Project Summary

Texas Department of Transportation

0-6071: Development of Roadside Safety Devices for Very High Speed Roadways

Background

As TxDOT plans for future expansion of the state's highway network, interest in higher design speeds has been expressed as a means of promoting faster and more efficient travel and movement of goods within the state. This project began the process of developing roadside safety hardware suitable for use on high-speed highways. Based on research conducted under project 0-5544, the impact conditions selected for the design and evaluation of this high-speed hardware include a speed of 85 mi/h and an angle of 25 degrees for barrier impacts. The design vehicles are those specified by the AASHTO *Manual for Assessing Safety Hardware (MASH)* and include a 5000-lb, ½-ton, 4-door pickup truck and a 2425-lb passenger car.

What the Researchers Did

The selected impact speed results in an impact severity far outside the normal design range. Therefore, conventional engineering design practice was of limited value. Finite element simulation was used as a tool to evaluate the impact performance of selected barrier designs.

After evaluation of several barrier systems, two designs were selected for further evaluation through full-scale crash testing. These included an energy absorbing bridge rail concept and a modified wood post thrie beam guardrail. The analyses raised some performance concerns with these systems. However, considering the challenge of accommodating these severe impact conditions and in absence of any clear failure predicted for either design vehicle, TxDOT elected to proceed with the full-scale crash testing.

What They Found

Energy-Absorbing Bridge Rail

The energy-absorbing bridge rail (shown in Figure 1) contained and redirected the passenger car. The maximum occupant compartment deformation of 9.0 inches in the right side floor pan/toe pan area corresponds to the allowable limit recommended in *MASH*. The lateral occupant impact velocity of 40.7 ft/s slightly exceeds the 40 ft/s limit recommended in *MASH*. It is noted that under *NCHRP Report 350*, a value of 41 ft/s was considered acceptable by FHWA. Therefore, impact performance was considered marginal.

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In a subsequent test, the energy-absorbing bridge rail contained and redirected the pickup truck. However, upon exiting the bridge rail, the truck rolled over and the outcome was unacceptable. It is noted that the occupant compartment deformation and occupant risk indices were within the limits specified in *MASH*.

Modified Thrie Beam Guardrail

The truck was not successfully contained and redirected by the modified thrie beam guardrail. Failure of the upstream anchorage permitted the vehicle to penetrate behind the barrier. This outcome is not necessarily an indictment of the modified wood post thrie beam guardrail. The system was performing as expected and redirecting the pickup truck prior to the end anchor failure.

Figure 1. Photograph of High-Speed Energy-Absorbing Bridge Rail with passenger Vehicle.

What This Means

The energy-absorbing bridge rail and modified wood post thrie beam guardrail failed to meet all of the evaluation criteria recommended in the new AASHTO *MASH*. New or modified designs are required to address these performance issues before implementation can be addressed. Recommendations for further research and development of these systems are discussed in research report 0-6071-1.

The tests have provided an enhanced understanding of vehicle and hardware performance at very high impact speeds. The results will be useful in future design efforts and validation of simulation models for these severe impact conditions.

For More Information:
0-6071-1 Analysis of Roadside Safety Devices for use on Very High-speed Roadways

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