RESEARCH
PROJECT CAPSULE [24-1P]

January 2024

TECHNOLOGY TRANSFER PROGRAM

Evaluation of Louisiana Maintenance and Rehabilitation Treatment Decision Matrix for Cost-Effective and Timely Pavement Preservation

JUST THE FACTS:

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36 months

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used / Implementation Potential

PROBLEM

DOTD has collected digital pavement data biennially for over 25 years using contracted data collection vehicles (DCV) and stored the collected pavement condition data in Pavement Management System (PMS), which provides a continuous pavement condition assessment statewide. In the current DOTD's pavement asset management practice, the collected actual pavement distress condition data are first converted into different distress indices (e.g., roughness, rutting, patching, alligator and random cracking) on a scale from zero to 100 and then used with a distress-trigger-value-based treatment decision matrix to provide the recommended treatment action based on existing pavement conditions. However, some of the adopted trigger values in the treatment decision matrix were found based on few projects with few years and log-miles of distress data. Even though they provided a baseline for treatment selection, some of those values were not reliable and should be updated. Therefore, there is a need to review, modify, and update the current PMS decision matrix and to provide recommendations on the trigger values for the different treatment types used in seven current DOTD's pavement classifications in order to ensure optimum timing and cost-effective selection of maintenance and rehabilitation treatments.

OBJECTIVE

The objective of this study is two fold. First, the study will review and evaluate the current PMS decision matrix and provide recommendations on the trigger values for different maintenance and rehabilitation treatment types based on mechanistic-empirical pavement design, pavement performance modeling, machine learning, decision-tree optimization, and cost-benefit treatment timing analyses and approaches. Second, modifications will be introduced to the PMS decision matrix in order to ensure optimum timing and cost-effectiveness selection of the different treatment methods.

METHODOLOGY

Initially, the research team will conduct a comprehensive assessment of DOTD's state-of-the-practice in pavement treatment selection. Strategies employed by other U.S. states for pavement treatment decisions will also be reviewed. Currently, DOTD's practice relies on a trigger matrix table, considering various pavement distress indexes' trigger values. Data collection will align with the current DOTD trigger value matrix table classification. The trigger value evaluation and adjustment method involve establishing treatment-based pavement performance models for the Pavement Condition Index (PCI) and other pavement distress performance indexes. The process for trigger value evaluation and adjustment is illustrated in Figure 1 on the next page. Treatment-based models, machine learning, neural network, and other techniques will be established for PCI and other pavement indexes. The PCI range for each treatment will be determined by considering current practices, historical data, literature, and engineering judgment. Pairing PCI with different pavement distress indexes will facilitate the identification of a reasonable range to trigger specific treatments. The evaluation of the current treatment resets table will be based on distress data from DOTD's historical projects. The updated matrix will be validated using project-level data. Pavement service life for selected projects will be calculated, and the impact of treatment timing will be analyzed through cost-

benefit analysis. This involves applying different treatments at various times, calculating treatment costs, and assessing benefits over a 30-year life cycle. Pavement Mechanistic-Empirical (ME) modeling will be employed to determine the trigger value range for structural overlay or in-place rehabilitation. The Pavement ME will also be utilized to create performance curves, exploring the influence of pavement structure, traffic, and climate. In addition, any modification to the current decision matrix will be reviewed and justified by DOTD engineers during the project. The study will conclude with a cost-benefit analysis on randomly selected projects, revealing the benefits of the updated trigger value matrix.

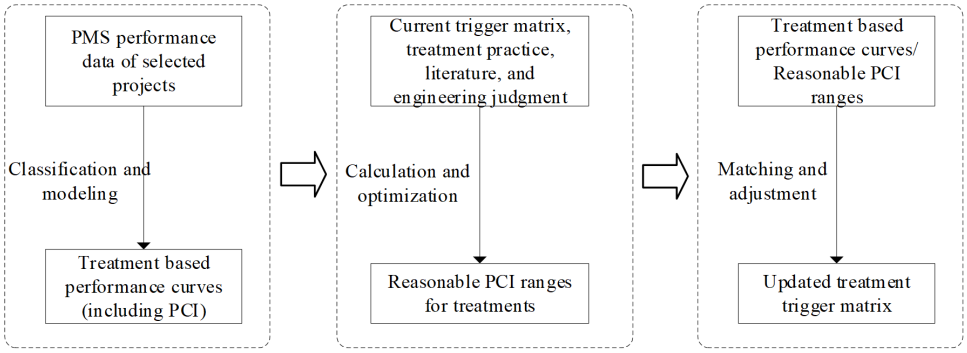

Figure 1. Steps to carry out trigger value evaluation and adjustment

IMPLEMENTATION POTENTIAL

It is anticipated that findings of this study will include an updated/modified treatment decision matrix table and various performance models for cost-effective and timely maintenance and rehabilitation of pavements. Results will be immediately implementable by pavement preservation and PMS of DOTD.