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RESEARCH
SERVICES SECTION

TECHNICAL SUMMARY

Technical Liaison:
Brad C. Wentz, Becker County
bcwentz@co.becker.mn.us

Administrative Liaison:
Dan Warzala, Mn/DOT
dan.warzala@dot.state.mn.us

Principal Investigators:
Joe Labuz, University of Minnesota
Shongtao Dai, Mn/DOT

PROJECT COST:
$102,000

Transverse cracks like these may be repaired by full depth reclamation or cold-in-place recycling, but are too severe for mill and overlay.

LRRB
LOCAL ROAD RESEARCH BOARD

Decision Tree for Choosing the Optimal Asphalt Pavement Rehabilitation Method

What Was the Need?

In recent years, Minnesota engineers have increasingly relied on recycling techniques when repairing the state's asphalt roads. In addition to the savings from reused materials, recycling can save money in hauling and processing costs. Moreover, rehabilitation through recycling can result in shorter construction time when compared to total reconstruction.

Minnesota roads have already benefited from the following rehabilitation processes, which were central to this study:

- **Full Depth Reclamation.** The entire paved surface is reclaimed, pulverized and recycled into a usable base. The material may be strengthened further with stabilizing agents. This is the best of the three methods for eliminating road distress, but it is also the most labor-intensive.
- **Cold-In-Place Recycling.** The top 2 inches to 4 inches of pavement are reclaimed and cold-mixed with new asphalt concrete. The recycled material is applied on top of 1 inch of original hot-mix asphalt. This method is more suitable for low-volume roads than high-volume roads.
- **Mill and Overlay.** The top 1 inch or 2 inches of pavement are milled (removed), and a new layer of HMA is applied. This method is relatively quick and inexpensive, but the roads tend to have shorter life expectancy.

While Mn/DOT had funded several prior research efforts concerning these techniques, before this study, no formal guidelines had been established for Minnesota engineers to follow when deciding which technique to use or which specifications to follow for a given project. Often decisions were made based on personal experience and a degree of experimentation.

What Was Our Goal?

The primary objective of this effort was to produce a best practices guide to recommend pavement rehabilitation methods for asphalt pavements based on current, available pavement performance data. This guide would also provide construction specifications for each of the three rehabilitation techniques.

What Did We Do?

Researchers began by gathering data from available asphalt pavement rehabilitation projects throughout Minnesota from the past 20 years, including some current projects for which on-site visits were possible. For each project, the database describes the road conditions before and after rehabilitation, focusing on several parameters: cracking, ride, rutting, age and traffic volume. From this data, researchers were then able to calculate (for each road):

- **Ride quality index** (indicating pavement roughness).
- **Surface rating** (indicating overall pavement distress).
- **Individual weighted distresses** (indicating pavement distress for a specific type of cracking).

continued

"We developed a database of asphalt road rehabilitation projects that will also prove valuable for future studies."

–Brad C. Wentz,
Becker County Highway Engineer

"The study provides an excellent tool for county and city engineers to use when deciding which type of rehabilitation techniques to implement."

–Shongtao Dai,
MnROAD Research Operations Engineer

Produced by CTC & Associates for:
Minnesota Department of Transportation
Research Services Section
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1899
(651) 366-3780
www.research.dot.state.mn.us

This cold-in-place recycling train is used for reclaiming the surface, conveying and crushing the millings, mixing the recycled material and laying the new cold mix.

They then analyzed the data and consulted highway engineers from six districts around Minnesota to create a decision tree for determining the most suitable method of rehabilitation for a given project. In addition, they also developed a list of best practices for each of the three methods.

What Did We Learn?

Decision Tree. Researchers were able to set a surface rating threshold at which rehabilitation becomes necessary. When the SR is greater than 3.0 (on a scale of 4.0), repairs may be avoidable, but when the SR is lower than 3.0, one of the three rehabilitation methods is recommended. The project report provides a guide for calculating the necessary values for the decision tree. Factors considered in the decision include road geometrics, pavement condition and bridge deck structural adequacy. The report includes a step-by-step checklist to provide engineers with a simple and useful tool for following the recommended decision procedures.

Best Practices. Once the decision tree is executed, the engineer can refer to best practices guidelines produced by this study for implementing the rehabilitation project. Depending on the method chosen, the report provides design and construction specifications covering necessary pavement thickness, ideal mixture design, equipment requirements and other factors. These guidelines may require field adjustments, but they provide a starting point for implementing the rehabilitation methods.

What's Next?

The results of this effort are being incorporated into a pavement rehabilitation training course for county and city engineers to be administered through the Minnesota Local Technical Assistance Program.

This study highlights the value of a comprehensive database for road rehabilitation projects. The primary investigators suggest that this database should be maintained and expanded going forward. Such a database will prove valuable for future studies.

Also, this project focused on the effectiveness of the three rehabilitation techniques, but only generally treated economic considerations. While the appropriate choice of rehabilitation method will likely lead to cost savings, a new study examining the cost considerations and life-cycle costs of each method is a logical next step.

This Technical Summary pertains to the LRRB-produced report 2008-06, "Pavement Rehabilitation Selection," published January 2008. The full report can be accessed at http://www.lrrb.org/PDF/200806.pdf.