Period Covered: October 1 through December 31, 2010 (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: ____ PLANNING ___X__ RESEARCH & DEVELOPMENT
Annual Budget	**Multi Year Project Budget** $995,000	

PROGRESS:

CONSTRUCTION ACTIVITIES

Six crack surveys of bridge decks that were constructed using innovative concrete mixes for improved constructability and sustainability have been completed. The concrete decks contain concretes with cement blended with fly ash, silica fume, and slag, lower paste contents, and 7 or 14-day curing periods. The crack density for the six bridges has been determined. Analysis of the crack surveys will be completed once all of the construction information has been obtained.

Two LC-HPC bridges were constructed on 10/28/2010 and 11/10/2010. The bridges are located in Shawnee, Kansas, which is in the Kansas City area. Post-construction conferences were held on 11/8/2010 and 11/19/2010, respectively.

KU visited with KDOT design engineers on December 13, 2010 to discuss adoption of the LC-HPC curing specifications into the current KDOT construction specifications for cast-in-place reinforced concrete bridge decks. KDOT bridge engineers were favorable to the idea and will work with KDOT materials and construction management personnel to evaluate this change.

LABORATORY ACTIVITIES:

Laboratory tests involving a polymer-foam air-entraining agent produced by Miracon, called Tough Air, have started. Three mixes with Tough Air have been completed, including two control mixes with no shrinkage reducing agent (SRA) and one mix with 0.32 gallon/yd^3 of SRA (trade name Tetraguard® AS 20). Free shrinkage, scaling, and freeze-thaw test specimens were cast. The stability of the air void system using Tough Air is currently being evaluated.

The Tough Air mixes are being compared with mixtures containing the same SRA with a conventional air-entraining agent, MicroAir. Three mixes, with 0.32, 0.64, and 1.28 gallon/yd^3 of SRA, have been completed along with a control mixture containing MicroAir and no SRA. Free shrinkage test are currently underway and scaling results are pending. Freeze-thaw tests are also scheduled.

LABORATORY RESULTS:

Scaling tests in accordance with the Canadian standard test BNQ 2621-900/2002 Annex B and ASTM C972 of the Tough Air mixes are in progress. The 21-day test results for two mixes, Control and 0.32 gallon/yd^3 SRA with Tough Air, indicate that the cumulative mass loss is below 1.5 kg/m^2 for both, indicating adequate performance to date.

At 30 days, the mixes with Tough Air exhibit similar free shrinkage performance to those with MicroAir.

ACTIVITIES PLANNED FOR NEXT QUARTER:

Once the stability of the air void system for the Tough Air has been evaluated, further tests such as free shrinkage, freeze-thaw, scaling, air void analysis, and strength tests will be conducted on a broader range of mixtures. Tough Air will be used along with Tetraguard and silica fume. Parallel mixes with the same components, but with MicroAir as the air-entraining agent, will provide a direct comparison for use in the evaluation of Tough Air.

A second series of specimens, similar to that used for Tetraguard, will be cast with a new SRA. The mixes will contain 0.32, 0.64 and 1.28 gallon/yd^3 SRA. The new SRA is supposed to provide air-void systems with better stability that those obtained with Tetraguard.

A series of lightweight aggregate replacement concrete batches will be evaluated based on free shrinkage, freeze-thaw, scaling, air void analysis, strength, and permeability. Low replacement levels (8% and 10% by volume of aggregate) of lightweight aggregate will be used in the concrete to help reduce shrinkage. These replacement levels will also be tested in the combination with silica fume and slag. Earlier work in the project has shown that low replacement levels of lightweight aggregate greatly reduce shrinkage. The principal goal of the new series will be to evaluate the durability of mixes of this type.

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: 50%

__X__ on schedule _____ behind schedule, explain:

Expected Completion Date: June 30, 2013