

Project Title: Placement of Guardrail on Slopes
State Technical Representative: Dick Albin
TTI Project Manager: Akram Abu-Odeh
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Project Objective

Simulate and develop a guardrail design that meets NCHRP TL-3 crash test criterion and can be installed with the face of the beam element aligned with the slope break.

Work Performed to Date

The five bogie tests of the W6x8.5 steel posts were analyzed to identify the best suited post length for the on slope placement. Moreover, simulations of these bogie tests were conducted to calibrate the post-soil model for the future full scale simulation of the guardrail on slope system.

Results of Work Performed

An energy based approach was used to identify the best post length and slope configuration. Based on the bogie tests the 7-ft and the 8-ft long posts with 2H:1V slope ratio (Tests 2 and 3 respectively) have the closest energy profile as compared the reference test (Test 1) as shown in figure 1 below.

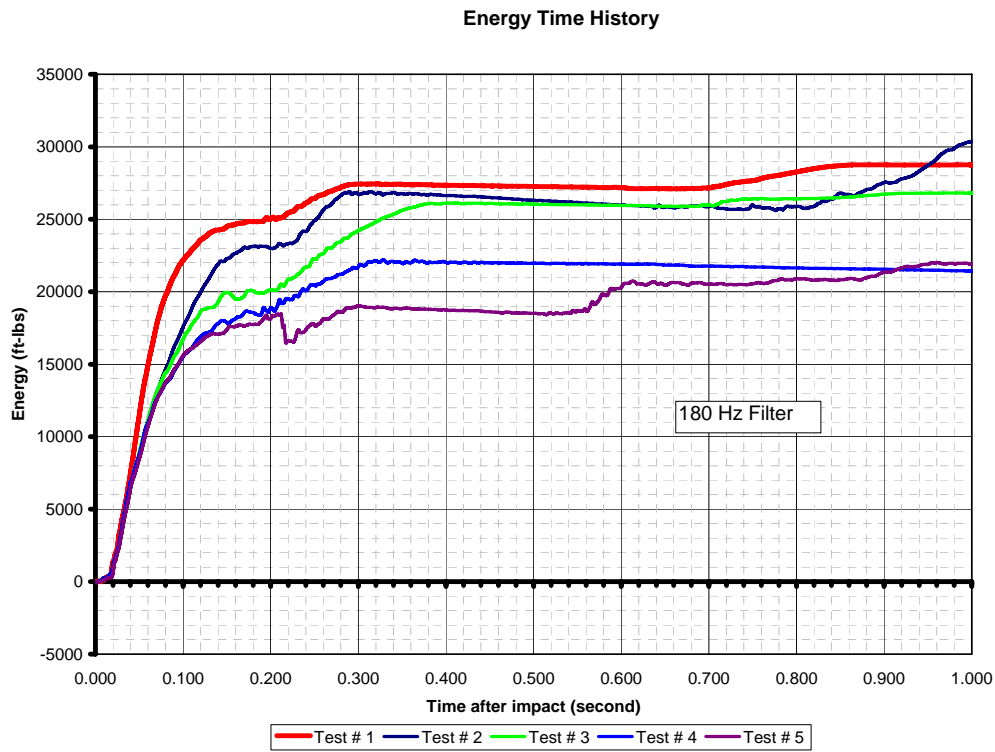


Figure 1 Energy plots for the bogie tests.

However, when the posts were extracted from the soil after testing, the 7-ft post did not show any sign of yielding or permanent deformation (see figure 2). Therefore, the 7-ft post was not considered sufficient for on slope placement, and the 8-ft post with 2H:1V slope was selected for further investigation.



Figure 2 Extract posts after bogie tests

Simulation of key bogie tests was completed. Tests that were simulated include test 1 (6-ft post on flat ground), test 2 (7-ft post on 2V:1H slope) and test 3 (8-ft post on 2V:1H slope). Comparisons between tests and simulations for test 3 are shown in figures 3 and 4 below. The simulation results show good correlation with the test data.

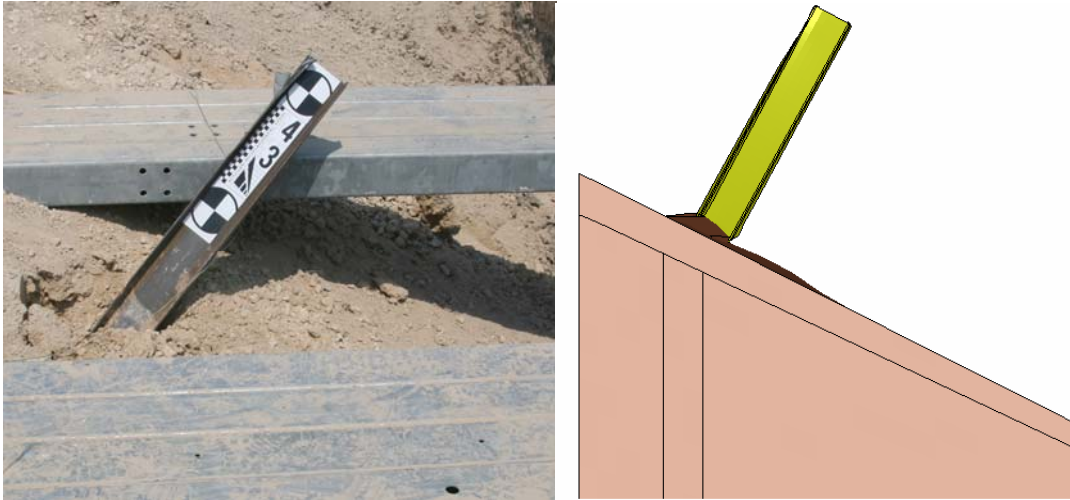


Figure 3 Test 3 and simulation of test 3.

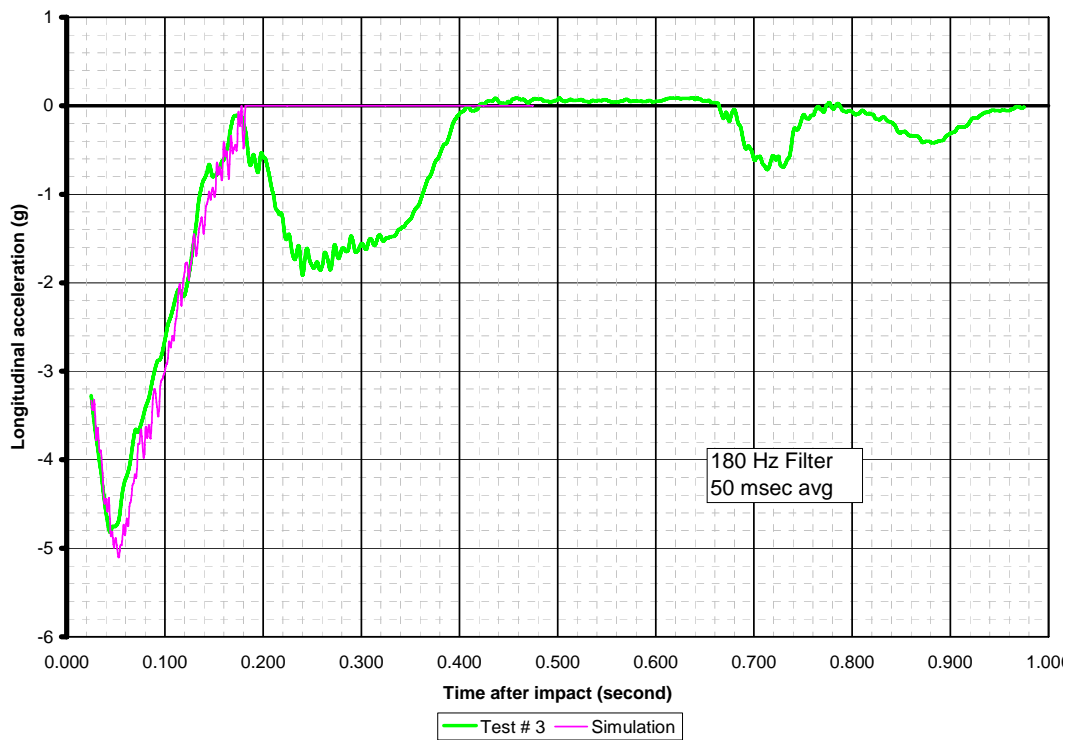


Figure 4 Acceleration for both bogie test 3 and its simulation.

Work Remaining to be Completed

Two models of the guardrail system on slope are being constructed, one with the standard post spacing (6-ft 3-in) and the other one with half of the standard spacing (3-ft 1.5 in) . The regular post spacing system simulation will be conducted first to examine the system behavior at this space interval. If the performance looks unsatisfactory or marginal, then the half spacing system simulation will be conducted and the response will be studied.

A design recommendation will be made to the project's pooled fund technical representative based on the results of the full-scale simulations. Once the final design of the guardrail system is approved, a full scale crash test will be conducted. The crash test is currently scheduled in the third week of November 2006.