TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Iowa DOT

INSTRUCTIONS:
Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF-5(193) Suppl. #101	☑ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☐ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 4 – December 31)

Project Title:		
Iowa DOT Combination Bridge Separation Barrier with Bicycle Railing		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Faller, Bielenberg, Reid, Rosenbaugh	(402) 472-9064	rbielenberg2@unl.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
2611130099001		7/01/2016
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
12/31/2018	12/31/2018	0

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$254,445.00	$21,735.00	15

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$7,827.00	

Project Description:

The objective of this research is to develop a MASH TL-2 crashworthy, low-height, vertical-face traffic barrier with an attached crashworthy bicycle railing. It is desired that the low-height, vertical-face traffic barrier be applicable for standard applications and that the crashworthy bicycle railing attachment can be added as desired. The barrier system should minimize the height of the concrete barrier portion of the system and provide improved visibility and sightlines, including when the bicycle railing attachment is used. In addition, the new railing system should comply with current AASHTO LRFD guidance for bicycle railings with respect to the parapet and/or the parapet and combination railing.

The research effort to develop a MASH TL-2 crashworthy, low-height, vertical-face traffic barrier and attached crashworthy bicycle railing will proceed in two phases. Phase I will consist of the development and analysis of design concepts, and Phase II will consist of evaluation and full-scale crash testing of the proposed design.

Phase I

The Phase I research effort will begin with a literature search to review crash tested vertical parapets and bicycle/pedestrian rails. The information will be reviewed to suggest potential vertical concrete parapet geometries and designs as well as provide background information on existing crashworthy combination railings. Following the literature search, the researchers will estimate the lowest vertical-faced concrete barrier height that is sufficient to meet AASHTO MASH TL-2 crash testing requirements and can also be used with a pedestrian/bicycle railing. A 24-in. minimum height will be the lowest potential parapet height based on the AASHTO LRFD guidance for a pedestrian separation barrier, as noted previously. However, no rigid parapets have been evaluated at that height under the MASH TL-2 criteria.

LS-DYNA simulation with the 2270P vehicle will be used to evaluate potential minimum rail heights for the vertical parapet of 24 in. or greater. A baseline simulation model will be created and validated against the best available relevant crash

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

To date a literature search has been performed on previous crash testing and development of TL-2 and TL-3 vertical concrete parapets as well as combination bridge rails. Information has also been collected regarding low-height TL-2 and TL-1 barriers that includes portable concrete barriers as well. Information on the Zone of Intrusion and occupant head ejection that may be relevant to the project was collected as well.

The researchers used the materials from the literature search to begin simulation analysis of the minimum TL-2 parapet height. MwRSF has developed models of recent vertical parapet tests for calibration and is conducting the height analysis. The researchers also reviewed critical vehicle components relative to the barrier height in existing tests to help establish the minimum barrier height. The literature review data and simulation will then be applied to select the minimum height.

This quarter the effort to determine the minimum TL-2 concrete parapet height was continued. Simulation of a MASH TL-3 test of the Texas T-222 vertical bridge rail was conducted to validate simulation of the 2270P vehicle into a vertical concrete parapet. Analysis of the simulation results found that the simulation tended to overestimate vehicle pitch and roll values. Attempts were made to adjust vehicle to barrier friction and the deflection of the barrier to better match the physical crash test, but improvement was minimal. Further analysis simulated TL-2 impacts of the 2270P vehicle into extremely low height parapets with heights of 14 in. and 18 in. The simulation models tended to suggest vehicle redirection for both of these impacts, but previous testing has indicated that 18 in. barrier heights are not sufficient to redirect pickup trucks. Thus, it was determined that the tire and suspension models for the 2270P vehicle may not be sufficient to predict vehicle interaction with the low height parapet.

A second analysis of existing vehicle testing on low height parapets was undertaken that compared critical points on the

Anticipated work next quarter:

MwRSF plans to meet with Iowa representatives in May to discuss the height analysis and select the parapet height moving forward. Next, MwRSF will work on the development of the combination rail per Iowa's design criteria in the proposal and submit concepts for review. We would expect the design concepts to be completed for review in the summer of 2017. Following Iowa's review and selection of a preferred concept, we will perform a second round of simulation on the preferred design to evaluate it and develop details for testing. This effort and the summary report should be completed by the end of 2017 which would be consistent with the proposal timeline.

Fabrication and testing would be planned for 2018.

Significant Results:

None.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None.

Potential Implementation:

Investigation and evaluation of a MASH TL-2 crashworthy, low-height, vertical-face traffic barrier and an attached crashworthy bicycle railing will provide IaDOT with a safe option for shielding bicycle facilities and also may be used without a railing for pedestrian separation.