

Project Title: Pooled Fund for the Development of Approach Guardrail Transitions for Box Beam and MGS

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Introduction

The second edition of the *Manual for Assessing Safety Hardware (MASH)* was published by the American Association of State Highway and Transportation Officials (AASHTO) in December 2016 (1). Concurrent with this publication, an agreement for the implementation of *MASH* was jointly adopted by AASHTO and the Federal Highway Administration. This research is a step in the Wyoming Department of Transportation's ongoing efforts to implement the *Manual for Assessing Safety Hardware (MASH)* to enhance roadside safety and reduce the severity of run-off-road crashes.

Objective

The objective of this research was to develop a *MASH* Test Level 3 (TL-3) compliant approach guardrail transitions. This included transitions from box beam roadside guardrail and the Midwest Guardrail System (MGS) to the Texas Department of Transportation Type C2P bridge rail system, and a box beam guardrail to a concrete parapet or bridge rail.

Project Description

Finite element simulation was used to design the transition systems. Finite element models were developed for the approach guardrails, transitions, C2P bridge rail, and concrete transition parapet. Simulations were performed using models of the MASH 1100C passenger car and 2270P pickup truck following MASH impact conditions for transitions. The results of the simulations were used to modify the designs to address any identified deficiencies. The final designs were subjected to full-scale crash testing to evaluate compliance with MASH evaluation criteria.

Project Results

Both the downstream and upstream ends of the box beam guardrail transition to C2P bridge rail met the performance criteria for MASH TL-3 transitions. The downstream end of the MGS transition to C2P also met the performance criteria for MASH TL-3 transitions. The upstream end was successfully tested to MASH criteria in previous research. Both transition systems to the C2P bridge rail are considered MASH compliant.

The downstream end of the box beam transition to concrete parapet successfully met MASH criteria for TL-3 transitions. The impact performance of the upstream end was evaluated through finite element simulation and is considered MASH compliant. Shape transitions were developed to transition the vertical concrete profile to which the box beam transition is attached to a New Jersey or single slope profile. The shape transition from vertical to New Jersey profile satisfied MASH criteria for TL-3 transitions. The shape transition from vertical to single slope profile was evaluated through finite element simulation and is considered MASH compliant.

References

1. American Association of State Highway and Transportation Officials. *Manual for Assessing Roadside Safety Hardware, Second Edition*. Washington, DC, 2016.