Refer to: HSA-10/WZ-133

Mr. Ron Faller
Midwest Roadside Safety Facility
1901 "Y" Street, Bldg. C
P.O. Box 880601
Lincoln, Nebraska 68588-0601

Dear Dr. Faller:

Thank you for your September 12, 2002, letter requesting Federal Highway Administration (FHWA) acceptance of the Minnesota Department of Transportation (DOT) temporary work zone sign stand 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 you conducted and a CD 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 description of the device follows:

The Minnesota DOT rigid panel portable sign support is a stiffened perforated square steel tube "H-Footprint" device:

- Vertical upright masts are 44.5 mm (1.75 inch) square galvanized Telespar ASTM A-653 Grade 50 steel tubing with 2.67 mm (0.105 inch) wall thickness and a length of 1524 mm (60 inches.)
- Outside vertical upright tubing is 50.8 mm (2 inch) square galvanized Telespar ASTM A-653 Grade 50 steel tubing with 2.74 mm (0.108 inch) wall thickness and a length of 911 mm (33.875 inches.)

- Horizontal legs are 38.1 mm (1.5 inch) square galvanized Telespar ASTM A-653 Grade 50 steel tubing with 2.74 mm (0.108 inch) wall thickness and a length of 1524 mm (60 inches.)
- Vertical stubs from the legs are 38.1 mm (1.5 inch) square galvanized Telespar ASTM A-653 Grade 50 steel tubing with 2.74 mm (0.108 inch) wall thickness and a length 305 mm (12 inches.) It is welded to the horizontal leg on all four sides.
- The outside vertical upright tubes slide over the vertical uprights and the vertical portion of the legs slide into the vertical upright masts with 7.9 mm (0.3125 inch) diameter x 63.5 mm (2.5 inch) long hex head S30400 threaded bolts used to fasten the masts and legs.
- The solid, 2.74 mm (0.108 inch) aluminum sign panel was 1219 mm (48 inch) diamond shaped and fastened to the stand with four 7.9 mm (0.3125 inch) x 63.5 mm (2.5 inch) long hex head S30400 threaded bolts.
- Height to bottom of sign: 335 mm (13.1875 inches) Height to top of outer tube 959 mm (37.74 inches). Height to the Warning Light bolt, 1,481 mm (58.3125 inches).
- The legs have a mass of 9.1 kg (10 pounds) and the panel, masts, outside tubes, and light have a mass of 36.75 lg (81 pounds.) One 20 kg (45 pound) sandbag was placed at the end of each leg.

Testing

This crash-testing program used a hard-nosed bogie vehicle of a mass larger than the standard 820C test vehicle. There are significant constraints involved in using such a non-standard testing device, some of which are:

1. The potential vehicle velocity change must be considered insignificant.
2. The crush characteristics of an automobile bumper must not be expected to have a significant affect on the trajectory of the test article.
3. The profile of the bogie vehicle must be configured to replicate the outline of a production vehicle. The MWRSF bogie was configured to replicate the outline of a Geo Metro, a vehicle commonly used in testing of work zone devices.
4. No part of the test article may intrude into the windshield area of the vehicle after impact.

The two tests and their results summarized below were within these constraints.

Stand-alone examples of the devices were tested in separate tests, one head-on and one turned at 90 degrees, as called for in our guidance memoranda. The complete device, as tested is shown in Enclosure 1. The crash test is summarized in the table below:

Test Number	MNSB-12	MNSB-13
Test Article	Head-on	End-On
Flags or lights	One lightweight warning light on each stand	
Test Article Mass (each)	45.8 kg (91 pounds) plus ballast	
Bogie Inertial Mass	974 kg (2148 pounds)	

Impact Speed	97.5 km/hr (60.6 mph)	98.8 km/hr (61.4 mph)
Approx. Velocity Change	10 km/hr, 2.78 m/s	10 km/hr, 2.78 m/s

Findings
The rigid frame of these stands caused them to be pushed ahead of the bogie, or knocked to one side. Neither showed any potential for approaching the windshield or causing any other passenger compartment intrusion. The trajectory of the sign stands in these tests indicate that the bogie vehicle, even though it was not within the specification range of an NCHRP Report 350 820C test vehicle, was acceptable for establishing the crashworthiness of the stands. The results of the testing met the FHWA requirements and, therefore, the devices 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.

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

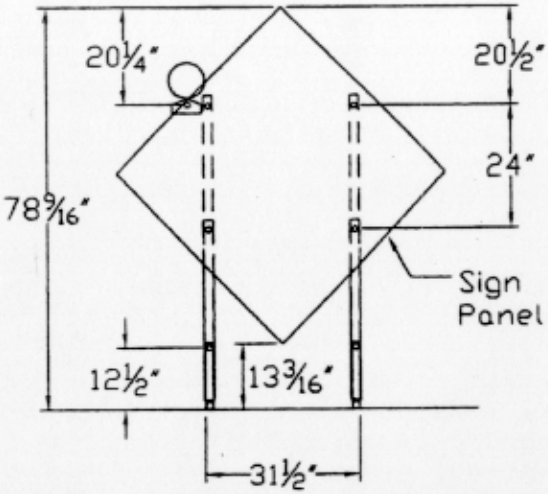
- Our acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance 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 FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number WZ-133 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.

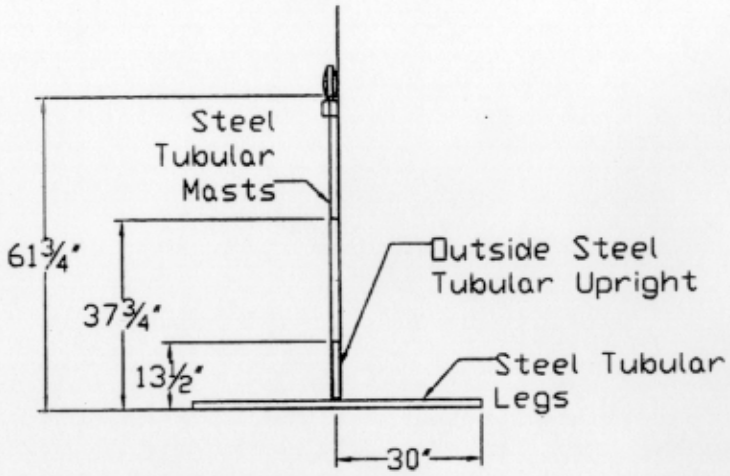
Sincerely yours,

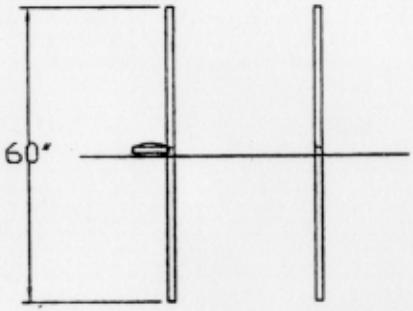
Carol H. Jacoby, P.E.
Director, Office of Safety Design

Enclosure

System: MNSB-12





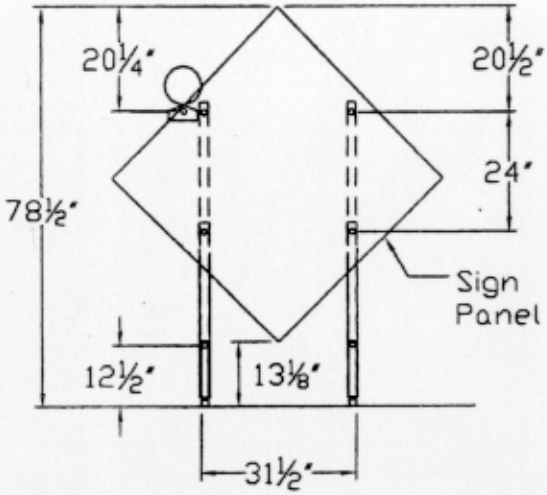


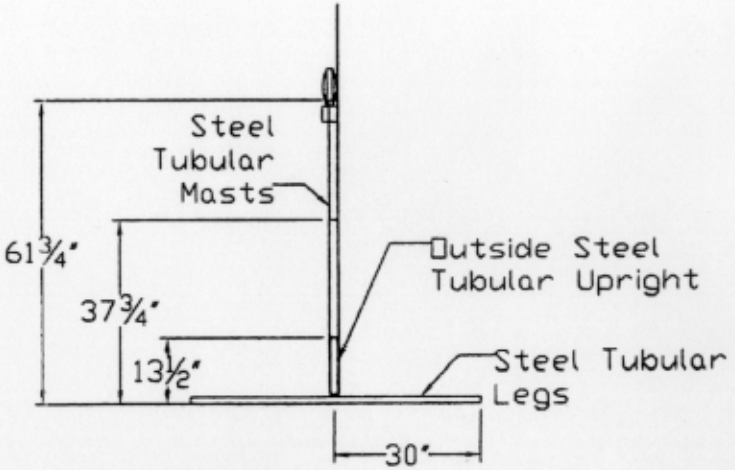
48" x 48" Rigid Panel System

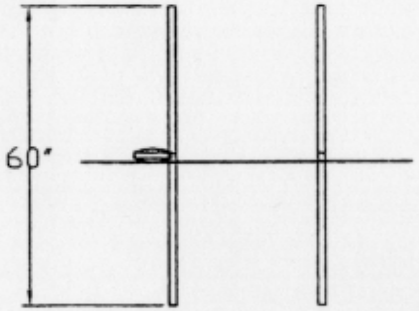
- Vertical Upright Masts – 1.75" sq. x 0.105" wall x 60" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Outside Vertical Upright Tubing – 2" sq. x 0.108" wall x 35.875" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Legs, Horizontal Portion – 1.5" sq. x 0.108" wall x 60" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Legs, Vertical Stub – 1.5" sq. x 0.108" wall x 12" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Vertical stub of the leg is welded to the horizontal portion of the leg on all four sides
- Outside vertical upright tubings slide over the vertical upright masts
- Vertical stub of legs slide into vertical upright masts – 0.3125" diameter x 2.5" long hex head S30400 threaded bolts were used to fasten the masts and legs
- Sign Panel – Reflective aluminum, 48" wide x 48" long with a 0.108" thickness
- Panel fastened to vertical mast supports with four 0.3125" diameter x 2.5" long hex head S30400 threaded bolts. A 0.9375" OD x 0.0625" thick washer was placed between the head of the bolt and the sign panel
- Light – "Toughlite 2000" flashing warning light attached to the sign panel
- Ballast – 45-lb sandbag at end of each leg

48" x 48" Rigid Panel System Design Details, Bogie Test MNSB-12

System: MNSB-13







48" x 48" Rigid Panel System

- Vertical Upright Masts – 1.75" sq. x 0.105" wall x 60" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Outside Vertical Upright Tubing – 2" sq. x 0.108" wall x 35.875" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Legs, Horizontal Portion – 1.5" sq. x 0.108" wall x 60" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Legs, Vertical Stub – 1.5" sq. x 0.108" wall x 12" long galvanized telespar ASTM A-653 Grade 50 steel tubing
- Vertical stub of the leg is welded to the horizontal portion of the leg on all four sides
- Outside vertical upright tubings slide over the vertical upright masts
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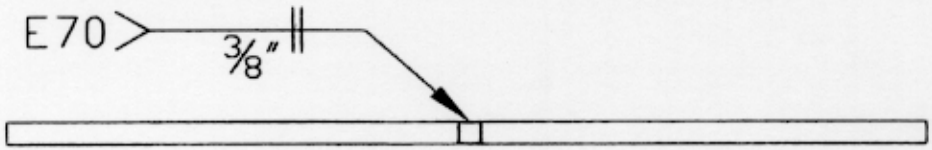
- Light – "Toughlite 2000" flashing warning light attached to the sign panel
- Ballast – 45-lb sandbag at end of each leg

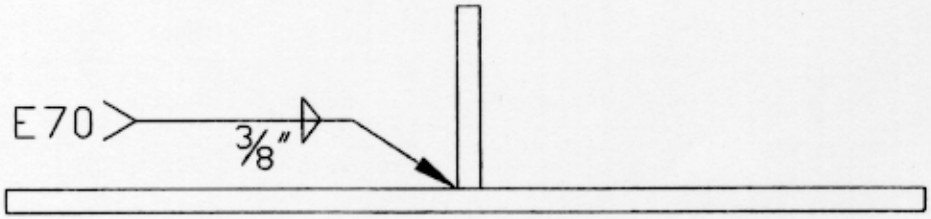
48" x 48" Rigid Panel System Design Details, Bogie Test MNSB-13

System: MNSB-12 & MNSB-13

Top View (Legs)



Side View (Legs)



48" x 48" Rigid Panel System Leg Fabrication Details, Bogie Tests MNSB-12 and MNSB 13