



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

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

September 18 1996

Refer to: HNG-14/SS-69

Mr. D. Lance Bullard, Jr.
Safety Quest, Inc.
505 University Drive
Suite 701
College Station, Texas 77840

Dear Mr. Bullard:

This is in response to your request that the Federal Highway Administration (FHWA) accept a steel U-channel slip splice breakaway sign support system for use on the National Highway System. On February 28, you wrote to Mr. Gerald L. Eller transmitting a March 1996 report of full-scale automobile testing the Texas Transportation Institute conducted on a three-post support using prototype slip splices, a video of the crash tests, drawings of the recommend designs, and other documentation. We responded on March 15 denying acceptance on the basis that the tested prototype slip-bases were not manufactured in the same way, as the production models would be. Your August 16 letter to Mr. Nicholas Artimovich transmitted pendulum test data, which compared the prototype to production model bases.

Requirements for breakaway supports are those in the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals. We also recognize the testing and evaluation guidelines the National Cooperative Highway Research Program Report Number 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features.

The full-scale automobile tests of a triple-post, 5.9 kg/m U-channel sign support are summarized in the following table:

Test Number	220500-1	220500-2	220497
Test Item	Prototype	Prototype	Prototype
Impact Speed	35.0 km/h	34.8 km/h	102.1 km/h
Soil Type	Weak	Standard	Standard
Soil Plate Used?	Yes	No	No
Velocity Change	2.8 m/s	1.5 m/s	3.8 m/s

Occupant Impact Speed	1.5 m/s	1.4 m/s	1.6 m/s
Stub Height	89 mm	89 mm	89 mm

The stub for the support mounted in weak soil was embedded to a depth of 1425 mm and included a 360 mm x 360 mm x 6.3 mm soil plate on each post approximately 100 mm below the ground line. Embedment in standard soil was 815 mm and did not use a soil plate.

Your August 16 letter transmitted the results of 1,088-kg pendulum test performed on both the prototype slip splice and production versions. The production versions are made of ductile iron and are shown in the enclosed drawings. A summary of these tests is shown in the following table:

Test #	-1*	-2*	-3*	-4	-5	-6	-7	-8
220500								
Splice Version	Proto	Proto	Cast	Proto	Proto	Cast	Cast	Cast
Post	Single	Single	B-to-B	B-to-B	B-to-B	B-to-B	Single	Single
Post Mass	18 kg	18 kg	36 kg	36 kg	36 kg	36 kg	18 kg	18 kg
Orientation	0 deg	90 deg	9 deg	0 deg	90 deg	90 deg	0 deg	90 deg
Impact Speed, km/h	30.8	31.7	31.0	30.5	30.7	30.7	31.0	30.8
Occupant Contact, m/s	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Velocity Change	0.28	0.26	0.26	0.28	0.31	0.33	0.18	0.19

Notes:

*These three test numbers repeat the numbers of the full-scale tests shown above.

All supports were installed in “standard” soil. “Proto” refers to the machined prototype version. “Cast” refers to the production model slip splice hardware. “B-to-B” is back-to-back U-channel posts bolted at 457 mm. There was no theoretical occupant contact with the “vehicle” interior. All stub heights were 89 mm.

The 1,088-kg pendulum you used is a non-standard mass fitted with a non-standard nose and would not be acceptable for independent testing. However, since it is being used in this case to compare the performance of known slip splices (the prototypes tested with automobiles) to the case production model, we will accept its use in this case. As you noted, the velocity changes of the supports using the castings are very comparable, even better in most cases, than the tests on the prototypes.

Because the results of the full-scale testing of the prototype installations met the stub height and change-in-velocity criteria recognized by the FHWA, and the pendulum

testing of the cast production slip splices compared favorably, single or back-to-back U-channel supports using the cast production model slip splices will be acceptable for use on the National Highway system, in the range of conditions tested, when proposed by a State. One, two, or three posts up to 5.9 kg/m (11.8 kg/m for back-to-back posts) may be used in a 2.1-meter span in strong or weak soil. A one-post support with the slip splice may be used as an omni-directional device when approaching traffic is expected from various directions. Additional full-scale testing would be required to determine the crashworthiness of multiple supports being hit at an angle of 90 degrees.

Our acceptance is limited to the breakaway characteristics of the tested slip splices 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. We anticipate that the States will require certification from you or the manufacturer that the hardware furnished has 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.

Should you seek to patent this U-channel slip splice and are ultimately successful, it would be a proprietary product. To be used in Federal-aid projects, except exempt, non-NHS projects: (a) must be supplied through complete bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities for that no equally suitable alternative exists or; (c) they 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,

Seppo I. Sillan, Acting Chief
Federal-Aid and Design Division

Enclosures

Geometric and Safety Design Acceptance Letter SS-69