Development of Quality Standards for Inclusion of High Recycled Asphalt Pavement Content in Asphalt Mixtures

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Abstract

Public highway agencies encourage the use of recycled asphalt materials (RAM) in constructing pavements to the maximum extent possible with an equal performance. Low temperature cracking potential is a primary concern with high RAM mixtures, which is caused by the aging of asphalt through the oxidation. To minimize a low temperature cracking, various rejuvenators have been utilized in the past instead of bumping down a PG grade of the specified virgin asphalt for high RAM mixes. Although the current Iowa DOT's specification allows RAP materials up to 30% with softer binder, limited construction projects have been performed, which utilized more than 20% RAP materials.

The main purpose of this research is to evaluate high RAM mixtures up to 45% RAP with rejuvenators for Iowa DOT and local public agencies by performing laboratory tests and field implementation. The specific findings from this study include:

• Rejuvenators consistently lowered both critical high and low temperatures of virgin binder of PG 58-28S.

• Due to its high variability, FTIR could not determine the effectiveness of rejuvenators in lowering the aging of RAP binder.

• 34% and 45% High RAP mixtures with rejuvenators were compacted well exceeding 93% field density.

• Based on HWT test results, field mixtures with rejuvenators performed better in rutting performance than ones without.

• Based on DCT test results, field mixtures with soft binder endured the highest fracture energy.

• Based on SCB-IFIT test results, rejuvenators improved cracking resistance of RAP mixtures but not RAS mixtures.

• Based on test results of both DCT and SCB-IFIT, there was a good correlation between test results of SCB-IFIT and DCT.
• Based on a condition survey of test sections performed after one year since construction, all test sections performed very well with very little distress whereas test sections without rejuvenators developed several hairline cracks. Rejuvenators were effective in delaying an initiation of cracking.

• When mixtures with rejuvenators were aged, rutting decreased in HWT test but cracking increased in SCB-IFIT test.

• Both 34% and 45% RAP mixtures with rejuvenators were successfully constructed.

For future studies, an approval process for rejuvenators that incorporates long-term aging of the material should be developed. Increasing the maximum RAM percentage up to 50% should be considered for some mixes with additional options for RAM use and binder formulations, which may provide greater flexibility to contractors and binder suppliers. High RAM project sites should be monitored to determine the effectiveness and limitations of design, construction and performance of high RAM mixtures and develop QA/QC aspect of using softer binders and rejuvenators. Finally, a comprehensive asphalt recycling strategy encompassing high RAM mix up to 50%, CIR and HIR should be developed in consideration of both economic and sustainability analyses.