The Ohio Department of Transportation
Office of Research & Development
Executive Summary Report

Pavement Forecasting Models

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Problem

The ability to forecast future pavement condition is highly valuable in supporting various pavement management decisions. ODOT has compiled roadway inventory, pavement condition history, and construction activities data into a comprehensive pavement management database. To fully benefit from this database to support decisions regarding future repair strategies, it is necessary to forecast future conditions and to determine the remaining service life of pavement sections. Such forecasting capability will significantly benefit ODOT in choosing the most cost-effective rehabilitation strategies to maintain and preserve the State's highway systems.

Objectives

1. To develop models to forecast future pavement conditions using data available to ODOT.
2. To determine remaining service life of pavement sections based on the forecasted condition.
3. To develop decision trees for selecting rehabilitation strategies.
4. To determine an appropriate initial PCR rating for a rehabilitated pavement section.
5. To include local federal aid routes in the pavement management database.

Description

After reviewing the literature, several different pavement condition forecasting models were developed based on available data in the ODOT

pavement database, which contains the condition history of each pavement section, along with its location, year of construction, thickness, materials used, climate, and rehabilitation records.

Individual regression, family regression, and Markov probabilistic models were developed. For the latter two types of models, pavement sections were first grouped into "families" of similar characteristics, based on pavement type, priority, District location, and past performance. Forecasting models were then developed for each such "family". The developed models were evaluated by comparing the predicted conditions with the actual measured conditions for the five year period of 2001-2005.

Findings

The Markov model has the highest overall prediction accuracy among all the models evaluated, and it has the important advantage of being able to predict future distresses in addition to the PCR values.

The remaining service life of each pavement section is determined based on the conditions predicted by the Markov model and a terminal condition specified by the user. The default terminal condition for Priority system pavements is a PCR value below 65, and for General system pavements, a PCR below 60.

Appropriate initial PCR values after various maintenance and rehabilitation treatments were determined after analyzing distress progressions after the treatment. These initial PCR values provide a more realistic reflection of the actual pavement condition, and encourage selection of treatments that are longer-lasting.

A set of rehabilitation treatment decision trees were developed in cooperation with the Office of Pavement Engineering staff. These decision trees consider pavement type, priority, traffic volume, past treatment and performance, and current distress condition to recommend an appropriate maintenance or rehabilitation treatment for a given pavement. A tool has also been developed to apply the decision trees to the forecasted pavement conditions, thereby allowing the consequences of different multiyear work plans to be evaluated.

In addition to the database for the entire State highway network, a database for local federal-aid routes was developed as an addendum to this study. Although the data currently available for local routes are much less complete than that for State routes, tools have been developed to help local agencies manage their pavement assets.

Conclusions & Recommendations

As a result of this study, ODOT can forecast future pavement conditions and estimate the remaining service life of pavements. Current and future rehabilitation needs can also be determined. Such capabilities will benefit planning and management decision-makings at both project and network levels.

The Markov model is recommended due to its overall accuracy and its ability to predict individual distress in addition to PCR. Further efforts to integrate the outcomes of this study into a decision support tool that will be used routinely by the Central and Districts Offices is recommended.

Implementation Potential

The pavement forecasting model and various tools developed in this study have been included in the current ODOT pavement management database. They may be implemented readily as part of a comprehensive Pavement Management System.