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) 2016 ☐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	$50,806.49	15%

Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Completed This Quarter
$25,788.41	$25,788.41	5%

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 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.

KU researchers traveled to Indiana this quarter to perform crack surveys on a series of internally cured bridge decks and obtain copies of construction records. After consulting with Indiana Department of Transportation (InDOT) personnel on the construction of these bridges, additional recommendations for storage and preparation of lightweight fine aggregate for use in internally cured concrete were established, including the measurement of aggregate properties before and during construction. Before batching, stockpiles were allowed to drain for 12 hours, after which tests to determine specific gravity and absorption were performed. These tests were repeated during placement of the bridge decks as well as at the end of batching. This allows researchers to monitor the amount of internal curing water being provided throughout construction.

Suggested guidelines for the determination of lightweight fine aggregate properties were developed by KU researchers for MnDOT and the concrete supplier for use in upcoming bridge decks. This procedure references the same method used by Purdue University and InDOT for the internally cured Indiana bridges.

35% COMPLETE

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

MnDOT placed its first internal curing LC-HPC bridge deck on the night of 9/22/2016. KU researchers were present during construction. MnDOT Bridge No. 62892 is a pedestrian bridge over I-94 in St. Paul, MN.

KU researchers were also present two days prior to concrete batching to record the properties of the fine lightweight aggregate used for the bridge. In accordance with ASTM C75, 18 samples were obtained from various locations throughout the stockpile. These samples were consolidated to provide a final sample used to perform specific gravity and absorption tests. Using a centrifuge, the aggregate was placed in a wetted surface dry (WSD) condition for measurement of specific gravity and absorption. Average values for specific gravity and absorption were 1.56 and 23.1%, respectively. After collaborating with the concrete supplier, an absorption value of 23.1% (measured 2 hours prior to batching) was selected for batching. This resulted in 7.9 lb of internal curing water per 100 lb of cementitious material (7.9 lb/cwt). Additionally, the surface moisture measured right of batching, 5.0%, was used. It should be noted that the surface moisture immediately before batching was substantially lower than the values of 12% and 11% that were obtained in the two days prior to mixing. This reduction in surface moisture was due to the fact that the stockpile was allowed to drain for 12 hours before batching.

An upcoming internally cured LC-HPC bridge deck along I-35 near Hinckley, MN is scheduled for early October 2016.

8% 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:

KU researchers will continue to evaluate concrete mixture proportions using trial batches cast in KU laboratories. The second internal curing LC-HPC bridge deck for MnDOT is scheduled for early next quarter; KU personnel will be present.

Significant Results this quarter:

Laboratory tests completed to date for internally cured concrete mixes developed for this project are all within limits set by MnDOT specifications.

The first bridge deck utilizing internal curing was placed in St. Paul on 9/23/2016.

Crack survey results for a series of internally cured concrete bridge decks in Indiana exhibit low crack densities.

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

Nothing to report.