

Period Covered: July 1 through September 30, 2009 (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: Rodney Montney	Project No: TPF-5(174)	Project is: <input type="checkbox"/> PLANNING <input checked="" type="checkbox"/> RESEARCH & DEVELOPMENT
Annual Budget	Multi Year Project Budget \$995,000	

### PROGRESS:

#### **NEW STUDY PARTNER:**

We are pleased to welcome the Oklahoma Department of Transportation as a study partner on Phase II.

#### **FIELD ACTIVITIES:**

The 7<sup>th</sup> annual meeting of construction of Crack-Free Concrete Bridge Decks was held on July 23, 2009 in Kansas City, MO. A CD containing presentations from the meeting, updated list of participants, updated specifications, and the latest version of KU Mix was sent to all participants and research sponsors.

#### **LABORATORY ACTIVITIES:**

A larger freezer unit for scaling evaluation and a unit for freeze-thaw evaluation were installed. The units are being evaluated to ensure that they will satisfy the tests requirements. Durability evaluations (scaling, freeze-thaw, and air-void system) for concrete mixtures containing slag, Class F fly ash and shrinkage reducing admixture (SRA), will be resumed in the next quarter.

#### **LAB RESULTS:**

The two test series that were initiated to evaluate the contribution of lightweight aggregate to reducing free shrinkage show promising results. The first series included three replacement levels of lightweight aggregate (8.4%, 11.3% and 13.8% by volume). As expected, as the amount of lightweight aggregate increased, the amount of free shrinkage decreased from 363 microstrain at 30 days for the control mix (no lightweight aggregate, 14-day cure) to 220 microstrain at 30 days for the mix with 13.8% (by volume) of lightweight aggregate and a 14-day cure. The second series evaluated the use of an 8.4% (by volume) replacement of lightweight aggregate in mixes with Grade 100 slag (0%, 30% and 60% slag mixtures). A significant reduction in shrinkage was noted with the addition of lightweight aggregate with the Grade 100 slag. After 30 days of drying, the control mix (14-day cure), without slag or lightweight aggregate, had a shrinkage of 297 microstrain, while at 30 days the mixture with 8.4% (by volume) lightweight aggregate and 30% slag exhibited a shrinkage of only 120 microstrain.

The test to evaluate the performance of restrained shrinkage (ring) specimens with high cement paste content was completed. Cracks with widths of 0.004 in. and less were observed. Crack formation was not always clearly defined based on the data provided by the strain gages mounted on the rings.

**ACTIVITIES PLANNED FOR NEXT QUARTER:**

Lab test methods to evaluate evaporable water and non-evaporable water in hardened concrete are being developed. The results of these tests will be correlated with free shrinkage test results.

A series of scaling and freeze-thaw specimens will be cast to evaluate the effect of slag and the combined effects of Class F fly ash and an SRA on concrete durability. Samples of the hardened concrete from this series will be evaluated by the Kansas Department of Transportation in accordance with ASTM C457 "Test Method for Microscopical Determination of Parameters of Air-Void System in Hardened Concrete – Procedure A: The Linear Traverse Method." Freeze-thaw evaluation will be performed in accordance to ASTM C666 "Standard Test Method for Resistance of Concrete to Rapid Freezing in Air and Thawing in Water – Procedure B".

KU will continue to work with KDOT and other partners to schedule LC-HPC bridge decks for Phase II of the project.

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: 25%

  X   on schedule        behind schedule, explain:

Expected Completion Date:   June 30, 2013