TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Wisconsin 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. #114	☐ 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: Evaluation of Anchored Temporary Concrete Barrier to MASH 2016 TL-3		
Name of Project Manager(s): Faller, Bielenberg, Reid	**Phone Number:** (402) 472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611130104001	**Other Project ID (i.e., contract #):**	**Project Start Date:** 10/01/2016
Original Project End Date: 5/31/2018	**Current Project End Date:** 5/31/2018	**Number of Extensions:** 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
$190,745.00	$78,633.46	40

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$78,146.60	

Project Description:

The research objective is to conduct full-scale vehicle crash testing on both the bolt-through, tie-down anchorage system for concrete road surfaces with a reduced embedment epoxy anchorage as well as the steel pin tie-down anchorage system for asphalt surfaces. All testing will be performed on F-shape PCB according to the Test Level 3 (TL-3) impact safety standards found in MASH 2016.

The research effort for this study will test and evaluate the bolt-through, tie-down system for concrete road surfaces and the steel pin tie-down system for asphalt surfaces for use with F-shape PCBs to MASH 2016. MASH 2016 requires two full-scale crash tests to evaluate the length-of-need of longitudinal barriers.

Test no. 3-10 with the 1100C vehicle may be omitted as it is not deemed critical for evaluation of the barrier system. Previous full-scale crash tests of rigid safety-shape concrete barriers under both NCHRP Report No. 350 and MASH have found that safety-shape barriers can safely redirect small car vehicles. Additionally, small car testing of New Jersey shape PCB systems found that deflections during small car impacts are generally minor, and that the small car performance with respect to the PCB was similar to the rigid barrier testing. Based on these previous tests, it is believed that the small car testing would not be necessary to evaluate the tie-down anchorages for use with F-shape PCBs. Test no. 3-11 is more critical due to concerns for increased barrier loading during 2270P impacts, the need to evaluate the barrier restraint system, and determine dynamic deflection and working width. It should be noted that it may be worthy to consider evaluation of the system with the 1100C vehicle in order to build further confidence in the safety performance of these systems based on the recent switch to new vehicle types as part of the implementation of the MASH criteria and the lack of experience and knowledge regarding the performance of the new vehicle types with certain types of hardware. Additionally, it should be noted that any tests within the evaluation matrix deemed non-critical may eventually need to be evaluated based on additional knowledge gained over time or additional FHWA eligibility letter requirements.

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

Preliminary discussions with the sponsor were held this quarter concerning the potential to modify the anchors used in the bolt-through, tie-down system for concrete road surfaces. There has been some concern in the past regarding the use of plain steel anchor rods epoxied into bridge decks due to the potential for corrosion if left in place. In order to remove these rods, they must be cored out of the deck which is problematic. Thus, the potential to replace the A307 rods fro the original system with stainless steel rods of equivalent strength was discussed. This would allow the rods to remain in place after use.

MwRSF has began research of potential stainless steel rod materials for use in the bolt-through, tie-down system for concrete road surfaces. Once an appropriate material is identified, MwRSF will review the material with WisDOT to get t heir feed back prior to developing CAD details and fabrication of a test system.

In this quarter, MwRSF finalized the details for the full-scale test setups. For the concrete anchorage, review of the potential stainless steel anchors indicated that 300 series stainless steels should provide the best corrosion resistance and comes ins several grades with greater strength and ductility than A307 Grade A. If the test was conducted with a 316 stainless anchor with greater capacity than the original A307 anchor and the test passes MASH TL-3, the A307 anchor may no longer be considered crashworthy as it has lower capacity. Thus, there were two potential options for moving forward.

1. Test with the original A307 anchor and then use engineering analysis to justify the 316 stainless anchors as an alternative based on the material strength.
2. Test with the 316 stainless anchors. Then we may need to specify a stronger (a449 or A193 B7) plain steel threaded rod as an equivalent.

After discussion with WisDOT, it was decided to pursue option 1.

Anticipated work next quarter:

In the upcoming quarter, will attempt to run the second full-scale crash test for this project. Testing of the asphalt pin tie-down will be dependent on the availability of asphalt and an appropriate space on the test site for installation.

Significant Results:

CAD details for both of the PCB anchorage tests were completed.

Test no. WITD-1 on the concrete anchored PCB was successful under MASH TL-3.

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:

The tie-down anchorages for use with F-shape PCBs provide a safe, cost effective, non-proprietary option for reducing the deflection of free-standing PCBs and retaining PCB segments installed adjacent to drop-offs and bridge deck edges. Evaluation of the barrier systems to the MASH 2016 criteria will allow state DOTs to continue to use these systems on roadways and ensure that their safety performance will remain adequate with respect to the current vehicle fleet. Full-scale crash testing will also identify the dynamic deflection and working width of the barrier systems with respect to the current vehicle fleet.