

Refer to: HSA-10/WZ-149

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Dear Dr. Faller:

This is in response to your letter of February 5, 2003, requesting Federal Highway Administration (FHWA) acceptance of the Michigan Department of Transportation's Temporary Sign Stand as a crashworthy traffic control device for use in work zones on the National Highway System (NHS). Accompanying your letter were reports of crash testing conducted by the Midwest Roadside Safety Facility and video of the tests. You requested that we find these devices 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 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 sign stand follows:

(System Nos. 5 and 6) a 1,730-mm wide x 1,829-mm deep x 3,264-mm tall steel sign support with a 1,219-mm x 1,219-mm x 15.9-mm thick plywood diamond-shaped sign panel with reflective material mounted at a height of 1,540 mm from the ground to the bottom of the sign panel and with a lightweight "Empco-Lite" Type A warning light mounted at a height of 2,597 mm from the ground to the top of the warning light and with 15.88 kg of sandbags at the end of each leg.

## Testing

A total of six devices were crash tested as part of the Michigan DOT program. System Nos. 1 and 2 were the original version of the stand which failed due to passenger compartment intrusion. System Nos. 3 and 4 were 12-foot long Type III barricades which also failed to meet the evaluation criteria. System Nos. 5 and 6 were the redesigned sign stand using stiffened masts, relocated warning light, revised sign-to-post fasteners, and the omission of the speed advisory plate.

Full-scale automobile testing was conducted on the final design of the sign stand. Two stand-alone examples were tested in tandem, one oriented at 90 degrees to travel, and the next placed 60 feet downstream at a head-on orientation, as called for in our guidance memoranda. The successfully tested stand was modified from an earlier design that was tested in a prior crash test program.

The tests are summarized in the table below.

|                              | Michigan Temporary Sign Stand                          |                      |
|------------------------------|--|----------------------|
| Test Number                  | MI-3, System 5   | MI-3, System 6       |
| Sign Stand Orientation       | 90 degrees (End-on)                                    | 0 degree (Head-on)   |
| Weight of Stand, Sign, Light | 53.5 kg +/-  | 53.5 kg +/-          |
| Mounting heights             | 1540 mm  | 1540 mm              |
| Flags? Lights?               | Empco Lite Model 400                                   | Empco Lite Model 400 |
| Mass of Sand Ballast         | One 31.75 kg bag at each end of each leg               |                      |
| Mass of Test Vehicle         | 896 kg   |                      |
| Impact Speed                 | 101.0 km/hr  | 91.3 km/hr *         |
| Velocity Change              | 2.7 m/s  | n/a                  |
| Extent of contact            | 95 mm roof crush                                       |                      |
| Windshield Damage            | Spider cracking in upper right. No deformation or hole |                      |
| Other notes                  | *Low speed is acceptable.                              |                      |

## Findings

Damage was limited to the front end of the vehicle (bumper, grill, radiator), minor spider cracking of a portion of the windshield, and 95 mm of roof deformation (from the corner of the 90-degree orientation sign panel, in the vicinity of the warning light.) The velocity change caused by System 5 (90-degree orientation) slowed the vehicle enough to drop it below the tolerance for a 100 km/hr test. The possibility of this occurring was known when FHWA established the recommendation to hit two examples of the device on the same run of the test vehicle. We concur in your analysis that the damage would not have been significantly greater had System 6 been struck at 100 km/hr. The results of the testing met the FHWA requirements and, therefore, the Michigan Temporary Sign Stand described above and detailed in the enclosed drawings are acceptable for use on the NHS under the range of conditions tested, when proposed by a State.

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, or 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 or the Michigan DOT will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You or the Michigan DOT should supply information to potential users that would allow them to certify 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 by the FHWA as number WZ-149 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.

Sincerely yours,

Michael S. Griffith  
Acting Director, Office of Safety Design  
Office of Safety

Enclosures

Modified Portable Road Panel System

- Vertical Upright Mast - 44.45 mm x 44.45 mm x 2.16 mm wall x 2743 long galvanized telescopic steel tubing
- Outside Vertical Upright Tubing - 50.00 mm x 50.00 mm x 2.77 mm wall x 912 mm long galvanized telescopic steel tubing
- Legs, Horizontal Portion - 50.80 mm x 50.80 mm x 6.35 mm thickness x 1829 mm long L-shaped steel angle
- Legs, Vertical Stub - 50.80 mm x 50.80 mm x 2.67 mm wall x 152 mm long steel tubing
- All telescopic steel tubing contain 9.53 mm diameter punched holes, spaced 25.40 mm on center, along the total length
- Vertical stub of the leg is tack welded to horizontal portion of the leg on three sides
- Outside stiffening tubes slide over the vertical upright masts and are bolted at the top and bottom of the stiffening tubes with 7.9 mm x 51 mm coarse bolts with nut and washer
- Masts slide inside vertical stub of legs - No bolt or fastening device used
- Panel - Reflective plywood, 1219 mm wide x 1219 mm long with a 15.88 mm thickness
- Panel fastened to vertical mast supports with quick-release 9.5 mm x 76 mm - 16 zinc coated steel hex bolts with 14.3 mm nut and 38.1 mm x 1.6 mm thick flat washer
- Light - "Encoc-Lite", model no. 400 Type A Flashing Warning Light attached to the corner of the sign panel with only one battery placed in the box at the outermost slot in the battery box
- Bolt for the warning light was placed 51 mm in from and perpendicular to each edge line of the panel along the centerline drawn between the two side corners of the panel
- Ballast - 15.88-kg of sandbags at end of each leg

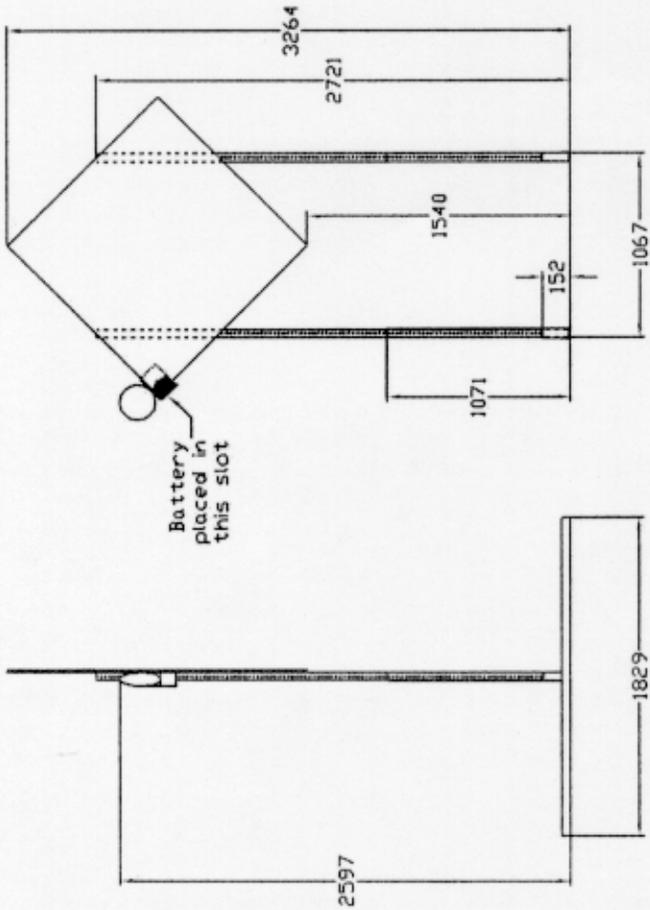


Figure 4. System Nos. 5 and 6 Sign Support Details, Test MI-3