Period Covered: July 1 through December 31, 2003 (Quarterly Report)

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: ____ PLANNING ___X__ RESEARCH & DEVELOPMENT
Annual Budget	**Multi Year Project Budget** $950,000	

Progress:

On October 1, deck casting procedures were observed on a bridge under construction by King Construction.

Comments from most but not all of the state technical contacts were received on the first draft of the special provisions for the construction of crack-free bridge decks. A number of states indicate that they are currently implementing many of the items in the special provisions while others commented that some of the proposed requirements would be difficult to implement. A full summary awaits receipt of comments from the balance of the participants. States that have not submitted their comments have been contacted.

Work continued on the optimization of concrete mix designs for reduced cracking. Mixes were developed using 1 in.$^{+}$ maximum size aggregates, optimized with up to 5 aggregates. Testing on 1¼ in. quartzite, quartzite chip, and 1 in. limestone aggregates was completed. It was observed that the shrinkage reducing admixture may be incompatible with the superplasticizer and air entraining agent now in use. Work on mixes containing coarse ground Type II cement continues.

Work also continued on the evaluating the cracking tendency of concrete using the ring test. The third practice ring (cast at the end of the previous quarter) cracked 27 days after casting. A fourth practice ring was cast using a mortar mix to see if the test would correctly determine when the ring cracked. A visible crack was observed in this ring just a few days after casting, as would be expected with this high-cement content mix. These results provide confidence in this test procedure.

Ring tests on four mixes are now underway. The mixes include one older MoDOT high-cement content mix, one current KDOT mix, and two optimized low-cement content mixes, one with Type I/II cement and one with coarse ground Type II cement. Three restrained ring specimens, three free shrinkage specimens, and two cylinders were cast for each mix. The specimens were demolded after 24 hours and wet-cured for two more days. After curing, the shrinkage specimens were placed in 50% relative humidity tents, where they will remain for the balance of tests. Strain gage readings from the steel rings were taken on the day of casting for the ring specimens and free shrinkage measurements began after the specimens were demolded. Daily monitoring of the specimens is continuing. The cylinders will be testes at 28 days.

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

SUMMARY OF ACTIVITIES EXPECTED TO BE PERFORMED NEXT QUARTER:

Comments to the proposed special provisions for low-cracking bridge decks will be summarized and addressed. A revised proposal based on these comments will be submitted for review.

Work will continue to identify new bridge construction projects (in Kansas and in other states) that are eligible for implementing the identified "best practices." A total of 20 bridges will be constructed over the course of the project using the new recommendations. State representatives are encouraged to send their nominations to the project team for consideration.

Work will continue to optimize concrete mix designs. Goals for the next quarter include casting free-shrinkage specimens to further evaluate the effects of using coarse ground Type II cement, optimized aggregate gradations, large aggregate sizes, superplasticizers, and shrinkage-reducing admixtures. Work will include addressing admixture compatibility problems, optimizing mixes containing 1 in. maximum size aggregate, and minimizing paste content for mixes containing (1) coarse ground Type II cement and (2) Type I/II cement with shrinkage reducing admixture.

STATUS AND COMPLETION DATE

Percentage of work completed to date for total project is: 18

__X__ on schedule _____ behind schedule, explain:

Expected Completion Date: _____March 31, 2008