Research Summary

Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide (Phase II)

Research Need

MassDOT is striving to improve its highway infrastructure's resiliency to climate change, environmental impacts, and traffic loading by implementing new technologies that can provide valuable return on investment. These improvements should begin with the pavement design process which currently utilizes antiquated empirical design methods from the 1960's.

AASHTO's new Mechanistic-Empirical (M-E design) pavement design method is currently used or being evaluated by at least 33 state agencies and would be a significant improvement in design. AASHTO M-E design predicts pavement distresses utilizing prediction models that were developed and nationally calibrated using in-service pavements. To accurately predict the design performance in Massachusetts, these models need to be calibrated according to Massachusetts local conditions.

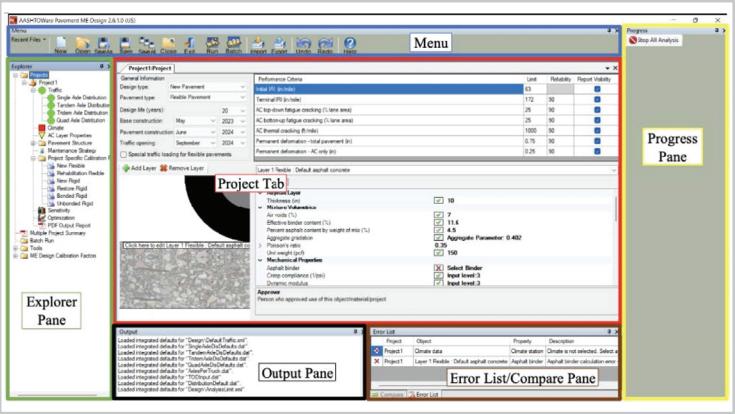
Goals/Objectives

Due to the complexity of the research problem, a multi-phase (four phase) approach over several years was suggested. The objectives for this second phase were:

1. Develop an AASHTOWare® Pavement M-E Design software users manual for MassDOT.

2. Develop a local experimental plan and sampling template.

3. Continue initial testing of already sampled mixtures to accelerate future phases of this research.



Methodology

The experimental plan designed for this phase of the project included:

1. Develop a standalone manual that shows a user a thorough step-by-step procedure on how to use the AASHTOWare® Pavement ME Design software. The manual will guide users on how to generate the data (materials properties, climatic data, and traffic data) as they relate to local locations within the state of Massachusetts.

2. Develop a statistical plan or sampling template to refine the calibration of the AASHTOWare® Pavement ME Design software distress and IRI prediction models based on local conditions, policies, and materials.

3. Continue initial dynamic modulus testing that is required for the M-E design using plant-produced mixtures already sampled.

Key Findings

Due to its complexity and sophistication, the procedure for utilizing the AASHTOWare® Pavement M-E Design software, as well as the required inputs (climate data, traffic data, material data, etc.), is not obvious and intuitive for the user. The user needs experience and knowledge to utilize the software correctly. Therefore, a standalone manual was developed for MassDOT in this study that shows a user a thorough step-by-step procedure on how to use the software. The manual guides users on how to generate the data, in particular materials properties, climatic and traffic data as they relate to local locations within the state of Massachusetts.

A preliminary experimental and sampling plan for local verification/calibration of the distress functions and smoothness regression equations in the AASHTOWare® Pavement M-E Design was developed. Relying solely on LTPP site data would have resulted in too few sites for the local calibration process. Hence, it was suggested to test new mixtures, and the sites where these mixtures are placed be included in the local verification-calibration process.

Several plant-produced mixtures were tested in this study to generate the inputs necessary to run designs using the AASHTOWare® Pavement M-E Design software. The mixtures selected were those most produced on regular basis (based on tonnage) in Massachusetts and not developed for a specialized application. The testing of these mixtures included: measuring the dynamic modulus at different temperatures and different frequencies using the Asphalt Mixture Performance Tester (AMPT) and determining the complex modulus and the phase angle of the asphalt binder used in each mixture measured using the dynamic shear rheometer. This data was analyzed and combined with the as-built properties of the mixture obtained from production data to create cut-and-paste formatted data that can be directly input into the AASHTOWare® Pavement M-E Design software.

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Project Information

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22-XXX

Key Words:

Mechanistic-Empirical, distress, prediction, pavement design

Use of Findings

This study was conducted as phase two of a four phase larger research project aimed at implementing the AASHTO MEPDG in Massachusetts.

The goal of this study was to develop an AASHTOWare® Pavement M-E user manual and develop a local experimental plan and sampling template. Additionally, testing was conducted on typical plant-produced mixtures sampled from across Massachusetts in an attempt to accelerate future phases of this research.

The findings of this phase build upon the findings from the prior phases and support the future phases of the larger research project.

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