RMRC

Recycled Materials Resource Center

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Research Project 66

Design System for HMA Containing a High Percentage of RAS Material

Project Objectives

- Develop a test method to quantify the contribution of RAS binder to the HMA blended binder properties without use of chemical solvents
- Determine the effect of combining RAS and RAP on blended binder properties
- Create and analysis tool allowing users to estimate the effect of varying levels of RAS

Project Summary

The use of Reclaimed Asphalt Shingles (RAS) and Reclaimed Asphalt Pavement (RAP) have been found to be both environmentally sound and economical for use in pavement mixtures, and as a result reclaimed asphalt has become the most recycled material in the United States, with as much as 80% of the total asphalt removed annually being reused in some form according to the FHWA. It is estimated that approximately 11 million tons of reclaimed asphalt shingles are available annually, either from manufacturers' scrap or construction waste. RAS and RAP usage can help offset the rising asphalt construction costs associated with binder and mix design prices. Environmentally, the use of recycled (reclaimed) material reduces construction waste and conserves natural resources.

However, there are cautions. The primary concern with utilizing higher percentages of RAS materials in HMA is the effect of the blending, if any, that occurs between the aged binder within the RAS material and the virgin binder on the effective binder properties. RAS binder is heavily oxidized during production and, similar to the RAP binder, continues to age-harden over time, resulting in a stiffer binder with less ability to relax stress compared to the virgin binder. It's reported that binder extracted from mixes containing RAS materials demonstrated a higher performance grade compared with binder extracted from mixes without RAS, validating the concept that not only does the RAS binder blend with the virgin binder, the effect of the blending can be significant. Mixtures that do not properly account for the blending that can occur between the RAS and virgin binder may then be prone to distresses caused by overly stiff binder such as thermal and fatigue cracking.

The limited use of higher percentages of RAS (and RAP) material in new HMA mixes is a direct consequence of the lack of understanding that exists with regard to the effect of the blending that occurs between the virgin binder and the RAS and/or RAP binder. A binder characterization procedure that can estimate the extent and effect of this binder blending without the use of chemical solvents is needed to better understand how RAS and RAP influences blended binder properties. This research aims to characterize the extent and effect of binder blending with RAS and RAP material.

Project Partners

Asphalt Research Consortium

End Results

Three effects were recognized as products of this research. The first is that the effect of RAS materials on the blended binder continuous grade at all critical temperatures is dependent on the RAS source. The second is The effect of 'stockpile turnover' for a single RAS source on the blended binder continuous grade was clearly demonstrated, indicating a need for project specific sampling. Finally, it is shown that the cumulative effect of RAP and RAS on the blended binder continuous grade is additive

Further Information

The Recycled Materials Resource Center (RMRC) is a national center that promotes the appropriate use of recycled materials in the highway environment. It focuses on the long-term performance and environmental implications of using recycled materials