

JOINT TRANSPORTATION RESEARCH PROGRAM

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Performance Assessment of Road Barriers in Indiana

Introduction

An in-service performance study of widely used types of barriers was conducted for various road conditions in Indiana to help designers and highway engineers select the most promising solutions among viable alternatives. The current guidelines for median barriers recommend conducting such studies. The recent introduction of high-tension cable barriers in medians has provided highway agencies with an additional barrier alternative that must be evaluated together with the other alternatives.

The in-service performance study investigated three types of road barriers: concrete walls, W-beam guardrails, and high-tension cable barriers installed on divided roads in Indiana. The performance for barriers on undivided roads was not analyzed in this study due to the limited crash data and the lack of embankment information. Nevertheless, the results obtained for the studied roads and the past research on the impact of medians on safety allowed extrapolation to include undivided multilane roads among the results for implementation. Furthermore, the obtained results for cable barriers allowed including double-run median cable barriers, which are not yet implemented in Indiana.

Findings

The evaluation of the in-service performance of barriers considered all types of crashes whose frequency and severity might be affected barriers: run-off-road crashes, rollovers, collisions after vehicle's redirection, and head-on collisions. Three effects of barriers were investigated: the effect of barriers on the crash frequency (road level), the effect of barriers on the probability of harmful events (crash level), and the effect of harmful events on the probability of injury outcomes (person level).

For median barriers, this study found that the number of barrier-relevant crashes was higher with the use

of median barriers, mostly due to the additional collisions with barriers and the increased redirecting of vehicles back to traffic. These undesirable effects of barriers were surpassed by reducing the frequency of highly hazardous events such as cross-median crashes, rollover events, and collisions with firm roadside hazards. This shift from more harmful to less harmful events substantially reduced both the fatalities and the severe injuries.

The average (unit) crash costs were estimated for roads without barriers and for roads with various barrier scenarios. The crash costs were reduced by 50% where cable barriers were in medians wider than 50 feet and where concrete barriers or guardrails were in medians less than or equal to 50 feet wide. Roadside barriers (guardrails) reduced the unit crash costs by 20% to 30%.

Median cable barriers were found to be the most effective among all the studied barriers due to both the smallest increase in crash frequency and least severe injury outcomes. A cable barrier's offset to the travelled way was also investigated in this study. When considering vehicles moving in one direction, the nearside cable barriers installed at an offset of less than or equal to 30 feet performed better than far-side cable barriers with a larger offset, thanks to the better protection they provide against rollovers in the event of impact with the median



drain. Consequently, the biggest safety benefit can be expected where cable barriers are installed in the median along both its edges.

Implementation

Implementation of the results of this study is facilitated with a set of crash modification factors (CMFs) and unit crash costs (UCCs) estimated for the studied 51 road-barrier scenarios. These scenarios involve concrete walls, guardrails, and single- and double-run cable barriers installed in medians, as well as roadside guardrails installed on one or both sides of divided and undivided multilane roads. The estimated CMFs and UCCs are key components of a procedure developed for evaluating the safety benefits of barriers using either comprehensive or

economic costs. The procedure is applicable to multilane new and modernized existing roads.

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