U.S. Department
of Transportation

**Federal Highway
Administration**

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

April 2, 1998

Refer to: HNG-14

Mr. Kaddo Kothmann
President
Road Systems, Inc.
P.O. Box 2163
Big Spring, Texas 79721

Dear Mr. Kothmann:

In your March 19 letter to Mr. Henry H. Rentz, you requested Federal Highway Administration's (FHWA) review of information you enclosed on your Flared Energy Absorbing Terminal (FLEAT) and acceptance of this w-beam guardrail terminal as a National Cooperative Highway Research Program (NCHRP) Report 350 test level 3 (TL-3) device. To support your request, you also included a description of the FLEAT-350, a summary of crash test results, a composite crash test video tape, drawings, photographs, and a March 1998 test report for the certification test which was run at the Midwest Roadside Safety Facility. A second report (also dated March 1998) prepared by the Southwest Research Institute, entitled "Full-Scale Crash Evaluation of a Flared Energy Absorbing Terminal" included information on the three additional tests that were run at that testing facility. We received a copy of this report with your March 27 letter to Mr. Rentz.

The FLEAT-350 is a w-beam guardrail terminal that is linearly offset from the line of rail by 1200 mm over its 11400-mm length. Its main components include an impact head and guide tube assembly, a modified w-beam rail section, a breakaway anchor assembly, and a series of seven weakened timber posts, the first two being 140 mm x 190 mm x 1080 mm long set in 1830-mm steel tubes and the next five being 150 mm x 200 mm x 1830 mm long set directly into the ground. Design details are shown in Enclosure 1. The FLEAT-350 dissipates impact energy in end-on hits by bending and flattening the w-beam rail element as the extruder head is forced back along the rail. For downstream hits, the tension in the rail is transmitted to the anchorage system, resulting in containment and re-direction of an impacting vehicle.

A total of four tests were conducted to certify the FLEAT-350 as meeting the evaluation criteria of the NCHRP Report 350. These included the 820-kg car and the 2000-kg pickup truck at zero degrees on the end of the terminal (Report 350 tests 3-30 and 3-31, respectively), the car at post 2 at 15 degrees (critical impact point, test 3-34), and the pickup truck at the beginning of the barrier length of need at post 3 at 20 degrees (test 3-35).

The summary sheets for each of these tests are enclosed as Enclosure 2. We noted that the occupant impact velocities and the subsequent ridedown accelerations were below the preferred NCHRP Report 350 evaluation criteria for both end-on hits. We noted also that the 820-kg car was smoothly stopped in only 5.48 meters. After initial impact, the 2000-kg truck continued 32 meters behind the rail before stopping. Although the energy absorbing nature of this terminal significantly reduced the distance traveled behind the terminal after impact (compared to non-energy absorbing terminals), the post-crash trajectory seen in test 3-31 re-emphasizes the need for a clear, relatively traversable runout area behind all guardrail terminals.

We agree with your assessment that a reverse-direction impact test (test 3-39) is not necessary based on earlier tests on similar systems. Tests 3-32 and 3-33 (15 degree angle hits on the nose of the terminal with the 820-kg and 2000-kg vehicles) can also be waived because these tests are demonstrably less severe than tests 3-30 and 3-31 for gating terminals with designs similar to the FLEAT-350.

Based on our review of the information you submitted, we consider the FLEAT-350 to meet appropriate NCHRP Report 350 evaluation criteria at TL-3. Therefore, it may be used on the National Highway System (NHS) when such use is requested by a transportation agency. Since the FLEAT-350 is a proprietary terminal, its use on Federal-aid projects, except exempt non-NHS projects, is subject to the conditions noted in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is enclosed for your ready reference as Enclosure 3.

Sincerely yours,

Dwight A. Horne

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

3 Enclosures