Joint Transportation Research Program

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Demonstration Project for Asphalt Performance Engineered Mixture Design Testing

Introduction

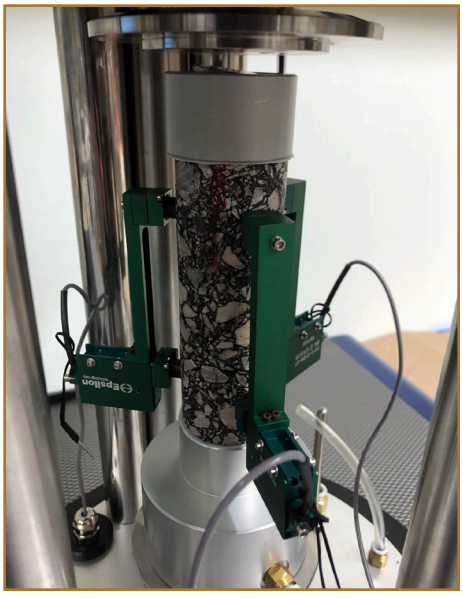
The complicated nature of asphalt mixtures makes it difficult to predict the performance of asphalt pavements over their service lives; and several visions of performance-based mixture design have been developed over the past decades. The Federal Highway Administration (FHWA) intends to unify these performance-focused methods under a single vision called Performance Engineered Mixture Design (PEMD), which can be used to predict the performance of asphalt mixtures.

The FHWA is supportive of state departments of transportations (DOTs) adopting index and predictive performance tests, especially those making use of the Asphalt Mixture Performance Tester (AMPT). Under the Accelerated Implementation and Deployment of Pavement Technologies Program, the FHWA provided state DOTs the opportunity to evaluate and better understand the AMPT and its testing capabilities. The FHWA is therefore encouraging state DOTs to gain experience with the requirements of the procedures and analysis tools for PEMD.

The main objective of this study is to evaluate the fatigue cracking of three INDOT mainline pavement projects and to better understand the fundamental engineering testing capabilities of the AMPT.

Findings

The results of dynamic modulus and cyclic fatigue tests indicate that AMPT testing can be used to effectively



Specimens in the Aphalt Mixture Performance Tester.

evaluate INDOT asphalt mixtures during the mixture design and production phases. However, detailed planning and effective training are needed to help ensure the successful completion of AMPT testing. The study yielded the following findings.

- The FlexMat software is not entirely user friendly and was initially designed to handle output from only one manufacturer's equipment type. A more robust software program will need to be more fully developed before widespread use can occur.
- Great care must be taken in small core (38 mm) specimen preparation, especially when the small cores are taken from thin surface mixture field cores. Extra precaution must be taken to obtain the best possible quality without any visible damage. Additionally, the cutting saw needs to be inspected regularly to ensure the blade cuts a completely flat surface. A poor core/cut can cause an uneven tensile load distribution during cyclic fatigue testing, which results in unacceptable test results (e.g., end failure).
- AASHTO TP-133 test method sample preparation and test setup can influence the final test results. This influence is even more evident for asphalt mixtures with higher dynamic moduli and lower phase angles. These more brittle mixtures do not behave well at the currently recommended AASHTO TP-133 test temperature. A higher test temperature and lower strain level for testing such mixtures might provide more acceptable results.
- The AASHTO TP-133 methods provides guidance on determining the target on-specimen strain levels. Although, helpful in estimating the initial strain levels, it appears these suggested values are too high for INDOT's asphalt mixtures. A lower on-specimen strain level should be selected for the first cyclic fatigue test of each mixture.
- The AMPT was specifically developed for evaluating performance of asphalt mixtures. Although it is not complicated to work with the AMPT, there are a myriad of details that must be looked after. AMPT technicians should be thoroughly trained, the testing organized, and technical resources provided to ensure successful test completion.
- Dynamic modulus testing can differentiate between asphalt mixture characteristics, such as relaxation capability and stiffness. Lower relaxation and higher stiffness can mean a mixture is more susceptible to cracking.
- All four asphalt mixtures tested in this project indicate adequate cracking resistance according to the currently suggested FHWA guidelines for standard traffic.

Implementation

While many challenges were experienced during the execution of this research, not the least being a worldwide pandemic that closed the testing laboratories, the results demonstrate that both AMPT testing and performance engineered asphalt mixture designs can be implemented in Indiana. Successful implementation would require additional testing and training and upgrades to the FlexMat software.

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