

Effect of Asphalt Rejuvenating Agent on Aged Reclaimed Asphalt Pavement and Binder Properties

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Introduction

Hot in-place recycling (HIR) preserves distressed asphalt pavements while minimizing use of virgin binder and aggregates. The final quality of an HIR mixture depends on the characteristics of the original binder, aging of the pavement surface during service, and whether or not new binder or rejuvenator was added to the mixture. An HIR mixture should maintain desired properties for additional service periods, making asphalt binder modification inevitable. Asphalt binder modifications in HIR are commonly performed by adding an asphalt rejuvenating agent (ARA). However, ARA may adversely affect the qualities of new HIR and potentially fail to improve the quality of the final surface.

Project Description

The objective of this research was to investigate the effects of rejuvenation on HIR performance characteristics by assessing critical performance indicators such as stiffness, permanent deformation, moisture susceptibility, and cracking resistance. A two-step experimental program was designed that included mechanical property measurements of the HIR mixture and rheological properties of the extracted binder. The level of mixing occurring between new and aged binder with ARA was also investigated. HIR samples were obtained from three Kansas Department of Transportation projects, and Hamburg wheel-tracking device, dynamic modulus, flow number, Texas overlay, thermal stress restrained specimen, and moisture susceptibility tests were conducted on mixtures with and without ARA.

Project Description (Continued)

Rheological studies on the extracted binder included dynamic shear rheometer and bending beam rheometer tests. The miscibility of new and aged binder was investigated using scanning electron microscope (SEM) images, energy dispersive X-ray spectroscopy (EDXS), and the exudation droplet test (EDT). Study results showed significant variability in the mechanical performance of HIR mixtures, which was attributed to the variability of binders as observed in EDT, SEM, and EDXS studies.

Project Results

Life-cycle cost analysis (LCCA) showed that HIR is an economic maintenance alternative for asphalt projects in Kansas. LCCA results showed that pavement design strategies with HIR activities will result in alternatives with lower net present values when compared to alternatives without HIR maintenance activities.

Project Information

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