Road Pavement Density Analysis Using A New Non-Destructive Ground Penetrating Radar System

ABSTRACT

Density is an important parameter to determine the strength of road, and it will ensure the safety of the use as well as maintaining the quality of road pavement. In this paper, the validation of GPR mixture model based on the microwave nondestructive free space method to determine the density of road pavement typed Hot Mix Asphalt (HMA) will be presented. The frequency range of operation used is 1.7{2.6 GHz. The attenuation is a major factor for gathering the density of road pavement predictably. The existing mixture model has been used to produce simulation data for determining the predicted complex permittivity and attenuation due to various densities of road pavement. The GPR laboratory measurement is performed where the measured attenuation due to various densities was obtained. The comparison results between measurement and simulation were investigated, and the relative errors in between were calculated to see the performance of the model. The best performance of mixture model was selected due to the smallest mean error using the optimization technique. An improved attenuation formula or optimized mixture model was obtained from the optimization technique to produce the better model. The ¯nding from the optimization process suggested that three additional constant parameters which are volume factor, permittivity factor and attenuation factor need to be included to improve the existing mixture model. The optimized mixture model is introduced as GPR mixture model in this work. The validation process at ¯eld test had been conducted to evaluate the performance of optimized GPR model and produce the error range from 3.3% and 4.7%. At the end of this project, the GPR mixture model can be used as a calibration curve where the values of predicted density of a given real road pavement can be read directly once the attenuation values are known.