TECHSUMMARY

September 2023

State Project No. DOTLT1000425 | LTRC Project No. 22-1SA

Safety Effectiveness of Cable Median Barriers in Louisiana

INTRODUCTION

Cross-median crashes usually result in more fatalities and serious injuries compared to most other types of crashes. Implementation of median barriers is a primary countermeasure for preventing cross-median crashes. The Federal Highway Administration (FHWA) included median barriers in the list of proven safety countermeasures for roadway departure; therefore, transportation agencies are encouraged to consider implementing median barriers on divided highways to reduce fatalities and serious injuries and to achieve safety goals. Accordingly, cable median barriers (CMB) have been commonly installed on the median of rural freeways all over the United States. Louisiana DOTD started to implement CMB on freeways and expressways in 2008. As of February 2022, Louisiana has approximately 623 miles of CMB throughout the state (Figure 1), and the goal is to install nearly 731 miles by the end of 2023. While CMB are known for reducing the number of fatal and serious injury crashes, it is possible less severe type of crashes could increase after CMB installation because of the reduced clear zone. The higher frequency of less severe crashes along with the increased repair cost associated with cable barriers should be a prime concern when evaluating the effectiveness of CMB.

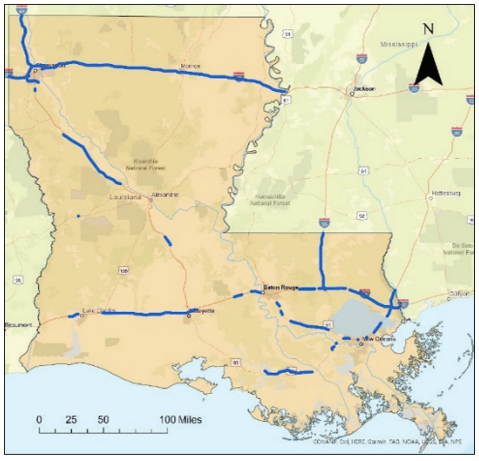

Figure 1. Spatial distribution of CMB segments in Louisiana

OBJECTIVE

The goal of this project was to evaluate the effectiveness of CMB installed on Louisiana highways. Specifically, the objectives were to investigate safety effectiveness of CMB and estimate the benefit-cost ratio of CMB.

SCOPE

This project focused on Louisiana freeway and expressway that have CMB in operation for three years or more. Therefore, based on the availability of crash data, 23 existing CMB segments throughout the state consisting of 275 miles were used in this study.

METHODOLOGY

For a better understanding of CMB effectiveness, targeted crashes such as median-related crashes and cross-median crashes must be analyzed. This study employed a unique flowchart based on the Louisiana crash data and filtered out the median-related and cross-median crashes from the total number of crashes. A three-year observational before-and-after analysis was done to compare the observed frequency of crashes before and after CMB implementation. Greater attention was given to cross-median head-on and large vehicle crashes as well as median-related motorcycle crashes. A comparative analysis was done to figure out if there is any significant difference in the performance of testing level 3 and 4 CMB. To account for the change in traffic volumes during the before and the after periods, the improved prediction model was used to accurately estimate the crash modification factors (CMF). Finally, a comprehensive benefit-cost analysis was conducted to evaluate the cost-effectiveness of CMB in Louisiana.

CONCLUSIONS

The results from the observed crash analysis and the improved prediction method show that CMB is highly effective in reducing fatal and severe injury crashes, particularly for cross-median crashes. The cross-median fatal and severe injury crashes declined by 100%, and the total cross-median crashes were also reduced by 62%. For median-related crashes, a 51% and 7% reduction of fatal and

LTRC Report 684

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SPR: TT-Fed/TT-Reg-5

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moderate injury crashes was observed, respectively, while the property-damage-only (PDO) crashes increased by 201%. The reductions in head-on crashes are 37%, 88%, and 88% for total crashes, median-related crashes, and cross-median crashes, respectively. The estimated impressive crash modification factors for the targeted crashes and their corresponding standard deviation indicate the assurance of crash reductions after the implementation of CMB. At 95% confidence, the upper bound of estimated CMF for all severity levels of cross-median crashes was less than one (Figure 2), which demonstrates a notably impressive performance of CMB.

TL-4 CMB were found to perform slightly better than TL-3 in preventing cross-median crashes as well as median-related fatalities and more severe injuries. The descriptive statistics also showed that rainy weather and wet pavement contributed to the increase in median-related crashes. Additionally, pickup trucks/van/SUVs were found to be more susceptible to cross-median crashes compared to passenger cars.

Finally, the benefit-cost analysis using the economic crash unit costs yielded B/C ratios of 2.163, 1.646, and 1.378 for total, median-related, and cross-median crashes, respectively. Notably, when using the comprehensive crash unit costs, the estimated benefit-cost ratios were considerably greater (Figure 3), demonstrating that CMB are not only lifesaving but also cost-effective countermeasures.

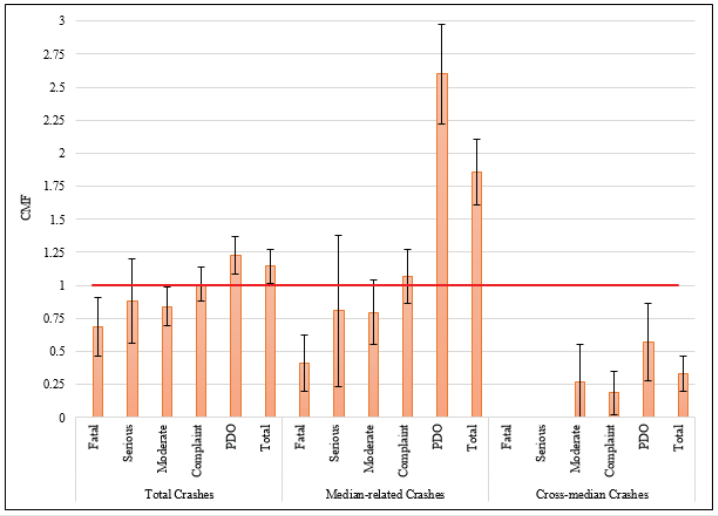

Figure 2. CMF by crash severity for total and two targeted crashes

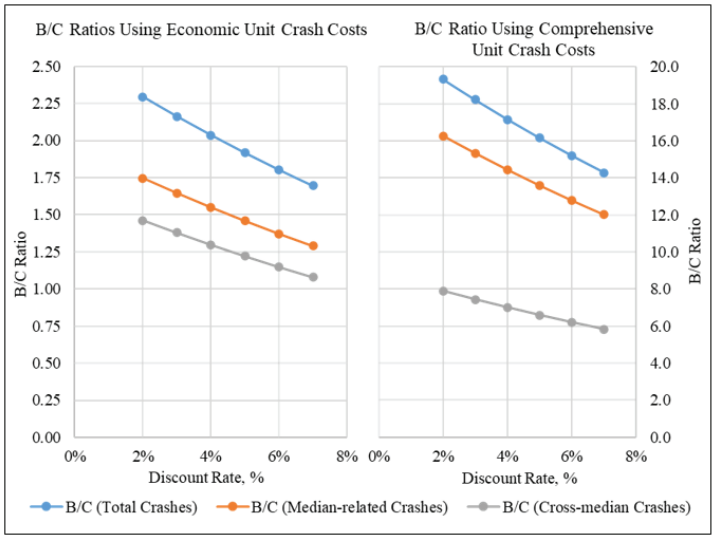

Figure 3. Benefit-cost ratio for different discount rates

RECOMMENDATIONS

Based on the comprehensive analysis of CMB on Louisiana freeways, this project has revealed that CMB is an effective and economically justified crash countermeasure. Thus, DOTD should continue implementation of CMB along the state's rural interstate systems where feasible. Additionally, as this study encountered difficulties in collecting repair and maintenance data from districts, DOTD should consider developing Standard Operating Procedures and Timelines for the repair and maintenance of CMB. All districts need to provide similar performance and achieve comparable results in the repair and maintenance of this roadside safety feature.