

INFORMATION: Buried-in-backslope Guardrail
Anchor on 1V:4H Foreslope

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Mr. Dwight A. Horne's July 10, 1998 memorandum advised you that a buried-in-backslope W-beam terminal had been successfully tested to the National Cooperative Highway Research Program (NCHRP) Report 350 at test level 3 (TL-3) and provided information on the tested designs. These tests were run on installations with a 1V:10H foreslope (with and without a flat-bottomed ditch) and on an installation with a 1V:6H foreslope forming a V-ditch with a 1V:4H backslope. This non-proprietary terminal has now been successfully tested when installed over a 1V:4H foreslope. The design details for the 1V:4H foreslope installation are essentially identical to the 1V:6H foreslope design which were included with the original acceptance memorandum.

The earlier test on the 1V:6H foreslope and the subsequent test on the 1V:4H foreslope design, plus several transition and longitudinal barrier tests are included in the Texas Transportation Institute report titled "NCHRP Report 350 Assessment of Existing Roadside Safety Hardware" dated August 2000. This report is available on a CD with the same title, identified as Publication No. FHWA-RD-01-042 and dated January 2001. Copies of this CD will be mailed shortly to each FHWA Resource Center and Division office. Additional copies may be obtained upon request from Mr. Richard Powers by telephone at (202) 366-1320 or via e-mail at richard.powers@fhwa.dot.gov.

As noted in the original acceptance, a buried-in-backslope w-beam design should be the terminal of choice at locations where a natural backslope is reasonably close to the point where the barrier is introduced. When properly designed and located, this type of anchor eliminates the possibility of an end-on impact with the barrier terminal and minimizes the likelihood of vehicular intrusion behind the barrier. Key elements common to all buried-in-backslope designs include: (1) using a flare rate that is appropriate for the design speed of the highway until the ditch flow line is reached; (2) keeping the w-beam rail height constant relative to the roadway grade until the barrier crosses the ditch flow line (and beyond where practical); (3) adding a rubrail whenever the clearance from the bottom of the w-beam to the ground line exceeds approximately 450 mm; (4) providing at least 22 m of barrier extending upstream from the beginning of the area of concern to the point where the barrier crosses the ditch flow line (to allow some recovery area for an impacting vehicle that may ride up a relatively flat backslope and get behind the barrier);

and (5) using an anchor (concrete block or steel posts) that is capable of developing the full tensile strength of the w-beam rail.

The designs used in all the steel post anchor tests had 2.4-m long steel posts at all locations where there was a rubrail, and steel anchor posts consisting of three 1.8-m long posts spaced at 952 mm with four 15-mm bolts attaching the rail to each post. In reviewing crash test results and by comparing the tested anchor details to other crash-tested w-beam terminals, it appears that the tested anchor design may be unnecessarily conservative. Therefore, either or both of the following modifications may be made at the state's option: (1) the 2.4-m long posts beyond the ditch flow line may be shortened as long as a minimum of 1.2 m embedment remains below the existing ground line (in which case the total length of each post will vary since the distance from the ground line to the top of the w-beam rail decreases as the barrier is flared into the backslope) , and (2) the three 1.8-long steel posts used for the anchor may be reduced to two posts, spaced at 1905 mm, and their length may be reduced to 1.2 m, all of which will be below ground. As with all roadside safety hardware, agencies using either the tested anchor design or one or both of the modifications noted above are advised to monitor their installations to verify acceptable field performance.