Feasibility Assessment of Warm Mix Asphalt (WMA) in Arkansas

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20BASU24

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Tran-SET

Arkansas State University

Ergon/Paragon Testing

Total Project Cost:

$100,099

Assesing the feasibility of the use of selected additives in the production of WMA binders in Arkansas.

Even though the warm mix asphalt (WMA) technologies are not a new concept in the U.S., they have not been adopted by many state agencies including the Arkansas Department of Transportation (ArDOT). This is mainly due to the lack of performance data of WMA for Arkansas conditions. ArDOT has not adopted any additive-based WMA technologies even though their benefits in terms of energy saving are promising. They can reduce production temperatures by 16° C to over 55° C compared to traditional hot mix asphalt (HMA). The reduction in production temperatures leads to reduced emissions, dust, and production costs. The WMA technologies can also extend the paving season or hauling distance in certain locations where the construction of HMA is restricted to warmer months. The proposed study will minimize the research gap by generating performance data that is currently not available in terms of viscoelastic properties of additive modified binders. For this, a laboratory study will be undertaken to evaluate four warm mix additives, namely Sasobit®, Aspha-Min®, Evoflex® and Radiset®, by mixing them with the three ARDOT-certified performance grade (PG) binders. First, the changes in rheological properties of the asphalt binder upon the addition of WMA additives will be evaluated by following a series of conventional binder testing protocols. Then, the chemical properties and surface free energies of the modified asphalt binder will be evaluated. Among other properties, the reductions of mixing of compaction temperatures due to use of these additives will be evaluated. This study's findings will determine the best WMA

Problem Statement

Warm mix asphalt (WMA) technologies allow reductions of production temperatures of asphalt mixes. The benefits of these technologies to the United States in terms of energy savings and air quality improvements are promising, but these technologies need further research to validate their expected performance and added value. WMA technologies can reduce the production temperature of the hot mix asphalt (HMA) by 16° C to over 55° C. The reduction in production temperatures can lead to reduced energy consumption, emissions, dust, and production costs. These technologies can also extend the paving season in certain locations where the construction of the HMA is restricted to warmer months. However, no performance data of WMA additive-modified binders and mixes are available for conditions in Arkansas. The proposed study will generate such data for the first time and reduce the research gap.

Objectives

The main goal of this study is to assess the feasibility of selected additives in producing WMA binders in Arkansas. In particular, their effects on the viscoelastic and chemical properties of selected asphalt binders will be determined in labs. The specific objectives are listed below:

- Evaluate changes in asphalt binder's viscosity due to the addition of WMA additives.
- Determine changes in binder grade of the selected asphalt binder due to the addition of WMA additives;
- Determine the effect of WMA additives on the oxidation of the selected asphalt binder.
- Evaluate the effect of short term aging, using the rolling thin film oven (RTFO), on binders with and without additives at a reduced temperature.
- Determine the chemical properties components of the asphalt binder with and without WMA additives

Intended Implementation of Research

Workforce Development: This will be achieved directly by training graduate, undergraduate, and high school students interested in pursuing a career in STEM or Transportation Engineering career.

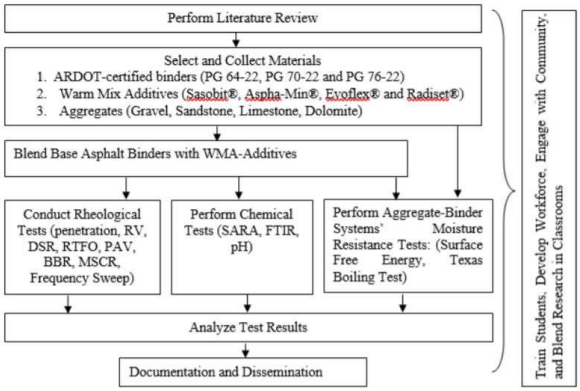

Figure 1. Flow diagram of the proposed research project

Education: This task supports the federal initiative to build the next generation of transportation professionals to meet the demands of the rapidly changing the 21st-century transportation system. The PI currently supports and mentors five graduate students and three undergraduate students from external grants. The proposed study will help the PI to recruit and train more graduate and undergraduate students in transportation research.

Outreach: Technical articles, posters, and presentations will be delivered at national and local conferences and symposia such as ASCE, Transportation Research Board, ARDOT, Tran-SET, and Create@STATE. Also, a Create@State radio (KASU) podcast will be prepared.

Anticipated Impacts/Benefits of Implementation

The findings of this study will help government agencies (state, city and county) and asphalt industries in the region to use knowledge learned on the use of additive-based WMA technologies. It is expected to be a significant cost saving for these agencies by producing asphalts at lower production temperatures that will be safer for the environment and humans. Main deliverables for this project are:

1. An implementation report containing technology transfer (T2) activities involving the major stakeholders and implementation ratings established by the project review panel.
2. A final report and quarterly reports containing the technical findings and an overall assessment of the usage of WMA for conditions prevailing in Arkansas.
3. Presentation(s) at symposia such as the ArDOT Annual Technical Research Committee (TRC) Conference and at the Tran-SET Annual Conference showcasing the findings of the study.
4. A podcast and webinar broadcasting major findings of the research.

Web links

- Tran-SET's website https://transet.lsu.edu/research-in-progress/

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit our website, LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.