



## RESEARCH SERVICES

OFFICE OF POLICY ANALYSIS,  
RESEARCH & INNOVATION

## TECHNICAL SUMMARY

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### Principal Investigator:

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### PROJECT COST:

\$35,400



While the SafeLane system provided excellent traction, it wore quickly, including by debonding at expansion joints.

# Making Roads and Bridges Resistant to Frost and Ice

## What Was the Need?

Since the 1990s, Mn/DOT has been using anti-icing chemicals to help prevent frost and ice from building up on its roads and bridges. Unfortunately, chloride ions from deicing salts corrode the steel bars that reinforce bridge decks, causing premature deterioration. The anti-icing chemicals can also damage the environment, including surrounding soil, vegetation and water.

Consequently, Mn/DOT is interested in methods that prevent dangerous road and bridge icing while minimizing the damaging effects of deicing chemicals. One possible method is the Cargill SafeLane™ anti-icing overlay, said by its manufacturer to consist of a unique aggregate that absorbs and stores liquid deicing chemicals. This property allows the pavement overlay to resist icing while preventing the chemicals from seeping into and damaging the steel reinforcement within the pavement. Research was needed to test these claims and evaluate whether this anti-icing overlay system would be suitable for use in Minnesota.

*Researchers investigated the effectiveness of the Cargill SafeLane anti-icing overlay system on bridge decks and found that while it significantly increased traction and reduced crash rates, it was subject to rapid wearing caused by traffic and snowplows.*

## What Was Our Goal?

The objective of this study was to evaluate the effectiveness of the Cargill SafeLane overlay system for reducing crashes, winter maintenance costs and the frequency of deicing chemical applications on bridge decks. Specifically, researchers evaluated its:

1. Performance as a sealcoat to reduce damage caused by the chloride in deicing chemicals used during the winter season.
2. Improvement of traction, retention of deicing chemicals between applications and reduction of vehicle crash rates.
3. Bond to the underlying concrete bridge deck.

## What Did We Do?

Researchers applied the SafeLane overlay system—consisting of a mixture of epoxy and crushed aggregate—to the southbound lanes of four Minnesota bridge decks and evaluated their performance over two to three years against that of northbound control lanes.

Each installation was studied for rates of crashes attributable to winter conditions, while one installation in Hibbing, Minnesota, was also studied in more detail for traction properties, wear performance and maintenance costs. For the Hibbing installation, researchers conducted laboratory tests of how well SafeLane's system of crushed aggregate and epoxy bonded to the underlying concrete. Over the next three years, researchers periodically conducted visual inspections for cracking, wear in wheel paths and shearing from plows; tested core samples for the depth and concentration of chloride intrusion; and conducted skid testing by measuring the friction between the road surface and the skidding tire of a test trailer with a locked wheel. To test the ability of the overlay to retain deicing chemicals, researchers asked plow operators to fill out forms that summarized their observations concerning its performance by comparing road surface conditions for the southbound overlay lanes and northbound nonoverlay lanes.

*“This project is a starting point for finding innovative anti-icing technologies to make Minnesota roads safer and less expensive to maintain.”*

—Farideh Amiri,  
Mn/DOT Maintenance  
Operations Research  
Engineer

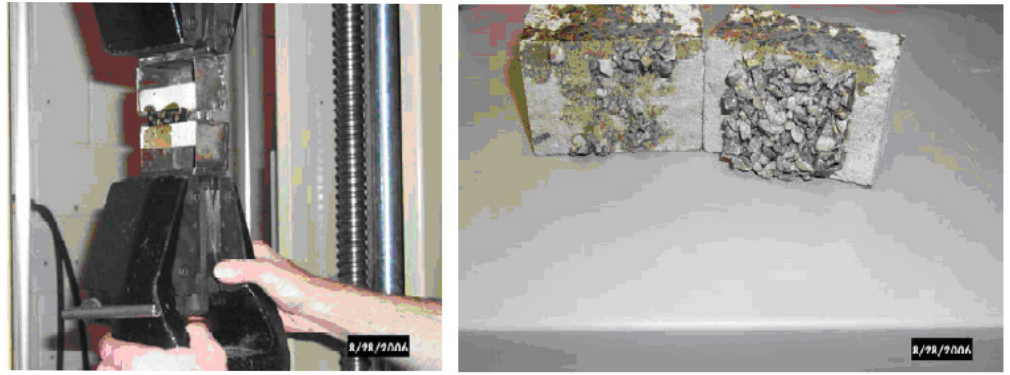
*“The SafeLane system initially offers outstanding traction for vehicles and seems to reduce crash rates, but wears rapidly. More research is required to find a cost-effective system.”*

—John Evans,  
Professor, University of  
Minnesota Department  
of Chemistry and  
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To test the strength of the bond between the SafeLane aggregate-epoxy system and the underlying concrete, researchers used a bond pull-out machine (left) to measure the force required to pull them apart (right).

### What Did We Learn?

Results indicated that while the SafeLane overlay shows promise for improving traction, reducing crash rates and protecting against the intrusion of chloride, it is subject to rapid wearing both from snowplows and normal traffic. Researchers noted that:

- The SafeLane system adhered well to the underlying pavement.
- Initially, the traction afforded by the coarse, rough aggregate was outstanding.
- Each installation showed a reduction in crash rates, which researchers inferred was the result of improved traction and the retention of deicing chemicals.
- As a sealcoat, the system afforded excellent protection against the intrusion of chloride and would likely decrease the corrosion of reinforcing steel over the service life of any bridge deck to which it was applied.
- The system is subject to significant, rapid wear, primarily due to plow blade shearing forces, but also from normal traffic in wheel paths. The observed shearing of the aggregate is consistent with loss of traction as measured by skid testing. Researchers predict that the service life of the overlay is limited to 3.5 to 5 years.

### What's Next?

Because of the short duration of this study, researchers recommend that more thorough, longer-term studies be conducted to confirm the expected service life for the SafeLane overlay system predicted in this study. They also recommend investigation of other overlay systems with aggregates less susceptible to damage from snowplow blades, and Mn/DOT has initiated another study, “Comparative Performance Study of Polymeric Chip Seal and Ultra Thin Bonded Wear Course Systems Applied to Bridge Decks and Approaches,” to analyze seven types of overlays on nine bridges in four Mn/DOT districts. Mn/DOT’s ultimate goal is to deploy an end-user product that maintains friction on roadways and bridges during snow and ice events, while reducing chloride damage and maintenance costs.

*This Technical Summary pertains to Report 2010-13, “Evaluation of the SafeLane™ Overlay System for Crash Reduction on Bridge Deck Surfaces,” published March 2010. The full report can be accessed at <http://www.lrrb.org/PDF/201013.pdf>.*