

0-6976: Development of Concrete Median Barrier for Flood-Prone Areas

Background

Concrete median barriers are used to prevent serious cross-median crashes by preventing penetration of vehicles into oncoming traffic. These solid concrete barriers are used on highways with high speeds to provide positive containment of vehicles and to help reduce maintenance and repair needs.

When implemented in flood-prone areas, concrete median barriers can act as a dam for floodwaters during severe weather events by raising the height of floodwaters and increasing the severity of flooding on both the highway and the surrounding roads and communities. Flooded areas require significant repair before the highways can be reopened and the level of safety for motorists restored.

The objective of this research was to develop a median barrier for flood-prone areas that is in compliance with the American Association of State Highway and Transportation Officials *Manual for Assessing Safety Hardware (MASH)* Test Level (TL) 4 standards, with the primary intent to accommodate desired water flow. The researchers took into consideration placement of openings to reduce other hazards such as vehicle snagging, and to optimize driver safety by considering the secondary effects of median barriers including glare shielding and passage of animals.

What the Researchers Did

The researchers developed concepts of concrete median barriers for implementation in flood-

prone areas, giving consideration to preferred characteristics of design including profile shape and barrier height.

The researchers conducted hydraulic testing of the selected preferred designs to determine which barriers allowed adequate flows given varying flood conditions, while still maintaining structural design elements necessary for strength and stability requirements. The researchers performed detailed engineering analyses through finite element simulations to determine appropriate dimensions and characteristics of openings and/or scuppers for each of the design concepts. The researchers verified whether each design could accommodate service load requirements.

The researchers used the results to assess the probability of each design concept to meet *MASH* TL-4 impact performance requirements and provide other desirable functional characteristics during flooding conditions.

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Project Completed:

8-31-2020

The design option of a 42-inch-tall single-slope large-scupper median barrier (LSMB), with 18-ft-long and 13-inch-tall scuppers, was chosen for investigation through full-scale crash testing per *MASH* TL-4 requirements (Figure 1). This testing involves use of passenger vehicles and single-unit trucks impacting the barrier at high speed.



Figure 1. Large Scupper Median Barrier.

The researchers evaluated the vehicle crash tests in accordance with the criteria presented in *MASH*, which are based on structural adequacy and occupant risk factors. Structural adequacy is based on the barrier's ability to contain and redirect the impacting vehicle. Occupant risk rates the potential risk of hazard to occupants in the impacting vehicle.

What They Found

The LSMB is a median barrier designed to mitigate roadway flooding while also providing crashworthy cross-median protection. The barrier is a modified version of the Texas Department of Transportation (TxDOT) 42-inch-tall single-slope concrete barrier. The large scuppers located at the bottom of the barrier allow water to traverse across the roadway instead of being dammed on one side, and allow small wildlife to easily traverse the roadway instead of being blocked by a solid concrete barrier.

The *MASH* TL-4 matrix was successfully performed on the LSMB including *MASH* test designations 4-10 (small passenger car), 4-11 (pickup truck), and 4-12 (single-unit truck).

What This Means

The LSMB is considered *MASH* TL-4 compliant. The TxDOT Design Division can implement this median barrier through its respective standard sheets.

For More Information

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Keyword: Research