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TECHNICAL SUMMARY

Authors:
Dave Van Deusen, MnDOT
Dave.VanDeusen@state.mn.us

Ben Worel, MnDOT
Ben.Worel@state.mn.us

Project Coordinator:
Sandy McCully, MnDOT
Sandra.McCully@state.mn.us

A five-axle tractor-trailer drives MnROAD's low-volume, closed loop to simulate rural traffic conditions.

MnROAD Phase II Research Innovations Projected to Save Millions of Dollars

What Was the Need?

MnDOT has operated the MnROAD pavement test track along Interstate 94 near Albertville, Minnesota, since 1994. MnROAD's overall goal is to provide information that MnDOT can use to improve pavement construction, design and maintenance—saving money and improving pavement performance. The facility has a 3.5-mile section carrying live I-94 traffic; a 2.5-mile low-volume, closed loop driven by a MnROAD five-axle tractor-trailer; and a 1,000-foot roadway for testing new paving methods and the impact of heavy vehicles on low-volume roads. These segments are divided into more than 70 test cells with a variety of pavement types and designs. All three segments have embedded electronic sensors that collect data.

In addition to MnROAD's value as a demonstration facility, researchers estimated a benefit-cost ratio of 3.8 over the next 10 years. Projects of particular value include investigations of low-temperature asphalt cracking, concrete overlays for asphalt pavements and concrete surface grinds.

MnROAD's Phase I research focused on concrete and asphalt structural designs, including spring and winter load restrictions, mechanistic-empirical pavement design and low-temperature cracking. Implementation of these results has provided an estimated $33 million in annual savings in Minnesota, and up to $749 million nationwide.

What Was Our Goal?

This project was initiated to summarize the outcome and benefits of the research conducted as part of MnROAD Phase II, running from 2007 to 2016.

What Did We Do?

Phase II was designed around partnerships with government, academia and industry to help develop and fund more than 20 research projects. Through these partnerships, a comprehensive program of pavement research at MnROAD and associated resources was developed that addressed asphalt and concrete construction, pervious pavements, maintenance, full-depth reclamation, recycled materials and the impacts of heavy farm equipment on pavements. Investigators estimated direct benefits for these projects and calculated a benefit-cost ratio based on costs from the 10 years of Phase II.

What Did We Learn?

The benefits of MnROAD research will take several forms:

- Direct benefits, with quantifiable monetary benefits due to material savings or enhanced performance.
- Indirect benefits, which result in improved construction processes that improve quality or performance or save time but are difficult to quantify.
- Avoidance, which takes advantage of MnROAD's status as a testing ground to evaluate practices that are too risky to attempt in the field.
- Demonstration, which provides a low-risk environment to test new approaches before wider implementation.

Phase II projects of particular note include:

- Investigation of Low Temperature Cracking in Asphalt Pavements, which evaluated laboratory procedures, material properties and pavement features to help select as-

continued

"MnROAD's goal is to get smarter about how we build, design, repair and maintain pavements. MnROAD has a long history and it's been successful at having implementable research benefits."

—Dave Van Deusen,
Research Operations Engineer, MnDOT Office of Materials and Road Research

"MnROAD is working toward expanding the number of partners utilizing and benefiting from the research facility. Partnerships will be essential to help provide both the research needs, direction and funding for the future. We want to do research that can be used by a wide range of customers throughout the world."

—Ben Worel,
Operations Engineer, MnROAD

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MnROAD's test sections contain thousands of sensors that collect data about pavement conditions, environmental conditions, traffic and weather for numerous research projects.

phalt mixtures that will resist low-temperature cracking, and which resulted in implementation of the disk-shaped compact tension test for mixture evaluation.

- Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements, which determined that optimal thicknesses are significantly thinner than what had been predicted by older procedures.
- PCC Surface Characteristics Concrete—New Construction and Concrete Surface Characteristics—Rehabilitation, which demonstrated the feasibility and effectiveness of innovative grinds to improve pavement durability and safety as well as reduce noise and costs.

The overall costs of Phase II included research, construction, instrumentation, salaries and costs related to buildings, equipment and information technology support. Funding came from MnDOT operating funds, MnDOT State Planning and Research funds, the Local Road Research Board, other state research funds, Federal Highway Administration and industry partners. Total costs were $27.5 million.

MnDOT anticipates direct benefits from Phase II research of nearly $104 million over the next 10 years, for a benefit-cost ratio of 3.8. MnDOT believes this estimate is conservative because it doesn't consider indirect benefits that are not quantifiable or the value of demonstrating new technologies or avoiding errors. Demonstrating new technologies is a particularly valuable, but hard-to-quantify benefit of MnROAD. Implementing new technologies is risky for local engineers, and without a demonstration facility, they may never have the confidence to attempt new approaches.

What's Next?

Phase III research, running from 2017 through 2026, will focus on two partnerships with states, industry, academia and other national full-scale research facilities. The National Center for Asphalt Technology in Auburn, Alabama, is one of the major partnerships developed over the last year to assist MnROAD and its customers. Research is scheduled to begin in September 2015 with NCAT focusing on pavement preservation and development of pavement cracking performance tests. This partnership will allow researchers to build and monitor test sections in both northern and southern climates.

A new pooled fund study will help develop the research needs and funding for Phase III. The National Road Research Alliance is a collaboration of state agencies, local government, industry, FHWA, academia and consultants focusing on local and state-sponsored research, implementation, technology transfer and training. To join these partnerships, visit http://www.dot.state.mn.us/mnroad/partners/index.html or contact Ben Worel or Dave Van Deusen.

This Technical Summary pertains to Report 2015-19, "Benefits of MnROAD Phase-II Research," published May 2015. The full report can be accessed at http://mndot.gov/research/TS/2015/201519.pdf. *Phase II research projects are described at* http://www.dot.state.mn.us/mnroad/projects/newindex.html.