

Project Title: Placement of Guardrail on Slopes
State Technical Representative: Dick Albin
TTI Project Manager: Akram Abu-Odeh
Project Contract Period: 4/01/2006-6/31/2007
Reporting Period: 1/01/2007-3/31/2007

Project Objective

Develop a guardrail design that meets NCHRP Report 350 TL-3 crash test criteria and can be installed with the face of the beam element aligned with the slope break.

Work Performed to Date

Two additional analyses were conducted on guardrail on slope systems. This brings the total systems analyzed to three. All the systems shared the following parameters and conditions:

- 1- The posts were placed 1-foot on the 2H:1V slope as shown in figure 1 below..
- 2- All the posts are 8-ft long W6x9 steel posts with a standard block out.
- 3- Test conditions are per NCHRP Report 350 test designation 3-11 (2000 kg pick up, impact speed is 100 km/hr and impact angle 25 degrees).

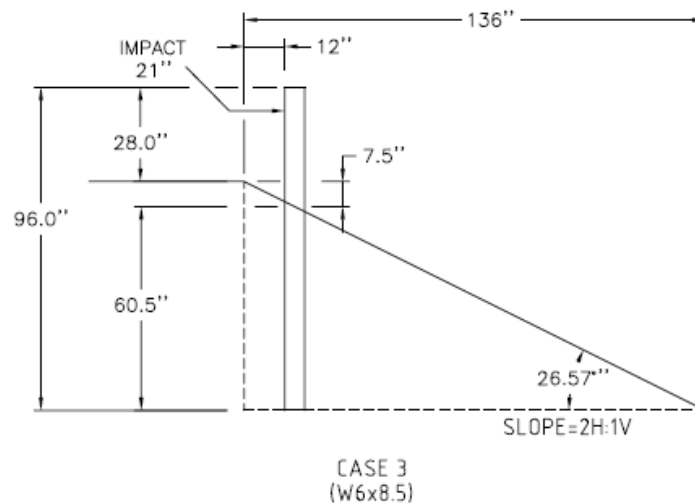


Figure 1 Cross section of post placement.

The three guardrail systems simulated are:

- Case 1- A 12-Gauge W-Beam with standard (6'-3") post spacing as shown in figure 2.
- Case 2- A 12-Gauge W-Beam with half (3'-1.5") post spacing as shown in figure 3.
- Case 3- A 10-Gauge W-beam with standard (6'-3") post spacing as shown in figure 2.

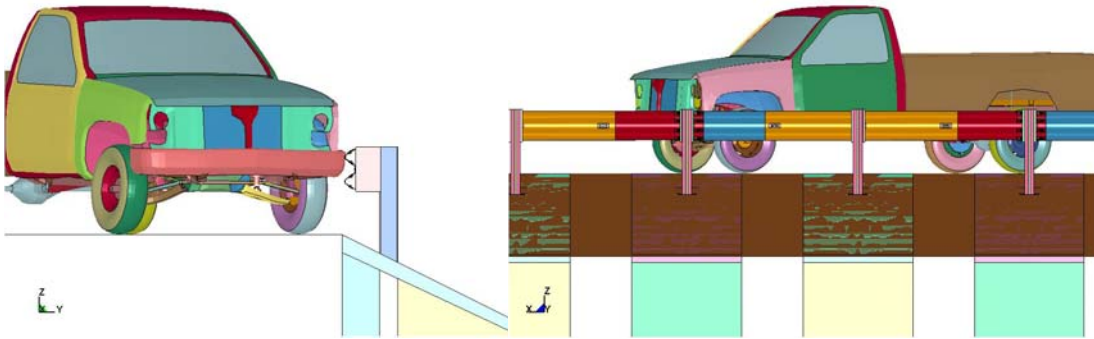


Figure 2 Guardrail on slope system with 6'-3" post spacing.

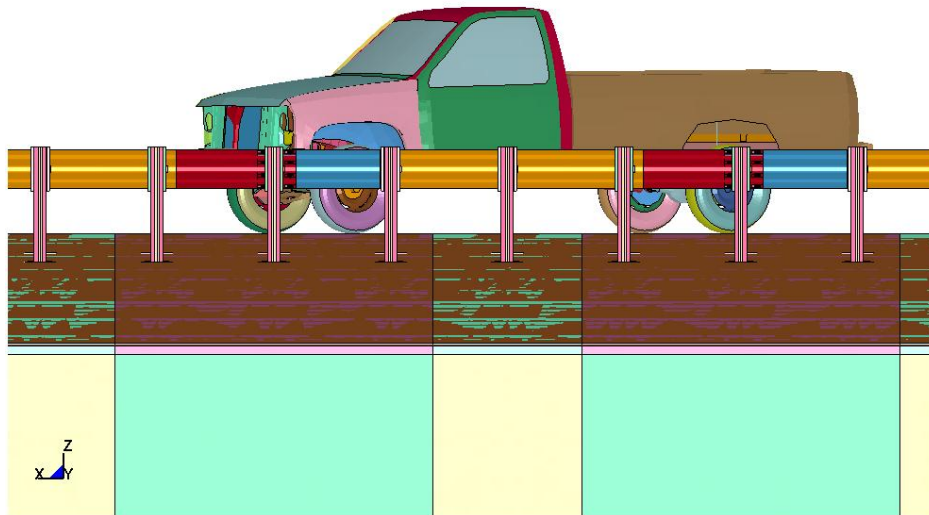


Figure 3 Guardrail on slope system with 3'-1.5" post spacing.

Results of Work Performed

Case 1: The vehicle would most likely over ride the w-beam rail. The simulation suggests that the truck would continue to climb and over-ride the rail as shown in figure 4.

Case 2: The system would most likely re-direct the vehicle without overriding, however; there is increased snagging between the front left wheel and the posts. This caused increased pitching of the vehicle and subsequently an increased roll angle. This is shown in figure 5 below.

Case 3: The system would most likely re-direct the vehicle without overriding. Snagging and pitching is not as significant nor roll angle. A snap shot of the simulation is shown in figure 6 below.

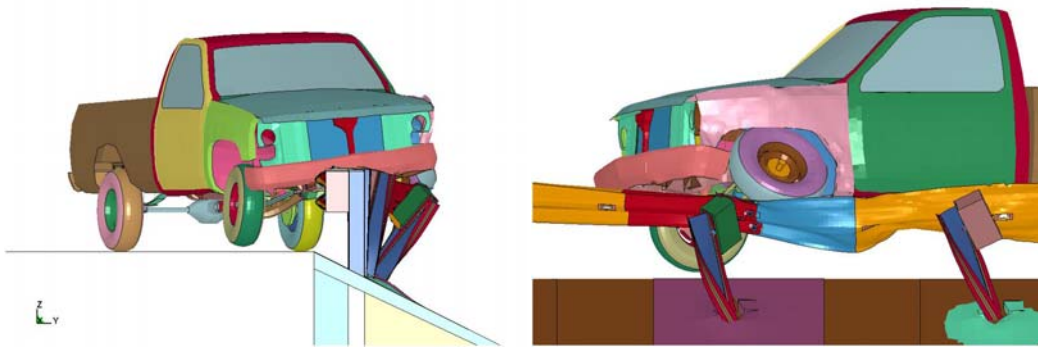


Figure 4 Vehicle-barrier interaction associated with test 3-11 impact of a guardrail on 2H:1V slope with 8-ft long posts spaced at 6'-3".

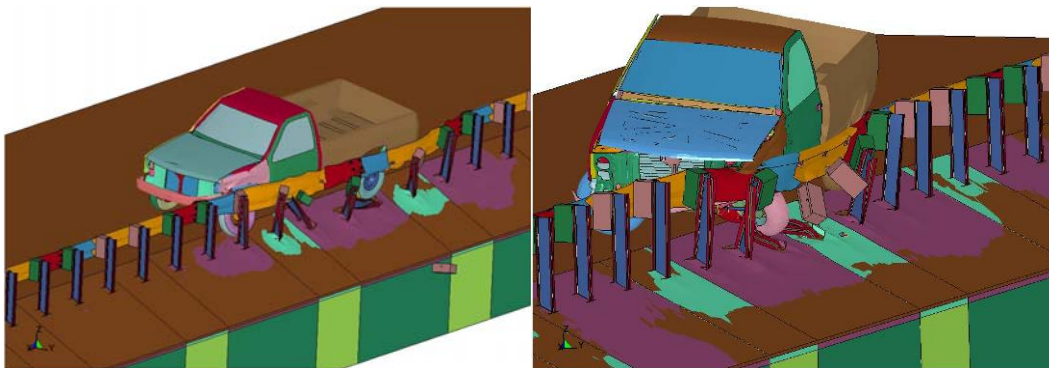


Figure 5 Simulation with 3'-1.5" post spacing.

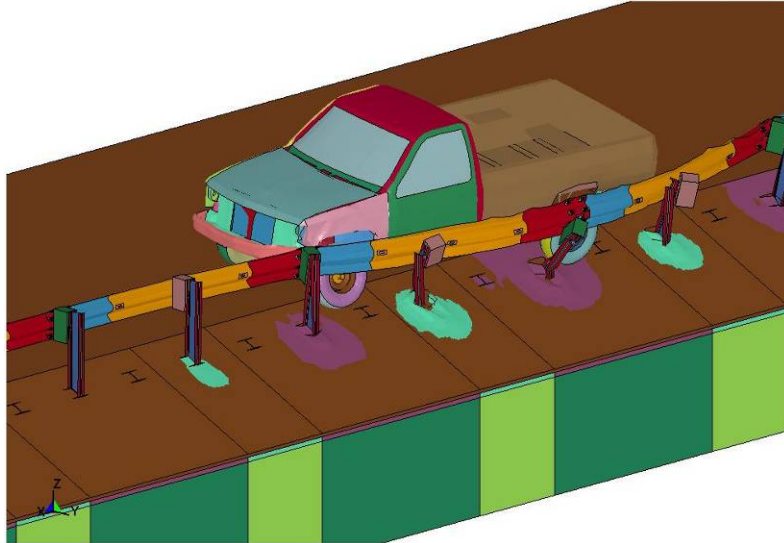


Figure 6 Guardrail on slope system with 6'-3" post spacing and 10-Gauge W-Beam.

Work Remaining to be Completed

A recommendation was made to the State Technical Representative to use Case 3 design, the 10-Gauge W-Beam rail with a standard (6'-3") post spacing, for a full scale crash test. Once the final design of the guardrail system is approved, a full-scale crash test will be conducted to verify impact performance.