

Executive Summary, Technology Transfer, and Research Readiness Level Assessment

Development and Testing of a Bridge Rail for Low-Volume Roads

Research Objectives

The research objectives for this project included the development and full-scale crash testing of a TL-2 bridge railing for use on rural, low-volume roadways. The bridge railing utilized side-mounted, weak steel posts in order to limit encroachment of the system over the bridge deck.

Additionally, the bridge railing limited damage to the bridge deck during impact events. A detailed analysis of the required length of need was performed to identify the minimum length of the guardrail adjacent to the bridge and limit the total installation costs. All crash testing was conducted and reported according to the TL-2 safety requirements found in MASH.

Research Benefits

The successful development and evaluation of an optimized TL-2 bridge railing resulted in a treatment option for rural bridges on low-volume roadways that not only minimizes material and labor costs, but also maximizes the traversable width of the bridge deck by keeping all attachment hardware off the top surface of the bridge deck.

Additionally, barrier installation lengths were minimized based on roadway speeds, clear zone widths, and end termination considerations. Using only the required minimum system length further reduced the costs for safety treatments for these bridges.

Background

NCHRP project 22-12(03) recently provided guidelines for the selection of bridge rails based on roadway characteristics, such as traffic volume, percentage of heavy trucks, speed, lane width, curvature, and perceived risk of a railing failure. In general terms, it was found that a TL-2 system would be warranted for nearly all roadways with a traffic volume less than a few thousand vehicles per day due to the low risk of vehicle encroachment. This study did not consider TL-1 barriers in their analysis. However, the cost difference between a TL-1 and a TL-2 system is often minimal. Thus, bridges located on rural, low-volume roadways will likely warrant a TL-2 bridge railing.

Conclusion

Full-scale crash testing was conducted according to test designation no. 2-11 of the American Association of State Highway Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH 2016). The 2270P vehicle impacted the bridge rail at 25.5 degrees and 44.2 mph and was successfully contained and redirected. Damage to the bridge rail consisted of bent posts and deformed guardrail. No damage to the deck or sockets was observed. Thus, the tests passed all evaluation criteria of MASH 2016 test designation no. 2-11. The new railing was deemed MASH TL-2 crashworthy with a post spacing of 75 in. and MASH TL-3 crashworthy with a post spacing of 37.5 in. BARRIER VII simulations showed that the new railing could be directly connected to the Midwest Guardrail System (MGS) without a transition. Guidance was provided pertaining to the length of guardrail required adjacent to the bridge rail.

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Interested in finding out more?

Final report is available:
[HERE](#)

NDOT Recommendations Based Off of Research Project

MwRSF worked closely with NDOT engineers and TAC members throughout the design and evaluation of the optimized TL-2 bridge rail to ensure the system evaluation meets the needs of NDOT design criteria. The W-beam bridge rail design was crash tested, evaluated and met the FHWA specifications. Therefore, the next steps for NDOT implementation will be;

- The Bridge office will standardize the TL-2 bridge rail and include the standard in the Bridge Office Policies and Procedures (BOPP) Manual with the appropriate policy for its use.
- Roadway Design will standardize the guard rail associated with the TL-2 bridge rail.

The TL-2 bridge rail standard will be shared with the county and cities engineers at the 2021 Bridge Conference.

Research Readiness Level (RRL) Assessment

Level 5: Standard Practice

Research/Technology fully implemented and understood. No follow-up is necessary.

RRL 5

Technology Transfer

PRESENTATIONS

- Midwest Pooled Fund Program (annual meeting in 2018, 2019, and 2020)
- International Bridge Conference (2019)
- AASHTO T-7 Technical Committee on Guardrail and Bridge Rail (2018)
- Task Force 13 (2018)

PUBLISHED REPORTS

- Development and Testing of a Bridge Rail for Low-Volume Roads on MwRSF's website -
<https://mwrsf.unl.edu/reportResult.php?reportId=399&search-textbox=tl-2>

**This brief summarizes Project SPR-P1 (17) M068
“Cost-Efficient, TL-2 Bridge Rail for Low Volume Roads”
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