VALIDATION OF MECHANISTIC EMPIRICAL DESIGN APPROACH FOR PAVEMENT DESIGN – CASESTUDY FOR SRI LANKA

Karasinghe Arachchige Ruksala Nishani Jayarathna

138029M

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DECLARATION

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To

My Loving Parents

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K.A. Ruksala Nishani Jayarathna

ABSTRACT

Pavement design is a vital part in new road construction and rehabilitation of roads. American Association of State Highway and Transportation Officials (AASHTO) pavement design guideline and Transport Research Laboratory (U.K) Road Note 31 (TRL RN-31) guideline are widely used for designing road pavements by most of the road agencies. Both these design guidelines are empirical guidelines and based on empirical formulas developed from experimental studies conducted in extreme weather conditions. In recognition of the potential of analysing pavements and predicting their performance, pavement design agencies have been encouraging the movement towards mechanistic empirical pavement design methods. Performance models used for the empirical pavement designs are basically derived from experiments which are conducted in controlled laboratory conditions. So it should be validated before utilising for the road pavement designs. The aim of the research was to check the applicability of Mechanistic Empirical (M-E) models developed by Austroad guide for tropical climatic conditions prevails in Sri Lankan roads. The computer program CIRCLY which is based on Austroad guide was used for the analysis. Cumulative Damage Factor (CDF) given by the computer program was compared with the in service pavement condition. Pavement Condition Index (PCI) was used to represent the pavement condition. PCI values were calculated only for structural based distresses as assessed by type, severity and density according to the *ASTM method*. CDF values obtained from CIRCLY were verified with the PCI values obtained from the pavement condition. Since PCI and CDF have a good relationship, CIRCLY software which is based on Austroad pavement design guideline could be introduced as a good analytical tool for designing road pavements in tropical climatic conditions. Then the research was focused on evaluating the suitability of a mechanistic empirical pavement design tool CIRCLY to investigate a pavement failure. In this study, failure of a non-structural surface road which is failed immediately after completing the construction was selected for the analysis. This road was designed according to the Overseas Road Note 31(ORN 31) and designed with a non-structural surface type, Double Bitumen Surface Treatment (DBST). Soil samples collected from critically damaged locations were tested. Results showed that the inadequate strength of the sub base layer as the reason to the failure. Failure investigations were done using a mechanistic tool CIRCLY and reliable reclamation method was proposed.

Key words: Mechanistic Empirical pavement design, CIRCLY computer program, Pavement Condition Index (PCI), Failure analysis

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LIST OF ABBREVIATIONS

Abbreviation	Description
AASHTO	American Association of State Highway and Transportation Officials
ABC	Aggregate Base Course
AC	Asphalt Concrete
CBR	California Bearing Ratio
CDF	Cumulative Damage Ratio
CESAL	Cumulative Equivalent Standard Axle Load
CNSA	Cumulative Number of Standard Axles
DBST	Double Bitumen Surface Treatment
DESA	Design Equivalent Standard Axles
ESAL	Equivalent Standard Axle Load
M-E	Mechanistic-Empirical
MEPDG	Mechanistic Empirical Pavement Design Guide
PCI	Pavement Condition Index
RF	Reliability Factor
SAR	Standard Axle Repetitions
ITT	Indirect Tensile Test
TRL Road Note 31	Transport Research Laboratory Road Note 31
WMAPT	Weighted Mean Annual Pavement Temperature

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