

Steel-Backed Timber Guardrail

Design and Construction Notes for Aesthetic Barriers

Steel-backed Timber Guardrail (January 15, 2002)

1. The steel-backed timber guardrail has been crash tested and meets the requirements of NCHRP Report 350. The blocked-out option, type A, is approved for Test Level 3 (design speeds of 100 km/h and less). The option without the block-out, type B, is approved for use for Test Level 2 (design speeds of 70 km/h and less). The preferred installation is the type A.
2. Numerous designs for the steel-backed timber guardrail and its terminals have been reviewed and tested during the development of this system. Federal Lands Highway Standard Drawings for berms, turn-down terminals, and back-slope anchored terminals reflect the best compromise of safety, aesthetics, and ease of construction. Due to the possible effect on the crashworthiness of the guardrail, any modifications to Federal Lands Highway Standards for the steel-backed timber guardrail must be approved by the Federal Lands Highway Office.
3. The grading in front and directly behind the guardrail and terminals must be at a slope of 1:10 or flatter for the guardrail to be effective.
4. The maximum dynamic deflection of the steel-backed timber guardrail is approximately 215 mm for design speed of 70 km/h. The dynamic deflection is approximately 580 mm for design speed of 100 km/h. The back of the rail must be set at least these distances from a fixed objects, such as a tree or bridge pier.
5. Field modifications to the structural steel, such as enlargement of the bolt slots, are not permitted, due to the effect on the crashworthiness of the system.
6. There should be at least 600 mm between the back of the guardrail posts and the top of a 1:2 slope or steeper. If this is unobtainable, the length of the guardrail posts should be increased to 2.4 m. The increase strength of the 2.4 m posts without the 600 mm soil backup is marginal and should only be used for short segments.
7. The Federal Lands Highway Office has standard drawings designed specifically for the steel-backed timber guardrail for a back-slope anchored terminal, a berm, and a flared anchored terminal (turn-down), and may be used:
 - a. Where there is a back-slope to tie to, the preferred terminal is the back-slope anchored terminal (BAT). This terminal has been approved for use by the Federal Highway Administration. The terminal used with the type A block-out is approved for NCHRP 350, Test Level 3. The Type B, non-blocked system is approved for NCHRP 350, Test Level 2. The Crash

tests with similar designs with W-beam guardrail have established a weakness in this design where the guardrail crosses a ditch. Due to this weakness, ditches under this terminal should be as flat as possible. It is recommended that the sideslopes of the ditches be no steeper than 1:10.

- b. Where there is adequate room, and no back-slope to tie to, the preferred terminal is the flared anchored terminal (FAT) with an earth berm. The terminal section should be located outside the clear zone. The earth berm should be oriented approximately parallel to the roadway. It is intended that each berm will be stacked to fit its particular location. For safety, aesthetics, and maintenance considerations, it is desirable to flatten the slopes of the berm as much as possible. A 1:3 sideslope on the berm facing the roadway is considered minimally acceptable. It is also desirable to increase the height of the berm, but the 1:20 approach slope must be maintained.
 - c. Where it is not possible to construct an earth berm or tie to a backslope, the guardrail may be terminated using the FAT without a berm. Crash tests on similar turn-down designs have demonstrated the potential for this type terminal to launch a vehicle or produce a rollover. However, this terminal is superior to leaving the exposed guardrail end that could snag or even penetrate a vehicle. The widened shoulder area and guardrail flare aids is providing stability for a vehicle riding up on the terminal.
8. The Federal Lands Highway Office has standard drawings design specifically for the steel-backed timber guardrail to connect to a straight parapet wall. Currently the only approved transition that has been successfully tested to NCHRP 350 test levels is a transition to a straight parapet/wall utilizing a rub-rail. This transition was tested to NCHRP 350, Test Level 2 (design speeds of 70 km/h and less). Additional transitions are currently being revised for approval by the Federal Highway Administration.