



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

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

December 12, 1989

Refer to: HNG-14/SS-15

Mr. John G. Bestgen  
Regional Federal Highway Administrator (HEO-01)  
Albany, New York

Your September 5 office memorandum to Mr. Thomas O. Willett contained a request that the acceptability of the subject aluminum sign supports be determined. The supports are described in a letter from the Vermont Agency of Transportation forwarded with your office memorandum.

In the State's letter evidence of acceptability of the supports is based on an analytical approach contained in FHWA Notice N5040.20 dated July 14, 1976. This approach should no longer be used for two reasons. First, the values set forth in the Notice are intended to ensure acceptable performance under the 1975 AASHTO breakaway requirements, which specified a 2,250-pound automobile as the design vehicle. The 1985 AASHTP breakaway requirements (contained in Standard Specifications for Structural Supports of Highway Signs, Luminaires and Traffic Signals), as modified, become FHWA's requirements effective July 1, 1990. The AASHTO requirements specify a 1,800 pound automobile as the design vehicle. Second, the approach is not as conservative as it was believed to be when issued. It was based on a set of assumptions that has not proven universally valid. It was assumed that support fracture or collapse would occur in low speed impacts at a force level and time to ensure specified performance. At higher speeds timely fracture was expected to occur or, under the conditions prescribed in the Notice, pullout would occur to ensure specified performance. In some tests of supports that were predicted by the Notice procedures to be acceptable, the basic assumptions proved invalid when tested in the soils recommended in the 1981 NCHRP Report 230 and unacceptable results were observed. Therefore, we now believe support acceptance must be more firmly based on crash test experience.

Fortunately, Texas Transportation Institute conducted full-scale crash tests of tubular aluminum sign supports for the Florida Department of Transportation in 1985. One post tested was 4 inches in diameter and had a wall thickness of 3/16 inches. The aluminum was the same as that used in Vermont's calculations, namely Aluminum Association Alloy 6061-T6. The post was tested in NCHRP "strong" soil only. Impact speeds were 19.4 and 61.9 m.p.h. with 1,800 pound automobiles. The velocity changes were 14.67 and 7.4 feet-per-second respectively. These results are acceptable under FHWA

breakaway criteria. Tests of posts with diameters of 4.5 inches and 5 inches were unsuccessful.

Based upon the passing tests, we can also conclude that a single 3-inch diameter, 3/16-inch thick walled post will meet FHWA breakaway criteria. However, we cannot determine if a dual 3-inch diameter post will be acceptable without further testing. (The extrapolation procedure is based upon knowing the results of a single posttest with identical hardware. The single 4-inch post test does not give us the information needed to extrapolate a single 3-inch post to a dual 3-inch post installation.)

Because the velocity change in the low speed test of a single 4-inch diameter post was close to the FHWA upper limit of 16.0 fps, it will not be acceptable to sue more than one such post within a 7 foot path, unless further crash testing proves otherwise.

Vermont also requested that 2-inch x 2-inch x 0.1875-inch square aluminum tubular sign supports be considered acceptable. While these supports would have been considered acceptable under the rules currently in effect, they have not been crash tested. Since no State, which is a member of the pooled-fund HPR study, "Small and Large Signs Supports" uses square aluminum tube sports; they will not be tested under this study. Vermont may wish to reconsider participation in this study, as their funding support will give them a vote as to which supports will be tested.

As a final point we would like to emphasize the need for testing small sign supports in both strong (S-1) and weak (S-2) soils. The process developed in NCHRP intended that devices be tested in both soil types so as to ensure universal acceptability. We will delineate this policy more fully in a future communication with the field.

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