UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF MECHANISTIC-EMPIRICAL DISTRESS PREDICTION MODEL FOR THE PERFORMANCE OF SUPERPAVE DESIGNED ASPHALT PAVEMENT USING SIMPLIFIED DYNAMIC MODULUS ANALYSIS METHOD

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of the requirement for the Degree of
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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a panel of examiners has met on 11th November 2015 to conduct the final examination of Nuryantizpura binti Mohamad Rais on her Doctor of Philosophy thesis entitled "Development of Mechanistic-Empirical Distress Prediction Model for the Performance of Superpave Designed Asphalt Pavement Using Simplified Dynamic Modulus Analysis Method" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

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AUTHOR'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 acknowledge as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi Mara, Regulating the conduct of my study and research.

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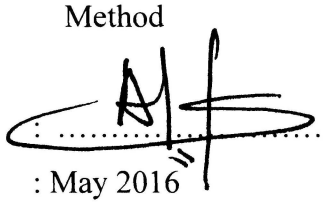
Signature	: 
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ABSTRACT

The permanent deformation becomes a major problem as axle loading increases where it normally happens on highly stressed roads. Permanent deformation always is a potential major distress where the ruts trap water and cause hydroplaning. Therefore, it is important to make efforts to minimize permanent deformation and at the same time it is necessary to develop a model to predict the potential permanent deformation development when designing an asphalt pavement overlay. Thus, it is necessary to predict the distress prediction models using Superpave mixes other than conventional mixes in order to be efficient in assessing and controlling permanent deformation of asphalt pavements. In relation, there is absence of Mechanistic-Empirical pavement distress prediction models developed to predict the Superpave mixes permanent deformation under Malaysian environmental conditions. In order to take this gap into consideration, this study was conducted to investigate the use of dynamic modulus in the development of permanent deformation distress prediction model. The following procedure was used: The simplified dynamic modulus analysis method established in this research can be good indicators to describe how a master curve's shape varies with asphalt, nominal aggregate size, aging, and confinement level. The authors have developed the simplified master curve model which can predict dynamic modulus beyond the measured data set. This model used inverse sine-hyperbolic function with the addition of four coefficients (α, β, x_o, y_o) which can describe the shape of the master curve. The simplified master curve model was verified by the actual laboratory data and further supported by statistical analysis. The finding of this study is also expected to provide a better understanding of how to evaluate and incorporate new materials into the Mechanistic-Empirical Pavement Design Guide. The VESYS layer rutting model only requires two permanent deformation parameters; α_i and μ_i. Therefore, the VESYS layer rutting model was finally adopted with minor modification to model asphalt pavement overlay permanent deformation. It is relatively simple model to use in the implementation process. The final lab expression for FHV mix was initially selected for the field calibration and validation process are; c is 80.0 for resilient strain, b is 0.91 for rutting accumulation or seasonal trend, μ is 1.61 for calibration and validation, α is 0.09 for calibration and validation. These local calibration factors are the adjustments applied to the coefficients or exponents of the transfer function to eliminate bias between the predicted and measured pavement distresses. The combination of calibration factors can also be used to minimize the standard error of the prediction equation. The standard error of the estimate measured the amount of dispersion of the data points around the line of equality between the observed and predicted values. The recorded experience in this analysis can be used for future model Mechanistic-Empirical calibration and validation in Malaysia or to assess existing pavement conditions provided similar materials and specifications are applied.

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