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Development of a Design Methodology for Asphalt Treated Mixtures

INTRODUCTION

The increase in energy costs has led to a significant rise in the cost of mixtures containing asphalt cement. This resulted in a need to search for alternatives that reduce the cost of those mixtures without compromising performance. One such alternative is the use of asphalt treated mixtures. Asphalt treated mixtures are hot mix asphalt (HMA) mixtures consisting of crushed rock or natural gravel mixed with low percentages (1 percent below standard HMA mixtures) of paving grade asphalt cement. These mixtures cost less than typical HMA mixtures because they can be produced with less expensive aggregates and lower percentages of asphalt cement binder and easier compaction efforts. Asphalt treated mixtures can be used in the construction of base course layers as well as shoulders of a pavement structure.

This report summarizes the results of a study that was conducted to develop a simplified design methodology for asphalt treated mixtures through the examination of the performance of mixtures that have a different aggregate gradation from typically available sources.

OBJECTIVE

The primary objective of this research was to develop a simplified design methodology for asphalt treated mixtures that is durable, stable, constructible, and cost effective.

A secondary objective of this research was to compare the performance of the asphalt treated mixtures to unbound granular materials and conventional asphalt mixtures that are currently used in the construction of base layers in Louisiana.

METHODOLOGY

This research study was conducted in two parallel parts. Part I consisted of designing asphalt treated mixtures with different aggregate sources and conducting a laboratory testing program to characterize the behavior of the designed mixtures. A detailed list of these aggregate sources and the laboratory characterization program is found in the final report.

In Part II of this study, four overlay rehabilitation projects were selected in Louisiana to evaluate the constructability of asphalt treated mixtures designed in Part I. In each of the four selected projects, a 1-mile test section of the roadway shoulder was constructed using one of the asphalt treated mixtures designed and evaluated in Part I. In-situ testing along with a suite of laboratory testing is also detailed in the final report to characterize and evaluate the expected performance of these mixtures.

LTRC Report 453

Read online summary or final report:
www.ltrc.lsu.edu/publications.html

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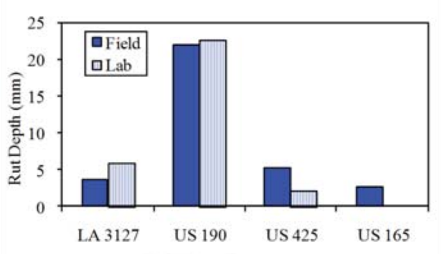
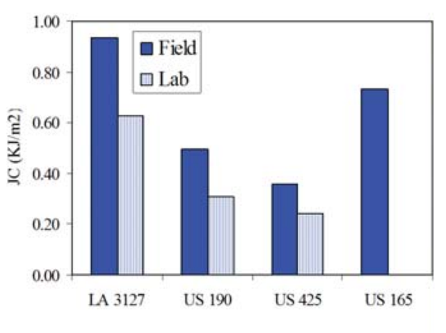
CONCLUSIONS

The results of Part I showed that the asphalt treated mixtures containing limestone aggregates had the best laboratory performance among all other mixtures designed in this study. Furthermore, their performance was similar to conventional base course HMA at high and intermediate temperatures. The results of the laboratory test conducted in Part I also showed that the asphalt treated base mixtures have several folds of improvement of unbound granular base materials in terms of stiffness and permanent deformation resistance. In addition, the Mechanistic-Empirical Pavement Design Guide (MEPDG) analysis showed that asphalt treated mixtures can be used to extend the service life and/or reduce the design thickness of a pavement structure as compared to pavement structures containing unbound granular materials. The results of Part II of this study demonstrated that asphalt treated mixtures can be successively produced in conventional HMA plants and constructed in the field. This report documents a simplified method of determining field density base on 30 gyrations of a Superpave gyratory compacted (SGC) sample. The in-situ tests' results showed that asphalt treated mixtures exhibited similar moduli to those of conventional HMA base course mixtures.



Loaded wheel tracking (LWT) field results



Semi circular bend (SCB) test results of lab and field mixtures

RECOMMENDATIONS

A simplified design methodology for durable, stable, constructible, and cost effective asphalt treated mixtures was developed based on the results of this study. The following initiatives are recommended in order to facilitate the implementation of this study:

- Allow the use of the proposed asphalt treated mixtures in construction of the wearing course layer of the roadway shoulder. The minimum thickness of the asphalt treated layer should be 3 in.
- Implement the proposed asphalt treated mixtures in the construction of base course layers in flexible and rigid pavements.
- Apply a minimum structural layer coefficient (.30) equal to current asphalt base course mixtures (unmodified binders) when using this mixture.
- Allow the use of the proposed asphalt treated mixtures in pavement widening and patching.

Future Work

- Evaluate the performance of asphalt treated mixtures with smaller nominal aggregate size.
- Evaluate the performance of asphalt treated mixtures with a high content of recycled materials.

Construction of asphalt treated mixtures layers

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