TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Virginia 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 # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5 (225)	**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☐Quarter 3 (July 1 – September 30) ☐Quarter 4 (October 1 – December 31)	
Project Title: Validation of Hot-Poured Crack Sealant Performance Based Guidelines		
Name of Project Manager(s): Imad L. Al-Qadi	Phone Number: 217-265 0427	**E-Mail** alqadi@illinois.edu
Lead Agency Project ID: VCTIR 98160	**Other Project ID (i.e., contract #):**	**Project Start Date:** 09/01/2010
Original Project End Date: 09/01/2014	**Current Project End Date:** 06/30/2016	**Number of Extensions:** 2 extensions in total for 1.5 years

Project schedule status:

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

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
730,000 (after revision 885,400)	$795,626	90%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$21,773	$21,773	90 % (with updated schedule)

Project Description:
Recently, performance-based guidelines were developed as a systematic procedure to select hot-poured bituminous crack sealants. These guidelines are the outcome of the pool-fund North American Consortium led by the University of Illinois at Urbana-Champaign and the National Research Council of Canada. The work proposed a "Sealant Grade" (SG) system to select hot-poured crack sealant based on environmental conditions. A special effort was made to use the equipment originally developed by the Strategic Highway Research Program (SHRP), which was used to measure binder rheological behavior as part of the Performance Grade (PG) system.

These developed laboratory tests allow for measuring hot-poured bituminous-based crack sealant's rheological and mechanical properties over a wide range of service temperatures. Preliminary thresholds for each test were identified to ensure desirable field performance. Then, the preliminary thresholds were utilized in the SG system based on extensive laboratory testing, limited between-laboratory testing, and limited field performance data.
However, because the preliminary thresholds were determined based on only limited field data, mainly from Canada, a comprehensive field study is urgently needed to validate and fine-tune the present threshold values.
Furthermore, the developed guidelines should be validated in several states under various climate zones.

Tasks:
I. Laboratory Validation
II. Field testing and installations
III. Test section monitoring
IV. Threshold value fine tuning
V. Cost effectiveness quantification
VI. Development of crack sealant selection procedures and installation guidelines.

Objectives:
The developed laboratory tests and the new guidelines must be verified for precision and bias between laboratories as well as within laboratories. In addition, since preliminary thresholds were established for each test based on extensive laboratory testing but with limited field and within-laboratory data, an extensive field study is urgently needed to validate and fine-tune the threshold values. Hence, this proposed study aims 1) to validate the developed laboratory tests, 2) to determine the thresholds using a more diverse array of field performance data, and 3) to implement crack sealant guidelines for field application.

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

Meetings:

No meetings took place in this quarter.

Task-I: Laboratory Validation (95% completed):

Progress in the laboratory testing is summarized as follow:

- New adhesion molds are used to test field aged samples collected from Ontario and Minnesota during third survey. The new adhesion test results correlated well with the Ontario field performance. However, that was not the case for the Minnesota test site. It has to be noted that current adhesion test recommended by AASHTO provisional test specifications also showed poor correlation with field performance.

- Indiana DOT agreed to join the Inter-laboratory study. Up to date, test results from 8 different labs are available for CSBBR test. Results from 2 labs are invalid due to data recording. Retests are planned for these labs. For the RV test, 5 laboratories had sent the test results to date. It is expected to receive the results from two more labs; VDOT and MNDOT. MSCR tests using DSR is yet to be completed by other laboratories.

- 4 year aged sample are collected from ATREL test site. The aged sample will be used to extend the aging model and also evaluate sealant's aging potential using DSR, BBR and DT test.
- CSBBR and DTT tests on field aged samples collected from test sites is completed. Same as preliminary results, a good

correlation was observed between lab and field performance.

- ATLAS facility was used to evaluate field tracking of two sealants. Sealants were applied with overband and then, the temperature was elevated to 60°C and was recorded every second. At each cycle of tire pass, a picture was taken from the test area at the same scale. The sealants were ranked based on number of cycles to failure. The ranking obtained from field performance is different than that obtained from the high temperature testing using DSR (both shear and MSCR test). It was concluded that the mechanisms of overband wear could not be replicated by the accelerated testing applied at high temperatures.

Task-II: Field Testing and Installation (100% completed):
- This task is completed

Task-III: Test section monitoring (100% completed).
- This task is complete

Task-IV: Threshold value fine-tuning (90% completed).

- There was a good correlation between CSBBR and CSDTT test methods and field performance of the sealants. For BBR two thresholds were selected. Minimum threshold for stiffness at 1 second to ensure the good overband performance and fine-tuned maximum threshold to ensure sealants durability during the service life. Other thresholds are currently being investigation.

Task-V: Cost effectiveness quantification (80% completed).
- Cost effectiveness of sealant treatment was assessed. Two approaches were used throughout the study.
These are equivalent annual cost and the benefit to cost ratio methods. The former one is simpler and easier and attributed more benefits to sealing application. The second approach uses more detailed information and attributes relatively lower benefits compared to the other.
According to the findings of the cost effectiveness evaluation, sealant treatment was found to a cost effective approach. Benefit to cost ratio is the most reliable technique to compute the cost effectiveness of the preservation technique.

Task-VI: Development of crack sealant selection procedures and installation guidelines (100% completed).
The installation guideline was finalized.

Anticipated work next quarter:

1. New adhesion fixture will be used to evaluate sealants adhesion properties.
2. Adhesion thresholds will be validated and fine-tuned.
3. Chemical and compositional level testing will be continued on aged samples.
4. Inter-laboratory task will be completed.
5. LCCA analysis and reports will be completed by using real costs collected from DOTs.
6. Final report of the project will be drafted.

Significant Results:

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that

might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Potential Implementation:

Based on the field validation study at various test sites, performance thresholds in Sealant Grade System will be Updated. These thresholds were initially determined based on limited field data. The finalized grade system can be used by States and other agencies for selecting sealants based on climatic region. Sealant field installation guidelines will also be available at the end of this project.

Some external lab results were questionable and further evaluation of the data will be performed.