ABSTRACT

During its planning and evaluation process, the asphalt pavement capacity is importantly affected by the temperature. Asphalt pavement temperature is a function of climatic factors environment, and greatly influenced by geographical location (latitude). This research aims to develop the temperature profile model of asphalt pavement in the tropics in Indonesia and to analyze the effect of temperature on the stiffness modulus of asphalt (S_b) and asphalt mixture (S_m). The asphalt mixture consists of AC-WC and AC-BC both conditioned at early aged pavement in the laboratory and taken from pavement on site at the age of 3 years old. The case study are a involves several national roads in Bali Province.

Data is measured directly from the air temperature (T.Udara), humidity (RH) and asphalt pavement temperature (T.00, T.20, T.65 and T.70) by means of a thermocouple equipped with a data logger. Data measurements are analyzed with a software produced by SAGA Technology and statistical regression models. The S_b and S_m are analyzed mechanically using DSR to test the viscous and elastic behavior of bitumen and using UMATTA to test the direct tensile strength with repeated loads. In addition, the Sb and Sm are empirically analyzed with Ullidtz, Shell and Nottingham methods.

The study found significant positive relationships between an independent variable of air temperature (T.Udara) and dependent variables of T.00, T.20, T.65 and T.70 respectively. On the other hand, significant negative relationships exists between an independent variable of RH and dependent variables of T.00, T.20, T.65 and T.70 respectively. By combining of all dependent variables, the alternative regression models are constructed to describe relationships among these variables. The best regression model is indicated with the highest Adjusted R^2, the smallest SEE, the highest F statistic value and t statistic value less than 0,05. In addition, the best model should meets the requirements formulti-colllinearity and normality tests for nuisance errors. Further, the best model is validated against observational data giving Mean Absolute Percentage Error (MAPE) less than 10%, and is concluded to produce accurate estimations.

The study also found significant relationships between the temperatures of S_b and S_m. Based on DSR tests, an increase of temperature by 6^0C decreases S_b by 56,42%. The S_b rasio between Ullidtz models and DSR for original asphalt, recovery asphalt taken from mixed asphalt in the laboratory and on site were 1,294, 0,737 and 0,241 respectively.Meanwhile, an increase of temperature by 10 ^{o}C decreases of 60 % S_m (UMATTA), 64,15 % (Shell) and 60,56 % (Notthingham). For AC-WC and AC-BC mixed asphalt in the laboratory, the S_m rasio between Shell models and UMATTA test were 1,010 and 0,937 respectively and Nottingham models were 1,999 and 1,840 respectively. For AC-WC and AC-BC mixed asphalt taken on site, the S_m rasio between Shell models and UMATTA test results were 1,073 and 1,129 respectively and Nottingham models were 1,931 and 2,005 respectively. The use of Shell models produce S_m relatively close to the results of testing UMATTA while Nottingham models provide S_m that the amount is almost twice that of the results UMATTA test. Models are constructed to describe relationships among asphalt pavement temperature profile with S_b, S_m and between S_b with S_m. Models are indicated with R^2 > 0,97.