TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): ____Kansas 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 # *TPF-5(336)*	**Transportation Pooled Fund Program - Report Period:** ☒ Quarter 1 (January 1 – March 31) 2017 ☐ Quarter 2 (April 1 – June 30) ☐ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 1 – December 31)

Project Title: Construction of Low-Cracking High-Performance Bridge Decks Incorporating New Technology		
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Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:** **January 1, 2016**
Original Project End Date: **December 31, 2018**	**Current Project End Date:** **December 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	Total Percentage of Work Completed
$270,000	$80,064.57	24%

Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Completed This Quarter
$13,008.25	$13,008.25	4%

Project Description:

Bridge decks constructed using low-cracking high-performance concrete (LC-HPC) have performed exceedingly well when compared with bridge decks constructed using conventional procedures. The LC-HPC decks have been constructed using 100% portland cement concretes with low cement paste contents, lower concrete slumps, controlled concrete temperature, minimum finishing, and the early initiation of extended curing. Methods to further minimize cracking, such as internal curing in conjunction with selected supplementary cementitious materials, shrinkage-reducing admixtures, shrinkage-compensating admixtures, and fibers have yet to be applied in conjunction with the LC-HPC approach to bridge-deck construction. Laboratory research and limited field applications have demonstrated that the use of two new technologies, (1) internal curing provided through the use of pre-wetted fine lightweight aggregate in combination with slag cement, with or without small quantities of silica fume, and (2) shrinkage compensating admixtures, can reduce cracking below values obtained using current LC-HPC specifications. The goal of this project is to apply these technologies to new bridge deck construction in Kansas and Minnesota and establish their effectiveness in practice,

The purpose of this study is to implement new technologies in conjunction with LC-HPC specifications to improve bridge deck life through reduction of cracking. The work involves cooperation between state departments of transportation (DOTs), material suppliers, contractors, and designers. The following tasks will be performed to achieve this objective.

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

TASK 1: Work with state DOTs on specifications for the construction of six LC-HPC bridge decks per state to be constructed over a three-year period.

MnDOT has previously indicated that two internally cured LC-HPC bridge decks are planned for 2017. Specific projects have not yet been designated. Upon receiving information on these projects, KU personnel will begin collaborating with the contractor and material supplier to address concerns and share experience from 2016 construction.

45% COMPLETE

TASK 2: Provide on-site guidance during construction of the LC-HPC bridge decks.

Lessons learned from the two bridge decks constructed in 2016 will be used to better execute future projects. KU will work closely with the concrete supplier in regards to handling and preparing fine lightweight aggregate to ensure that the desired amount of internal curing water is achieved during batching. The determination of surface moisture on the day of casting and continued monitoring throughout batching are primary components of this process. The amount of free surface moisture in fine lightweight aggregate can drop significantly over a period of 12 hours, thus decreasing the amount of water being added to the mix. For projects in 2016, conducting test batches prior to batching concrete for the actual bridge decks is imperative to ensure the concrete is able to be pumped. Specifically, the same size pump that will be used in placing the bridge deck needs to be used in the test batch. For the failed LC-HPC deck attempt in October of the last quarter, it was indicated that the concrete supplier used a smaller pump for the trial batch than the pumps on site during construction.

12% COMPLETE

TASK 3: Perform detailed crack surveys on the bridge decks, 1 year, 2-3 years, and (if approved) 4-5 years after construction. Prior research has demonstrated that it takes at least three years to consistently establish the long-term cracking performance of a bridge deck. The surveys will be performed using techniques developed at the University of Kansas to identify and measure all cracks visible on the upper surface of the bridge deck. If desired, DOT personal will be trained in the survey techniques and may assist in the surveys, as appropriate.

This task will be performed after the construction of the bridge decks. Crack surveys of the internal curing and control decks will be conducted during the summer, one and three years after construction.

0% COMPLETE

TASK 4: Correlate the cracking measured in Task 3 with environmental and site conditions, construction techniques, design specifications, and material properties, and compare with results obtained on earlier conventional and LC-HPC bridge decks.

0% COMPLETE

TASK 5: Document the results of the study. Interim and final reports will be prepared covering the findings in Tasks 1-4.

0% COMPLETE

Anticipated work next quarter:

Laboratory testing of concrete mixtures with internal curing will continue to be evaluated by KU researchers. For the upcoming projects, KU researchers will work with DOTs and material suppliers on developing procedures for handling and storing fine lightweight aggregate at batch plants.

Significant Results this quarter:

Concrete mixtures that provide slump and air contents within MnDOT specifications have shown to be within shrinkage and durability test limits. Additional mixtures were developed to investigate the effect of lowering the water to cementitious material (*w/cm*) ratio from 0.45 to 0.42 and 0.39. Additionally, mixtures that include silica fume were also included in this test series. For batches that fell below the minimum air content, results have shown negative effects in scaling and rapid chloride permeability (RCP) tests. Mixtures incorporating silica fume have also shown a reduction in scaling performance.

Circumstances 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).

The second internally cured bridge deck for Minnesota was not successfully completed and as previously indicated by MnDOT a replacement bridge is not planned for the remainder of their study. KU, however, is prepared to work with MnDOT if the decision is made to include a replacement bridge to the study. Restrictions on KDOT funding has limited the ability to construct and evaluate bridge decks in Kansas.