

**Project Title:** Placement of Guardrail on Slopes  
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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**

Five bogie tests of W6x8.5 steel posts were conducted. The first test was a reference test of a standard 6-foot post installed on level ground with slope break 2 feet behind the back of the post. The second test was conducted on a 7 foot steel post placed on a 2H:1V slope one foot down from the slope break. The third and fourth tests were performed on 8-foot long posts placed one foot down from the slope break on 2H:1V and 1.5H:1V slopes respectively. The last test was conducted on a 9 foot steel post placed on a 1.5H:1V slope one foot down from the slope break. The nominal target speed for the 1990 lb bogie vehicle with a crushable honeycomb nose assembly was 21 mph.

**Results of Work Performed**

In all tests except test 2, the posts yielded at a point below grade and were displaced through the surrounding soil. In test 2, the 7-foot long post did not plastically bend, but merely deflected through the surrounding soil. A summary of the bogie test results is shown in the table 1.

**Table 1 Summary of bogie tests**

Test #	1	2	3	4	5	Units
Initial Velocity	20.8	22.2	20.4	21.1	21	mph
Height of Post	72	84	96	96	108	in
Embedment depth	44	48.5	60.5	58	70	in
Distance To Bend From Soil Surface	8	N/A	15.5	15	16.5	in
<b>Max force 10-ms Average</b>	16.82	11.15	11.40	11.96	11.01	Kips
<b>Max force 50-ms Average</b>	14.02	8.45	9.59	8.73	8.92	
<b>Max Kinetic Energy</b>	28757.61	26911.96	24262.77	21839.22	19036.93	ft-lbs
<b>Max Accel 10-ms Average</b>	-8.45	-5.61	-5.73	-6.01	-5.53	g
<b>Max Accel 50-ms Average</b>	-7.05	-4.25	-4.82	-4.39	-4.48	
<b>Peak Dynamic Deflection Due to Primary Impact in X Dir.</b>	480	818	635	722	695	mm
	18.9	32.2	25.0	28.4	27.4	in

**Work Remaining to be Completed**

Work on simulating some of these bogie tests continues. Additionally, work is underway on preparing a full scale simulation of the final guardrail system configuration. A full scale crash test will be conducted after the predictive impact simulations have been completed and the design details finalized.