



IMPLEMENTATION SUMMARY

Technical Liaison:

John Brunkhorst, McLeod County
John.Brunckhorst@co.mcleod.mn.us

Project Coordinator:

Bruce Holdhusen, MnDOT
Bruce.Holdhusen@state.mn.us

Principal Investigator:

Rena Kuehl, SRF Consulting Group, Inc.

LRRB PROJECT COST:

\$33,689



The guide's graphic-heavy format helps illustrate concepts like anti-icing.



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Putting Research into Practice: Snow and Ice Control Guide Provides Quick Reference for New Maintenance Staff

What Was the Need?

Winter road maintenance is one of the most important tasks performed by the maintenance staff at local transportation agencies to ensure traffic safety and mobility after snowstorms. Many of these local agencies, however, are experiencing a high rate of staff turnover as veteran workers retire. Also, most local agencies have a relatively small maintenance staff responsible for all of the agency's maintenance needs throughout the year. These workers do not have the luxury of focusing on plowing and deicing full time.

As a result, many agencies need a source of basic winter maintenance information that can bring new staff up to speed on winter maintenance equipment, materials and practices. While this information is currently available from many sources, there was no simple guide that collected up-to-date information in a concise, visual format.

What Was Our Goal?

The goal of this project was to develop an easy-to-read, quick reference guide to basic winter road maintenance that could help bring new maintenance staff or managers up to speed or serve as a refresher for maintenance staff members who only work on winter maintenance for part of the year.

What Did We Implement?

This project was initially intended as a guide to deicing and anti-icing chemicals that implemented results from the "Salt Brine Blending to Optimize Deicing and Anti-Icing Performance" project (Phase 1: [2012-20](#); Phase 2: [2014-43](#)). The scope of the project expanded to address winter maintenance equipment, technologies and best practices, incorporating information from a host of research, but particularly the [Minnesota Snow and Ice Control Field Handbook for Snowplow Operators, Second Revision](#).

How Did We Do It?

To develop this guidebook, investigators synthesized information from the laboratory and field tests of the salt brine blending project, as well as other research. They also gathered photos from the project's Technical Advisory Panel and other sources, which are used throughout the guide to clearly illustrate a wide range of topics.

What Was the Impact?

This project produced the Snow and Ice Control Guidebook, which presents basic information about winter road maintenance in a visual format that can be read quickly. The guide has the following five sections, each including images to help illustrate the concepts discussed:

Investigators developed a reference guide to help new maintenance staff and managers quickly learn the basics of snow and ice control. The guide's many photos help illustrate winter maintenance strategies, equipment, materials, technologies and best practices that may not be familiar to staff members who have limited experience in winter maintenance.

“This guide is a general overview of most aspects of snow and ice control. It provides the fundamentals for staff members who haven’t necessarily been exposed to the various aspects of winter maintenance.”

—John Brunkhorst,
County Engineer,
McLeod County

“This guide is a unique resource that describes specific plow types and plow geometry. A lot of people unfamiliar with winter maintenance don’t have any idea that so much detail is involved.”

—Rena Kuehl,
Senior Associate Traffic
Safety Engineer, SRF
Consulting Group, Inc.

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Minnesota Department
of Transportation
Research Services & Library
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1899
651-366-3780
www.mndot.gov/research

WINTER MAINTENANCE MATERIALS

A variety of winter maintenance materials are available for local agencies to use to manage snow and ice. This table summarizes the commonly used materials, their uses, attributes and environmental impacts.



	Abrasives	Solid Rock Salt (NaCl)	Salt Brine	Magnesium Chloride (MgCl ₂)	Calcium Chloride (CaCl ₂)	Acetates Calcium Magnesium Acetate Potassium Acetate
Usage	Mix with salt to provide traction to slippery roads.	Deicing or anti-icing	Prewetting and anti-icing	Deicing, prewetting, and anti-icing	Deicing	Anti-icing Anti-icing
Typical Form	Sand (paved roads) or gravel (unpaved roads). Mixed with salt (20% to 33% salt).	Solid granular	Liquid	Liquid or solid	Liquid	Liquid Liquid
Lowest Practical Melting Temperature	Lowest practical melting temperature	15° F	15° F	-10° F	-20° F	20° F -15° F
Positive Attributes	- Provides temporary traction - More effective than chemicals at very low temperatures and for spot traction at targeted locations (hills, curves, bridges, intersections, shaded areas, windblown areas) - Useful alternative in environmental sensitive locations (no salt roads)	- Excellent melting capacity - Lower cost compared to other chemicals - Clear roads of snow and ice	- Prevents snow and ice from bonding to pavement (anti-icing) - Lower cost compared to other chemicals - Reduced granular scatter when used for prewetting - Low cost	- Reduced amount of product used, reduced salt and abrasive use over rock salt - Better cold temperature performance than rock salt - Persists on the road surface, aiding in larger black ice prevention than sodium chloride	- Better cold temperature performance than rock salt - Reduced amount of product used	- Non-corrosive - Often used on bridge anti-icing systems

The guide includes a side-by-side comparison of winter maintenance materials, including the relative advantages, disadvantages, environmental impacts and functional temperatures of each material.

- **Snow and Ice Control Strategies:** This section describes the practice and value of anti-icing and deicing activities along with the potential benefits of prewetting granular deicers or anti-icers.
- **Snow Plows and Equipment:** This section provides several details related to snow plows, many of which have not been compiled in one, easy-to-use guide. The section presents types of snow plows (front-end, wing or underbody); parts of a plow (including the shoe, cutting edge and mold board); types of vehicles that can be fitted with plows (such as dump trucks, motor graders and loaders); types of cutting edges (steel, carbide, combination, multiblade, ceramic or rubber); solid and liquid material spreaders; and in-cab control options (joysticks, knobs, push buttons and dial controls). The importance of equipment calibration is also discussed, and links to additional guidance are provided.
- **Winter Maintenance Materials:** This section includes a chart that compares abrasives, rock salt, salt brine, magnesium chloride, calcium chloride and acetates. The table presents each material’s positive and negative attributes, its environmental impacts and the lowest temperature at which each is effective. This section also includes a brief description of blended products and corrosion inhibitors, and the results of another study that calculated the benefit-cost ratio for using several types of materials.
- **Winter Maintenance Technologies:** This section provides an overview of Road Weather Information Systems (RWIS) along with a specific reference to MnDOT’s RWIS website. Information about Maintenance Decision Support Software and automatic vehicle location technology is also provided.
- **Winter Maintenance Policies and Best Practices:** This section highlights the Minnesota Snow and Ice Control handbook as a source for best practices in winter maintenance, and several sources of model snow and ice control policies. It also provides links to training opportunities and resources that offer more detail about specific facets of winter maintenance.

What’s Next?

The guide is complete and ready for local agencies to use. In response to a request from the Local Road Research Board (LRRB), the investigators have developed a [PowerPoint presentation](#) based on the guide that can be used in training sessions.

Investigators will be presenting the guide at several conferences, including the Minnesota city and county engineers conferences in January 2017. LRRB also plans to email the guide to city and county engineers associations.

This Implementation Summary pertains to the LRRB-produced Report 2016RIC11, “Snow & Ice Control Guidebook,” published June 2016. The full report can be accessed at mndot.gov/research/TS/2016/2016RIC11.pdf.