

Period Covered: April 1 through June 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 \$995,000	

PROGRESS:

CONSTRUCTION ACTIVITIES

Three LC-HPC bridge decks were placed this past quarter. The first half of the twelfth LC-HPC bridge constructed in Kansas was placed on April 4 in Hartford. The thirteenth LC-HPC bridge was placed on April 29 in Pleasanton, KS, and the second and third (final) sections of the fourteenth placed on May 2 and May 21, in Overland Park. Qualification slabs for the Hartford and Pleasanton bridges were placed on March 28 and April 16, respectively. A post-construction meeting was held on May 21, 2008, with KDOT, Clarkson Construction, and Ashgrove-Fordyce (concrete supplier). This meeting covered the construction of four LC-HPC decks placed last fall as part of the I-435 and US-69 highway project.

Crack surveys were performed on seven bridge decks during the quarter. On May 20, 2008, the eighth LC-HPC bridge constructed in Kansas was surveyed. Some cracking occurred along the locations of the piers. On May 26, the ninth LC-HPC deck and its associated control deck were surveyed. The control deck for the sixth LC-HPC bridge constructed in Kansas was surveyed on June 10 and demonstrated significant transverse cracks located along the piers of the deck. On June 17 and 18, the first and second LC-HPC decks constructed were surveyed along with the control bridge. A small amount of map-cracking was observed on the first two LC-HPC decks, while the control deck contained numerous transverse cracks in the middle (near the pier) and longitudinal cracks at either end. Preliminary evaluations of crack densities continue to show that LC-HPC decks have just a fraction of the total cracking found on the control decks. Twelve more crack surveys are scheduled for the next quarter.

LABORATORY ACTIVITIES

Work continues in the materials laboratory. For the restrained ring test specimens that were cast last quarter (KDOT mix with 602 lb/yd³ of cement and 0.44 water-cement ratio and the mix with 535 lb/yd³ of cement and 0.45 water-cement ratio), results showed that specimens with 1.5-in. concrete thickness cracked earlier than specimens with 2.5-in. concrete thickness. A series of restrained ring tests specimens with 1.5-in. thickness concrete thickness were subsequently cast. Mixes contained different water-cement ratios (0.39, 0.42, and 0.45) with constant cement content (535 lb/yd³). A mix with 40% cement replacement by class F ash with a water-cement ratio of 0.45 and constant paste content was also cast. All specimens were cured for 14 days.

Scaling and freeze thaw tests started this quarter. Specimens were cast containing a control batch with 535 lb/yd³ and a water-cement ratio of 0.45 and test batches with 30% and 60% replacements of cement with Grade 120 GGBFS and a water-cementitious material ratio of 0.45. All mixes had the same paste content.

Free shrinkage specimens to inspect the effect of long-term curing on mixes with a 40% replacement of class C fly ash were cast. The mixes include a control batch with 535 lb/yd³ of cement and 0.45 water-cement ratio and a batch with the mineral admixture (40% replacement of class C fly ash) with a paste content equivalent to the control batch. The specimens are being cured for 7, 14, 28, and 56 days.

RESULTS

The specimens cast to check the effect of concrete thickness (1.5-in. and 2.5-in.) on restrained ring tests have cracked. For the KDOT mix with 602 lb/yd³ of cement and 0.44 water-cement ratio, the three 1.5-in. thick specimens cracked at 6, 9 and 12 days whereas the three 2.5-in. thick specimens cracked at 22, 27 and 34 days.

Preliminary results for the free-shrinkage study to evaluate long-term curing on a mix with a 40% replacement of class F ash indicate that long term curing does help reduce shrinkage. At 30 days, the batch with 40% replacement of class F ash (with a water-cement ratio of 0.45 and equivalent paste content as the control batch) shrinks more than the control batch (with 535 lb/yd³ of cement and 0.45 water-cement ratio) when cured for 7 and 14 days. These results match the previous test results. When cured 28 days, the fly ash batch shrinks less than the corresponding control batch cured for 28 days and is similar to the control batch cured for 56 days. With 56 days curing, the specimens for both batches shrink less than the specimens cured for 28 days.

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

ACTIVITIES PLANNED FOR NEXT QUARTER

Crack surveys for another 12 bridges (LC-HPC and control decks) are scheduled for the next quarter.

Scaling and freeze-thaw specimens will be cast to examine the effect of a shrinkage reducing admixture. The dimensions of ring test specimens will be evaluated and a new size of test specimen will be tested.

The first annual meeting for Phase II of the Pooled Fund Study will take place at the Kansas City Airport Hilton on July 24, 2008.

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 will officially begin on July 1, 2008 with the annual meeting scheduled for July 24, 2008.