



TECHNICAL SUMMARY

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LRRB PROJECT COST:

\$71,475



This segment of Minnesota Highway 38 has yellow centerlines and white edge lines that delineate a 4-foot bicycle lane.



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Prioritizing Pavement Markings on Low-Volume Roads

What Was the Need?

Minnesota has many miles of low traffic volume roads, most marked with yellow centerline and white edge lines. Applying and maintaining these markings represent a significant financial investment for local agencies, which typically work within very constrained budgets. These agencies needed more information about the value and the initial and ongoing costs of typical 4-inch and enhanced 6-inch pavement markings on low-volume roadways. They also needed clarification and guidance for prioritizing pavement marking installation and maintenance that could work within their limited budgets.

What Was Our Goal?

The goal of this research was to develop a prioritization approach and a decision-making tool for using pavement markings on low-volume roads based on the benefits and costs of these markings. Local agencies could then use these resources to make cost-effective decisions about installing and maintaining pavement markings.

What Did We Do?

Researchers took a multistep approach to identifying critical pavement marking information and practices:

- They conducted a literature search of existing research on typical (4-inch) and enhanced (6-inch) pavement markings, focusing on the benefits (such as crash reduction and improved lane-keeping), costs and current maintenance practices.
- Researchers surveyed Minnesota counties to learn about their current practices and management approaches for pavement markings.
- Investigators also reviewed existing County Road Safety Plan (CRSP) methodology to learn about research and data used to rank at-risk road segments and identify CRSP improvement strategies, specifically the range of pavement markings that CRSPs recommended.

Researchers were then able to develop a prioritization approach and a decision-making tool that incorporated both past research and local state of the practice. In addition to producing a final report describing task results, they developed a brochure explaining the approach, the tool and implementation steps.

What Did We Learn?

The literature search revealed limited research addressing traditional pavement marking use and effectiveness on local roadways. Pavement markings produce safety benefits, including reduced crash rates, but showed no real effects on vehicle speed, indicating that pavement markings may not alter driver behavior. Only limited efforts were identified in the literature aimed at investigating the prioritization and management of pavement markings.

Researchers developed a decision-making tool to assist local agencies in developing effective maintenance practices within their limited budgets as they work to install and preserve pavement markings on miles of low traffic volume roads.

“This innovative tool will help local agencies make pavement marking decisions under tight budget constraints, where the question is always how to best allot funds for competing needs. This tool clarifies the problems and helps prioritize the possible solutions.”

—David Veneziano,
LTAP Safety Circuit Rider,
Iowa State University
Institute for Transportation

“This tool is a valuable resource that will allow local agencies to make better pavement marking decisions in their counties.”

—Bruce Hasbargen,
County Engineer,
Beltrami County

Produced by CTC & Associates for:

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Pavement Marking Prioritization Tool																							
Enter data into highlighted boxes and under the highlighted sections.																							
1.) Enter total marking budget:											\$150,000.00												
2.) Enter total marking cost estimates (per foot): (i.e. cost for two edgelines on a roadway, not individual.)											Centerlines	Edgelines	Centerlines & Edgelines	Enhanced Visibility	Milled Markings								
											\$0.05	\$0.08	\$0.13	\$0.17	\$0.54								
3.) Enter project data in cells below:																							
Site	Project/Roadway				Length (miles)	Road Type:	Route Prioritization				Marking Type Prioritization												
							# of CRSP Stars (0 if not CRSP project)	Roadway Functional Class:	Pavement Condition:	Traffic Volume	Current marking age	Total pavement width (in feet):	Marking Cost Preference:	Marking Durability:	Crash Reduction Potential:								
1	193	46-1	646	10	TH 71 TO 1.5 MI W	1.5	1) CSAH	5	5) Local	2) Fair	620	2) 2 years											
2	194	47-1	647	15	TH 71 TO 0.04 MI S OF RR AVE	0.37	1) CSAH	0	4) Min. Coll.	2) Fair	940	1) 1 year											
3	195	47-1	647	21	0.04 MI SO RR AVE TO RR AVE	0.04	1) CSAH	0	4) Min. Coll.	2) Fair	940	1) 1 year											
4																							
5																							
6																							

The spreadsheet tool developed through this project allows users to enter road site characteristics and pavement marking choices from a range of project options to generate results such as cost, durability and potential safety enhancement.

The survey of local Minnesota agencies revealed that most counties use centerline and/or edge lines, which may be the result of MnDOT State-Aid Operation Rules. Some counties mark all their roads; most use 4-inch latex paint or epoxy markings. Repainting schedules depend upon road age, marking condition and county budgets.

A review of Minnesota counties’ CRSPs showed they included pavement marking recommendations. The CRSPs recommended, on average, 109 miles of pavement markings in every county. Applying one linear foot of centerline costs about 5 cents; 100 miles of centerline cost \$26,400. Because of the extent of these recommendations, researchers directly incorporated the methods and directives from the CRSPs into their prioritization approach and tool.

The spreadsheet tool produced through this project allows users to enter road site characteristics such as pavement condition, road width, the CRSP rating and traffic volume, as well as the age of extant markings, costs, durability and the potential for crash reduction. Pavement marking options include centerline and/or edge lines, high visibility markings and enhanced durability materials. The tool uses factor weights that assign a relative importance to each criterion for any potential marking approach compared to other alternatives. The result is a performance rating score for each marking alternative. Thus, the tool assists not only in identifying the physical aspects of a road segment, it also incorporates the agency’s preferences, priorities and budget through a priority-weighting feature that generates the cost or cost range for a marking project.

The decision-making tool will be available in the [Resources](#) section on the Local Road Research Board (LRRB) website.

What’s Next?

Recommendations for further research include conducting a follow-up survey of users of the new spreadsheet tool to facilitate future modifications, creating databases of roadway characteristics to simplify agencies’ use of the tool, and performing additional research on the safety and other effects of pavement markings. Researchers also encouraged agencies to keep in mind a proposed national retroreflectivity rule for the Manual on Uniform Traffic Control Devices that could affect pavement marking practices on low-volume roads. This rule has not yet been finalized or implemented.

This Technical Summary pertains to LRRB-produced Report 2018-21, “Investigating the Necessity and Prioritizing Pavement Markings on Low-Volume Roads,” published June 2018. The full report can be accessed at mndot.gov/research/reports/2018/201821.pdf.