

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Enhancing MDOT's New Pavement Management Tool (PMT) Inputs Through Data-Driven Analysis

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PROJECT COST: \$128,000

COST SHARING: 20% MDOT, 80% FHWA through the SPR, Part II, Program

MDOT Project Manager



Michael Eacker, P.E.

Pavement Management Engineer
Construction Field Services

EackerM@Michigan.gov
517-281-7702

RESEARCH ADVISORY PANEL MEMBERS:

Jorind Bardhollari, Lina Chapman, André Clover, Ric Cnossen, Rob Green, Alison Hamlin, Tim Lemon, Kyle Rudlaff and Margaret Szajner.

Data-driven tools to manage Michigan's pavement projects

In the past, the Michigan Department of Transportation (MDOT) has relied on professional engineering judgment to identify and implement reconstruction, rehabilitation or maintenance treatments for asphalt and concrete pavements. The agency's historical pavement condition data and maintenance records, however, contain valuable information. After analyzing data on thousands of pavement segments, researchers developed methods to identify how pavements deteriorate over time, how different treatments impact pavement conditions and when decisions are made to implement treatments. The resulting tools can support MDOT in consistently and transparently planning and prioritizing pavement treatments, which will enhance pavement management across the network.

PROBLEM

Managing road pavement over its life cycle requires multiple considerations, including pavement conditions, time periods over which different types of deterioration occur and the ability of maintenance treatments to improve conditions. MDOT has primarily relied on professional judgment to assess pavement conditions on a case-by-case basis and on available resources to prioritize and implement pavement projects. Pavement management decisions driven by observations and data would support efficient use of agency capacity to maintain, rehabilitate or reconstruct pavements.

In previous work, MDOT and researchers developed an updated condition measure,



Decision-support tools based on MDOT's historical pavement condition and maintenance data can help guide pavement project investments.

the Pavement Distress Score (PDS). Additionally, MDOT is developing a pavement management tool for prioritization and optimization of pavement fixes. In this project, MDOT was interested in data-driven tools that would provide the necessary inputs to support that tool. This would

"The results of this research will help MDOT make better, more data-driven pavement project selections and optimize our investments across our pavement network."

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Project Manager

allow the agency to compare and prioritize pavement projects across the state, optimizing transportation investments.

RESEARCH

To develop the tool, researchers relied on MDOT's data on pavement condition trends and maintenance records detailing the timing and outcomes of treatments contained in the Pavement Analysis, Valuation, Examination and Tracking (PAVETrack) system. Data from several thousand asphalt and concrete pavement segments were organized by reconstruction, rehabilitation and maintenance treatment types.

Key pavement condition metrics, or general condition ratings (GCRs), included the International Roughness Index (IRI), cracking, rutting, faulting and the newly developed PDS. To characterize pavement deterioration, researchers used two approaches to calculate the time it took for pavement segments to transition from good to fair and from fair to poor condition.

The first approach involved statistically analyzing discrete steps between conditions of individual pavement sections. A mathematical model in the second method aggregated pavement section data to identify a deterioration trend over time for each condition metric. Researchers then quantified the changes in condition resulting from each treatment type by examining conditions before and after treatments.

To consider pavement condition in the same scale, researchers reviewed how other states normalize pavement condition metrics using utility to have consistent measures for comparison. Utility is a concept where GCRs, which are all on different scales and have different units of measure, can be converted to the same scale (100 to 0).

Next, the research team used the historical data to identify pavement conditions just before treatments were implemented, indicating what thresholds were reached in practice to decide when to reconstruct, rehabilitate or apply a maintenance treatment. They also determined the typical condition improvements from those various treatment types.

RESULTS

Both approaches produced helpful data in capturing variability across pavement segments and providing overall condition trends by geographical areas.

The data analyses allowed researchers to develop tools to help guide treatment decisions. Interactive spreadsheets for each condition measure (IRI, cracking, rutting, faulting and PDS) for both asphalt and concrete pavements identify deterioration trends. The spreadsheet tools also enable quantification of pavement condition improvement for each treatment category and the pavement condition when a reconstruct, rehabilitation or maintenance treatment was applied.

A separate spreadsheet tool can facilitate the calculation and visualization of utility values for each condition metric, allowing consistent comparison, specification of different levels of importance for GCRs or combining condition variables into one utility value.

These tools let MDOT objectively compare pavement conditions and suggested treatment thresholds to identify and prioritize near-term projects and compare different treatment strategies.

IMPLEMENTATION

MDOT can immediately use the methods in the pavement treatment decision-making process while it continues to explore a comprehensive pavement management tool. The tools can be updated as new data becomes available and treatment practices evolve.

Research Administration

Principal Investigator

M. Emin Kutay, Ph.D., P.E.

Professor

Department of Civil and
Environmental Engineering

Michigan State University

428 S. Shaw Lane, Room 3554

East Lansing, MI 48824

kutay@msu.edu

517-353-9297

Contact Us

PHONE: 517-281-4004

E-MAIL: MDOT-Research@Michigan.gov

WEBSITE: Michigan.gov/MDOTResearch

**The final report is available
online at**

[MDOTjboss.state.mi.us/TSSD/
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