Joint Transportation Research Program

Principal Investigator: Andrew P. Tarko, Purdue University, tarko@purdue.edu, 765.494.5027

Program Office: jtrp@purdue.edu, 765.494.6508, www.purdue.edu/jtrp

Sponsor: Indiana Department of Transportation, 765.463.1521

SPR-3550 2012

Use of Barriers in Rural Open Road Conditions —A Synthesis Study

Introduction

Although sufficiently wide medians and clear zones improve roadside safety, the AASHTO Design Policy allows for the use of barriers under restricted conditions. Recent experience with Indiana's I-69 corridor challenges the current design practice with regard to medians and clear zones in rural areas. Significant savings could be realized by the Indiana Department of Transportation (INDOT) if the medians and clear zones on new and reconstructed facilities were narrower than prompted by the current design standards. Modern protective devices, such as high-tensioned cable barriers, offer protection with a lower risk of vehicle damage and personal injury than do traditional concrete barriers and guardrails. Although the increased cost of right of way (ROW) is the primary reason for this synthesis study, rapidly growing personal injury medical costs must also be considered. The practice of making investments in road infrastructure is based on benefit-cost analysis, which includes both ROW and medical costs.

The objective of this synthesis study is to identify if the existing design guidelines and research reports can support a new practice of narrowing the median and the clear zones of an existing rural four-lane interstate to accommodate two additional traffic lanes without widening the current ROW. The study follows three research steps leading toward the study objective:

1. Identify the existing body of knowledge pertaining to the safety impact of the median and clear zone width and the presence of median and roadside barriers and guardrails.
2. Identify the design conditions and corresponding solutions involving barriers and guardrails that are acceptable from the point of view of safety and costs. This objective will be accomplished only if sufficient knowledge exists to allow making such assertions.
3. Identify research needs to accomplish the second objective, if it is not attainable with the documented current knowledge.

Findings

The efforts presented in this report were conducted by the Purdue research team in order to understand the mechanism of roadway departure crashes and to identify the effects of several potential strategies. This report provides an overview of the statistics at the national level, a literature review from both the United States and other countries where a narrow or no clear zone is used, and a simulation study. Potential strategies for restricted ROW scenarios were identified, as well as the limitations of the study and future research directions.

The results of this study are applicable to depressed medians with a width of about 45 feet and without barriers. The findings are summarized in the table below.

The limitations of this study apply primarily to the simulation study executed with the Roadside Safety Analysis Program (RSAP). Some of our concerns with RSAP might have been addressed in its new version, which became available after we completed our research. Future research should address the limited understanding of the mechanism of vehicle encroachment and rollover, and current knowledge of the safety effect of the barrier offset needs to be confirmed and further extended. The presented results are based on past research and our simulation experiments. A statistical analysis of the safety performance of the existing Indiana barriers should complement our findings.

Implementation

The design recommendations and corresponding tables will be discussed by the INDOT Division of Highway Design and Technical Support and considered for implementation where feasible by means of appropriate revisions to the Indiana Design Manual. broadly circulated to employees.

Recommended Design Solutions for Adding Two Traffic Lanes to Four-Lane Rural Freeways

Median Width (ft)	Clear Zone Width (ft)	Hazard Outside Clear Zone	Recommended New Lanes Placement	Recommended Median Barrier	Recommended Clear Zone Barrier	Crashes Cost	Remarks
44	26	No	Both in median	Barrier	None	Increases	Requires benefit-cost analysis
44	26	Yes	One in median; one in clear zone	Barrier	Barrier	Reduces	
44	32–44	No	One in median; one in clear zone	Barrier	None	Reduces	
44	32–44	Yes	One in median; one in clear zone	Barrier	Barrier	Reduces	
58+	32–38	No	Both in median	Barrier	None	—	Not studied
58+	32–38	Yes	Both in median	Barrier	Barrier	—	Not studied

Source: *Fatality Analysis Reporting System (FARS) Encyclopedia.* National Highway Traffic Safety Administration. http://www-fars.nhtsa.dot.gov/Main/index.aspx.

Recommended Citation

Chen, E., J. Brown, and A. P. Tarko. *Use of Barriers in Rural Open Road Conditions—A Synthesis Study*. Publication FHWA/IN/JTRP-2012/08. Joint Transportation Research Program, Indiana Department of Transportation and Purdue University, West Lafayette, Indiana, 2012. doi: 10.5703/1288284314670.

View the full text of this technical report here: http://dx.doi.org/10.5703/1288284314670

Published reports of the Joint Transportation Research Program are available at: http://docs.lib.purdue.edu/jtrp/

PURDUE UNIVERSITY

JTRP

INDIANA DEPARTMENT OF TRANSPORTATION INDOT