TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Wisconsin 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(302)	**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: Modified Binder (PG+) Specification and Quality Control Criteria		
Name of Project Manager(s): Barry Paye	**Phone Number:** (608)246-7945	**E-Mail** barry.paye@dot.wi.gov
Lead Agency Project ID: 0092-14-20	**Other Project ID (i.e., contract #):**	**Project Start Date:** 9/30/2014
Original Project End Date: 9/30/2015	**Current Project End Date:** 9/30/2016	**Number of Extensions:** 0

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
$195,686.00	$134,245.85	72%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$43,480.27 22%	$43,480.27	75%

Project Description:

The intent of this project is to provide essential information to five partner state agencies (Wisconsin, Ohio, Idaho, Kansas and Colorado DOTs) to support standardization of PG+ specifications by identifying those PG+ test methods that are reproducible and show promise in simulating actual field performance.

Based on the stated needs and goals, the main objectives of the proposed pooled fund research include:

1- Perform detailed assessment of current PG+ and modified binder quality control procedures in partnering states in terms of reliability, applicability, and relevance to performance and quality of modified asphalt binders.

2- Use a range of modified binders, representative of the products currently specified by partner states, to develop unified test procedures and specification criteria based on products placed in the field.

3- Improve product quality and reliability through conduct of ruggedness studies and development of precision and bias statements for selected tests.

4- Introduce consistency to current products supplied by elimination or reduction of differences in modified binder acceptance tests and criteria throughout member states.

5- Validate and establish relevance of suggested PG+ and quality control procedures in terms of mixture performance

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

The following points summarize the progress achieved during Q1 of 2016:

--Mixture Performance Testing Completed: Testing of asphalt mixtures using the Asphalt Thermal Cracking Analyzer (ATCA) was completed for 10 out of the 13 mixtures included in the project. The ATCA allows measuring the following properties:

1. Fracture Temperature,
2. Fracture Stress (strength)
3. Relaxation Modulus (stress divided by strain during cooling)
4. Coefficients of contraction in the liquid and glassy states as well as the Glass Transition (Tg) of mixtures.

The data collected to date indicates that there is a significant differences in fracture temperature depending on binder used and the mixture design. The range is between -17.7 deg C for the Ohio mix with PG 64-28 to -36.4 deg C for the Colorado mix with the PG 64-28. No relationship between the PG grade and the Fracture temperature could be found. The coefficients of contraction in the liquid state also varies significantly and the range is between 4.3 E-5 for the Ohio mix with PG 64-28 to a maximum of 6.4 E-5 for the Kansas mix with PG 64-34.

Sample preparation has begun for the two other mixture performance tests, SCB and IDT Fatigue, and will be the primary focus for Year 2 Quarter 2.

-Binder Testing: Ten out of thirteen binder testing methods have been conducted, analyzed and completed for binders in the study. All binder testing methods (including BBR, BYET and SENB) are expected to be completed by 4/18/2016. The correlation between binder properties and mixture cracking temperatures are not found. The new parameter called Delta Tc, which represents the difference between the continuous grade for the (m) and the (S) from the BBR testing does not show any correlation with the cracking temperatures. More analysis will be conducted to define if any of the binder

Anticipated work next quarter:

Four remaining tasks are required in order to complete the original work plan: 1) IDT Fatigue Mixture Testing, 2) SCB mixture testing, 3) Ruggedness testing of BYET and ER-DSR binder tests, and 4) Collection of pavement performance survey data.

Task (1) IDT Fatigue testing: fatigue testing will be conducted at one stress level for all mixtures to be correlated with LAS, BYET and Elastic Recovery testing of binders. It is anticipated that all IDT fatigue testing will be finished by June 30th, 2016.

Task (2) SCB Testing: The UIUC testing procedure was selected for testing. These results will be correlated with the fatigue testing results and the same binder testing parameters. It is anticipated that all SCB testing will be finished by May 30th, 2016.

Task (3) Ruggedness testing: Three different types of ruggedness testing will be carried out at MARC laboratories: 1) Elastic Recovery DSR, 2) Binder Yield Energy testing at 25 C and 3) Binder Yield Energy Testing at 4 C. Also, multiple labs are encouraged to participate in the study. Testing will require testing 16 samples with two different operators, equipment models and asphalt binder types per testing procedure and temperature. MARC team will ship binder to laboratories interested in participating in the study, but this is not required.

Task (4) Collection of Survey Data: UW researchers will follow up with member states to collect field survey data upon completion of the mixture performance testing plan.

Significant Results:

The significant result from last quarter is related to the Thermal Cracking behavior of mixtures. It is clear that the BBR binder data do not correlate with Mixture Cracking Temperature for the materials tested to date. Therefore, more analysis will be carried out to find if the SENB binder results and the BYET at 4 C can be used to estimate mixture performance. Based on discussion with member state, MARC team agreed on writing three White Papers that will summarize all the binder testing results with the following objectives:

White Paper #1. Analysis of MSCR %R parameter regarding: a) detection of elastomer polymer modification, b) selection of MSCR limits when compared with the AASHTO M332 standard and 3) recommendations for implementation.

White Paper #2: Discussion of available intermediate temperature testing methods that show promise capturing intermediate cracking resistance of pavements. Historical correlations between binder testing and the field will be used to justify preliminary limits for binders provided by members states to UW researchers.

White Paper #3: Alternative binder testing methods to the current BBR S and M values that help more accurately capture an asphalt binders resistance to thermal cracking. All available low temperature mixture performance data will be provided to comment on the extent to which binder properties affect low temperature cracking resistance.

All papers will be provided to Pooled Fund member states by end of April, 2016.

Another significant result is regarding the publishing of the BYET and ER-DSR procedure as the AASHTO TP 123, representatives of member states and the research team provided significant support for this result.

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).

None at this time.

Potential Implementation:

The ER-DSR procedure (AASHTO TP123) shows a high potential to replace the AASHTO T301 that requires the ductility bath.

This procedure of ER-DSR requires much less time for preparation and testing, requires much smaller amount of binder, and give more technically accurate results for Elastic Recovery as the geometry of the sample is kept relatively constant.