Performance Assessment of Flexible Pavements: Fuzzy Evidence Theory Approach

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Abstract

Pavement performance evaluation is one of the most important steps of the pavement management system. It consists of identifying pavement condition according to various distresses occurs in the pavement surface. Data collection in performance assessment of road is done in several ways. An attempt has been made to address the problem and a new formalism is proposed for performance assessment of flexible pavements. Vagueness in the perception of expert for performance assessment of pavement based on techno-scientific parameters in linguistic terms for the domain base usage coupled with impression in parametric data calls for the application of fuzzy modeling. For this study fuzzy evidence theory weightage method "Dempster's Shafer's (D-S)" is applied to determine the Pavement Condition Distress Index (PCDI) of flexible pavement. D-S theory provides a designed framework to overcome the risk of uncertainty and ignorance. For the assessment of pavements five major structural indicators like longitudinal cracks, transverse cracks etc. and eleven major functional indicators like potholes, rutting, patching etc. are considered. Expert opinion is taken from the experts who are involved in the field of transportation engineering. Questionnaire Survey methodology has been adopted for the collection of experts opinions. Five linguistic terms are used for the same, which are, 'Very important', 'Important', 'Average', 'Less important' and 'Not Important'. Based on PCDI, Pavement Condition Index (PCI) is calculated. The rating of flexible pavements is also done based on PCI. For the application of the model, five road segments of MIDC Chakan, Pune area is considered. PCI of all the road segments is determined by using the stated index. Based on PCI value, road segment 1 rated 5 with less PCI value and road segment 4 rated 1 with high PCI value. The defined method is also compared with the rating system given in Indian Road Congress (IRC -82-2015).

Keywords: Pavement; Performance; Assessment; Distress Condition; Structural Indicators and Functional Indicators.

1. Introduction

Pavement management is the process of planning the maintenance and repair of a road network to provide better conditions for the road network. A Pavement Management System (PMS) is a planning tool used to aid pavement management decisions. Typical tasks performed by pavement management systems include: identifying good, fair and poor pavements; Assign importance ratings for road segments, based on traffic volumes, road functional class, and community demand; Schedule maintenance of good roads to keep them in better condition; Schedule repairs of poor and fair pavements as remaining available funding allows. Most of the cost-effective Maintenance and Rehabilitation (M&R) strategies developed using the pavement management system (PMS) is due to accurate pavement evaluation [1]. Distresses are recorded in terms of their extent and severity. Rating of stretches for prioritization is done based on their condition. While standard templates are available for rating different distresses, still there are possibilities of variation in human judgments [2]. Decision-making in pavement management involves uncertainties, subjective