Texas A&M Transportation Institute

Texas Department of Transportation

PROJECT SUMMARY REPORT

0-7021-01: Develop Enhanced Protection of Median Openings between Parallel Bridge Structures

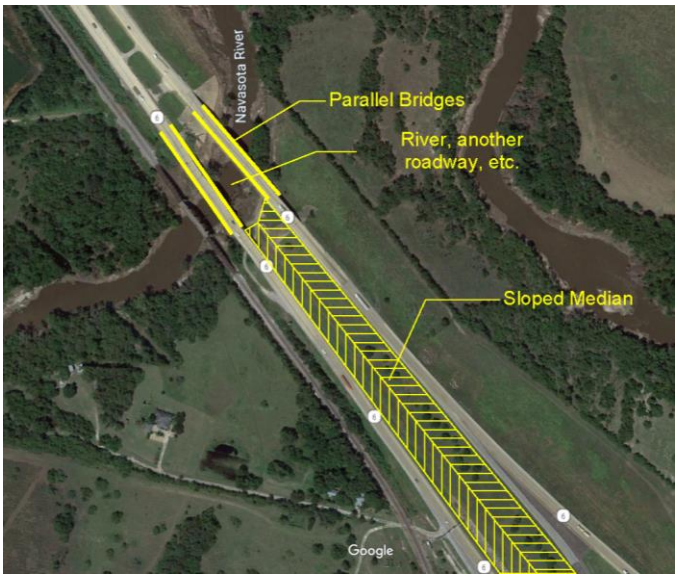
Background

Roadway departure crashes are a leading cause of fatalities and serious injuries in this country. One type of roadway departure crash involves vehicles entering the sloped medians between two parallel bridges. Figure 1 shows such a condition. The sloped nature of the median directs vehicles toward potentially hazardous areas that the bridges span, such as rivers, roadways, etc. These crashes have led to injuries and fatalities in Texas and other states.

The objective of this project was to develop a median opening protection system (MOPS) suitable for implementation in sloped medians between parallel bridges. One primary goal was to use currently available technologies to speed implementation. The MOPS was intended to prevent motorists from experiencing these roadway departure crashes between parallel bridges with a wide variety of vehicles. By addressing these specific objectives, the project aimed to significantly enhance the overall safety of the motoring public, contributing to a safer transportation environment.

What the Researchers Did

The initial phase involved an in-depth exploration of locations where this type of roadway departure crash has occurred in Texas. This exploration allowed researchers to identify common characteristics among the crash sites, which could be used in future identification of locations suitable for MOPS implementation. An evaluation of existing vehicle-arresting systems also identified potentially suitable technology that could be modified for sloped median installation, including vehicle nets, gravity- and friction-based truck ramps, low-density engineered materials, sand barrels, and others. After evaluating the pros and cons of each option, the team selected a modified net capture device for further development and analysis. The team then modified the design, with the assistance of the net manufacturer, for sloped median installations. This modification process included a mechanism to hold the net parallel to the sloped median faces.



Map data ©2019 Google

Figure 1. Sloped Median between Parallel Bridges.

Installing a net on a V-shaped slope resulted in a gap between the ground and the lower edge of the net at the valley of the V-shaped median. This would create the potential for smaller vehicles to submarine under the net. Recognizing the importance of addressing potential underride scenarios, the research team added a tether to hold the net at the appropriate height in the valley of the V-shaped median.

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Project Completed:
8-31-2023

The project then advanced to construction, installation, and full-scale testing, completing three crash tests involving a *Manual for Assessing Safety Hardware* (MASH) small car, a MASH pickup truck, and a bus/motorcoach. Following testing setbacks, the MOPS design was modified to improve crashworthiness. At the conclusion of the project, the MOPS successfully contained and arrested both the MASH small car and pickup truck. Figure 2 shows the pickup truck as the MOPS contains and arrests it. Modifications for arresting the motorcoach are recommended for future research.

Figure 2. Full-Scale Crash Test with MASH Pickup Truck.

What They Found

The research team conducted an in-depth examination into crashes occurring between two parallel bridge structures to determine characteristics of locations suitable for MOPS implementation. Data from this study revealed a significant portion of these crashes occurred on rural interstates, with 57.7 percent on four-lane roads. A substantial 70.8 percent of these crashes occurred in areas where the posted speed limit was 60 mph or higher. Most of these crashes occurred on clear days during daylight hours and dry conditions, which indicates that poor visibility or slippery conditions do not have a significant correlation with these crashes. The research report lists other characteristics of these crash locations.

The researchers successfully developed a system designed to contain and decelerate vehicles using readily available technologies. The MOPS design can be installed in median openings between parallel bridges and requires less maintenance than alternative mitigation strategies. The MOPS demonstrated crashworthy performance in the crash tests, successfully containing and arresting both MASH passenger vehicles—the small car and pickup truck. Challenges emerged during the bus/motorcoach crash tests, and therefore, further research is needed for design modifications to arrest this class of vehicle.

What This Means

This project evaluated roadway departure crashes between two parallel bridges, allowing researchers to identify common characteristics of crash sites. These characteristics can be used in future efforts to identify locations suitable for MOPS implementation. The team also developed a MOPS to serve as a solution to mitigate these crashes. The research team developed the MOPS using currently available technologies to speed implementation. Subsequent crash testing showed the MOPS's ability to successfully contain and arrest passenger vehicles. Further research and design modifications are needed for containment of buses/motorcoaches.

This project offers a solution to mitigate crashes between parallel bridges. With roadway departure crashes being a leading cause of fatalities and serious injuries, this project enhances roadside safety and is another step toward ending the streak of deaths on Texas roadways.

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www.txdot.gov
Keyword: Research

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This research was sponsored by the Texas Department of Transportation and the Federal Highway Administration. The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented here. The contents do not necessarily reflect the official view or policies of FHWA or TxDOT. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. Trade names were used solely for information and not for product endorsement.