

# **EVALUATING THE USE OF LOWER VMA REQUIREMENTS FOR SUPERPAVE MIXTURES**

## **PROBLEM STATEMENT**

The Florida Department of Transportation (FDOT) adopted the Superpave system of asphalt mixture design in 1996, and for the most part, has followed AASHTO guidelines exactly with respect to the system. With respect to the volumetric property voids in the mineral aggregate (VMA), the Department has followed AASHTO's minimum requirements exactly. However, at the mixture design stage, contractors have struggled to meet the minimum VMA requirement for coarse graded mixtures, especially those that use native Florida aggregates. Contractors are forced to gap grade a mixture in order to obtain the minimum VMA requirement. Furthermore, the mixtures that barely meet the minimum VMA requirement at the mixture design stage often result in mixtures with substandard VMA during production due to aggregate breakdown and rounding in the plant drum.

Since the introduction of the Superpave mixture design system, there has been considerable discussion nationwide about the VMA requirements being equal for fine and coarse graded mixtures. With respect to asphalt film thickness, it is rationalized that a coarse graded mixture would require less VMA since there is less surface area in the mixture (due to more coarse and less fine aggregate) compared to a fine graded mixture. Recent research completed at the University of Florida (UF) indicates that not only are the VMA requirements for coarse graded mixtures set too high, in terms of film thickness, but that this excessive VMA may be resulting in coarse graded mixtures that are substandard in terms of rutting and cracking. The gap grading used in coarse graded mixtures to obtain the necessary minimum VMA is the suspected cause of the substandard mixture. The gap grading results in less particle interaction and more unnecessary asphalt binder, both of which lead to decreased rutting and cracking resistance. One potential solution would be to lower the minimum VMA requirements for coarse graded mixtures with no other changes. However, there is concern that this change could simply result in a contractor using lower quality aggregates without changing gradation or asphalt binder content. It may be beneficial to have some additional aggregate gradation requirements implemented as well as a VMA reduction. Additional preliminary research conducted by UF indicates that a subtle change to the aggregate percentage passing the nominal maximum aggregate size may provide a coarse graded mixture with lower but adequate VMA and improved rutting and cracking resistance.

## **OBJECTIVES**

The change in aggregate gradation and its effect on rutting and cracking is the subject of this research proposal. Specific objectives include the following:

1. Evaluate the effects of the percentage passing the nominal maximum aggregate size on the rutting and cracking performance of asphalt mixtures.

2. Provide modifications to the specifications if the results of the study indicate that changes would be beneficial.
3. Use this information as part of a more comprehensive, long-term study of the effects of aggregate characteristics and gradation on asphalt mixture performance.

## **FINDINGS AND CONCLUSIONS**

Test results indicate that the addition of coarse aggregate on the 12.5 and 9.5 mm sieves of 12.5 mm coarse graded mixtures improved the rutting performance of the mixtures. However, cracking performance was adversely affected by the addition of coarse aggregate. Moisture sensitivity results varied depending on the test method used. Permeability results were unaffected by the gradation change.

Since cracking is the predominant form of distress for Florida pavements, it is recommended that no change be made to the Department's specifications at this time. Performance test results indicate that not all mixtures perform at their optimum when designed volumetrically. The Department should continue to conduct research and move towards implementation of one or more performance tests to augment or replace volumetric mix design.

## **BENEFITS**

The results of this research indicate that mixture changes that improve rutting performance of asphalt mixtures do not necessarily improve cracking resistance. Therefore, the Department has learned that the Superpave gradation requirements should not be changed at this time to include more coarse aggregate. In addition, this research has shown the importance of having performance-related test procedures for evaluating a mixture's performance potential. The Department should continue towards the implementation of performance tests (instead of volumetric design only) at the mix design stage.

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