

Evaluation of Additional Laboratory Tests for Design of Full-Depth Reclamation Mixtures Using Foamed Bitumen

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Abstract

The mix proportion design methods for full-depth reclamation mixtures using foamed bitumen normally fix a constant active filler content, and an indirect tensile strength (ITS) test is used to determine the optimum bitumen content. However, it has been reported in the literature that for some materials the ITS test is not sufficiently sensitive to bitumen content. This lack of sensitivity is a problem for the practitioner engineer who has to validate the bitumen content adopted in the mixture design. The main objective of this work is to examine the sensitivity to bitumen content of additional laboratory tests that could complement current design methods based on ITS. The mixtures used in the study were prepared by using three recycled blends of reclaimed asphalt pavement and aggregate that were mixed with bitumen foam contents of 1.25%, 2.5%, and 3.75%. Test results confirmed the low sensitivity of the ITS test, and it was found that the indirect tensile fatigue (ITF) test was the most sensitive among all tests. To explain the higher sensitivity of the ITF test compared with the ITS test, a stress-strain diagram and a simple unidirectional mechanical model were developed. In addition, an S-N fatigue diagram was used to illustrate that at a larger number of load cycles, the effect of the foamed bitumen content is clear, as shown in the experimental work. Overall, the laboratory program and material behavior analysis indicate that when the ITS test does not provide conclusive results, the laboratory program should be complemented with ITF tests to determine the optimum foamed bitumen content with more reliability..