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2021 RESEARCH PROJECT STATEMENT

Research Topic:

Optimization of MassDOT's High Performance Thin Lift Mixtures

Research Budget and Timeline:

- \$160,000-\$200,000
- 21-27 months (of which final 3 months are for review)

Problem Statement and Objectives

MassDOT and municipalities within the Commonwealth are utilizing new technologies to enhance the resiliency of their pavements because increased resiliency extends the service life of the road network. One method to enhance road resiliency is to use high performance thin asphalt overlays (HPThinOL) as a pavement preservation strategy. HPThinOLs have become an integral component of the "pavement preservation toolbox" as noted by the Federal Highway Administration (FHWA), Foundation for Pavement Preservation, and other groups. HPThinOLs are placed on roads that have remaining structural capacity that is expected to outlive the pavement preservation strategy. Several state agencies such as NJDOT, NYDOT, ODOT, and other state agencies have specifications for HPThinOL that generally require the use of Polymer Modified Asphalt (PMA). These mixtures are required to meet enhanced performance characteristics compared to traditional dense graded hot mix asphalt (HMA).

MassDOT has some experience using PMA in its asphalt mixtures but has had much more experience using asphalt rubber (AR). AR is defined by the American Society for Testing and Materials (ASTM) Specification D6114-97 as "a blend of paving grade asphalt cements, ground tire rubber (GTR) and other additives, as needed, for use as binder in pavement construction." The Department typically specifies AR for gap-graded hot mix asphalt mixtures which require a higher amount of asphalt binder as compared to a typical dense graded mixture. Because of their high binder content, asphalt rubber gap-graded (ARGG) mixtures have several positive performance qualities such as: improved fatigue cracking resistance, improved ability to mitigate reflective cracking, resistance to aging and oxidization, resistance to surface-initiated cracking, and resistance to rutting due to higher viscosity and softening point. These benefits have been observed with the multiple projects that employed ARGG going back to 2008, most of which still exhibit satisfactory pavement conditions after years of service life.

In an effort to foster innovation and to encourage competition, MassDOT is piloting a special provision which allows contractors to choose between placing HPThinOLs either



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as an ARGG or a PMA dense-graded mixture. While different mixtures, both materials are required to meet identical performance targets utilizing a Beam Fatigue, SCB and Hamburg Wheel Tracking Test. However, MassDOT has yet to determine if using a dense graded polymer modified high performance thin overlay mixture provides the same (or better) performance and life cycle costs as compared to the asphalt rubber gap graded mixtures in which there is more experience. MassDOT wishes to evaluate its ARGG and PMA HPThinOL specifications and performance characteristics as they currently stand. This will allow MassDOT to optimize the use of HPThinOLs and improve road resiliency.

Research Objectives

1. Evaluate current MassDOT ARGG and PMA HPThinOL mixes and benchmark their performance and construction costs relative to each other and a conventional control mixture.
2. Evaluate the long-term aging characteristics of each mixture.
3. Determine if it is possible to optimize materials or design parameters to improve on the current specifications.
4. Perform a life cycle cost analysis for the optimized mixture types.
5. Compare PMA HPThinOL mixtures to the ARGG mixtures in terms of both performance and life cycle cost analysis.
6. Determine which mixture is better for MassDOT to utilize as a pavement preservation strategy in terms of performance and cost. This will optimize the service life of the strategy.

Anticipated Outcomes and Deliverables

The research will provide MassDOT with a recommendation, along with supporting data, of the most appropriate mixture for MassDOT to utilize as a HPThinOL pavement preservation strategy in terms of performance and cost. The outcome of the project will be

- a. A report outlining the performance and life cycle cost differences between PMA dense-graded mixtures, AR gap-graded mixtures and a conventional control mixture. It will explore areas where the current specifications can be enhanced. The report will also recommend which mixture is better for MassDOT to utilize as a HPThinOL pavement preservation strategy in terms of performance and cost. This information is necessary so that MassDOT can focus efforts on specifying and refining specifications for the mixture which best improves the resiliency of the roads.
- b. Draft update to MassDOT's hot mix asphalt material specifications and Quality Assurance program.



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- c. A webinar and technical brief explaining the outcomes of the research.

It is advised that the research team should conduct several workshops for both MassDOT and Industry to explain the final recommendation, the comparison measures, and the costs analysis.

Deliverables:

1. Final Report
2. Final Presentation
3. Draft Specification
4. Webinar(s) to disseminate results among key stakeholders