TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): ____Kansas DOT________________________________

INSTRUCTIONS:
Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # **TPF-5(048)**	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) X☐Quarter 2 (April 1 – June 30) ☐Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 1 – December 31)

Project Title:
Midwest Accelerated Pavement Testing Pooled Fund

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Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
RE-0328-01	**RE-0508-01**	**Various**
Original Project End Date: **Multi-year project**	**Current Project End Date:** **06/30/14**	**Number of Extensions:** **5**

Project schedule status:

☐ On schedule ☐ On revised schedule ☐ Ahead of schedule X☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Total Percentage of Work Completed
FY 2003: $ 267,302; FY 2004: $ 269,973 2005: $ 64,957; FY 2005: $ 884,362; FY 2008: $ 164,503; FY 2009: $ 286,000	**$1,970,151.87**	**100% (FY2003) , 100% (FY2004 100% (FY2005), 97% (FY 2009)**

Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Completed This Quarter
$50,848.52	**$50,848.52 (a charge was made for the unpaid CISL service Fees)**	**7%**

Project Description:

FY 2003: The objective of this research was to compare the performance of an A7-6 clay subgrade soil stabilized with lime, fly ash, cement and EMC2 (a commercial chemical compound commercialized by Soil Stabilization Products Co.) using a full-scale accelerated pavement test at the KSU Civil Infrastructure Systems Laboratory (CISL). Four pavement sections were constructed during November and December 2002, all having the same four-inch thick asphalt concrete surface layer. The subgrade soil was stabilized to a depth of six inches with the four different stabilizing agents. In total, 800,000 passes of the 30,000 lbs dual axle were applied to the pavement with lime treated embankment soil while 1,200,000 passes of the 30,000 lbs dual axle and 800,000 passes of the 24,000 lbs single axle were applied to the pavements with cement and fly-ash treated embankment soil. The pavement with the EMC2 stabilized base has failed at approximately 50,000 load repetitions after exhibiting severe rutting and cracking. Each of the three remaining pavements exhibited more than 0.5 of rutting, the pavements with cement and fly-ash treated soil exhibited cracking in the asphalt surface layer. The cement stabilized embankment showed very similar performance to that of the lime treated embankment. After 2 million passes, the pavement with fly-ash stabilized soil showed more cracking than the pavements with cement and lime treated soils. The final report has been published.

FY 2004: The objectives of this research were: a) to construct and evaluate thin PCC overlays on existing PCC and HMA pavements; b) to determine the parameters that effect the performance of these sections; c) to develop design input parameters and to modify/ enhance the existing design procedure (s) for thin PCC overlays. The objectives was accomplished by conducting a full-scale accelerated pavement test at CISL on two pavements with thin PCC overlays on existing PCC and, two pavements with thin PCC overlays on distressed HMA layers. The two thin white-topping pavements were constructed and tested first. The asphalt concrete layers were first placed and compacted. Longitudinal and transverse saw cuts were performed in the HMA layers to simulate severely cracked layers. Milling was done on the asphalt concrete layers and the PCC overlay was placed. More than 2 million passes of the 26,000-lb single axle were applied but no visible distresses have been observed with the exception of a single transverse crack in the 4 inch thick overlay. The PCC pavements were placed and distresses using thumping load applied at the joints. The distressed pavements were shot blasted and the PCC overlays were constructed. More than 1,500,000 axle load repetitions were applied to these pavements. Both pavements exhibited transverse cracking. The post-mortem evaluation was finalized and the Finite Element Modeling to estimate the response of the overlays was conducted. The final report has been published.

FY 2005: The objectives of this research are: a) to validate and calibrate the dynamic resilient modulus model used in M-EPDG for asphalt concrete mixes and to compare it with the field-measured modulus, for two mixes in each of the four Mid-West States; b) to validate the relationship used in M-EPDG between the dynamic modulus and pavement response; c) to validate the relationship used in M-EPDG between pavement response (strains) and pavement performance; d) to compare the performance of coarse and fine Superpave mixes; e) to validate and calibrate the Asphalt Pavement Analyzer (APA) as a screening tool for estimating rutting performance of Superpave asphalt mixes. To achieve these objectives, twelve pavements will be constructed for this experiment and will be built in six pairs. Three pairs will be 'fatigue cracking' experiments and will aim to verify the fatigue cracking properties of asphalt concrete. The remaining three pairs will be 'rutting' experiments and will aim to determine the rutting life of asphalt concrete pavements. In total, six HMA mixes will be used, two for each state. One 'fatigue cracking' and one 'rutting' pavement will be built and tested for each mix. The work on this project started with the design and the construction of twelve pavement structures containing HMA mixes representative for those used in Kansas, Missouri and Iowa; the foundation of the Iowa pavements were constructed but the HMA paving was postponed due to inclement weather. Accelerated loading was applied first to the Kansas pavements; the "rutting" pavements, tested at 35°C, exhibited more than 0.75 inches of rutting after 400,000 passes of the 23,000 lbs single axle. The application of 2,000,000 passes to the Kansas "fatigue cracking" pavement sections is completed. More than 700,000 passes have been applied to the Missouri and Iowa "rutting" sections; The Iowa sections failed in rutting after 100,000 passes since the mixture had higher than design asphalt content. Missouri fatigue sections received 2.2 million load repetitions with no signs of distresses. Rutting remains under 1/4" on both lanes. Testing of Iowa fatigue section ended after 1,000,000 repetitions with no signs of fatigue cracking. However, it failed in rutting with rut depths of 0.3" and 0.47" for the two mixes tested. Good progress in data analysis has been made in this quarter and a manuscript based on preliminary results has been presented at the ISAP'10 Intl. Confc., August 1-6, Nagoya, Japan. Data analysis was completed in this quarter. Draft final report has been submitted to the project monitor and has been reviewed. **The final report will be published soon.**

FY 2009: The objective of this experiment was to study rehabilitation of low-volume paved roads with Geocells and different in-fill materials on a marginal subgrade under real world traffic and to develop a design method for this type of rehabilitation. The experiment had three test cells, each with a different in-fill material. The Geocell design was chosen based on the results of the CISL #15 experiment. Three different in-fill materials - crushed limestone, AB-3; Quarry waste; and Recycled Asphalt Pavement, RAP, were tested. The fourth test cell was the control section with a full-depth with crushed limestone (AB-3) or RAP material (25 cm) section. All sections were overlaid by a 50-mm (2-in.) hot-mix asphalt (HMA) overlay. The sections were loaded under wheel loading up to 1,000,000 repetitions of 89-kN (20-kip) single axle or to 12.5 mm (½ inch) rut depth whichever came first. Various instrumentation and performance monitoring were also done. Later, tests were repeated with reconstructed sections.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Finite-element (FE) modeling is complete. A TRB paper has been prepared and the final draft is being submitted to the project monitor

Anticipated work next quarter:

FY 2003: The final report has been published.

FY 2004: The final report has been published.

FY 2005: The final report will be published.

FY2009: Draft final report will be reviewed in the next quarter.

Significant Results:

FY 2005: The results of this research will provide valuable support for the calibration and implementation of the M-EPDG design model and will provide a database of pavement response and performance information valuable for verification of any mechanistic-empirical pavement design method. The results will also establish the fatigue and rutting behavior of fine and coarse Superpave mixes and will provide a screening tool for rut-susceptible mixes.

FY 2009: The results of this research will provide valuable results for development of a suitable Geocell design for paved roads for a variety of in-fill materials. Thus the experiment will result in a cost-effective rehabilitation strategy**.**

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

FY 2003 project testing and reporting got behind schedule because of equipment repairs and modifications that were required on earlier experiments. Also, the cumulative number of passes applied to the two pair of pavements was more than three times the number of passes estimated initially. FY 2004 project testing and reporting got behind schedule because of equipment modifications and the delay of FY2003 project. FY 2005 project is behind schedule due to inclement weather that delayed the asphalt paving. Additional loadings were applied to the Missouri sections. FY 2009 sections were reconstructed and retested due to catastrophic failure of the first experiment.