TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nebraska Department of Roads

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)* TPF-5(193) Suppl. #87	**Transportation Pooled Fund Program - Report Period:** ☑ 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: Guidelines for Placement of Breakaway Light Poles Behind MGS		
Name of Project Manager(s): Faller, Bielenberg, Reid, Pajouh	**Phone Number:** 402-472-9064	**E-Mail** rbielenberg2@unl.edu
Lead Agency Project ID: 2611130094001	**Other Project ID (i.e., contract #):**	**Project Start Date:** 7/10/2015
Original Project End Date: 6/30/17	**Current Project End Date:** 6/30/17	**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
$262,603	$253,304	95%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
	$21,912	

Project Description:

Light poles are a commonly found along most highways due to the need to provide proper illumination to critical areas of the road. It is not uncommon for light poles to be placed in areas where guardrail is present as well. In these situations, light poles must be placed sufficiently close to the roadway while not interfering with the performance of the guardrail system. However, several concerns exist when placing light poles in close proximity to guardrail that may affect its ability to safely contain and redirect vehicles. First, interaction between a deflected guardrail system and a pole may create unwanted stiffening or hinging of the barrier system about the pole, which may cause pocketing and increased loading to the guardrail. The pole may also present a snag hazard to impacting vehicles, which may cause increased vehicle decelerations and instabilities. Third, interaction between the guardrail posts and light pole may affect barrier performance. While the use of breakaway light poles may mitigate these concerns to some degree, the interaction between a guardrail system and a closely-positioned light pole requires further investigation.

The Illinois Tollway currently has many instances where light pole placement is desired directly behind W-beam guardrail in order to provide adequate road illumination. Illinois Tollway and Illinois Department of Transportation have recently adopted the Midwest Guardrail System (MGS) as their standard W-beam guardrail design. The current Illinois Tollway standard for light poles is to place the pole no closer than the minimum barrier clearance distance of 28 in. (standard 6 ft -3 in. post spacing), 23 in. (½-post spacing), and 14 in. (¼-post spacing). In order to accommodate poles positioned closer than the minimum barrier clearance distance, an investigation should be conducted to determine if the minimum standard distance for breakaway light poles can be reduced, and if so, determine the optimal position of the light pole with respect to the guardrail system. It is anticipated that computer simulation/modeling with non-linear finite element analysis will be conducted to reduce the number of required crash tests. Crash tests should be conducted according to the AASHTO MASH Test Level 3(TL-3) impact safety criteria.

The objective of this research effort is to develop guidance for safe placement of the Illinois Tollway standard light pole

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

Previously, two full-scale crash tests on the MGS offset pole were conducted. In test ILT-1, the MGS with a 31 in. rail mounting height and standard post spacing offset from a breakaway pole (Illinois Tollway pole) was successfully crash tested according to MASH test designation 3-11. The 50-ft tall, aluminum pole was installed at a 20-in. lateral offset from the back of post and a 24-in. offset from the post no. 13 in longitudinal direction. This pole location was selected as the critical pole offset based on simulation study efforts and consultation with the project sponsors. The MGS was impacted by a 5,000-lb pickup truck at a speed of 62.55 mph and at an angle of 25 degrees at the critical impact point which was located at 4 in. downstream post no. 11. During test ILT-1, the 2270P vehicle impacted the light pole and disengaged it from the base. The vehicle continued to be safely redirected by the barrier. Occupant risk values due to impact with the MGS and the pole were within the accepted MASH limits. As such, the test was successful. In test no. ILT-2, the MGS with an offset from the breakaway pole was crash tested using an 1100C small car according to MASH test designation 3-10. Pole was placed in 20 in. lateral offset from the back of the post and 16 in. from the post no. 13 along the barrier. All the other components and dimensions of the MGS and pole remained the same as test no. ILT-1 except that the top of rail height for the MGS was set to its maximum allowable value of 32-in. to maximize the potential for vehicle extension beneath the rail and interaction with the pole. A 2,420-lb passenger car impacted the MGS at a speed of 62.65 mph and at an angle of 25 degrees at the critical impact point which was mid-span between posts nos. 12 and 13. In test ILT-2, the small car safely was redirected and did not contact the pole. As such the pole did not break away and occupant risk values due to impact with the MGS and the pole were within the accepted MASH limits.

A meeting was held with TAC members on December 22, 2016. Crash test results were presented and recommendations for placement of breakaway poles in special applications including terminals, MGS trailing-end anchorage, MGS stiffness transitions, approach slopes, long-span MGS, wood post and non-blockout MGS were discussed with TAC members. Accordingly, an implementation guidance was developed and detailed in the research report.

Anticipated work next quarter:

During the upcoming quarter, and the project report will be completed with sponsor comments and an FHWA eligibility letter request will be submitted. A one page technical brief will be prepared for the sponsor as well.

Significant Results:

Two successful crash tests were conducted on the MGS in conjunction with a light pole located at the critical offset found in simulation phase of the study. The tests met the MASH TL-3 requirements and both 2270P pickup truck and 1100C small car were safely redirected.

Implementation guidance for MGS pole offsets were developed.

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 successful development and evaluation of a minimal offset for light poles placed adjacent to the MGS would allow the Illinois Tollway and the Illinois DOT to reduce light pole relocations in upcoming construction projects and avoid relocation in projects that are currently underway. Avoiding or reducing light pole relocations when minimum clearance distance is not met would reduce construction costs. In addition, the research could potentially reduce the need for supplemental lighting, planning, and analysis of lighting impacts due to necessary light pole relocation.