

## 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 checked="" type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
<b>Project Title:</b> Validation of Hot-Poured Crack Sealant Performance Based Guidelines		
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<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> 12/31/2015	<b>Number of Extensions:</b> 1 extension 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	634,442	85%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
45,751 <sup>1</sup>	45,751	95.8%

<sup>1</sup>June expenditures are not included.

**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 the last quarter.

**Task-I: Laboratory Validation (85% completed):**

Progress in the laboratory testing is summarized as follows:

- Aged sealants collected from ATREL test site in October 2013 are tested using BBR. By conducting BBR test on this set of samples, ATREL field aged sealants are evaluated for the fourth time during two years of aging. Based on the flexural results at low temperature, an aging model is being developed to evaluate the aging potential of the crust and bottom portions of the sealant. This model categorizes sealants into three groups; low, medium and high aging potential. This study will be extended to three years of aging and the model will be calibrated by field aged samples collected from other test sites.
- New concept for an adhesion test is under development. Several trial tests are performed to evaluate the feasibility of a new test. In the new test fixture, different sample size and shape is being evaluated using aggregate (mostly limestone) and aluminum substrate as stratum.
- The adhesion potential of sealants is evaluated using sessile drop method to obtain surface free energy of field aged sealants. The results show that this test can be a good qualitative indicator (good vs poor) of sealant field performance.

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

- Virginia test site will be added to the test matrix; a test site was arranged. Communications are ongoing for the

arrangement of the field installation. Installation is expected in Summer of 2014.

Task-III: Test section monitoring (90% completed).

Field Data collected during the third survey through Feb 2014 to March 2014 for Minnesota, Ontario, New Hampshire, Wisconsin, and New York test sites are being analyzed. According to the preliminary analysis most of the sealants after two and half years of performance showed poor condition (Performance index less than 70%). A summary of the field performance of the sealants is attached to the report.

Task-IV: Threshold value fine-tuning (80% completed).

The work on 2014 field survey data is in progress including statistical analysis. These data will be correlated with laboratory performance of the sealants. Preliminary analysis of for 2013 data shows a good correlation between field and lab performance (BBR test results). It also indicates that there is a need to have a minimum threshold for BBR stiffness as well as maximum threshold.

Task-V: Cost effectiveness quantification (0% completed).

No progress in this task this quarter.

Task-VI: Development of crack sealant selection procedures and installation guidelines (50% completed).

A draft of the installation guidelines was submitted before. It is expected to collect the reviews from the panel in this quarter.

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

1. ATLAS testing facility will be used to validate the tracking test developed using DSR. This test will be used to grade the Sealant performance at intermediate and high temperatures.
2. Laboratory testing will be conducted on field aged samples collected from test sites during the 2014 winter survey using BBR, SFE, and DTT.
3. The analysis of the data collected during the third winter survey will be completed.
4. Initial lab-field performance correlation will be done for the 2014 data.
5. Development of new adhesion test will be continued.
6. A conference call will be planned in the next quarter to discuss progress in the project.

#### **Significant Results:**

1. Based on the BBR test results on ATREL field aged samples, sealants are categorized based on their aging potential into three groups; A (low potential), B (medium potential), and C (high potential).
2. Field and lab performance correlation indicates that BBR can be a valid test to evaluate the sealants at low temperatures.
3. Sessile drop test on field aged samples shows that SFE can be a good indication for adhesion potential of crack sealants.
4. From field and lab performance correlation, it is clear that there is a need to have a minimum threshold for low temperature stiffness obtained from BBR test.
5. 2014 field survey data shows that almost 80% of the sealants are in poor condition (PI less than 70%) after two and half years of field performance.

**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).**

The research team has prepared an extension proposal and budget. The extension will be needed to conduct some of the tasks agreed upon in the previous meetings. An updated budget is also prepared to cover the extension period. The new budget does not require additional commitment from the partners.

The research team is experiencing some technical difficulties with the air temperature control of the dynamic shear rheometer resulted in delaying intermediate and high temperature grading of the sealants.

**Potential Implementation:**

Based on the field validation study at various test sites, performance thresholds use 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.