Research Project 37

RAP Mixtures and the Mechanistic-Empirical Pavement Design Guide

Recycled Materials Resource Center

University of New Hampshire

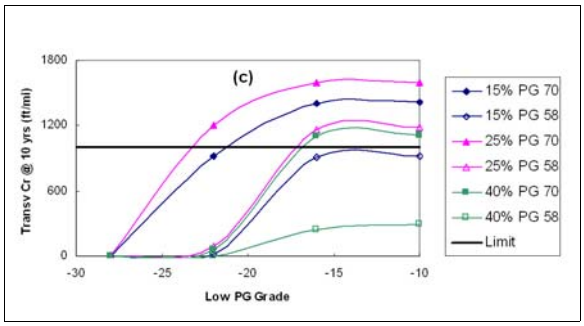
Federal Highway Administration

Project Description

Many agencies currently allow, or even encourage, the use of recycled asphalt pavement (RAP) materials in hot mix asphalt (HMA). The amount of RAP used varies depending upon agency experience and the application of national guidelines developed under NCHRP project 9-12. Currently, the state of New Hampshire allows up to 30% RAP from a known source or 15% RAP from an unknown source to be used in a mixture. The addition of the aged RAP binder in the mix increases the stiffness measured in the laboratory. Recent research conducted during RMRC Project 9 and the first part of Project 37 has shown that the addition of RAP also increases the VMA of the mixture. The increase in VMA decreases the mixture stiffness, offsetting the increase due to the RAP binder. However, how this translates to mixture performance in the field is not well defined.

The mechanistic-empirical pavement design guide (M-E PDG) uses various models to predict pavement performance from measured or predicted material properties. Level 1 analysis in the M-E PDG uses laboratory measured values for the specific mixture while Level 3 analysis uses predicted mixture properties that are based on the binder and aggregate properties in the mixture. With RAP mixtures, the appropriate binder properties are difficult to define, as there is partial blending that occurs between the RAP binder and the virgin binder. The purpose of this project will be to evaluate the predicted field performance of RAP mixtures using both the Level 1 and Level 3 analysis. Extensive material characterization has been performed on mixtures containing 15%, 25%, and 40% of two different RAP sources in previous RMRC projects. This information will be used for input into Level 1 analysis in the M-E PDG to determine the influence of the RAP on the field performance. Analysis will be performed for typical high and low volume pavement structure in the northeast U.S. Traffic and climate data used in the analysis will be obtained from state highway agencies as well as from LTPP sites. The predicted performance, in terms of rutting, longitudinal, fatigue, transverse cracking, and IRI for the different RAP mixes will be compared for developing relationships between percent RAP in mixes and performance. Level 3 analysis will be conducted using RAP binder properties, virgin binder properties, and combinations of the two to determine the appropriate method of dealing with Rap mixtures in the Level 3 analysis and the sensitivity of the results to the input parameters.

Typical pavement cross section analysed using M-E PDG.



M-E PDG predicted transverse cracking at 10 years versus assumed low temperature PG grade for RAP mixtures with different RAP percentages and high temperature PG grades.

Project Partners

New Hampshire DOT

End Products

The outcome of this project will be a better understanding of how to handle RAP mixtures within the framework of the M-E PDG. It will also provide some information on the expected performance of mixtures with various percentages of RAP in the field and serve as a basis for future research using accelerated load testing to bridge the gap between laboratory testing and true field performance.

Further Information

The Recycled Materials Resource Center (RMRC), a cooperative agreement between the University of New Hampshire and the Federal Highway Administration, is a national center that promotes the appropriate use of recycled materials in the highway environment. Its focus is on the long-term performance and environmental implications of using recycled materials.

For detailed quarterly progress reports for Project 37, as well as all RMRC-funded research projects, please see: http://www.rmrc.unh.edu/Research/researchlevel2.asp.

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