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, Phase II		
PROJECT MANAGER: Richard L. McReynolds, P.E.	Project No: TPF-5(174)	Project is: ____ PLANNING ___X__ RESEARCH & DEVELOPMENT
Annual Budget	**Multi Year Project Budget** $975,000	

PROGRESS:

BASF Construction Chemicals and the Silica Fume Association joined this phase of the Pooled-Fund collaboration as partners during the quarter.

The initial work in Phase II of Construction of Crack-Free Concrete Bridge Decks has focused on laboratory evaluation of the durability properties of concrete mixes that were shown to have low shrinkage in Phase I of the project. In addition, training workshops for new participants in this phase of the study and the construction of bridge decks with the modified specifications are being planned.

LABORATORY ACTIVITIES

A series of free shrinkage specimens were cast to evaluate the effect of long-term curing on mixes with a 40% replacement of cement with Class C fly ash. The control batch was cast with 535 lb/yd^3 of cement and a 0.45 water-cement ratio. Free shrinkage results from the control batch will be compared with results concrete with a 40% replacement of cement with Class C fly ash and a paste content equal to that of the control batch. Specimens were cured for 7, 14, 28, and 56 days.

A series of free shrinkage specimens to evaluate the effect of a shrinkage-reducing admixture (SRA) were cast. The control batch had a water-cement ratio of 0.44 and a cement content of 535 lb/yd^3; the SRA batches contained 1% and 0.5% (of the cement by weight) doses of the SRA. Personnel from the Kansas Department of Transportation performed tests to evaluate the air void system of the mixes. The tests included ASTM C457 "Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete" and an Air Void Analyzer test (AVA, Kansas Test Method KT-71). The SRA specimens that were tested using the air void analyzer resulted in an air void spacing factor below 0.254 mm (0.01 in.), which is the maximum allowed by the KDOT Concrete – 401.3.g Specification.

Restrained shrinkage (ring) specimens with a concrete thickness of 1.125 in. were cast. The time to cracking results will supplement the results obtained from specimens cast in Phase I of the study with concrete thicknesses of 1.5-in. and 2.5-in. The new specimens include mixes with a water-cement ratio of 0.35 and 0.45 and have a constant cement content of 535 lb/yd^3. A mix with 40% replacement of cement using Class F fly ash and a water-cement ratio of 0.45 was also cast. All specimens were cured for 14 days. The preliminary results show that the 1.125-in.-thick specimens crack earlier than the 1.5-in. or 2.5-in. specimens. Micro-cracks have been observed on the cracked specimens.

A series of scaling specimens were cast to evaluate the effect of a shrinkage reducing admixture (SRA) on concrete durability. The mixes include a control batch with a water-cement ratio of 0.44 and a cement content of 540 lb/yd^3 and matching SRA batches with 1% and 0.5% (of the cement by weight) doses of SRA.

OTHER ACTIVITIES

The first annual meeting for Phase II of the Pooled Fund Study was held at the Kansas City Airport Hilton on July 24, 2008. Meeting minutes, presentations, participant information, and the newest version of KU Mix were recorded on CDs and sent to all members of the study.

A workshop for the New York Department of Transportation has been scheduled for January 6, 2009.

ACTIVITIES PLANNED FOR NEXT QUARTER

Scaling tests of the mixes with SRA will conclude next quarter. Samples of the hardened concrete from the SRA scaling tests will be analyzed for air void system by the Kansas Department of Transportation according to ASTM C457 "Test Method for Microscopical Determination of Parameters of Air-Void System in Hardened Concrete."

Free shrinkage and strength specimens containing lightweight aggregates will be cast. Mixes will include an SSD Granite control, SSD Limestone, and SSD Granite mixes with three levels of sand replacement by lightweight fine aggregate, 13%, 18%, and 23% by volume. The lightweight aggregate replacement levels were selected to provide 75%, 100%, and 125%, respectively, of the calculated optimum quantity of water needed for internal curing. A method to vacuum saturate the lightweight aggregate will be specified. The effects of internal curing provided by the lightweight aggregate on reducing free shrinkage will be evaluated.

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: 5%

__X__ on schedule _____ behind schedule, explain:

Expected Completion Date: _____ June 30, 2013