

Period Covered: July 1 through September 30, 2008 (Quarterly Report)

KSDOT Progress Report  
for the

## State Planning and Research Program

PROJECT TITLE: Construction of Crack-Free Concrete Bridge Decks		
PROJECT MANAGER: Richard L. McReynolds, P.E.	Project No: TPF-5(051)	Project is: <input type="checkbox"/> PLANNING <input checked="" type="checkbox"/> RESEARCH & DEVELOPMENT
Annual Budget	Multi Year Project Budget \$950,000	

### PROGRESS:

Current work for Phase I of Construction of Crack-Free Concrete Bridge Decks includes the evaluation of the bridge decks that were cast in Phase I, the completion of construction of Phase I bridges, and the evaluation of results from laboratory work that was initiated in Phase I.

### CONSTRUCTION ACTIVITIES

Eight crack surveys of bridges constructed for Phase I of the Pooled Fund Study (five control and three LC-HPC bridge decks) were completed this quarter. Overall, crack densities for LC-HPC bridge decks continue to be a fraction of the value calculated for control decks. A monolithic control bridge in Emporia, Kansas was surveyed on June 26, 2008 (36.8 months old) and the crack density was determined to be 0.219 m/m<sup>2</sup>. Another control bridge in Linn County, Kansas was surveyed on June 26<sup>th</sup>, 2008 (14.4 months old) and had a calculated crack density of 0.177 m/m<sup>2</sup>. On July 1, 2008, an LC-HPC bridge in Topeka, Kansas (24.2 months old) was surveyed and the crack density was determined to be 0.019 m/m<sup>2</sup>. The corresponding control bridge was surveyed on the June 30, 2008 and crack densities were calculated to be 0.476 m/m<sup>2</sup> for the first placement (27.5 months old) and 0.069 m/m<sup>2</sup> for the second placement (21.5 months old and not open to traffic). Another control bridge (27.1 months old) in Emporia, Kansas was surveyed on June 30, 2008, and the crack density was calculated to be 0.665 m/m<sup>2</sup>, which was significantly higher than 0.351 m/m<sup>2</sup> measured last year. On July 15<sup>th</sup>, 2008, two LC-HPC bridges in Kansas City, Kansas were surveyed and found to have crack densities of 0.008 m/m<sup>2</sup> (9.4 months old) and 0.059 m/m<sup>2</sup> (8 months old). Several irregularities were noted for the construction of the LC-HPC bridge deck that resulted in a crack density of 0.059 m/m<sup>2</sup>, including a large superelevation that prevented proper curing of concrete on the high side of the deck, improper control of heating under the deck in sub-freezing weather, and high-slump concrete (exceeding 4 in.) that was placed in a large portion of the deck.

A pre-construction conference for a bridge that will be constructed in Missouri following a modified version of LC-HPC specifications was attended. Construction on the bridge is scheduled to begin in the spring of 2009.

### RESULTS OF LABORATORY WORK

Fifteen ring specimens with a concrete thickness of 1.5-in. were cast last quarter and fourteen have cracked. The cracks were identified visually while no obvious changes in strain gage readings were noted.

Scaling tests continue in accordance with Canadian standard test NQ 2621-900/2002 Annex B. After 56 cycles, the scaling results from the GGBFS Grade 120 series show that the specimens with 0% and 30% GGBFS replacement of cement met the test parameters in terms of mass loss (less than 1.5 kg/m<sup>2</sup>). The specimens with 0% replacement had 0.17 kg/m<sup>2</sup> of mass loss, whereas the specimens with 30% replacement had 0.57 kg/m<sup>2</sup> of mass loss. The concrete with 60% GGBFS replacement exceeded the parameter at the 35<sup>th</sup> cycle.

#### ACTIVITIES PLANNED FOR NEXT QUARTER

Crack surveys for three more LC-HPC bridges will be completed next quarter.

Scaling and freeze-thaw specimens will continue to be evaluated to examine the effect of a shrinkage reducing admixture.

Communication with the Missouri and Kansas DOTs will continue to determine construction dates and provide assistance where needed for the remaining bridge decks in Phase I of the study.

Project Personnel: David Darwin (Principal Investigator), JoAnn Browning (Co-Principal Investigator)

#### **STATUS AND COMPLETION DATE**

Percentage of work completed to date for total project is: 99%\*

  X   on schedule        behind schedule, explain:

Expected Completion Date:   March 31, 2010  

\*The project has been extended for an additional two years to allow the planned deck construction to be completed and the crack surveys to be conducted. The percentage of work completed will be held open at 99% for the balance of the project. Phase II of this project is now underway with funding from the KU Transportation Research Institute and the project has been approved for 100% SPR funding. TPF funding officially began on July 1, 2008.