MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

RESEARCH SUMMARY

MASH LEVEL 3 DESIGN, TESTING, AND EVALUATION OF THE MARYLAND TEMPORARY PRECAST SINGLE-FACE F-TYPE CONCRETE BARRIER

WHAT WAS THE NEED?

Temporary barriers play a crucial role in protecting road users and work zones, yet they must balance mobility, safety, and structural resilience. The Maryland Department of Transportation State Highway Administration (MDOT SHA) sought to evaluate an anchored, temporary precast single-face F-Type concrete barrier to meet MASH Test Level 3 (TL-3) crashworthiness criteria. The goal was to develop a design that could withstand high-speed vehicular impacts while minimizing deflection and structural damage, ensuring enhanced safety for both motorists and construction crews.

WHAT WAS THE GOAL?

The objective of this study was to design, test, and evaluate a temporary precast concrete barrier that meets MASH TL-3 requirements, ensuring its effectiveness in real-world crash conditions. The research aimed to determine the optimal reinforcement configurations, anchor placements, and connection details that would enhance performance while remaining practical for deployment on Maryland highways.

WHAT DID THE RESEARCH TEAM DO?

The research team conducted a series of finite element analysis (FEA) simulations to optimize the barrier's structural design before full-scale testing. These simulations evaluated different reinforcement layouts and anchor configurations to determine the most effective and cost-efficient design.

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Following the simulation phase, two full-scale crash tests were conducted:

- **MASH Test 3-10:** A 2,420 lb. vehicle traveling at 62 mph at a 25-degree angle to evaluate small vehicle impact performance.
- **MASH Test 3-11:** A 5,000 lb. vehicle traveling at 62 mph at a 25-degree angle to test performance under larger vehicle impact conditions.

Crash tests focused on vehicle containment, controlled redirection, and minimal barrier damage to assess the barrier's effectiveness. Additional factors, such as deflection, debris dispersion, and impact energy absorption, were also examined.

WHAT WAS THE OUTCOME?

The barrier successfully met MASH TL-3 crashworthiness criteria, demonstrating its ability to contain and redirect both small and large vehicles while maintaining structural integrity. Key findings include:

- Reinforcement Adjustments: The optimized reinforcement layout significantly reduced cracking and damage propagation, increasing the barrier's durability.
- Anchor Efficiency: The recommended anchored system effectively minimized barrier deflection, improving stability in crash scenarios.
- Impact Performance: Vehicles were successfully redirected with controlled deceleration, reducing the risk of secondary collisions.
- Structural Integrity: The barrier remained intact after both crash tests, with minimal damage to its connections and anchor points.

Overall, the results confirmed that the modified barrier design enhances roadside safety and is suitable for widespread implementation on Maryland highways.

HOW WILL SHA USE THE RESULTS?

The findings from this study will directly inform MDOT SHA's barrier implementation strategies, ensuring statewide deployment of a crash-tested, TL-3 compliant barrier system. The results will be shared with SHA project managers, contractors, and design engineers to guide future highway safety improvements and support data-driven decision-making.

Additionally, these insights will enhance SHA's infrastructure planning efforts, aligning with national safety goals while offering a cost-effective, high-performance roadside protection solution. As a result, the barrier design will be added to MDOT SHA's Barrier Toolbox as a pre-approved option for MASH TL-3 compliant installations, ensuring streamlined implementation and procurement for future highway projects.

LEARN MORE

To view the complete report, click here.

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