Effectiveness of Pavement Preservation

tech transfer summary

Utilizing the Iowa DOT's Pavement Management Information System, a variety of pavement preservation methods, including both flexible and rigid pavement treatments, were evaluated to determine their effectiveness.

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RESEARCH PROJECT TITLE
Effectiveness of Pavement Preservation Techniques

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The Asphalt Materials and Pavements Program (AMPP) at InTrans specializes in improving asphalt materials and pavements through research and technology transfer and in developing students' technical skills in asphalt.

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Objective

The objective of this research was to improve the understanding of pavement preservation effectiveness in Iowa using both qualitative and quantitative metrics.

Problem Statement

Optimal pavement preservation techniques vary depending on roadway type, pavement type, traffic demand, and which pavement distresses require proper mitigation. In many cases, a roadway can be preserved at a lower cost compared to traditional major rehabilitation or reconstruction. A key challenge for maintaining a robust pavement preservation program is ensuring funding.

Background

The Iowa Department of Transportation (DOT) has invested in collecting pavement performance information and storing it in their own pavement management information system. Combined with construction records, this database can be utilized to extract performance data on a project-by-project basis for various preservation methods.

Pavement preservation techniques can be integrated into a pavement management strategy so that treatments are applied over more miles at less cost.

Research Methodology

Qualitatively, a voluntary questionnaire was used to collect information about pavement preservation practices in Iowa counties. Quantitatively, important pavement performance indicators were used to quantify service life extension for various pavement preservation methods on flexible and rigid pavements.

Micro-surfaced pavement in Hamilton County, Iowa

The Iowa DOT's Pavement Management Information System (PMIS) was used to determine the effectiveness of preservation techniques on Iowa preservation projects.

For this project, four important pavement performance indices were examined:

- Pavement condition index (PCI)
- Rutting index, which is based on average rut depths
- Riding index, which is based on international roughness index (IRI) values
- Cracking index, which is based on the collective condition of current cracks

The performance of these indices over time was found by fitting trend lines to the PMIS data and then comparing the pre-treatment and post-treatment results. The service life extension was estimated for each performance index and the initial improvement within a year after treatment application for each index was also recorded.

This analysis was performed for the following types and numbers of preservation projects:

- **Flexible pavement preservation treatments**
  - 23 microsurfacings
  - 13 slurry seals
  - 34 hot-mixed asphalt (HMA) patching projects
  - 33 HMA crack sealing/filling projects
- **Rigid pavement preservation treatments**
  - 14 Portland cement concrete (PCC) patching projects
  - 7 PCC crack filling/joint sealing projects
  - 4 dowel bar retrofit/diamond grinding projects
  - 2 grinding and grooving projects

Key Findings

This study helped to demonstrate that pavement service life extension is achieved on many preservation projects in Iowa.

- For flexible pavement preservations, microsurfacings had 3.7 years of PCI service life extensions on average, while also extending the index services lives of the rutting, riding, and cracking indices more than the other HMA treatments.
- HMA patching was the next most effective pavement preservation technique for PCI service life extension.
- Slurry sealing and crack sealing/filling still showed promising results, but service life extensions were shorter across each index based on 2016 pavement preservation estimated costs per lane mile provided by the Iowa DOT.
- An anecdotal analysis of the data showed that, in some cases, on flexible pavements, pavement preservation treatments were helping to maintain the current condition of cracking distresses. While this is not demonstrating large improvement, maintenance that can slow deterioration of the pavement's condition is a success on its own.

The quantity of rigid pavement preservation projects was substantially lower than that of the flexible type, resulting in high sensitivity to average values.

- Trends were still determined, and dowel bar retrofitting and diamond grinding saw PCI service life extensions of 6.7 years, and a 10.0-year extension in ride quality.
- Grinding and grooving saw the next most substantial improvements, followed by crack sealing/joint filling and PCC patching, respectively.

Implementation Readiness and Benefits

This study works toward establishing data-driven pavement preservation guidance. The research compiles construction and performance data in one place to objectively analyze the cost-effectiveness of preservation strategies based on observed performance. The methodologies to determine index service life extensions and index value benefits are discussed extensively in the final project report.

While the quantity of projects with data remains relatively small, the framework for adding additional project data for each preservation method is soundly in place. In time, additional project data will be available to add to this study's analysis.

The immediate benefit of this research is that it provides a tool for agencies to assess their localized pavement performance, allowing for more effective treatment selection in terms of both performance and economics.