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

January 5, 2007

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

In Reply Refer To:
HSSD/CC-86B

Mr. Derek W. Muir
Group Managing Director, Hill & Smith Ltd.
Springvale Avenue, Bilston
Wolverhampten, WV14 OQL
West Midlands, United Kingdom

Dear Mr. Muir:

On December 29, 2006, Dr. Richard G. McGinnis, your consultant, representing BRIFEN USA, presented members of my staff with the final design details and crash test report for a modified proprietary end terminal for use with the BRIFEN Wire Rope Safety Fence. All testing was done under the direction of Southwest Research Institute at a test facility in Ardmore, Oklahoma. The test designated as National Cooperative Highway Research Program Report (NCHRP) 350 test 3-30 was completed successfully. In previous discussions between Dr. McGinnis and members of my staff, it was mutually agreed that since this terminal was a modification of a previously-approved terminal, and the modifications were deemed unlikely to affect previously-run tests (3-31, 3-32, 3-33, 3-34, 3-35, and 3-39), these tests could be waived if no concerns were noted in test 3-30.

The terminal tested is a modification of the Brifen® Wire Rope Gating Terminal (WRGT) which received approval from the Federal Highway Administration (FHWA) for use on the National Highway System (NHS) in approval letter CC-86 dated January 28, 2004. The new terminal is a flared-end wire rope gating terminal designated as Flared-End Wire Rope Gating Terminal (WRGT-FL), and it is useable with both 3-rope and 4-rope Brifen® WRSF set at either test level 3 (TL-3) or TL-4 rope heights. The new terminal was tested with a 4-rope TL-4 WRSF, which is the most critical configuration because of the higher risk of vehicle instability that results from the higher ropes.

There are two major differences between the original WRGT and the new WRGT-FL. The original WRGT is tangent to the centerline of the safety fence proper while the WRGT-FL flares away from the roadway to a maximum of 610mm at the anchor. Secondly, the original WRGT has 15 "transition" posts between the 4-post terminal section and the first standard length-of-need (LON) post. The WRGT-FL has no transition posts after the 4-post terminal

section making the fifth post a standard LON post for either a TL-3 safety fence or a TL-4 safety fence. There are several minor differences between the two terminals, i.e., spacing between post one and the anchor point in WRGT-FL increases from 1.75 m in the original WRGT to 2.0 m for the WRGT-FL to make all post spacing in the terminal the same, the weakening slot in the first four posts in WRGT-FL is larger than in WRGT, and rope heights in the two systems are slightly different.

Your terminal, called the BRIFEN WRGT-FL, consists of a single anchor and 4 non-standard posts spaced at 2.0 meters that are flared away from the roadway as viewed from the approach direction. Maximum flare occurs at the anchor and is 610mm offset from the centerline. The flare decreases to 457 mm at post 1,305 mm at post 2, 150 mm at post 3, and 75 mm at post 4. All four posts in the terminal are weakened at the ground line in two places by cutting a 12.5-mm x 3-mm notch in the face of the posts, oriented toward approaching traffic. Posts 1 thru 4 are installed in 406-mm long galvanized steel sockets. Posts 2 thru 4 are set vertically in 300-mm diameter cylindrical concrete foundations, while Post 1 is installed in a 355-mm diameter foundation and is sloped toward the approach end of the system by an angle of 79 degrees from horizontal. Sizes of the post foundations vary, depending on soil conditions and weather extremes; the post foundations in the test were 915-mm deep.

All four of the BRIFEN cables interweave around the first three anchor posts that have "S" (or "Z") shape cross-sections. Beginning at post 4 and continuing throughout the length of need the top cable is no longer weaved but is contained in a slot in the top of the post. Anchorage for the 4 ropes is a 915-mm diameter reinforced concrete cylindrical foundation. The anchor foundation size varies depending upon soil and weather conditions; the ones tested were 3.05-meters deep. A galvanized steel anchor plate attaches the ropes to the foundation. This plate is bolted to the top of the concrete foundation and sloped back at an angle of 12 degrees from horizontal. The overall layout, post designs, post spacing and detailed dimensions are shown in Enclosure 1.

The NCHRP Report 350 test 3-30 was conducted on an 88.5-m long installation, including the two 8-m long terminals. The summary sheet for this test is shown in Enclosure 2. As with all gating, non-energy absorbing terminals, impacts at or near the end of the WRGT will allow a vehicle to travel a significant distance behind or along the barrier, a factor that must be considered in the design and layout of the barrier installation. In cases where penetration behind the terminal is not acceptable (i.e., where significant vehicular intrusion may have severe consequences) and the barrier cannot be extended, an energy-absorbing crash cushion remains a feasible alternative. In test 3-35 previously conducted on the original terminal design, the pickup truck struck the fence approximately 1600-mm upstream from the first line post which would be 9,600-mm downstream from the terminal end of the modified design. For practical in-service placement, the beginning of the LON may be considered to be 9000-mm downstream from the terminal end.

Based on the results of this test on the modified terminal and the results of the previously-conducted tests on the original terminal design, the BRIFEN WRGT-FL may be assumed to meet appropriate evaluation criteria for a TL-3 terminal. Therefore, it may be used on the NHS with both TL-3 and TL-4 Brifen® WRSF designs with either 3 ropes or 4 ropes when

selected by the appropriate transportation agency. You will be expected to certify that any hardware you furnish has essentially the same chemistry, mechanical properties, and geometry as that tested, and to provide users with sufficient information on design and installation requirements to ensure proper performance.

As noted in the FHWA's February 27, 2003, acceptance letter B-82A, the BRIFEN system is currently manufactured in the United States from U.S. steel and is no longer subject to the "Buy America" provisions of Title 23 Code of Federal Regulations, Section 635.410. Because it is still a proprietary product, its use on the NHS must continue to comply with Title 23, Code of Federal Regulations, Section 635.411.

Sincerely yours,

John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

2 Enclosures