Modified Clusterwise Regression for Pavement Management

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Abstract : Typically, pavement performance models are developed in two steps: (i) pavement segments with similar characteristics are grouped together to form a cluster, and (ii) the corresponding performance models are developed using statistical techniques. A challenge is to select the characteristics that define clusters and the segments associated with them. If inappropriate characteristics are used, clusters may include homogeneous segments with different performance behavior or heterogeneous segments with similar performance behavior. Prediction accuracy of performance models can be improved by grouping the pavement segments into more uniform clusters by including both characteristics and a performance measure. This grouping is not always possible due to limited information. It is impractical to include all the potential significant factors because some of them are potentially unobserved or difficult to measure. Historical performance of pavement segments could be used as a proxy to incorporate the effect of the missing potential significant factors in clustering process. The current state-of-the-art proposes Clusterwise Linear Regression (CLR) to determine the pavement clusters and the associated performance models simultaneously. CLR incorporates the effect of significant factors as well as a performance measure. In this study, a mathematical program was formulated for CLR models including multiple explanatory variables. Pavement data collected recently over the entire state of Nevada were used. International Roughness Index (IRI) was used as a pavement performance measure because it serves as a unified standard that is widely accepted for evaluating pavement performance, especially in terms of riding quality. Results illustrate the advantage of the using CLR. Previous studies have used CLR along with experimental data. This study uses actual field data collected across a variety of environmental, traffic, design, and construction and maintenance conditions.

Keywords : clusterwise regression, pavement management system, performance model, optimization

Conference Title : ICCTE 2016 : International Conference on Civil and Transport Engineering

Conference Location : Venice, Italy

Conference Dates : June 13-14, 2016