Research Summary

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

Research Need

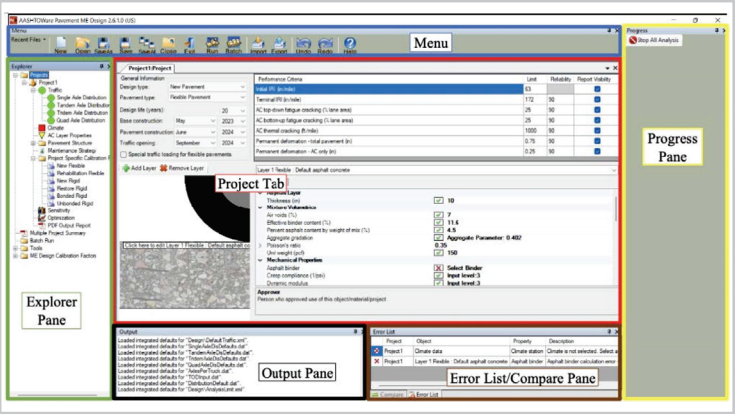
MassDOT is striving to improve its highway infrastructure's resiliency to climate change, environmental impacts, and traffic loading by implementing new technologies that can provide valuable return on investment. These improvements should begin with the pavement design process which currently utilizes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

AASHTO's new Mechanistic-Empirical Pavement Design (PMED) method is currently used or being evaluated by at least 33 state agencies and would be a significant improvement in design. AASHTO PMED method 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 main objective for this third phase was to collect/obtain relevant field (distress data, Falling Weight Deflectometer data, etc.) and laboratory data (mixture production data, mixture performance data, binder properties, etc.) that are needed for the local calibration of the AASHTO PEMD prediction models.



Methodology

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

1. Review the previously developed local experimental plan and sampling template from Phase II.

2. Evaluate the estimated sample size for bias and precision for each of the distress prediction models.

3. Select roadway segments and plant produced mixtures. Mixtures that represent the spectrum of mixtures produced in Massachusetts will be collected and tested in Phase III.

4. Continued laboratory testing of mixtures to obtain data for Level 1 PMED implementation.

5. Conduct field and forensic investigations.

6. Establish a calibration database using excel.

Key Findings

For this phase of the research study, MassDOT chose to focus on data collected from Long-Term Pavement Performance (LTPP) test sections located in Massachusetts and neighboring states. These projects were selected because they provide readily available traffic, climate, subgrade, materials, structure, and performance data. The study used these LTPP sites to evaluate the global calibration coefficients and determine whether regional adjustments were needed for Massachusetts.

A total of 18 new flexible pavement sections and 48 asphalt overlay sections were incorporated into the regional verification and calibration of the flexible pavement transfer functions.

In addition, several plant-produced mixtures were tested to generate inputs that will enhance the accuracy of calibration in Phase 4. The selected mixtures represented those most commonly produced in Massachusetts (by tonnage) rather than specialty mixtures. Testing included measurement of dynamic modulus at multiple temperatures and frequencies using the Asphalt Mixture Performance Tester (AMPT), as well as determination of binder complex modulus and phase angle with the Dynamic Shear Rheometer (DSR). These results were analyzed and integrated with as-built mixture properties obtained from production data to create formatted datasets that can be directly imported into the AASHTOWare® Pavement M-E Design software.

Based on the LTPP and laboratory data in this phase, regional calibration coefficients suggested for use in Massachusetts were determined. These coefficients were determined by distress type for new flexible pavements and asphalt overlays.

Recommendations for future verification efforts were also determined and presented.

Research and Technology Transfer Section
MassDOT Office of Transportation Planning
Planning.Research@dot.state.ma.us

Project Information

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Principal Investigators:
Professor Walaa S. Mogawer, P.E., F. ASCE
Performing Organization:
University of Massachusetts Dartmouth
Project Champion:
Edmund Naras, MassDOT
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Mechanistic-Empirical, distress, prediction, model calibration pavement design, transfer function, LTPP

Use of Findings

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

The goal of this study was to collect/obtain relevant field (distress data, Falling Weight Deflectometer data, etc.) and laboratory data (mixture production data, mixture performance data, binder properties, etc.) that are needed for the local calibration of the AASHTO PEMD transfer functions and to initiate the calibration process.

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

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