



# LOW COST LOCAL ROAD SAFETY SOLUTIONS

**W**-beam guardrail is a relatively inexpensive barrier that reduces the severity of run-off-road crashes by shielding motorists from hazards in a variety of roadside situations.

## W-Beam Guardrail Reduces the Number and Severity of Run-Off-Road Crashes

According to the National Highway Traffic Safety Administration, in 2005, 80 percent of run-off-road fatalities occurred on rural roadways. About 90 percent of these happened on two-lane roadways. Many transportation agencies are installing guardrail in an effort to reduce the number of fatalities and serious injuries that result from run-off-road crashes. Guardrail prevents vehicles from leaving the roadway and striking a hazard by containing and redirecting the vehicle.

W-beam guardrail (weak-post and strong-post) has been used for decades because it is an effective guardrail system that can be used in a variety of roadside situations. In fact, a recent state survey found that strong-post W-beam guardrail is the most commonly used guardrail system in the United States.<sup>1</sup> W-beam guardrail can shield fixed objects and steep slopes, can be used around curves to prevent vehicles from leaving the roadway, and can be used at bridge approaches where there is relatively little room for lateral deflection. Being able to install the same guardrail system at numerous locations simplifies maintenance and repair, because a wide variety of inventory does not have to be managed and personnel can be trained to repair fewer systems.



Courtesy of Glenn Schulte

The cost of W-beam guardrail varies depending on the type of posts used and the post spacing, but overall W-beam guardrail is relatively inexpensive and readily available in large quantities from many suppliers. In addition, the maintenance costs associated with strong-post W-beam guardrail are typically less than those associated with more flexible systems, because strong-post W-beam guardrail yields lower deflections and when damage is not to the safety components it may not need repair at all. Thus, when considering initial and maintenance costs, W-beam guardrail yields life cycle cost savings.<sup>1,2</sup>

Evidence from 32 studies that have quantified the effects of guardrail shows that guardrail along the edge of the road reduces the number of crashes and their severity. More specifically, guardrail reduced the crash rate by approximately 30 percent and, given that a crash occurred, the number of fatality and injury crashes by approximately 45

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percent and 50 percent, respectively. These findings apply both to new installations and to replacements of old installations.<sup>3</sup>

Another study investigated the performance of guardrail with respect to reported impacts (approximately 10 percent of the total impacts) and unreported impacts (approximately 90 percent of the total impacts). Assuming no injuries or fatalities occur in the unreported impacts, only 6 percent of all guardrail impacts involve an injury or fatality. In addition, a portion of the guardrail impacts resulting in injuries or fatalities involve obsolete, improperly constructed, or improperly maintained barriers and atypical impact conditions. When these are removed, the success rate is at least 97 percent. Thus, only 3 percent of guardrail impacts result in injuries or fatalities.<sup>4</sup>

Recent in-service evaluations of guardrail systems in Connecticut, Iowa, and North Carolina found a similar 3 percent severe injury rate for W-beam guardrail (weak-post and strong-post). In addition, approximately 70 percent of police-reported collisions with W-beam guardrail resulted in property damage only.<sup>5</sup>

Recently, Florida's Turnpike Enterprise implemented an initiative to install median guardrails to protect 187 miles of the Turnpike Mainline. Crash data compiled by Turnpike Traffic Operations shows a nearly 70 percent reduction in cross over crashes. Using protective barriers similar to the median guardrail system, Florida's Turnpike Enterprise is also implementing a plan to prevent motorists from veering off the Turnpike and entering the canals that parallel much of the Turnpike Mainline.<sup>6</sup>

Overall, evidence suggests that the installation of W-beam guardrail is a low cost safety improvement that reduces the number and severity of run-off-road crashes.

Additional information on the characteristics and performance of W-beam guardrail can be found in the *Roadside Design Guide*<sup>2</sup> and National Cooperative Highway Research Program (NCHRP) Synthesis 244.<sup>1</sup> Additional information on W-beam guardrail repair and maintenance can be found in Federal Highway Administration Report FHWA-RT-90-001 which can be accessed at <http://www.fhwa.dot.gov/tfhr/safety/pubs/90001/90001.pdf>.



Courtesy of Andy Artar

<sup>1</sup> Ray, M.H. and R.G. McGinnis. *Guardrail and Median Barrier Crashworthiness: A Synthesis of Highway Practice*. NCHRP Synthesis 244, Transportation Research Board, National Research Council, Washington, D.C., 1997.

<sup>2</sup> *Roadside Design Guide*. 3<sup>rd</sup> Edition. American Association of State Highway and Transportation Officials, Washington, D.C., 2002.

<sup>3</sup> Elvik, R. The Safety Value of Guardrails and Crash Cushions: A Meta-Analysis of Evidence from Evaluation Studies. In *Accident Analysis and Prevention*, Vol. 27, No. 4, 1995, pp. 523-549.

<sup>4</sup> Michie, J.D. and M.E. Bronstad. Highway Guardrails: Safety Feature or Roadside Hazard? In *Transportation Research Record: Journal of the Transportation Research Board*, No. 1468, Transportation Research Board, National Research Council, Washington, D.C., 1994, pp. 1-9.

<sup>5</sup> Ray, M.H., J. Weir, and J. Hopp. *In-Service Performance of Traffic Barriers*. NCHRP Report 490, Transportation Research Board, National Research Council, Washington, D.C., 2003.

[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_490.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_490.pdf).

<sup>6</sup> Fierro, D. Turnpike Puts Safety First With Median and Canal Barrier Program. In *Florida Transportation Monthly*, January 2007. <http://www.flatrans.com>.