies specifically to "generic" steel framed type III barricades, we agree that it is applicable to PSS Type III barricades as well. We also concur that the 16 1/4 inch centers will be acceptable in addition to the tested 20 inch centers.

**Findings - Supplemental request of January 31:**

Item (4) The informal crash testing shows that the “Life Vest™” attachment on a conventional plastic drum has little effect on the safe trajectory of the drum itself. Also, the attachment remains with the drum and does not become a hazard in and of itself. Therefore, it will be considered acceptable for use.

**Findings - Supplemental requests of February 19:**

(Item 2) “Navigator” Plastic Vertical Panel, with light is considered acceptable with a 7.25 kg (16 lb) rubber ballast, and with 305 x 610 mm, 203 x 915 mm, and 203 x 610 (12x24 in, 8x36 in, and 8x24 in) panels as long as the overall height of the device remains the same.

(Item 3) Plastic Type II Barricade with lights is acceptable in the following variations:

1. With or without the 11.3 kg (25 lb) of sand ballast in the legs.
2. Using 3660 mm, 3050 mm, 2440 mm, 1830 mm, 1220 mm (12 ft, 10 ft, 8 ft, 6 ft, and 4 ft) extruded HDPE 25.4 mm x 203 mm (1x8 in) boards.
3. Use of other extruded HDPE boards, the cross sections of which are shown in the enclosure for reference. The greater weight of the additional boards is not expected to affect the impact performance of the Type II barricade as both board are impacted by the front of the vehicle and put into motion.

As mentioned earlier, the use of rigid sign panels will not be acceptable without full-scale crash testing. There are two separate issues that cause us concern. First, the tests were conducted using a bogie vehicle. The FHWA has not accepted any work zone traffic control devices that have been tested using bogie vehicles. We have discussed the use of such surrogate devices with one of the crash test houses, and have tentatively agreed to review such tests if the results show that the test article is either knocked ahead of the bogie, or the test article is propelled upward and over the bogie so that there is no impact in the area of the windshield. The impact locations seen in the bogie tests of your Type II barricade with signs are right in the area of the windshield. Since we have no way of estimating the amount of glass damage, we are unable to judge whether the results would be successful. Our second concern is with the 90 degree impact. The sign panel adds a significant mass to the lightweight barricade panels and performance is likely to be affected.

Please note the following standard provisions, which 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 FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number WZ-102 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.

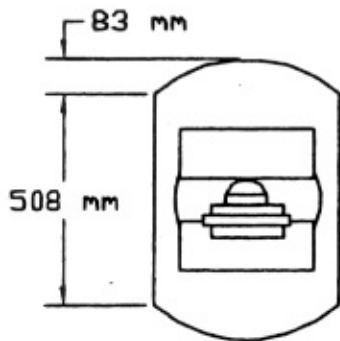
The Plastic Safety Systems traffic control devices may include patented components and if so are considered "proprietary." The use of proprietary work zone traffic control devices in Federal-aid projects is generally of a temporary nature. They are selected by the contractor for use as needed and removed 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 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, a copy of which is enclosed.

Sincerely yours,

A. George Ostensen  
Program Manager, Safety

Enclosure

FHWA:HSA-10:NArtimovich:tb:x61331:4/8/02  
File: WZ102PSSMarchFin.wpd  
cc: HSA-10 (Reader, HSA-1; Chron File, HSA-10;  
N. Artimovich, HSA



### NAVIGATOR VERTICAL PANEL

- \* Cone -- 102-mm diameter at top and 343-mm diameter at bottom
- \* Panels -- 914-mm long x 311-mm wide x 1.07-mm and 0.76-mm thick with and without reflective sheeting, respectively
- \* Base -- 13.61-kg rubber 673-mm long x 432-mm wide x 51-mm thick
- \* Warning Light -- 'TrafLite' attached to top of cone

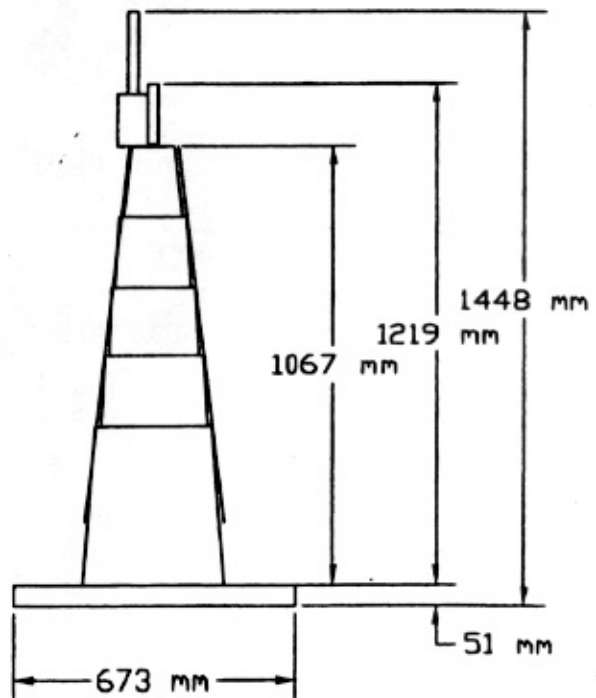
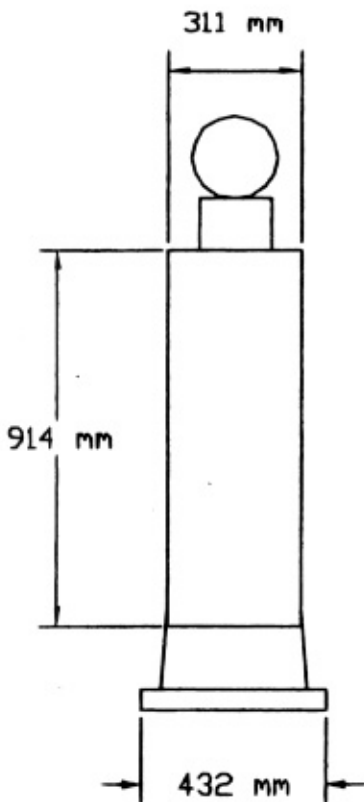


Figure 1. System Nos. 3 and 4 Vertical Panel Details, Test PSS-2

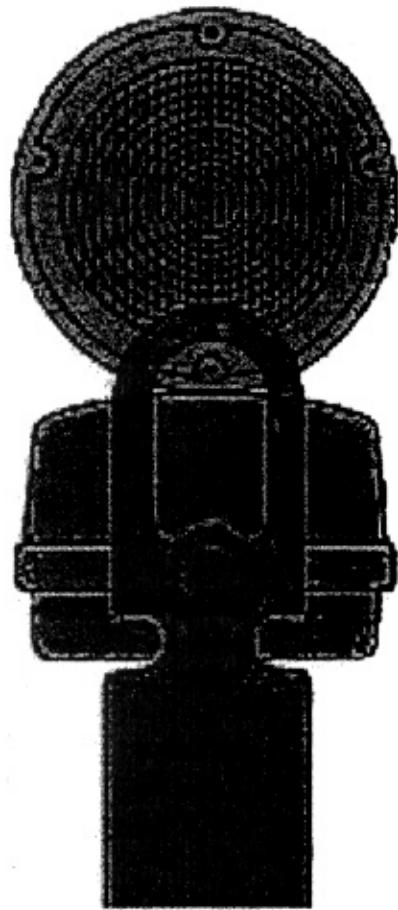
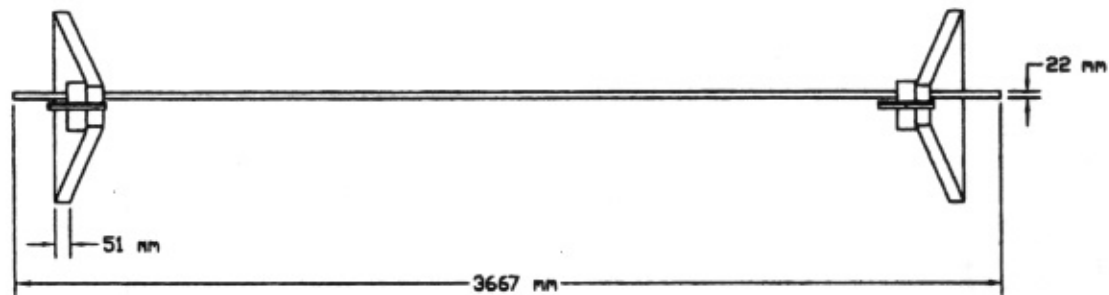
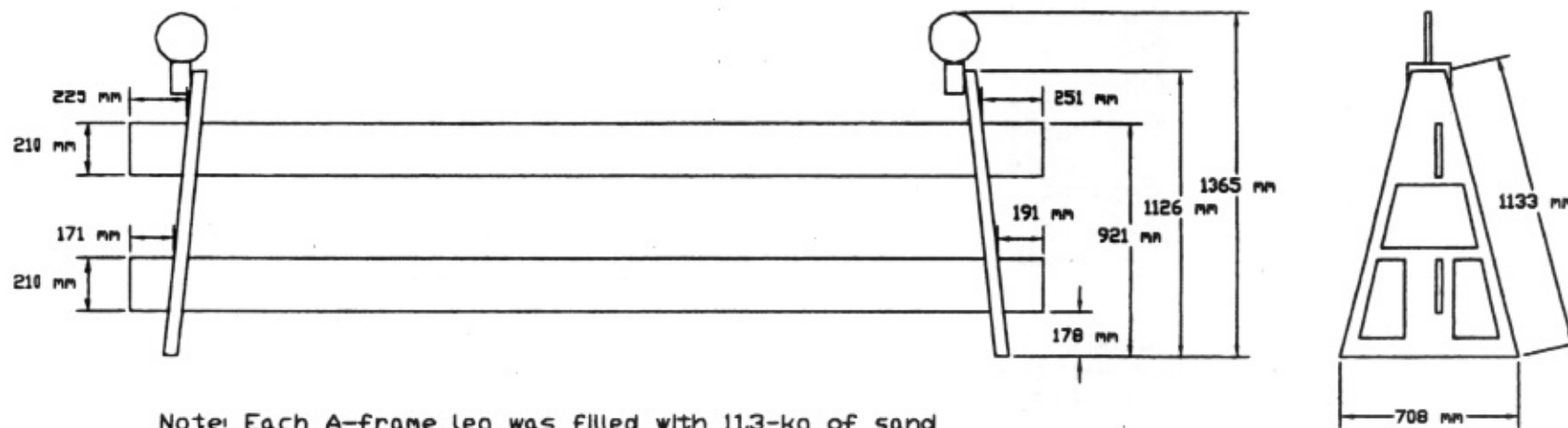


Figure B-2. Navigator Warning Light and Connection Details



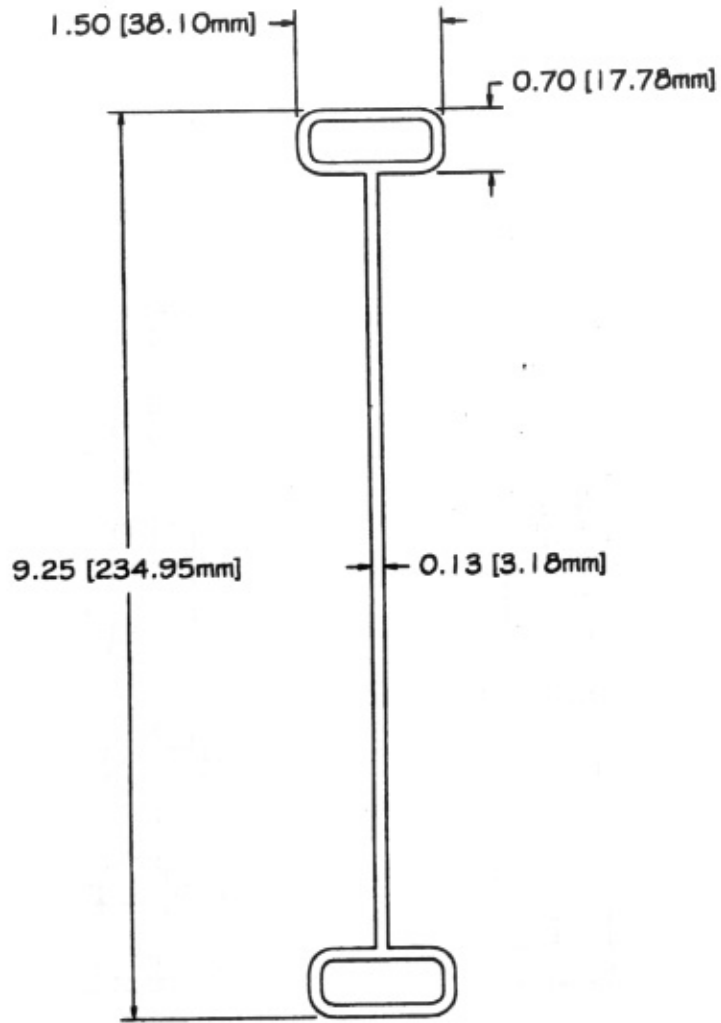


11



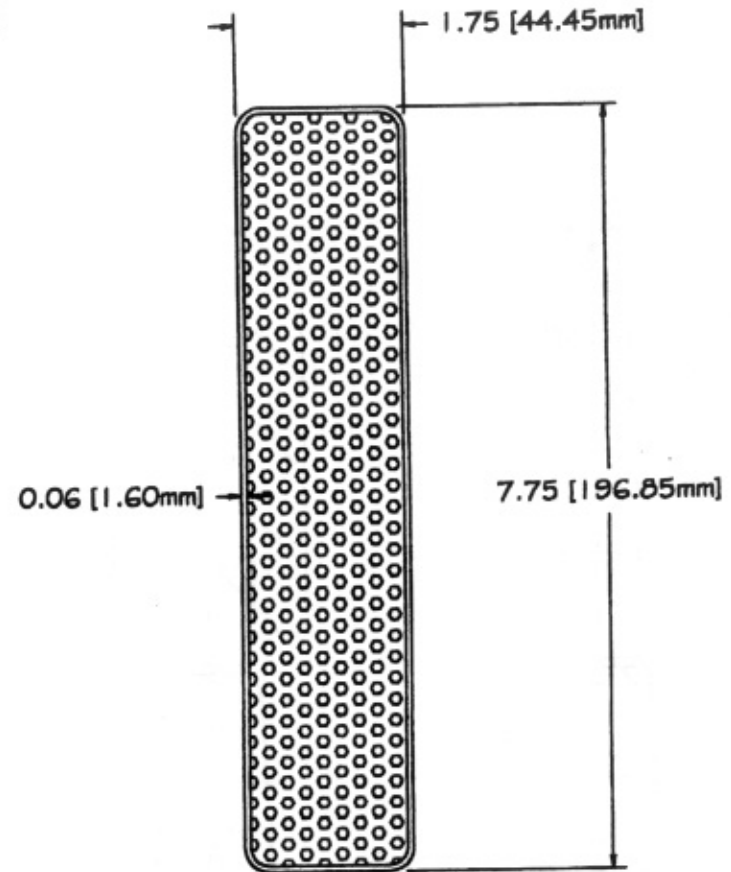
Note: Each A-frame leg was filled with 11.3-kg of sand

Figure 4. System No. 5 Barricade Details, Test PSS-3



I Beam Board  
HDPE  
0.75 lbs / foot

1.112 kg/m



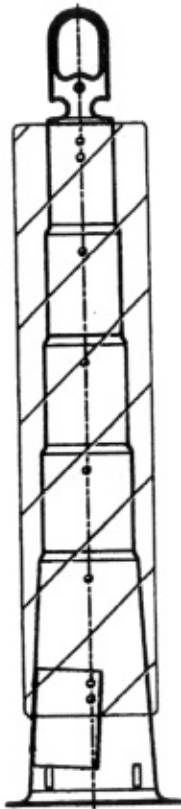
2 x 8 Board  
HDPE / foam filled  
0.93 lbs / foot

1.39 kg/m

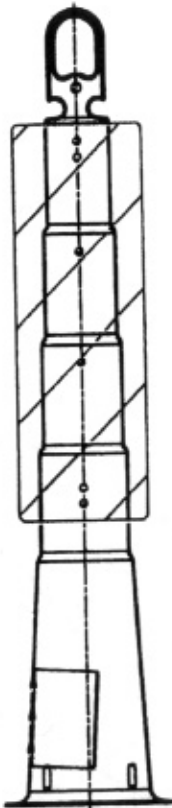
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E		Material: See note	Date: 2/15/02	By: CMM	Rev: FFWA-102
D		Sheet: 1 of 1	Scale: 1/2	Title:	
C		Tolerances unless noted:	F & A Frame other plastic boards		
B		± 0.080			
A		± 0.010			

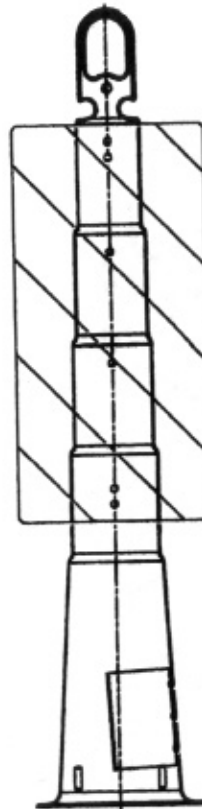




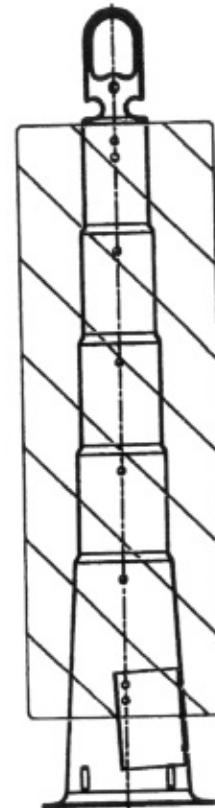
8" x 36" x 0.030"  
HDPE panel  
0.90 lbs



8" x 24" x 0.030"  
HDPE panel  
0.60 lbs



12" x 24" x 0.030"  
HDPE panel  
0.90 lbs



12" x 36" x 0.030"  
HDPE panel  
1.34 lbs

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E	
D	
C	
B	
A	

Material: N/A	Date: 2/4/02	By: CMM	File: NAV-VP2
Sheet: 1 of 1	Scale: N/A	Title:	
Tolerances unless noted:	± 0.080		
	± 0.010		

NAVIGATOR - VERTICAL PANEL



