

TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Minnesota Department of Transportation

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.

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| Transportation Pooled Fund Program Project # <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i> <p style="text-align: center;">TPF-5(341)</p> <p style="text-align: center;">http://www.pooledfund.org/Details/Study/590</p> | Transportation Pooled Fund Program - Report Period: <input type="checkbox"/> Quarter 1 (January 1 – April 30) <input checked="" type="checkbox"/> Quarter 2 (May 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 4 – December 31) | |
| Project Title: An Innovative Practical Approach to Assessing Bitumen Compatibility as an End Means of Material Specification | | |
| Name of Project Manager(s): PI: Eshan V. Dave / PC: Deborah Sinclair / TL: Benjamin Worel | Phone Number: 603-862-5268 | E-Mail eshan.dave@unh.edu |
| Lead Agency Project ID: MnDOT Contract 1036816 | Other Project ID (i.e., contract #): UNH Grant 14G305 | Project Start Date: 05/15/2020 |
| Original Project End Date: 04/30/2022 | Current Project End Date: 04/30/2022 | 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 |
|----------------------|--------------------------------|--------------------------------------|
| \$204,119 | 0.00 | 3% |

Quarterly Project Statistics:

| Total Project Expenses and Percentage This Quarter | Total Amount of Funds Expended This Quarter | Total Percentage of Time Used to Date |
|--|---|---------------------------------------|
| 0.00 | 0.00 | 2% |

Project Description:

A major challenge in current asphalt pavement material selection, specification and mix design processes is the lack of knowledge in determining compatibility between virgin binders and binders in recycled materials as well as those between binders (new and recycled) and rejuvenators. This lack of a characterization process to evaluate compatibility is a significant issue in the currently adopted U.S. practice for asphalt specification and purchase, whereby multiple sources of binders are often blended and most agencies allow for use of recycled asphalt pavements in the mixtures. The consequence of this is manifested in the form of inferior pavement performance and longevity, lack of guidance to agencies in adopting higher amounts of asphalt recycling, as well as selection of appropriate binders and rejuvenators.

The innovations from the proposed study will be realized in terms of novel applications of material characterization methods (most of which have not been evaluated for the proposed purpose) as well as recommendations to material selection and specification processes. Furthermore, the outcomes of the proposed study will allow NRRRA agencies (and others) to improve existing materials by correctly being able to identify compatibility and therefore select the right materials and additives to use. This would then lead to higher performance and overall greater sustainability for pavement materials. Both analytical and mechanical testing methods as well as advanced analyses will be evaluated to develop a practical and readily implementable protocol for binder compatibility evaluation. Possible examples of a practical binder compatibility characterization method based on preliminary research may include: a rheological index parameter measured using existing binder testing equipment or use of binder elemental analysis using tools such as X-ray fluorescence spectroscopy (XRF).

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

General: One project TAP meeting was held, and one project update presentation was made by research team during this quarter. A project kick-off meeting was held on June 1st, 2020 (minutes of the meeting and presentation are attached with this quarterly report). During this meeting, the material sampling plan and testing plan were specifically discussed by the research team and the project TAP. Second, a project update was made during the during NRRRA's Flexible Team Web-based Workshop on June 3rd, 2020.

Specific progress for various study tasks is provided below.

Task 1 Initial Memorandum on Expected Research Benefits and Potential Implementation Steps: During the proposal phase and the development of the work plan, key benefits were selected to clearly define the benefits the state agencies will receive from the results and conclusions of this research. The research team is currently developing the task 1 deliverable to provide an initial assessment of overall research benefits, a proposed methodology, as well as the potential implementation steps. A draft of the Task 1 deliverable will be submitted to the project TAP for review by end of July 2020.

Task 2 State of the Art Review, Material Selection and Testing Plan: The research team is conducting a thorough literature review regarding the available tools and techniques to assess compatibility of asphalt binders with respect to virgin and recycled asphalt sources as well as rejuvenators. In addition, the research team is currently working on finalizing the material sampling and testing plans based on the discussions and feedback from the TAP during the project kick-off meeting. The amount of material for different material groups (core group and validation group) that is needed for various performance and analytical tests included in this project have been determined by the research team. These material needs are being distributed to various contacts that are helping with coordination of material sampling efforts. A draft of the Task 2 deliverable will be submitted by end of July 2020 for review by project TAP.

Task 3 Material Sampling and Specimen Preparation: No progress to report.

Task 4 Analytical Assessment: No progress to report.

Task 5 Binder Performance Assessment: No progress to report.

Task 6 Mixture Performance Assessment: No progress to report.

Task 7 Final Memorandum on Research Benefits and Implementation Steps: No progress to report.

Task 8 Draft Final Report: No progress to report.

Task 9 Editorial Review and Publication of Final Report: No progress to report.

Anticipated work next quarter:

Key activities that will be undertaken in the upcoming quarter are the following:

Task-1&2: The research team will submit the initial memo and summary of literature review by the end of July 2020 to the TAP for their review.

Task-3: Task 3 is anticipated to start at the beginning of July for executing the material sampling plan that is developed in Task-2 of this study. Various material processing activities will be undertaken in this task as well; these will include binder extraction and recovery from mixtures, mixture long term lab aging, and preparation of mixture test specimens for use in Task 6 will also be undertaken.

In addition, a project update meeting will be conducted in late July or early August 2020. The research team will present the finalized list of selected materials and corresponding project sites. A detailed testing plan on the selected materials will be presented to the TAP for their feedback.

Significant Results:

Significant results from this quarter are listed below:

1.Literature review: the research team is currently conducting a thorough literature review. The review focuses on literature both in the asphalt materials domain as well as those available in fields of organic chemistry and polymer science.

2.Material sampling plan:

a) The A-C three core materials have been preliminarily identified based on the discussions between the research team and the project TAP. These binders are the reference binders to represent the “compatible” and “incompatible” bitumens (for core materials A and B), as conventionally understood, and have been utilized in field sections to enable future field verification. Table 1 below shows the detailed information for these binders. Two of the validation materials have been also identified and are shown in Table 1. The research team is still working on finalizing the other three validation materials (several potential candidate materials are being evaluated including materials representing US 8 test sections that were part of WHRP study and materials from NCHRP 09-58 project)

Table 1 Information for Core and Validation Materials (preliminarily selected)

| Material Group | Material | Base Binders | Binder Sources | Expected Binder Compatibility (Virgin and Recycled) | Corresponding Field Section/Pavement Built |
|----------------|----------|--------------|----------------|---|--|
| Core | A | PG 58-28 | Minnesota | Compatible | MnROAD/NRRA |
| | B | PG 64-22 | Alabama | Incompatible | NCAT, Alabama |
| | C | PG 64-22 | Missouri | Unknown | Missouri (District: SE) |
| Validation | D | PG 46-34 | Missouri | | Missouri (St. Louis Area) |
| | E | PG 58-28 | Illinois | | Illinois (Chicago region) |
| | F | TBD | TBD | | TBD |
| | G | TBD | TBD | | TBD |
| | H | TBD | TBD | | TBD |

TBD: To be determined.

b) In light of discussions with the TAP, research team decided to not include asphalt binder modifiers (such as polymer modification) for the A-C three core materials. Instead, modifiers will be considered to increase the material base evaluated in this project for the verification materials. The A-C core materials will be primarily used to evaluate the

compatibility and incompatibility between the binders (different sources), RAP (sources and dosages) and the rejuvenator additives (sources and dosages).

- c) The research team was able to locate significant quantities of aggregate and RAP from core materials A and B. Thus, as per the TAP's recommendation, all core and validation mixtures will be prepared using these same sources of aggregates and RAP. The research team will also conduct limited mixture performance tests and binder tests from as produced mixtures for the selected materials. In addition to binder and plant-produced mixtures, raw materials (aggregate, binder, RAP, additives) for each material type will also be sampled in case these materials are needed during the course of the project.
- d) The research team is currently working with NRRRA members to finalize the list of validation materials.
- e) Based on the preliminary testing plan proposed in the project, the table below shows the estimated the amount of materials needed for the two material groups.

Table 2 Estimated Amount of Material Needed for Each Group (A-H)

| Materials | Amount of Mixture Needed (lbs) | Amount of Raw Material Needed (lbs) | | | |
|------------------------|--------------------------------|-------------------------------------|---------|-----------|-------------|
| | | Binder | RAP/RAS | Aggregate | Rejuvenator |
| Core (A/B/C) | 875.0 | 60.0 | 435.0 | 875.0 | 3.0 |
| Validation (D/E/F/G/H) | 550.0 | 40.0 | 275.0 | 550.0 | 2.0 |

3. Material testing plan

- a) Based on the feedback from the TAP, the suggested binder analytical methods and the binder/mixture performance tests will be conducted on the three core materials. The tests/methods that show promise in identifying the compatibility/incompatibility of the core materials will be used for the validation materials to further evaluate their effectiveness. The research team will keep the same aggregate source and gradation but vary the binder sources (A-C binders) when designing the mixtures for the fractional factorial design that will be used with the core materials in this study.
- b) The material testing plan will be finalized based on the final material sampling plan, results of literature review and further discussions with the TAP.

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).

Nothing to report at this time.

Potential Implementation:

Nothing to report at this time.