

Period Covered: January 1 through March 31, 2011 (Quarterly Report)

KSDOT Progress Report  
for the

## State Planning and Research Program

PROJECT TITLE: Construction of Crack-Free Concrete Bridge Decks, Phase II

PROJECT MANAGER:	Project No:	Project is:
Rodney Montney	TPF-5(174)	<input type="checkbox"/> PLANNING <input checked="" type="checkbox"/> RESEARCH & DEVELOPMENT
Annual Budget	<b>Multi Year Project Budget</b> \$995,000	

### PROGRESS:

The date for the annual meeting has been set for July 19, 2011. The meeting will be held at the Kansas City Airport Hilton. More information will be sent as the meeting date approaches.

### LABORATORY ACTIVITIES:

Mixes with two different shrinkage-reducing admixture (SRA) products, SRA 575 and Tetraguard, are being tested in the lab. Doses of 0.5%, 1%, and 2% by weight of cement are being evaluated for both products. Tests are underway for free shrinkage, scaling, freeze-thaw, and strength performance.

A series of mixtures containing lightweight aggregate (LWA) has been completed. The LWA is expanded shale. This series includes a control with all normalweight aggregate; 8% replacement by volume of pea gravel with LWA; 10% replacement by volume of pea gravel with LWA; 10% replacement of pea gravel with LWA with a 30% replacement by volume of portland cement (cement) with slag cement (slag); 10% replacement by volume with LWA, 30% replacement by volume of cement with slag and 3% replacement by volume of cement with silica fume; and 10% replacement by volume of pea gravel with LWA, 30% replacement by volume of cement with slag, and 6% replacement by volume of cement with silica fume. These mixes have just been completed and are currently being tested for scaling and freeze-thaw performance, as well as for shrinkage and strength.

### LAB RESULTS:

Scaling evaluation of the SRA series mixes in accordance with the Canadian standard test BNQ 2621-900/2002 Annex B and ASTM C972 is in progress. For the Tetraguard series, the 35-day test results for the 4 mixes – control, 0.5% Tetraguard, 1% Tetraguard and 2% Tetraguard have been obtained. All mixes have had mass losses that are well below the failure limit of  $0.31 \text{ lb}/\text{ft}^3$  ( $1.5 \text{ kg}/\text{m}^2$ ) cumulative mass loss. The 1% Tetraguard and 2% Tetraguard are performing better than the control mix, while the 0.5% Tetraguard mix has more scaling than the control mix. The 0.5% Tetraguard mix has been recast and tests will be conducted shortly to verify the results.

For the SRA 575 series, the 21-day test results for the 4 mixes - control, 0.5% SRA 575, 1% SRA 575 and 2% SRA 575 - have been obtained. All mixes have mass losses that are well below the failure limit. The 0.5% SRA 575, 1% SRA 575 and 2% SRA 575 are performing better than the control mix.

The free shrinkage performance of the Tetraguard series and SRA 575 series is also being evaluated. For the Tetraguard series, the 1% Tetraguard and 2% Tetraguard mixes are being compared with the control mix. The 1% Tetraguard and 2% Tetraguard follow a similar trend for approximately the first 35 days, with the 2% Tetraguard specimens beginning to exhibit greater shrinkage than the 1% Tetraguard specimens after 35 days.

The free shrinkage performance of the SRA 575 series, 0.5% SRA 575 and 2% SRA 575 mixes is being compared to the control mix. The 0.5% SRA 575 mix and control mix specimens follow a similar trend while the specimens with 2% SRA 575 mix have lower shrinkage for approximately the first 28 days. After 28 days, the specimens cast using the 0.5% SRA 575 mix exhibit greater shrinkage than the control mix specimens.

Overall, the specimens cast using SRA 575 exhibit higher free shrinkage values than the specimens cast using Tetraguard. These mixtures will be replicated.

#### **ACTIVITIES PLANNED FOR NEXT QUARTER:**

Laboratory testing of concrete using the Miracon Tough Air, a proprietary air entraining admixture, is ongoing to determine the stability of the air void systems in concrete mixes. Mixes with both Tough Air and a shrinkage reducing admixture (SRA) will be evaluated in an effort to produce a more stable air void system with use of a SRA. Results may allow SRA mixes to more easily be used in field applications while still meeting air content specifications. The effects of Tough Air on scaling, freeze-thaw performance, shrinkage, and strength will also be evaluated.

Crack surveys will be initiated for this year on the LC-HPC and Control decks that have been constructed in Kansas.

KU personnel will continue to work with the concrete producer, contractor, and KDOT personnel on the third of three LC-HPC decks let in December 2009. Deck construction is scheduled for later in the year.

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: 55%

on schedule  behind schedule, explain:

Expected Completion Date: June 30, 2013