

0-7019: Development of a *MASH* Test Level 4 Compliant Guardrail

Background

There is a lack of public domain metal guardrail systems that are compliant with the American Association of State Highway and Transportation Officials *Manual for Assessing Safety Hardware (MASH)* Test Level 4 (TL-4). This test level is used for assessing barriers that are designed to contain passenger and freight vehicles. Several corridors in Texas are known to experience a larger percentage of freight and truck traffic. In these corridors, the safety of the motoring public can greatly benefit from the use of a *MASH* TL-4 compliant metal guardrail system. Some concrete barrier designs are *MASH* TL-4 compliant; however, a metal guardrail system can be more economical than a concrete barrier system. The Texas Department of Transportation (TxDOT) desired a metal guardrail system that meets the testing requirements of *MASH* TL-4, which involves testing with a 2,420-lb small passenger sedan, a 5,000-lb pickup truck, and a 22,000-lb single-unit truck.

What the Researchers Did

The researchers developed several preliminary design concepts of the new guardrail system, one of which was selected by TxDOT for further development through simulation and crash testing. The researchers then developed a full-scale finite element model of the selected system and performed impact simulations under *MASH* TL-4 impact conditions. Using the results of these impact simulations, the researchers made further improvements to the guardrail design and developed the final system design details for

crash testing. Figures 1 and 2 show the guardrail design. The researchers then constructed a prototype of the guardrail installation and performed *MASH* Test 4-12 with a single-unit truck, *MASH* Test 4-11 with a pickup truck, and *MASH* Test 4-10 with a small car to evaluate *MASH* TL-4 compliance of the new guardrail design.

What They Found

The metal guardrail design developed in this project passed *MASH* testing requirements for TL-4 longitudinal barriers and is ready for implementation in the field. This implementation can be achieved by developing a design standard for the guardrail system. The scope of the current project did not include design and testing of an end transition for the guardrail system. The researchers, however, did present a transition design that allows transitioning from the TL-4 guardrail to standard *MASH* TL-3 guardrail end terminals. While the researchers believe that this transition design has a good probability of meeting the transition testing criteria of *MASH*, a recently announced TxDOT research problem statement will lead to a research project for further evaluating the

Research Performed by:

Texas A&M Transportation Institute

Research Supervisor:

Nauman M. Sheikh, TTI

Researchers:

Roger P. Bligh, TTI

Project Completed:

1/31/2021

transition design through impact simulation analysis and full-scale crash testing.

What This Means

Use of the newly developed *MASH TL-4* guardrail will shield passenger and freight vehicles on high-speed roads from roadside hazards. This will improve the safety of the motoring public by

reducing fatalities and injuries. The metal guardrail also provides an alternate design to the currently used concrete barriers. Its use can be more favorable in areas that are not suitable for constructing an extensive foundation for installing a concrete barrier, or that would benefit from an open and more see-through barrier design.



Figure 1. *MASH TL-4* Guardrail Design.



Figure 2. *MASH TL-4* Guardrail with 10000S Test Vehicle.

For More Information

Project Manager:

Wade Odell, TxDOT, (512) 416-4737

Research Supervisor:

Nauman M. Sheikh, TTI, (979) 317-2695

Technical reports when published are available at <http://library.ctr.utexas.edu>.

Research and Technology Implementation Office

Texas Department of Transportation

125 E. 11th Street

Austin, TX 78701-2483

www.txdot.gov

Keyword: Research