Chapter V

Summary and Conclusion

The main purpose of this research is to determine critical asphalt pavement voids through laboratory aging. The critical void is defined as a void content in the asphalt pavement above which oxidative aging takes place rapidly.

Four types of asphalt mixtures were studied consisting of the Connecticut DOT specification classes 1 and 2 with both round and angular aggregates. For each mixture, samples were molded using a gyratory compactor at predetermined air void contents ranging from 5 % to 15 %.

An oven aging procedure was selected in this study to simulate field aging. In this procedure, oxygen in the air was used to accelerate the aging. The samples were placed in the oven maintained at 140^0 F for a period of 24 hours. During this period, air at a low pressure of 0.1 psi was applied to one face of the samples. Upon the completion of this process, the asphalt in the aged specimen was recovered using the Abson recovery method.

The parameters used to evaluate the effect of aging were the percent penetration retained (PPR) and the viscosity aging index (AI). The results show that air voids significantly affect the relative aging rate of the asphalt in the mixture. The relative aging rate increases with the air void revealing that mixtures with greater air void contents aged more.

Using the PPR, it is found that the critical pavement voids are between 9 % and 13 %. It is also shown that, at air void contents between 9 % and 13 %, class 1 mixtures aged more rapidly than the class 2. Below and above this range, the PPR values for all mixtures are about the same. Overall, the PPR result indicates that the class 1 mixtures aged more than the class 2.

Using the AI, the critical voids are determined to be between 9 % and 11 %. The results also show that mixture A (class 1 with gravel) aged more than the other mixtures.

The results can be used to establish the upper limit for pavement voids with the intent of controlling oxidative or air aging that occurs in the field. It is recommended that such an upper limit should not exceed 9 %.

In the field, the critical air void content cannot be determined directly. However, the void content is related to the pavement permeability which can be measured directly. In fact, the permeability controls the pavement aging. With the availability of critical air void determines the relative rate of aging, annual air permeability measurement may provide a means of determining the optimum time for the application of pavement sealing. Sealing sooner than needed is an inefficient use of resources, but sealing too late means sealing an already aged pavement.

The gradation of the mixture is found to be significant in determining the rate of aging. Using the PPR, it is determined that the coarser grade mixture (Connecticut DOT specification class 1) was less resistant to aging.

The viscosity temperature susceptibility of the asphalt before and after laboratory aging was also investigated. It is found that the asphalt viscosity temperature susceptibility was decreased after the aging.

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