Development of Pavement Condition Prediction Model for National Highways

R.M.K. Sandamal[1] and H.R. Pasindu[2]

Abstract

National Highways are basic infrastructure which provide the connectively for the urban development in a country. An accurate pavement performance prediction model is essential for pavement asset management systems to optimize the life cycle cost of preventive and corrective maintenance strategies. In this study, pavement roughness and relevant distresses progression of national highways in the long-term pavement performance data was analyzed to develop such a pavement condition prediction model. International Roughness Index (IRI) is a global parameter to measure the ride comfort of road users and unevenness of pavement, therefore use as the basis for the pavement prediction model in this research. High intensity of repetitive axle loading, and aging effect caused for the failure of pavement and distresses related to traffic load and aging are developed, hence pavement roughness is increased while distresses are propagated. Structural failure, functional failure due to the non- smooth riding surface are the reasons for increasing of vehicle operating cost (VOC) and waste of resources. The relationship between roughness and relevant distresses progression with pavement age was developed and validated with comparing such models developed by previous studies. The pavement distresses progression with the pavement age is analyzed by using regression analysis. Three curves are plotted to express the pavement deterioration, in that roughness deterioration curve is developed by considering the initial construction quality. Those deterioration models can be used to calibrate HDM-4 software to adopt for the local condition as a decision-making tool for the maintenance and rehabilitation work. Increasing of roughness is a function of progression of distresses which is use for the model calibration process in HDM-4 software as shown in equation 1.

$$\Delta RI = Kgp + \Delta RIs + \Delta RIc + \Delta RIr + \Delta RIt + \Delta RIe \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where: Kgp - calibration factor of general surface roughness development, ΔRI - gradual increase of pavement surface roughness, ΔRIs - structural pavement deterioration, ΔRIc – deterioration due to cracking, ΔRIr – deterioration due to rutting, ΔRIt – deterioration due to potholes, ΔRIe – deterioration due to climate effects

From the results of the study, the components of roughness deterioration due to the pothole (ΔRIt) and cracking (ΔRIc) are established. Combination of deterioration due to the structural

condition, climate effect and rutting are representing as a constant. The findings from the research can be used to HDM-4 model calibration of roughness increasing of national road network in Sri Lanka instead of using default values which are currently use for the pavement performance modelling.

Keywords: deterioration models, pavement condition, International Roughness Index, calibration

Author Details

1. Research assistant, Department of Civil Engineering, University of Moratuwa, Sri Lanka, 198046r@uom.lk
2. Senior lecturer, Department of Civil Engineering, University of Moratuwa, Sri Lanka, pasindu@uom.lk

Reference

1. Morosuik, G. & Michael, R. (2004). Modelling Road Deterioration and Work Effect in HDM-4. Asian Development Bank.