Joint Transportation Research Program

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Evaluation of Reclaimed Asphalt Pavement for Surface Mixtures

Introduction

The Indiana Department of Transportation (INDOT) has successfully used Reclaimed Asphalt Pavement (RAP) for decades because of its economic and environmental benefits. However, until recently, INDOT has disallowed the use of RAP in asphalt surface mixtures because of uncertainties regarding the types of aggregates contained in RAP and their resulting frictional properties, as well as the potential for the hardened asphalt binder in the RAP to increase the occurrence of thermal cracking.

This research was conducted to explore the effects of the inclusion of RAP with poor or unknown aggregate qualities in asphalt surface mixtures to establish maximum allowable RAP contents to provide adequate friction. The effects of RAP on thermal cracking were then investigated at the potential allowable RAP contents.

Slabs of asphalt mixtures with 15%, 25% and 40% of a laboratory fabricated RAP made with poor quality aggregate (with respect to friction) were tested to represent a ‘‘worst case.’’ The slabs were subjected to polishing to simulate the effects of traffic, and changes in the surface texture and friction were measured periodically. Based on these results, possible threshold RAP contents of 25% and 40% were proposed. These threshold limits were further evaluated by testing slabs made with field-sampled RAP materials from across the state. In addition, low temperature cracking tests were performed on mixtures at the potential RAP threshold limits.

Findings

- The testing showed that the addition of poor quality RAP materials did impact the frictional properties and cracking resistance of the mixtures, but that lower amounts of RAP had little effect. The frictional performance of the laboratory fabricated and field-sampled RAP materials was acceptable at contents of 25% but may be questionable at 40%.

- Field friction testing was also conducted on existing roadways with RAP to explore their field frictional performance. Several low volume roadways and one experimental interstate project were tested. The field results showed acceptable performance after 3 to 5 years of low volume traffic at RAP contents of 15% to 25% and after more than 10 years of interstate traffic with 15% RAP.

Low temperature indirect tensile testing showed an increased susceptibility to thermal cracking as the RAP content increased, but the change in critical cracking temperature was relatively small at the 25% RAP level. At 40% RAP without a change in the virgin binder grade, the critical cracking temperature was about 6 °C warmer than that of the control mixture. This finding supports the need for a binder grade change for RAP contents greater than 25%, as indicated in other research and as required by the current INDOT specifications.

Implementation Recommendations

The results of this work confirmed the current INDOT specifications regarding changing the virgin binder grade for mixtures with more than 25% RAP and the recent move to allow RAP in surface mixtures. The current specifications allow up to 40% binder replacement for Category 1 and 2 surface mixtures, and up to 25% for Category 3, 4 and 5 mixtures, with limits on the RAP gradation that require the use of the finer RAP fraction (100% passing the 9.5 mm [⅜ in] sieve). The results of this research showed that these specification limits are reasonable. A related research project, *Maximizing the*

Use of Local Materials in HMA Surfaces (SPR-3308), is evaluating the effects of various amounts of low frictional quality coarse aggregates on surface friction; based on the results of that project, INDOT may consider relaxing or eliminating the size restrictions on RAP for hot mix asphalt (HMA) surfaces. INDOT could also consider, on a case-by-case basis, proposals from contractors to mill and stockpile high friction aggregates surface courses separately so that higher RAP contents could be used without sacrificing frictional performance. Because of the costs associated with milling lifts separately and maintaining distinct stockpiles, it is recommend that this should be the contractor's proposal when it is feasible and advantageous to both INDOT and the contractor, rather than being a requirement for all projects. At the current time, there is not a high demand for this option.

These findings have already been implemented and future changes can be readily implemented by revising the specifications if warranted by the results of SPR-3308 and approved by the Specifications Committee. No additional costs are associated with the implementation and, in fact, eventually lower materials costs would be expected. Continued monitoring of the performance of RAP mixtures in the field can be implemented through the Pavement Management System and the INDOT Office of Research and Development friction testing program.

Recommended Citation

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Dynamic Friction Tester (DFT) in use.