UNIVERSITI TEKNOLOGI MARA

A STUDY ON MOISTURE INDUCED DAMAGE AND RUTTING OF HOT MIX ASPHALT

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Thesis submitted in fulfillment of the requirements
for the degree of
Doctor of Philosophy

Faculty of Civil Engineering

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

This research study was undertaken to evaluate the feasibility of improving the performance of hot-mix asphalt (HMA) pavements in Malaysia through the use of Superpave mix design systems. Laboratory tests to evaluate Superpave consensus and source aggregate properties were conducted to ensure that the local aggregates complied with the standard requirements for use in both mix design systems. The results obtained show that local aggregates are suitable for use in the Superpave mix design system. Sixteen mixtures, eight Superpave-designed and eight Marshall-designed, were evaluated. Results from the volumetric analysis indicate that the optimum binder content of Marshall-designed mix is more than the Superpave mix for one quarry and almost the same as the Superpave-designed mix for the other quarry. Tests were also conducted to evaluate the rutting and moisture susceptibility potential of these mixes. Results show that the Superpave-designed mixtures performed better in rutting and are less susceptible to moisture damage than the Marshall-designed mixtures. Tests were also conducted with the Superpave Simple Performance Tester (SPT) in an effort to predict moisture damage using the SPT dynamic modulus test. Correlation studies between SPT dynamic modulus and the AASHTO T283 moisture susceptibility test results showed a strong relationship. The SPT dynamic modulus test results were also found to correlate well with the dynamic creep, wheel tracking and resilient modulus tests. In general, correlation between the results from the SPT dynamic modulus and these tests to evaluate rutting shows moderate to strong relationships. Hence, it is envisioned that the SPT dynamic modulus test can be used to predict rutting and moisture susceptibility of HMA mixes.

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