

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	
	\$950,000	

Progress:

Nomination for bridge decks to be constructed using the research specifications continue to be requested. To date, one nomination has been received from Missouri and two have been received from South Dakota. Minnesota has indicated that they will nominate two bridge decks. Kansas has changed their field of nominees to include 14 low cracking deck projects with 12 control decks. Two of the low cracking decks and one control deck will be for prestressed concrete girder bridges. The next scheduled projects are control bridges that will be let in January (1) and March (1). No additional nominations for potential bridge projects to implement the research specifications were received this quarter from states other than Kansas.

Work has continued in the laboratory. Data continues to be collected for the free-shrinkage specimens, but most of the tests have not matured to a state worthy of discussion. Initial results indicate that specimens cast using the coarse-ground cement have consistently less shrinkage than those cast using Type I/II cement. In addition, significantly less shrinkage has been measured in specimens cast using quartzite aggregates than those cast with limestone.

A test program was begun during the last quarter to compare two types of high-range water reducers (HRWR), Glenium 3000NS and Rheobuild 1000. The program has been expanded to include a second series with the same HRWRs. Glenium is a polycarboxylate-based water reducer and Rheobuild is a naphthalene-based water reducer. Four batches were cast to evaluate Glenium, one batch with no Glenium and three batches with low, medium, and high dosage rates of Glenium. The same regimen was used for the Rheobuild. A third HRWR, Adva 100 (polycarboxylate based), has been added to the test program to correlate with the restrained-shrinkage tests (ring tests).

Testing continued on nine concrete mixes that are or could be used in bridge decks. Two of the mixes are typical bridge deck mixes from MoDOT and KDOT. The other seven mixes were developed in the laboratory and contain optimized aggregate gradations and reduced cement and paste contents. After approximately 160 days in the free shrinkage test, the MoDOT and KDOT mixes have the highest free shrinkage, with values of 600 and 520 microstrain, respectively. A group of mixes, including a control mix, a mixture with a 7-day curing time, a mixture with Type II coarse-ground cement, a mixture containing quartzite, and a mix with 497 lb/yd³ of cement, exhibit similar free shrinkage, between 425 and 475 microstrain. The mix with 14 days curing has a free shrinkage close to 400 microstrain, and the mix containing the shrinkage-reducing admixture has the lowest shrinkage at just 300 microstrain. All seven of the laboratory mixes are showing improved shrinkage behavior compared to the MoDOT and KDOT mixes.

In the restrained ring test, only one of the 27 concrete rings has cracked through 160 days of testing. The strain gage readings on one of the MoDOT rings increased sharply between days 101 and 103, and a crack extending vertically along the circumferential surface of the ring was observed.

The ponding cycles for the permeability tests (to evaluate the effect of cement coarseness) have been completed and cores have been taken. The cores are being tested for chloride content.

The first draft of the guidelines for optimizing aggregate gradation has been completed.

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

SUMMARY OF ACTIVITIES EXPECTED TO BE PERFORMED NEXT QUARTER:

Bridge deck candidates from the state representatives in the pooled fund project will continue to be sought.

Future work in the laboratory will include comparisons of the free shrinkage of specimens cast with quartzite, granite, and limestone aggregates. In addition, the free shrinkage of concrete made with different mineral admixtures will be compared. Results from the existing free and restrained shrinkage tests will continue to be evaluated.

The guidelines for optimizing aggregate gradation will be tested in the laboratory and revised for efficient implementation.

STATUS AND COMPLETION DATE

Percentage of work completed to date for total project is: 35%

 X on schedule _____ behind schedule, explain:

Expected Completion Date: March 31, 2008