



U.S. Department
Of Transportation
**Federal Highway
Administration**

400 Seventh St., S.W.
Washington, D.C. 20590

January 9, 1998

Refer to: HNG-14/SS-76

Mr. James Coburn
Traffic Engineer
New Hampshire Department of Transportation
P.O. Box 483
Concord, New Hampshire 03302-0483

Dear Mr. Coburn:

On October 17, 1997, Mr. Douglas Graham, your former Assistant Traffic Engineer, wrote to Mr. Nicholas Artimovich, requesting the Federal Highway Administration's (FHWA's) acceptance of certain thin-walled aluminum pipe and steel U-channel small sign supports for use on the National Highway System (NHS) when breakaway devices are required. Accompanying Mr. Graham's letter were reports, photographs, and films of the tests.

Testing of the supports conducted by the Texas Transportation Institute was in compliance with the guidelines contained in the NCHRP Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features. Requirements for breakaway supports are those found in the American Association of State Highway and Transportation Officials' (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals.

The tested aluminum tube supports were constructed from 6063-T6 schedule 10 seamless aluminum pipe with wall thickness of 3.2 mm (0.125 in). Two sizes of U-channel supports were tested, 3.7 kg/m (2.5lbs/ft) and 4.5 kg/m (3.0lbs/ft), made of 414-Mpa (60-ksi) and 550-Mpa (80-ksi) steel, respectively (although the report states that all U-channel supports were "Marion Steel" [550-Mpa] posts).

The tests are summarized in the enclosed "Table 26- Performance Evaluation Summary of Crash Tests performed on Aluminum Sign Support Installations" and Table 27- Performance Evaluation Summary of Crash Tests Performed on Steel U-Channel Sign Installations.

The single 102-mm (4.0 in) thin wall aluminum pipe supports were embedded 1.8 m (6.0ft) into the soil. Attached to the supports 152.4 mm (6.0 in) below ground level were

two 711 mm (28 in) long nominal 2 x 12 pressure treated wooden soil plates. The soil plates were attached in front of and behind the supports using 203.2 mm (8.0 in) long, 1.9 mm (14 gauge) channel brackets and post clamps. The channel brackets were attached to the wooden soil plates using two 12.7 mm (1/2 in) diameter x 57.2 mm (2-1/4 in) long carriage bolts with hex head nuts.

The dual aluminum pipe supports were constructed using either 76 mm (3.0 in) or 102 mm (4.0 in) diameter supports. The embedment depths were either 1.5 m (5.0 ft) or 1.8 m (6.0 ft), respectively. The dual support sign installations used the same hardware as was used with the single post supports to attach the soil plates, which were 1.8 m (6.0 ft) long, reaching across both supports.

The U-channel supports were driven directly into the soil to a depth of 0.9 m (3.0 ft) without soil plates or splices.

Sign panels were mounted at a height of 2.13m (7.0ft) to the bottom of the sign for the aluminum tube tests and at a height of 1.5m (5.0 ft) for the U-channel tests.

The test installation details are summarized in the table below.

Summary of Test Installation Details

Test #	Support Type	Embedment	Soil Plate
1-4	76 mm x 3.2 mm (3.0 in x 0.125 in) Dual Aluminum Pipe	1500 mm	Two 1800 mm long nominal 2 x 12 wood 150 mm below ground
6-9	102 mm x 3.2 mm (4.0 in x 0.125 in) Single Aluminum Pipe	1800 mm	Two 711 mm long nominal 2 x 12 wood 150 mm below ground
16, 17, 22	Modified* 102 mm x 3.2 mm (4.0 in x 0.125 in) Dual Aluminum Pipe	1800 mm	Two 711 mm long nominal 2 x 12 wood 150 mm below ground
23-26	Modified** 102 mm x 3.2 mm (4.0 in x 0.125 in) Dual Aluminum Pipe	1800 mm	Two 711 mm long nominal 2 x 12 wood 150 mm below ground
10-13	3.7 kg/m (2.5lb/ft) Dual Steel U-Channel 414-Mpa (60-ksi) steel***	900 mm	None
18-21	4.5 kg/m (3.0 lb/ft) Dual Steel U-Channel 550-Mpa (80-ksi) steel	900 mm	None

Notes:

* Each support in these three tests was modified by drilling two 38 mm (1.5 in) holes (in the direction of vehicle travel) at ground level and two additional 38 mm holes (perpendicular to the direction of vehicle travel) 457 mm (18 in) up from ground level. This system passed the strong soil tests, but failed when tested in weak soils. Therefore, this system will be acceptable for use in strong soil only.

** Each support in these four tests was modified by drilling four 25 mm (1 in) holes in the supports at two different elevations-four at ground level and four at 457 mm above ground level. The holes were oriented 90 degrees with respect to each other and 45 degrees with respect to the plane of the sign panel. This system passed in both soil types.

*** The 3.7 kg/m dual steel U-channel post used in tests 10 to 13 were 414-Mpa (60-ksi) “rail steel” posts and not the “Marion Steel” posts as stated in the test report. This was evident through visual observation of the test videos and confirmed via telephone conversation with the post supplier. In test 11 (high speed, strong soil) the sign panel hit the roof and deformed it 180 mm. This exceeds the FHWA guideline of 150 mm maximum acceptable deformation of the passenger compartment. The 1.5 m sign mounting height may have contributed to the severity of deformation in this test. The heavier 4.5 kg/m posts used in tests 18 to 21 were the less ductile 550-Mpa (80-ksi) Marion Steel posts and performed in acceptable manner. Therefore, 4.5-kg/m, 3.7-kg/m and lighter posts of 550-Mpa steel will be acceptable when the signs are mounted at a minimum height of 2.1 m to the bottom edge.

Note that a direct-burial, dual-post U-channel support of 4.5-kg/m rail steel posts has been acceptable for use in strong soil at a minimum mounting height of 2.1 m. this letter does not affect that determination.

The tested supports, described above, enumerated in the table below and shown in the enclosed drawings, met the change in velocity requirements of the FHWA. Stub heights for many tests exceeded the 100mm criteria contained in the AASHTO specifications, but because the test vehicle passed over them without difficulty, they are judged “not substantial.” Therefore, these supports are acceptable for use on the NHS within the range of conditions tested, except as modified in the table below, when requested by a State.

Summary of Acceptable Breakaway Supports

Support Type	# Of Posts	Modifications	Soils
76 mm x 3.2 mm (3.0 in x 0.125 in) 6063-T6 Dual Aluminum Pipe	One or Two with Soil Plate*	None	Both
102 mm x 3.2 mm (4.0 in x 0.125 in) 6063-T6 Single Aluminum Pipe	One with soil Plate*	None	Both
Modified 102 mm x 3.2 mm (4.0 in x 0.125 in) 6063-T6 Dual Aluminum Pipe	One or Two with soil plate*	Two 38 mm holes** at ground and bumper height	Strong only
Modified 102 mm x 3.2 mm (4.0 in x 0.125 in) 6063-T6 Dual Aluminum Pipe	One or two with soil plate*	Four 25 mm holes*** at ground and bumper height	Both
3.7 kg/m (2.5 lb/ft) 550 Mpa Steel U-Channel****	One or two*****	None	Both

4.5 kg/m (3.0 lb/ft) 550 Mpa Steel U-Channel	One or two	None	Both
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Notes:

* Soil Plates for single post supports are 710 mm long nominal 2 x 12 pressure treated wood boards secured to both sides of the post. Soil plates for dual post supports are 1800 mm long nominal 2. 12 pressure treated boards on either side of the post.

** The holes at the ground line are drilled in the direction of travel and the holes at the bumper height are perpendicular to the direction of travel.

*** All holes are oriented 45 degrees from the direction of travel.

**** The supports are to be made from the same type of steel as that used in the 4.5-kg/m support tests.

***** Sign mounting height is 2.1 m (min.) to the bottom of the panel, not the tested 1.5m.

Our acceptance is limited to the breakaway characteristics of the supports and does not cover their structural features. Presumably you will supply potential users with sufficient information on structural design and installation requirements to ensure proper performance require certification from the support manufactures or suppliers that the hardware furnished will have essentially the same chemistry, mechanical properties, and geometry as those you have described to us, and that they will meet the Federal Highway Administration change in velocity requirements.

Sincerely yours,

Dwight A. Horne
Chief, Federal-Aid and Design
Division

2 Enclosures

Federal Highway Administration

HNG-14: N Artimovich: 366-1331:gmorton: 1-6-98:COBURN2

Copies to:

HNG-1 HNG-10 HNG-14 Reader, 3128 File, 3128

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Geometric and Safety Design Acceptance Letter SS-76