



RESEARCH PROJECT CAPSULE [21-1P]

September 2020

TECHNOLOGY TRANSFER PROGRAM

Prediction of Road Condition and Smoothness for Flexible and Rigid Pavements in Louisiana Using Neural Networks

JUST THE FACTS:

Start Date:

August 1, 2020

Duration:

24 months

End Date:

July 31, 2022

Funding:

80/20 SPR

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Department of Transportation and
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POINTS OF INTEREST:

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

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PROBLEM

The Louisiana Department of Transportation and Development's (DOTD's) pavement management system (PMS) is designed to provide useful and objective pavement condition data for analysis so that pavement engineers and managers can make more consistent and cost-effective decisions in its pavement preservation and rehabilitation. DOTD currently uses pavement performance prediction models in treatment selection and budget planning, which are developed from non-linear curve-fitting regression of existing pavement condition data available in PMS. This study will review the importance of and urgency for DOTD to develop more accurate performance prediction models in order to make a cost-effective treatment selection for its pavement network.

OBJECTIVE

The objective of this study is to develop an artificial neural network (ANN) application system that can be used to estimate future pavement condition and smoothness for Louisiana flexible and rigid pavements based on DOTD's PMS and other related pavement data collected.

METHODOLOGY

To achieve the objectives of this study, a neural network based system will be developed, using the data collected by DOTD on regular basis and local weather information. The proposed methodology can be summarized as follows. A review and documentation of the current state of practice by DOTD will evaluate short-term and long-term road condition and maintenance strategies. PMS data for the Louisiana pavements will be obtained from DOTD databases as well as meteorological condition data for the project sites from local agencies. These data will be categorized as per research scope and assessed through statistical measures. The team will also conduct statistical analyses to identify the significant variables from the historic pavement distress and condition data, pavement structure, traffic data, climatic data to predict the pavement distresses, and smoothness. Also, the set of variables that dictates the prediction of pavement condition will be used as an input to the ANN models. These variables can be different for different condition indices in the prediction models. ANN models will also be developed for each performance indicator index using software applications. The models will be validated using an existing dataset. The proposed ANN models will be presented in an implementation ready format through the development of a single windows-based interface that can accommodate all the ANN models. All findings and analyses of this study will then be documented in a detailed report.

IMPLEMENTATION POTENTIAL

DOTD PMS Section may benefit from this research to obtain long-term pavement performance prediction for all PMS segments and short-term pavement conditions and smoothness for road segments without PMS data.