U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: INFORMATION: W-Beam Guardrail Installations in Rock and in Mowing Strips

Date: March 10, 2004

/***Original signed by***/
From: John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

In Reply Refer To: HSA-10/B64-B

To: Safety Field
Federal Lands Highway Division Engineers

Strong-post (both wood and steel posts) w-beam guardrail is designed to absorb some crash energy through post rotation in the soil prior to post failure. Restraining these posts by setting them in narrow holes drilled into solid rock, by setting them in concrete, or by placing a "mowing strip" around the posts can lead to early post failure, placing more load on the rail element itself and possibly leading to rail rupture and subsequent penetration by an impacting vehicle. Such behavior has been modeled using finite element analysis and verified in a limited number of full-scale tests. Two papers were presented this year at the TRB meeting in Washington, D.C. that addressed concerns related to w-beam guardrail performance when its support posts were restrained from deflecting upon impact.

The first of these was the MwRSF report entitled "Development of Guidelines for Placement of Guardrail Posts in Rock" by Rohde and Herr. The authors' final recommendations for guardrail placement in rock are summarized in Enclosure 1. Simply stated, posts in solid rock should be set near the roadside edge of 530-mm to 580-mm diameter shafts drilled 610-mm (24-inches) deep, and backfilled with a compressible material (ASTM C33 coarse aggregate, size no. 57) so the post can rotate back approximately 380 mm (15 inches) at the ground line upon impact. For locations where the solid rock is below the surface, the size and depth of the drilled shaft will vary as noted as the enclosure, depending on the depth of soil above the solid rock.

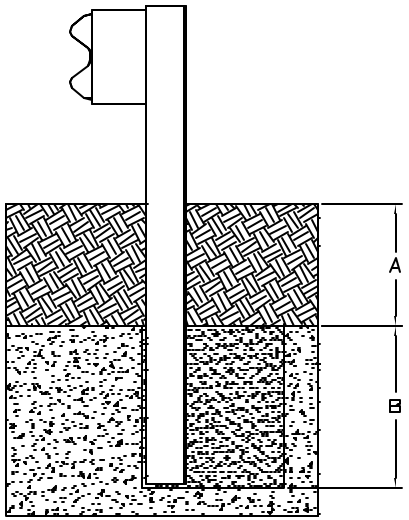
The second paper was the TTI report entitled "Evaluation of Guardrail Systems Performance When Encased in Pavement Mowing Strips" by Seckinger, Abu-Odeh, Bligh, and Roschke. The authors' summary recommendations for the design of mowing strips around w-beam barrier are shown in Enclosure 2. As noted, a minimum "leave-out" area in the mow strip that will allow at least 180-mm (7 inches) of post deflection at the ground line is recommended. This area is then backfilled with a low-strength concrete mix.

Concrete with a 28-day compressive strength of .85 Mpa (120 psi) was used in the crash tests, but any suitable backfill material having equal or lesser compressive strength may be used.

The AASHTO Task Force for Roadside Safety will review these recommendations and is likely to incorporate them in whole or in part into the next edition of the Roadside Design Guide. A secondary benefit of the recommended installation practices is increased ease of removal and replacement of any posts damaged in a crash. State DOT's should review their standard plans and specifications for strong post w-beam in light of these research findings and consider revisions where deemed appropriate. Electronic copies of both reports are included on the 2004 TRB CD that was given to all registered attendees.

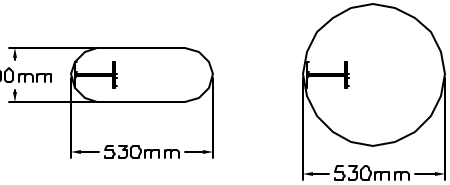
Attachments

Case 1



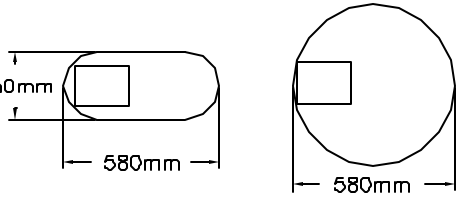
Plan View Steel Posts

Either hole configuration acceptable



Plan View Wood Posts

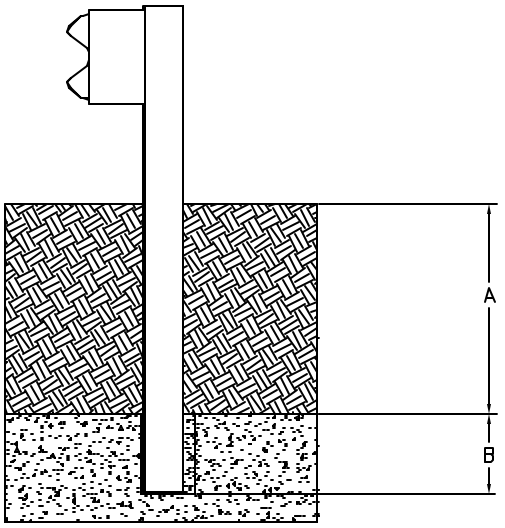
Either hole configuration acceptable

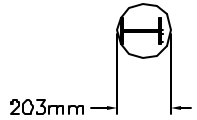


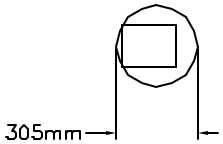
Notes

For overlying soil depths (A) ranging from 0 to 460 mm, the depth of required drilling (B) is equal to 610 mm.

Case 2

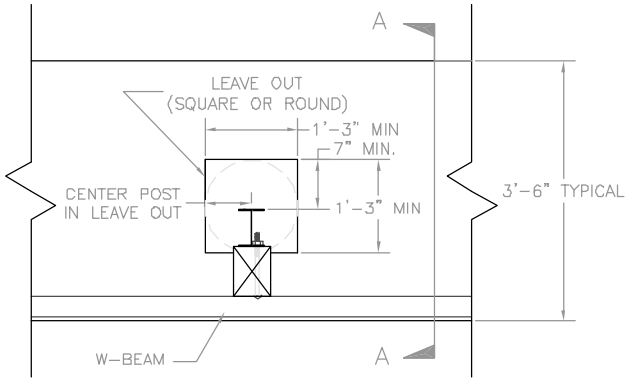




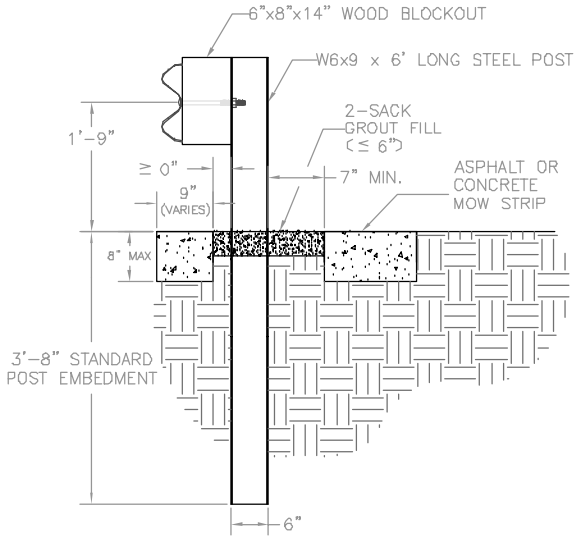


Notes

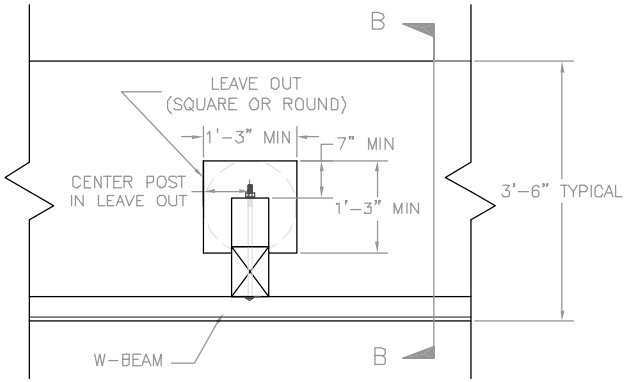
For overlying soil depths (A) ranging from 460 to the embedment depth of th post, depth of required drilling (B) is equal to either 305 mm or the desired embedment depth minus the depth of soil which ever is less.



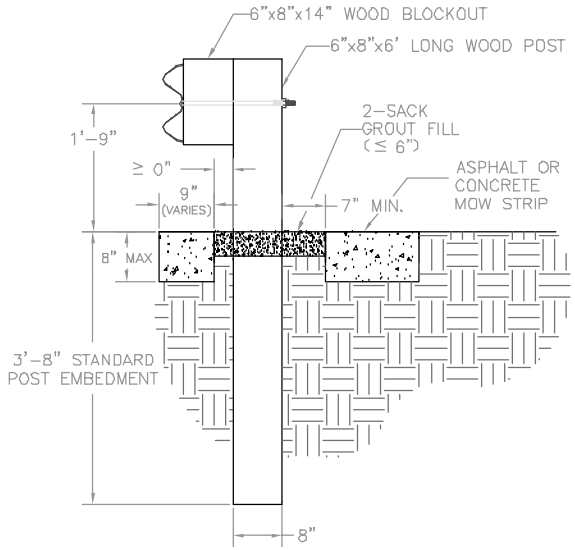
STEEL POST DETAIL



SECTION A-A



WOOD POST DETAIL



SECTION B-B