



TECHNICAL SUMMARY

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PROJECT COST:

\$42,493



Chip seals are typically applied to HMA pavements that are four to seven years old and can make these pavements look like new.



RESEARCH
SERVICES SECTION

Preventive Maintenance Best Practices for HMA Pavements

What Was the Need?

Pavements are currently deteriorating at such a rate that most agencies cannot afford to reconstruct them in a timely manner. As a consequence, many Minnesota agencies employ low-cost preventive maintenance techniques to extend pavement life: crack treatments such as rout and seal, clean and seal, and crack filling; and surface treatments such as thin overlays, chip seals, microsurfacing and fog seals. These treatments make asphalt pavements less prone to the effects of water and sunlight, which can harden and reduce the effectiveness of the pavement binder, leaving the pavement brittle. This can lead to cracking, raveling or the creation of rough patches on the pavement surface. Surface damage in turn allows water to penetrate the pavement's lower layers, causing them to soften and so reducing their ability to support the surface layers.

While maintenance treatments may help prevent or postpone these problems, such treatments are difficult to implement successfully over an entire network and must be applied at the right time to be effective. Implementation is further complicated by the improvement of bituminous aggregate selection, mix design, and quality control and assurance through [Superpave](#), the result of the asphalt research portion of the Strategic Highway Research Program.

What Was Our Goal?

The objectives of this study were to:

- Determine whether or not recent advances in bituminous mixtures and binder selection through Superpave necessitated a re-examination of current pavement management practices.
- Create a manual that provides Minnesota's city and county engineers with guidance on the use of preventive maintenance treatments as part of a long-term strategy for preserving and improving the condition of road networks.

What Did We Do?

Researchers first analyzed the effectiveness of pavement management treatments by modeling the decay of pavements over time using Mn/DOT historical pavement management data. This data has been collected since the 1960s during Mn/DOT's annual inspection of pavements using specially equipped vans that measure pavement roughness and rutting. Mn/DOT also routinely produces ratings of surface conditions using digital images of surface defects such as cracks and ruts collected every year. Taken together, this data is used to establish a surface rating that quantifies pavement condition and performance.

Next, researchers compared the surface ratings of roads that received preventive maintenance treatments to ratings for those that did not, taking into account the type of sealant used and the condition and age of the road to which the treatment was applied. Then they attempted to analyze this data to show how long various preventive maintenance measures extended the lives of pavements and whether applying treatments earlier in the lives of pavements was less costly than full rehabilitation later. These results and a literature search were used to create recommendations regarding available treatments and associated best practices for effectively applying them, detailing which treatments are best for which pavement conditions, when in the life of the pavement they should be applied and how often they should be applied.

“This project is a good beginning to quantifying the benefits of treatments for preventive maintenance; a follow-up project will focus on control sections and enhanced measurement techniques.”

–Tom Wood,
Mn/DOT Research
Project Supervisor

“Continued study of how preventive maintenance affects the performance of various types of pavements is necessary to clearly identify the benefits and opportunities for improvement.”

–Erland Lukanen,
Mn/DOT Pavement
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This project provided guidance on maintenance techniques like chip sealing as part of a long-term strategy to manage pavements.

What Did We Learn?

Changes in paving materials and methods over the last decade make it difficult to establish specifically at this point the degree to which current pavement management techniques extend pavement life and consequently provide cost savings. However, the literature review indicated that preventive maintenance treatments generally extend the lives of pavements. While Superpave improvements have eliminated rutting and delayed or reduced the rate of cracking, they do not adequately address long-term hardening caused by binder oxidation or increased moisture sensitivity with aging. Superpave pavements still require preventive maintenance.

These results formed the basis for a user manual for pavement preservation methods. This manual contains descriptions and definitions of the various available treatments as well as recommendations for the timing, type and application of treatments based on a pavement's age and surface condition. In general, the best time for preventive maintenance is any time before the condition of the pavement deteriorates to a point at which it must be rehabilitated or reconstructed. Cracks should be sealed as soon as transverse cracks form and surface treatments applied earlier in a pavement's life than is typical, when the surface still seems to be in relatively good condition.

Because such early preventive maintenance procedures are difficult to justify when pavements are in relatively good condition and other pavements in poorer conditions need attention, researchers recommend that the pavement preservation strategy include the appointment of a champion who advances the public's understanding, secures funding and ensures long-term agency commitment.

What's Next?

A subsequent Local Road Research Board study by the primary investigator of this study has been approved (“Cost-Effective Pavement Preservation Solutions for the Real World,” 2009-008: INV 886) to create a decision support system and training to provide city and county engineers with guidance in selecting among pavement maintenance options.

The report for the current project also recommends further research into the causes of nonload-related pavement cracking, the effects of deicing chemicals on hot-mix asphalt, and the effects of treatments on pavement safety and noise reduction.

This Technical Summary pertains to the LRRB-produced Report 2009-18, “Preventive Maintenance Best Management Practices of Hot Mix Asphalt Pavements,” published May 2009. The full report can be accessed at <http://www.lrrb.org/PDF/200918.pdf>. Please contact research.dot@state.mn.us for more information on the follow-up research mentioned.