

## 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.*

<b>Transportation Pooled Fund Program Project #</b> <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i>  TPF-5 (225)	<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input checked="" type="checkbox"/> Quarter 4 (October 1 – December 31)	
<b>Project Title:</b> Validation of Hot-Poured Crack Sealant Performance Based Guidelines		
<b>Name of Project Manager(s):</b> Imad L. Al-Qadi	<b>Phone Number:</b> 217-265 0427	<b>E-Mail</b> alqadi@illinois.edu
<b>Lead Agency Project ID:</b> VCTIR 98160	<b>Other Project ID (i.e., contract #):</b>	<b>Project Start Date:</b> 09/01/2010
<b>Original Project End Date:</b> 09/01/2014	<b>Current Project End Date:</b> 06/30/2016	<b>Number of Extensions:</b> 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)	\$818,512	92%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
\$22,885	\$22,885	92 % (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-funded 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 sixteen laboratory aged samples at three different temperatures for grade verification. Adhesion results and its correlation to the field shows that for each temperature a unique threshold should be selected.
- Indiana DOT agreed to redo the CSBBR test. Up to date, Only five valid series of test results are available for CSBBR test method. For Rotational viscosity test only the data from VDOT is pending. MSCR tests using DSR is yet to be completed by other laboratories.
- The effect of higher temperature for aging the laboratory samples in vacuum oven was evaluated as a case study. Four different types of sealant were selected to be aged at 130°C instead of 115°C. Sealants with rubber modification significantly showed a higher CSBBR stiffness than original aged samples. Stiffness changes for other two sealants were not significant.

- Hamburg wheel tracking test is being used to evaluate field tracking. Sealants are installed between two disks of asphalt mix or concrete with a proper overband. The test is conducted in room temperature. Tracking length with number of cycle are recorded. At each stage, a picture is also taken from the specimen at the same scale. Preliminarily results on three different sealants shows that this method can differentiate between poor and good performer and correlate with field performance.

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

- This task is completed

Task-III: Test section monitoring (95% completed).

- One more test site monitoring from Virginia test site is added to the scope. This test site evaluation will be arranged and completed in the next quarter.

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

- Different statistical tests were used to develop a composite score and to establish a quantitative correlation based on the field performance of the sealants with different test parameters obtained from laboratory test methods like stiffness, average creep ratio, maximum adhesion load, maximum direct tension load and extendibility. A variety of different statistical correlation techniques were used: Kendall's tau and regression methods. Among all parameters CSBBR stiffness and adhesion load had the highest score for the field performance of sealants with rout and seal treatment. For the clean and seal treatment, CSBBR stiffness and maximum direct tension load had the highest score.

Composite score is also calculated to find any possible correlation between the test methods. Higher scores were obtained for adhesion load and CSBBR stiffness which is an indication of a good correlation. This was also valid for direct tension load and CSBBR stiffness.

Task-V: Cost effectiveness quantification (90% completed).

- A life-cycle cost analysis (LCCA) was conducted using available data in the literature. A draft report that will also be a part of final report is drafted.

Task-VI: Development of crack sealant selection procedures and installation guidelines (80% completed).

- The installation guideline was finalized.

- Sealant selection procedure is underway and will be finalized in the next quarter.

#### **Anticipated work next quarter:**

1. New adhesion fixture will be used to complete testing on field aged samples.
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 by adding additional laboratories. A private consulting lab agreed to participate.
5. Second survey and evaluation will be conducted in the Virginia test site.
6. Sealant selection procedures will be developed.
7. 4 years field aged samples collected from ATREL test site will be tested.
8. Final report of the project will be prepared and shared with the panel members.
9. A face-to-face meeting is planned in the next quarter.

**Significant Results:**

New adhesion test shows an improvement in repeatability and results obtained so far is in good agreement with field performance.

BBR stiffness and adhesion tests showed similar trends indicating the influence of chemical composition on sealant's stiffness and adhesion characteristics. Both tests have good correlation to field performance. This is an important finding to use the BBR test as the pivot test to perform sealant grading.

**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.