In your December 3 letter, you requested formal acceptance of the Vermont Agency of Transportation’s GI-d W beam guardrail terminal at NCHRP Report 350 test level 2 (TL-2). You sent a videotape copy of the tests that were conducted on the GI-d design. A copy of the Texas Transportation Institute’s May 8, 1998 test report entitled “Testing and Evaluation of the Vermont W Beam Guardrail Terminal for Low-Speed Areas” by Arnold, Menges, and Butler was previously sent to all staff for informational purposes.

The GI-d terminal consists of a 3.8 meter W-beam rail section shop-bent to a 4.9 meter radius. The first post is offset 1475 mm from the tangent line of the guardrail proper, post 2 is at the midpoint of the curved section, and post 3 is at the tangent line of the barrier length of need. A steel rod which connects to the W-beam rail at post 3 and to a concrete anchor block between posts 2 and 3 provides the tensile strength needed to redirect vehicles impacting at or downstream from post 3. These and other design details are shown in Attachment 1.

Three tests were considered adequate to certify the GI-d as a TL-2 design and the test summaries are shown in Attachment 2. Since the terminal is classified as gaging, the angle tests at the nose were considered redundant, or was a head on impact with the 2000 kg pickup truck. Based on staff review of these tests, we agree that the GI-d meets the evaluation criteria for a TL-2 terminal and it may be used on the National Highway System (NHS) at locations where anticipated impact speeds are not expected to exceed 70 kmh. The GI-d must be installed on level terrain and with the full 1500 mm offset as shown on Vermont’s plan sheet. Since it is a gaging design, a reasonable recovery area behind and beyond the terminal is also needed wherever practicable.

Because the impact velocity and ride-down accelerations were very near the maximum values recommended in Report 350 in test 2-5-1, this terminal design has essentially no reserve capacity. To increase this capacity and to reduce the cost of the GI-d, the State may wish to replace the current anchorage system with the standard breakaway design that is used on the trailing end of the barrier not exposed to traffic. This modification would eliminate the concrete...
anchor, steel rod/hub back assembly, and the anchor rod connector. It would also eliminate the hard spot in the design that resulted in the high impact velocity and ride down accelerations noted in tests 2-34. No additional testing would be required should the Vermont Agency of Transportation elect to make this change. Please call Mr. Richard Powers at 12931 366-1020 if you have any questions regarding this recommended design modification.
Figure 1. Details of the Vermont terminal installation.
Figure 16. Summary of results for test 473080-2.
Figure 23. Summary of results for test 473080-3.
### General Information
- **Test Agency:** Texas Transportation Institute
- **Test No.:** 473080-4
- **Date:** 11/6/07

### Test Articles
- **Type:** Pressurized Gas
- **Orientation:** Standard Red
- **Vehicle:** 2000
- **Class:** 1967
- **Weight:** 2400 lbs

### Impact Conditions
- **Impact Velocity:** 15.16 ft/s
- **Angle - Radial:** 3.80 deg

### Exit Conditions
- **Speed Radial:** 54.26 ft/s
- **Angle - Radial:** 17.85 deg

### Component Risk Values
- **Impact Velocity (rad):**
  - x direction: 2.43
  - y direction: 5.63
- **Max. 0.050 in. Average B16:**
  - x direction: 2.17
  - y direction: 2.88
  - z direction: 1.48

### Last Angle Determination
- **Dynamic:** 0.33
- **Permanent:** 0.01

### Vehicle Damage
- **Exterior:**
  - VDS: 01F102
  - CRC: 01F102
- **Interior:**
  - OCCI: 1500000.00
  - Max. Occ. Contact: 0

### Post-Impact Behavior
- **(During 1.0 ft after Impact):**
  - Max. Rad Angle (deg): 9.6
  - Max. Pitch Angle (deg): 2.1
  - Max. Yaw Angle (deg): 26.8

Figure 29. Summary of results for test 473080-4.