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FATIGUE DAMAGE RATIOS AND RUTTING DAMAGE RATIOS FOR OVERLOADED HEAVY VEHICLES

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ABSTRACT

It is impossible for any country to have a rapid economic growth without a good and efficient transportation system. However, there are several problems affecting the transportation systems. One of the most important and common problem currently is the overloading of heavy vehicles and trucks. Road pavements performance, infrastructure performance, and safety are severely reduced by heavy vehicles overloading. Several studies carried out in Malaysia, United States of America, Colombia, Australia, France, Portugal, South Africa, China, Thailand, Pakistan, and Taiwan confirmed that overloading is a series problem around the world. This study aims to investigate the effects of overloaded heavy vehicles on flexible pavements in Malaysia, by developing models describing the degradation of flexible pavement fatigue and rutting lives under different axle loadings, axle configurations and tire pressures. The study also aims to determine fatigue and rutting damage ratios for each heavy vehicle types based on their actual weights for usage in flexible pavements design. Secondary data were collected from Weight-In-Motion stations, Falling Weight Deflectometer, Coring, Dynamic Cone Penetration and Ground Penetration Radar. The secondary data were used to form plenty of finite element models to form the deterioration models and damage ratios. Apart from the development of fatigue and rutting damage models and ratios, several other conclusions were derived. The study found that fatigue and rutting damage ratios increased rapidly due to overloading. Furthermore, it was found that the damage caused by single axle with two wheels is the largest, then the single axle with four wheels followed by tandem axle and then the tri-axle configuration. It was also found that tire pressure has a high effect of fatigue and rutting damages and thus regulations should include tire pressure limitation. Twenty four models were developed in this study to calculate fatigue damage ratios and rutting damage ratios for flexible pavement in Malaysia. Furthermore, Single trailer trucks with four axles, single unit trucks with two axles, and buses were identified to be causing most of the fatigue damage, while rutting is mainly caused by the same types of vehicles and single trailer trucks with six axles. The study also found that an average value of 4.23 for fatigue damage and 6.20 for rutting damage could be multiplied with heavy vehicles traffic volume to represent their effects and to be used for flexible pavements design in Malaysia.

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