

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
<b>Annual Budget</b>	<b>Multi Year Project Budget</b> \$950,000	

**Progress:**

The second annual meeting of state representatives was held at the Kansas City Airport Hilton on May 7, 2004. The meeting was attended by representatives from KU, FHWA (KS and MOrepresentatives), Delaware, Idaho, Indiana, Kansas, Michigan, Minnesota, Mississippi, Missouri, North Dakota, Texas, HGR, Inc., WR Grace, and Silica Fume Association. The revised specifications were presented at the meeting and a consensus of ideas for final modifications to the document was reached. Procedures for selecting bridges to be constructed, attracting quality contractors to bid for the projects, and for developing a spirit of "teamwork" during construction of the research bridge decks also were discussed. CDs containing the meeting minutes, slides with comments, and modified specifications were sent to all state representatives and attendees of the meeting. In addition, methods for using liquid nitrogen to cool concrete during casting of bridge decks were researched, and preliminary calculations of cost and effectiveness were presented.

The specifications were modified to reflect the discussion at the meeting on May 7, 2004. A list of potential bridge deck projects that will be let in the next two years was received from Ken Hurst (KDOT), including 12 bridge decks proposed to be used with the new specifications plus companion "control" bridge decks that will be constructed using traditional specifications. The latest modified specifications were sent to KDOT to be developed into special provisions for two bridge decks that will be let on September 15, 2004; the project also includes one bridge to serve as a control.

Laboratory work at KU continued during the quarter. Two free shrinkage test programs were initiated. One test program compared mineral admixtures and consisted of four mixes with a 70% aggregate content and a 0.45 water cement ratio. The mixes varied in the type and amount of mineral admixtures included in the design (0%, 10% silica fume, 30% slag, and 30% Class C fly ash). The second test program compared the free shrinkage of two mixes that had different aggregates (quartzite and limestone). At the time of this report, results from the first test program are not ready for evaluation, and the second test program demonstrates less shrinkage from the quartzite mix than the limestone mix. These tests remain in progress.

During this quarter, testing continued on the 12 concrete ring specimens and companion free shrinkage specimens that were cast in December. Data collection on the ring specimens was stopped after 160 days with no indications that any of the specimens had cracked. Rates of strain will be used to compare the relative restrained shrinkage properties of the mix designs. The next set of 15 steel rings returned from being polished and were instrumented with strain gages and wiring. Those 15, along with the 12 that were recently used in testing, were prepared for the next testing program. The variables tested in the next program include a range of cement contents, curing period, and the introduction of shrinkage reducing admixtures. New ring specimen molds were constructed for this test program to reduce the concrete ring thickness from 3 inches to 2.25 inches. The height of the concrete ring will remain at 3 inches. Finally, a 12 x 12 ft humidity room and shelving were constructed to house all the shrinkage and cracking specimens in one enclosure under the same environmental conditions.

In addition to the mix design, free shrinkage, and restrained shrinkage tests, permeability tests and concrete cooling methods have been investigated. AASHTO T 259 will be used

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

**SUMMARY OF ACTIVITIES EXPECTED TO BE PERFORMED NEXT QUARTER:**

Laboratory work will continue in the next quarter to finalize concrete mix recommendations in the research specifications. Preparations have been made for free shrinkage tests comparing granite, quartzite, and limestone mixes. Another test program is being developed to determine the effects of superplasticizers on free shrinkage. The free shrinkage specimens and ring specimens cast in previous quarters will continue to be evaluated. Permeability tests will begin this quarter as well.

The KU research team will review the special provisions generated by KDOT to reflect the research specifications. A letter requesting candidates for research bridge decks from other participating states will be sent in July, with a target range of construction dates indicated in the letter. Once these bridge decks are selected, work will begin to develop specific special provisions for the states supporting construction of the decks.

**STATUS AND COMPLETION DATE**

Percentage of work completed to date for total project is: 25%

  X   on schedule        behind schedule, explain:

Expected Completion Date:        March 31, 2008