Development of Pavement Performance and Prediction Models for Flexible Road Pavements in Sri Lanka

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Abstract

International Roughness Index (IRI) is a pavement performance indicator which reflects not only the pavement condition but also the ride quality and comfort level of road users". "Many highway agencies around the world consider the initial IRI value (IRI just after construction) as a quality assurance criterion while the prevailing IRI of a pavement as an indicator of required pavement maintenance actions or reconstruction needs.

The aim of this paper is to develop an accurate IRI prediction model for Road pavements in Sri Lanka using linear regression analysis". This model was developed based on data obtained from Road Development Authority (RDA) of Sri Lanka collected mainly using the Road Survey Vehicle. Models were developed for National Highways (A and B Class Roads) only. Further, variation of IRI for different climatic regions and for different vehicle compositions will be analyzed.

The key parameters that the IRI value directly related on a particular pavement was decided based on the literature and the availability of data. The proposed regression model from this paper predict IRI as a function of pavement age, Average Annual Daily Traffic (AADT), initial IRI (IRI just after pavement construction) and transverse cracks or alligator cracks combined length per unit area of the pavement. A set of available data was used to calibrate the regression model and using other set of data, relationship between the measured and predicted IRI values for the proposed model was observed using the coefficient of determination (R^2 value) as a statistical measure to determine how close the data are to the fitted regression line, as the validation process. The proposed model yielded an R^2 value of 0.58. To identify critical parameters in above relationship statistical coefficient p-value was used.

Then the variation of IRI was analyzed for different traffic categories. For AADT is greater than 50000 veh/day model yielded an R^2 value of 0.36. For ADT in between 50000 to 10000 veh/day model yielded an R^2 value of 0.21 and for category AADT less than 10000 veh/day model yielded an R^2 value of 0.61. It was observed that due to some erroneous data the accuracy of the models became lower. So it was decided to remove pavement sections with age more than 25 years and some unacceptable values of IRI measurements using Engineering judgement and reanalyze.

To identify the variation of IRI for different climatic conditions Western, Central and Northern provinces were selected. Western province has an annual average temperature of 27.4°C and an annual average Rainfall of 2420mm while Central province has 24.5°C and 1840mm and Northern province has 28°C and 1230mm. Models yielded R^2 values of 0.18, 0.45 and 0.72 for Western, Central and Northern provinces respectively. Due to low R^2 values it was decided to remove some unacceptable values of IRI measurements using and reanalyze.

Keywords: IRI, regression analysis, age, AADT, cracks, R^2 value, traffic categories, climatic regions.

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