Research Project: ***SP909B4E***
Date: ***May 2013***

RESEARCH SUMMARY

DESIGN AND EVALUATION OF FOAMED ASPHALT BASE MATERIALS

Problem

Foamed asphalt stabilized base (FASB) combines reclaimed asphalt pavement (RAP), recycled concrete (RC), and/or graded aggregate base (GAB) with a foamed asphalt binder to produce a partially stabilized base material. Although widely used, most experience with FASB materials is from regions that have quite different native materials, design standards, climate, and traffic conditions than in Maryland. This project evaluates the suitability of FASB for Maryland paving conditions.

Objective

The objectives of this study are to determine for Maryland conditions: (a) FASB mix design procedures; (b) typical engineering and structural design properties; (c) guidelines for FASB production and placement; and (d) best practices for construction quality assurance. The deliverables include recommended properties for pavement structural design and draft specifications.

Description

The study consisted of three major components: (a) laboratory evaluation of FASB mix design procedures; (b) field evaluation of in-place FASB stiffness, and the increase in this stiffness with time due to curing; and (c) direct laboratory measurement of the performance related properties of FASB, specifically dynamic modulus and permanent deformation resistance. The findings from these investigations were then synthesized into recommended material property values for pavement structural design and draft specifications.

The laboratory study of FASB mix design procedures evaluated two binders and eight different aggregate combinations over a range of foamed binder contents. The major emphasis of the mix design evaluation was on mixing and compaction moisture, accelerated curing procedures, and optimization of foamed binder content in terms of dry and soaked indirect tensile (IDT) strength.

The field evaluation component of the study considered several sites. The best in terms of comprehensiveness and quality of data was the MD295 lane addition project. FASB stiffness increase with time immediately after placement was monitored with a Zorn Lightweight Deflectometer (LWD) and a Humboldt Geogauge. The initial stiffness and the stiffness increase with time in the FASB sections were both substantially higher than for a conventional Graded Aggregate Base (GAB) section. Backcalculated FASB layer stiffness at 4 to 6 months after placement was an order of magnitude greater than the backcalculated GAB layer stiffness:

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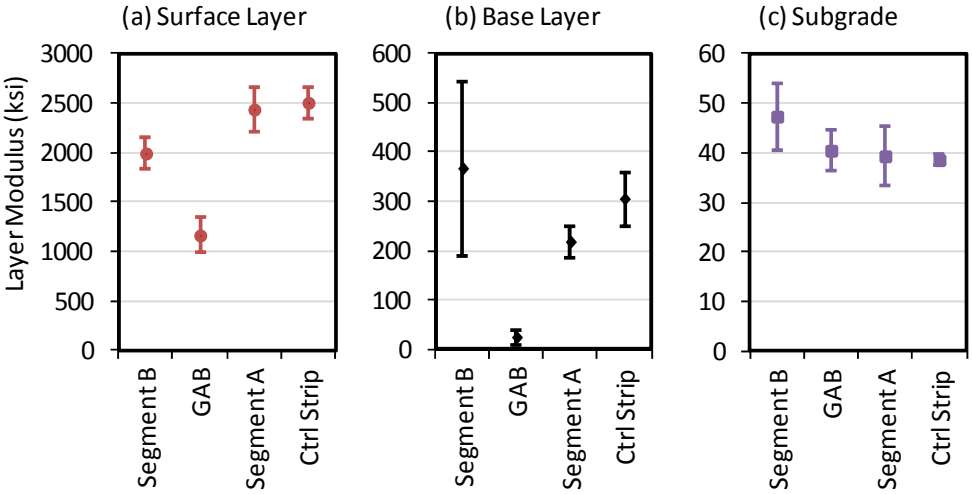

FASB dynamic modulus and repeated load permanent deformation characteristics were measured in the laboratory from cores taken 4 to 6 months after construction. The mean value of dynamic modulus at 77°F and 10 Hz loading rate measured from the MD295 FASB cores was 629 ksi. This value is approximately 75% of the stiffness measured from HMA cores from the MD295 project. FASB permanent deformation resistance as measured from field cores was found to be comparable to that of HMA, especially considering the lower stresses in the FASB layer because of its greater depth in the pavement structure.

Results

A primary objective of this study was the determination of default pavement structural design properties for FASB materials. These recommendations are:

- 50 psi IDT strength specification limit: E* = 400 ksi, a_2 = 0.35
- 40 psi IDT strength specification limit: E* = 300 ksi, a_2 = 0.30

The results of the study will also be used to develop draft specifications for FASB mix design procedures, FASB production and placement, and construction quality assurance procedures.

Report Information

Link to the full report: http://www.roads.maryland.gov/OPR_Research/MD-13-SP909B4E_Foamed-Asphalt-Base-Materials_Report.pdf

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