

**Project Title:** Placement of Guardrail on Slopes  
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**Project Contract Period:** 4/01/2006-6/31/2007  
**Reporting Period:** 11/01/2006-12/31/2006

## 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

Based on the analysis of the bogie tests and simulations that were previously reported, a guardrail design was selected for further evaluation through finite element modeling and simulation. The candidate design incorporates 8-ft long W6x9 steel posts with the 12-gauge W-beam rail element aligned with the break point of a 2H:1V slope. A full guardrail system with the above design parameters was modeled as shown in figure 1. The model was then used to simulate the impact of the 2000 kg pick up truck test vehicle impacting the rail at 100 km/hr and 25 degrees (i.e., NCHRP Report 350 test designation 3-11).

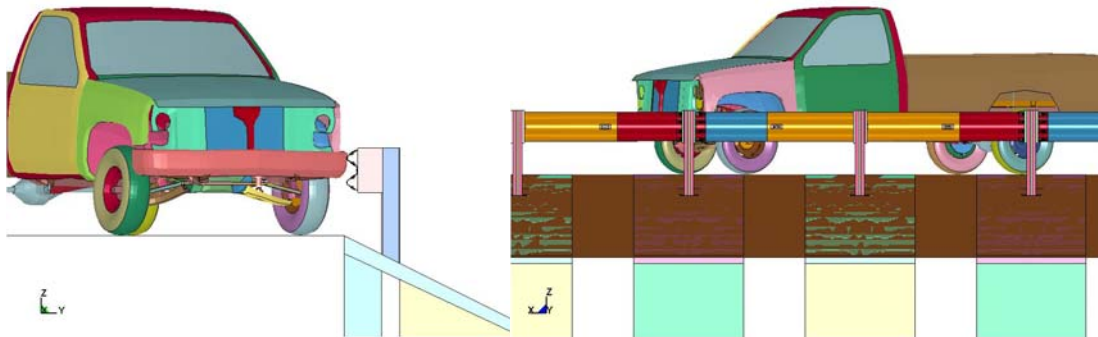
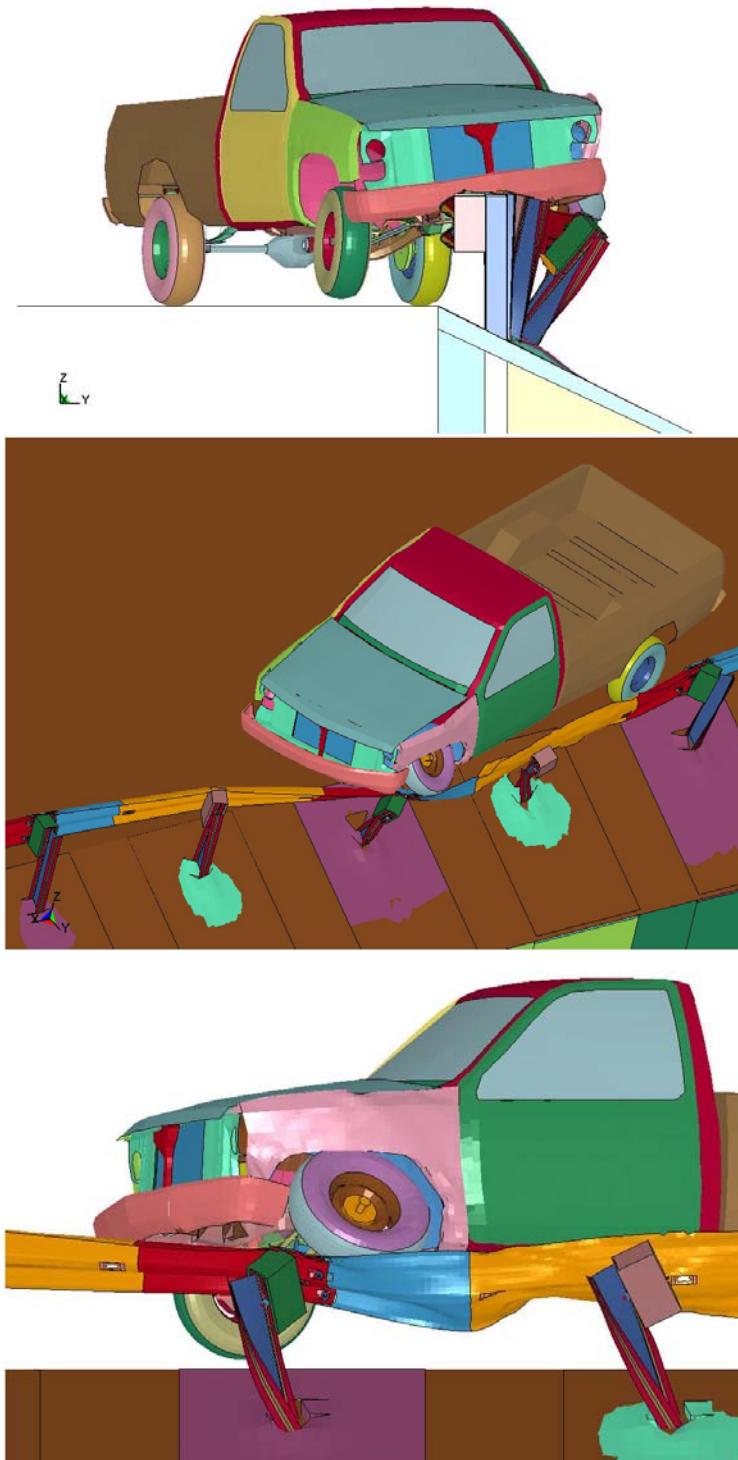


Figure 1 Guardrail on slope system with 6'-3" post spacing.

## Results of Work Performed

Early in the simulation, the front left corner of the truck began to over-ride the rail. As the simulation progressed, the front left tire also began to over-ride the rail. The simulation stopped just as the tire passed over the rail. Figure 2 shows images of the truck-rail interaction during this simulation. It is evident that the truck would continue to climb and over-ride the rail, and that the system would not be considered effective in redirecting the truck.



**Figure 2 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".**

### **Work Remaining to be Completed**

Another model of the guardrail system on slope with half of the standard post spacing (i.e., 3 ft-1.5 in) was constructed to investigate if the increased lateral stiffness would mitigate the truck over-ride problem. This guardrail system model will be subjected to an impact simulation following NCHRP Report 350 test 3-11 impact conditions (i.e., 2000-kg pickup impacting at 100 km/hr and 25 degrees). A design recommendation will be made to the project's pooled fund technical representative based on the results of that full-scale simulation.

Once the final design of the guardrail system is approved, a full-scale crash test will be conducted to verify impact performance. The crash test is currently scheduled in the first week of April 2007.