



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

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

July 13, 1995

Refer to: HNG-14/SS-56

Mr. Rick Mauer
National Sales Manager
Marion Steel Company
912 Cheney Avenue
Marion, Ohio 43303

Dear Mr. Mauer:

Thank you for your April 12 letter requesting that the Federal Highway Administration (FHWA) accept your company's "Lap Splice" breakaway system for Rib-Bak u-channel sign supports. Your letter was accompanied by the report Evaluation of the Crash Performance of Triple Steel U-Channel Sign Support Installations in Weak Soil by the Texas Transportation Institute (TTI), dated March 1995, which has since been supplemented by a draft strong soil test report from TTI dated June 1995. You provided additional information by facsimile on June 30.

Full-scale crash testing was done in accordance with the National highway Cooperative Research Program Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features. Requirements for the breakaway supports are found in the American Association of State Highway and Transportation Officials' (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires and These specifications have been adopted by the FHWA.

You requested comprehensive acceptance of your sign support system based on the low-speed tests in S-2 ("weak") soil only. While this soil and speed combination is usually considered a "worst case" for testing small sign supports, some spliced u-channel supports failed when tested in S-1 ("strong") soil. Therefore we requested that you run a test in S-1 soil also. We received the draft strong-soil TTI report on June 22.

Three tests were conducted on triple post installations directly buried in soil, one for each of two sizes of u-channels in weak soil and one for the larger of the two u-channels in strong soil. The supports were constructed from Marion Steel SP-80 Rib-Bak, 4.5-kg/m (3.0 pound/foot) and 6.0-kg/m (4.0 pound/foot) steel u-channel sign supports. One-meter (3.2-foot) long ground supports (stubs) were driven so that their tops were 25 mm above the ground line in both weak-soil tests and 100 mm above the ground line in the strong-

soil test. (Stubs and supports were made of the same weight u-channels.) A 150-mm (6 inch) Lap Splice was used to connect the sign support to the ground support stub. The Lap Splice consists of high strength Grade 9 bolts, self locking flange nuts, Grade 9 cut washers, and threaded spacers. The bolts are 100 mm (4 inches) apart, securing the support to the back of the stub. The spacers separate the webs of the stub and sign post to prevent post deformation during tightening of the splice bolts. The spacers are 9 mm (0.75 inches) square and drilled and tapped for an 8-mm (5/16-18 UNC) bolt. The soil plates, when used, were 305 mm (12 inches) wide at the top, 152 mm (6 inches) wide at the bottom, 152 mm (6 inches) high and 3 mm (0.12 inches) thick, with their tops located just below the ground line.

Test Number: 270687-	- MAR-1	-MAR-2	-MAR-3
Test Article	4.5 kg/m	6.0 kg/m	6.0 kg/m
Soil Type	Weak	Weak	Strong
Soil Plates Used?	No	Yes	No
Vehicle mass, kg (lbs.)	820 (1808)	820(1808)	820 (1808)
Impact Speed, km/h	34.6 (21.5)	34.2 (21.2)	35.0 (21.7)
Vehicle Delta V m/s (ft/s)	5.8 (19.1) *	3.9 (12.8)	6.3 (20.6) *
Est. High Speed Delta V m/s (ft/s)	1.3 (4.3)	1.2 (3.1)	1.8 (5.8)
Occupant Imp. M/s (ft/s)	3.6 (11.8)	3.2 (10.5)	4.9 (16.1)
Maximum Stub Height, mm (in)	267 (10.5) **	178 (7.0) **	100 (4.0)
Failure Mode	All 3 posts broke at bumper height.	All 3 Posts broke at bumper, two splices also separated.	One post broke at bumper height. Splices separated on the other two.

*Although the vehicle speed change exceeded the recommended limit of 5.0 m/s, the critical occupant impact speeds were within the 5.0 m/s requirement.

** Some portions of signposts exceeding the 100-mm height limit remained attached to the stubs, but they were easily traversed by the test vehicle and not considered hazardous.

The results of these tests meet the change in velocity and stub-height requirements adopted by ASSHTO and FHWA. Earlier testing by TTI for the Arizona Department of Transportation confirmed that the spliced triple-post installation of 4.5 kg/m Marion Rib-Bak posts performed in an acceptable manner when tested in strong soil (no soil plate needed). This was the subject of our acceptance letter dated August 31, 1989, (Number SS-13.)

Therefore, the 4.5- and 6.0-kg/m Marion Steel Rib Back sign supports with lap Splice connections will be acceptable for use on the National Highway System (NHS), under conditions comparable to those evaluated, when selected by a highway agency. The support stubs are to be embedded in soil, with 6.0-kg/m supports requiring soil plates when installed in weak soil. Soil plates may be used with 4.5-kg/m supports if an agency

desires. One, two, or three of these supports may be placed within a span of 2.1 m. The minimum clearance between the bottom of the sign panel and the ground line is to be 2:1 m.

Because the Marion Steel Lap Splice is proprietary, to be used in Federal-aid highway projects, except exempt non-NHS projects: (a) It must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that it is essential for synchronization with existing highway facilities or that no equally suitable alternate exists; or (c) it 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,

Jerry L. Poston, Chief
Federal-Aid and Design Division

Enclosure

Geometric and Roadside Design Acceptance Letter Number SS-56