

# Expanding the safety performance of guardrail end treatments

## Side-hit crash tests show positive results

A team of researchers with the Texas Transportation Institute's Safety and Structural Systems Division recently completed a set of side-impact crash tests designed to improve guardrail end treatments. The research was done in support of suggested changes in National Cooperative Highway Research Program (NCHRP) Report 350. "We expect the next set of crash guidelines, coming out in the next few years, to contain a side-impact requirement. We are showing that side-hit protection is practical. We will be ready," says Dean Alberson, a key member of the research team working on the effort.

Traditionally, crash testing is done on a straight track with the test car impacting the end treatment head-on. Recent studies and statistics show that in real-world crashes, the driver often loses control of the vehicle in such a way that the impact occurs with the car traveling sideways into the object. This "off-track" side-impact factor is something that must be considered as safety engineers continue to improve guardrail design.

In the last ten years, the safety of guardrail end treatments has been vastly improved with the advent of ET-2000, SRT and similar designs. Now a growing contingent in the safety field is suggesting these new designs may also be significantly improved. Malcolm Ray and John Carney, et al., estimate a loss of \$3 billion a year because a significant percentage of cars strike fixed roadside objects

going sideways, a condition for which engineers have never designed (1).

The original recommendations for an optional side-impact test in NCHRP Report 350 were to test at a speed of 30 mph. "This was considered then the highest speed we could hope to accommodate without significant injury to passengers," says Alberson. Based on statistical evidence that supports the likelihood that cars traveling sideways are quite often moving at speeds faster than that suggested speed of 30 mph, TTI researchers were successful in designing for and conducted crash tests using an impact speed of 35 mph.

"Nine percent more collisions can be accommodated if design speed is raised from 30 mph to 35," says Don Ivey, TTI safety engineer and inventor of one of the side-hit adaptations called CPSI. "Tests of four combinations of guardrail end treatments with side-hit modifications show conclusively we can economically improve side-hit safety," says Ivey

*Researchers used the following estimates in computing the cost-effectiveness of implementing the modifications:*

- There are now about 750,000 guardrail end treatments in place in the U.S.
- There are over 15,000 collisions with end treatments each year.
- There are over 100 deaths and 5,000 injuries each year.
- Current end treatments can be modified for side hits to reduce deaths and injuries by 50 percent.
- Societal cost is over \$500 million per year.
- The cost of those modifications will average \$100 or less per end treatment.
- Those modified end treatments could be placed in the field at the rate of 30,000 per year for the next ten years.

"With an investment of \$30 million over ten years, we calculate a savings of \$50 million," says Ivey. "That's a benefit/cost ratio of 1.7." The key findings of this research were presented at the 80th Annual Transportation Research Board Meeting (Paper No. 01-2791).



For more information, contact **Don Ivey** at (337) 824-59865 or [d-ivey@tamu.edu](mailto:d-ivey@tamu.edu).

### REFERENCES

1. a. Ray, M.H. Hargrave, M.W., Carney III, J.F., and K. Hiranmayee.

"Side Impact Crash Test and Evaluation Criteria for Roadside Safety Hardware." Paper No. 980797, Transportation Research Board Annual Meeting, Washington, D.C., January 1998.

b. Ray, M.H., and J.F. Carney III. "Side Impact Crash Testing of Roadside Structures." Report FHWA-RD-92-079. Vanderbilt University, May 1993.



The modified ET-2000 guardrail end treatment performed well under a 35 mph side impact crash test.

