

**Winter Maintenance Application Rates and Guidance
*for Parking Lots, Sidewalks and Trails***

Training Supplement

Prepared for Dane County Land and Water Resources
Department

September 2017

Connie Fortin – Fortin Consulting Inc.

Connie@fortinconsulting.com

215 Hamel Road

Hamel MN 55340

FORWARD

Once you put winter maintenance salt down, it doesn't go away. It alters the composition of soil, slows plant growth and weakens the concrete, brick and stone that make up our homes, garages, bridges, and roads. It travels into our lakes, rivers, streams and wetlands, putting our aquatic life at risk and endangering our freshwater resources.

In Dane County, winter maintenance salt causes large seasonal spikes in chloride levels of area lakes, rivers, streams and wetlands. Groundwater supplies are also being affected, as seen by rising chloride and sodium levels in many of Dane County's drinking water wells. Some estimates show that deicers applied to sidewalks, parking lots and trails make up about one half of the total winter maintenance salt applied in Dane County -- a substantial part of the total chloride reaching our waters. These concerns are not unique to our area. Research published in 2017, led by UW-Madison Center for Limnology, found that many of 371 North American study lakes show increasing chloride trends over the last 10 to 70 years, and thousands more are at risk ("Salting Our Freshwater Lakes," Proceedings of the National Academy of Sciences).

In recognition of these trends, the fact that deicers applied to sidewalks, parking lots and trails make up such a large percentage of overall winter maintenance salt applied in Dane County, and our desire to provide clear guidance to winter maintenance professionals working at this scale, Dane County has developed locally-tailored anti-icing and deicing application rate guidelines for parking lots, sidewalks, and trails. These guidelines, coupled with best practices such as first mechanically removing snow and ice, will help professionals safely and effectively confront winter storms, while having the least impact to our environment.

To develop these guidelines, Dane County invited participation from local private and public sector professionals to serve on the Winter Maintenance Application Rate Advisory Group. This group was led by Connie Fortin, a national expert who integrated her extensive knowledge of winter maintenance best practices and application rate guidelines into this project. Dane County is grateful to the Advisory Group members for their shared perspectives ranging from small and large scale private winter maintenance operations at health care facilities; county parks; college campuses; and municipal parking lots, sidewalks, and trails. Dane County appreciates additional insight from the Wisconsin Department of Transportation, environmental experts, policy experts and winter maintenance equipment and product sales associations. This advice shaped and strengthened the application rate guidelines now available for use by winter maintenance professionals in our area.

Feedback on the use of the guidelines is appreciated, especially during the winter of 2017-18 when they are being piloted and evaluated. Feedback can be sent to lakes@countyofdane.com. Dane County will work with Wisconsin Salt Wise partners to address the driving forces that influence the rate and frequency of winter maintenance salt application, and continue to promote best management practices that reduce chloride pollution and protect our environment.

---Project Manager, Susan Jones, Dane County Land and Water Resources Department (Office of Lakes and Watersheds). 5201 Fen Oak Drive, Madison, WI 53718. 608-224-3764.
jones.susan@countyofdane.com

PROJECT OVERVIEW

This project was designed to develop several pieces of guidance to help lower salt application rates for those maintaining parking lots, sidewalks and trails in the Dane County region of Wisconsin. The components of this project are not intended to be a stand-alone comprehensive guide to winter maintenance. They are intended to be a starting point from which trainings, a training manual, or other educational components can be developed to assist winter maintenance professionals pursuing winter maintenance practices with reduced salt use.

HOW TO USE THESE MATERIALS

The guidance developed for this project is but a small portion, a chapter in the book of successful winter maintenance operations. For example, aggressive physical removal of snow and ice is required before any de-icing activities should take place. By attending a training class (see www.wisaltwise.com for upcoming training) the winter maintenance professional will receive a well-rounded education in strategies for lower salt use, including a better understanding of how to use this new guidance developed for the Dane County region of Wisconsin.

Please note that without first implementing best management practices throughout the organization (such as calibrating equipment, aggressive mechanical removal, monitoring pavement temperatures, etc.) these charts will not be meaningful to winter maintenance operations.

THE COMPONENTS

- **Anti-icing (before the storm) Application Rate Guidelines for Parking Lots, Sidewalks and Trails** - a one-page chart that gives application rate advice for brine applied before a storm event. For an interactive version of this chart visit www.wisaltwise.com.
- **Anti-icing Winter Maintenance Strategies** – a two-page set of tips that are useful when anti-icing and when using the anti-icing guidelines chart. It is not a comprehensive guide to anti-icing.
- **Deicing Application Rate Guidelines for Parking lots, Sidewalks and Trails** – a one-page guidelines chart that gives application rate advice for granular products applied during and after a storm event. For an interactive version of this chart visit www.wisaltwise.com.
- **Deicing Winter Maintenance Strategies** – a two-page set of tips that are useful when deicing and when using the deicing guidelines chart. It is not a comprehensive guide to deicing.
- **The Future of Winter Maintenance Involves Liquid Only Strategies** – a fact sheet that gives a high-level introduction to liquid only maintenance strategies. It is intended to pique interest on the subject; not to be an instructional fact sheet.

Print the PDF versions of each of these components by visiting www.wisaltwise.com, and include [them at the end of this training supplement](#).

THE PROJECT TEAM

Project Manager

Susan Jones - Dane County, Land and Water Resources Department (Lakes and Watersheds)

Project Leader

Connie Fortin - Fortin Consulting Inc.

Process Advisors

Mindy Habecker - Dane County UW Extension

Kathy Lake - Madison Metropolitan Sewerage District

Technical Advisors

Jeremy Balousek - Dane County, Land and Water Resources Department (Engineering)

JR Brimmer - City of Sun Prairie

Josh Churchill - UW Health

Phil Connors - Independent contractor

Angie Dahl - Epic

Dan Dean - Mad Plowing and Mowing

Amanda DePagter - Dane County, Department of Administration (Facilities)

Ryan Doescher - Olson Toon Landscaping

Chris Egger - University of Wisconsin-Madison

Mary Evers Statz - UW Health

Andrew Fritsch - Barnes Inc.

Phil Gaebler - City of Madison Engineering

Mike Gresch - Steve Brown Apartments

Greg Hall - Village of DeForest

Al Johnson - Wisconsin Department of Transportation

Jon Lindert - Strand Associates Inc.

Travis Raymond - UW Health

Conrad Richer - Dane County, Land and Water Resources Department (Parks)

Brooks Rolli - Olson Toon Landscaping

Tom Rosemeyer - Madison Water Utility

Michael Schafer - University of Wisconsin-Madison

Ryan Schwab - Dane County, Land and Water Resources Department (Parks)

Robert Scott - University of Wisconsin-Madison

Mike Sproul - Wisconsin Department of Transportation

LeAnna Wall - Wisconsin Department of Transportation

Robin Werner - UW Health

Contributors

Tom Broadbent - Envirotech Services

Catherine Harris - Madison Metropolitan Sewerage District

Jessica Jacobson - Fortin Consulting Inc.

Reviewers

Pam Dunphy - Dane County, Department of Public Works, Highway and Transportation

Cory Horton - City of Fitchburg

Jeremy Johnson - The Bruce Company

Anti-icing Winter Maintenance Strategies

General Tips

Anti-icing is the proactive practice of applying a liquid deicer to dry pavement before the storm.

- It is intended to weaken the bond between the pavement and the snow to make physical removal of the snow easier.
- Anti-icing often allows for less material to be applied during or after the storm.
- Anti-icing is not intended to melt all of the snow that falls on it.
- Anti-icing will provide a small zone of melting under the snow.
- Anti-icing makes snow removal easier and leads to overall salt reduction.
- Calibrate equipment to ensure accurate application rates.

How to Use the Chart

- Recommended rates for salt brine are listed by each predicted type of event.
- Consider increasing your rates to the maximum rates:
 - When recommended rates for similar events in the past have not proven successful.
 - When the temperature is forecasted to go down.
 - If you are applying several days before the predicted storm.
 - If the forecasted precipitation is expected to be heavy.
- For products not listed in the chart, seek application rate advice from your vendor.

Product Tips

- Liquid products, not granular products, are recommended for anti-icing.
- Sodium Chloride (NaCl) brine is the most commonly used anti-icing product.
- Brine concentration can be easily tested with a hydrometer.
- Brine should be at a 23.3% (about 2.3 lbs of salt to 1 gal of water). This is its lowest freeze point concentration.
- When it is colder than 20 or 15 degrees F, there are other chemicals that can be used alone or added to brine to improve performance.
- Other liquid products can be used for anti-icing. Ask your vendor for application instructions.

When to use Anti-icing Strategies

✓ Do Anti-ice

- In advance of the storm. Twenty-four hours or less is ideal.
 - Anti-icing more than 24 hours before the storm may still work but it will depend on how much material is still on your pavements just before the storm. You may have to reapply.
- In a wet/dry pattern (e.g. streamer nozzles, not fan nozzles) (*see example below*)
- With pavement temperatures above 20° F. This is when brine anti-icing is most effective
- To prevent frost.

✗ Do Not Anti-ice

- On pavements with snow or ice.
- In drifting or blowing areas.
- With salt brine if pavement temperatures are below 15° F.
- Before a rain storm.
- On a poor quality broken-up parking lots or gravel.

Did it work?

- You should see snow melting on top of anti-icing as the first snow flakes fall, but the snow will soon accumulate on top of anti-icing.
- When removing the snow there is likely a thin slushy interface between the snow and pavement.
- You may see wet or partially wet tracks as the snow is pushed into the anti-icing chemical by vehicles or foot traffic.
- You may notice better traction (higher friction) on snowy surfaces that have been anti-iced.



Example of wet/dry anti-icing spread pattern

This is an incomplete list of strategies. For more information visit: www.wisaltwise.com

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Written by Fortin Consulting, Inc.

Dane County Department of Land and Water Resources (LWRD) has determined that these guidelines establish a best maintenance practice for those fighting winter storms so they can provide high quality service and a lower impact on our environment. By issuing these guidelines, LWRD does not intend to extend its liability beyond that imposed by state statutes.

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Anti-icing (before the storm) Application Rate Guidelines

Anti-Icing Application Rate Guidelines for Parking Lots, Sidewalks and Trails		
Anti-icing is a proactive practice intended to reduce the bond between the pavement and the snow and ice		
Predicted Weather	Recommended Rates	
	23.3% Salt Brine (NaCl) gallons/1000 sq.ft.	Other Products
Frost/Sleet	0.3	Follow manufacturers' recommendations
Black Ice	0.5	
Freezing Rain	Not recommended	
Light Snow ($<1/2$ in./hr.)	0.5	
Moderate or heavy snow ($\geq 1/2$ in./hr.)	0.6	

*Maximum rates can be calculated by increasing recommended rate by 0.15 gal/ 1000 sq.ft.

For an interactive version of this chart visit: www.wisaltwise.com

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Deicing Winter Maintenance Strategies

General Tips

Deicing is the practice of applying products to melt snow or ice during or after the storm

- For best results remove as much snow and ice as possible before applying deicers.
- Deicers are not intended to melt all of the snow or ice.
- Deicers are best used to reduce the bond of snow and ice to the pavement so that the surface can be mechanically cleared.
- Before reapplying deicer, make sure you have given it time to work.
- Granular salt can only melt in areas where the snow is touching the granule.
- Calibrate equipment to ensure accurate application rates.
- Deicers work slower when it is cold yet they retain the same ice melt capacity.

How to Use the Chart

- For warming pavement temperatures use lower end of application rates
 - (i.e. as in the morning as the sun comes out for the day)
 - In March, the sun angle warms the pavement more, and less material may be needed to have the same effect.
- For cooling pavement temperatures use higher end of application rates
 - (i.e. as the sun sets in the late afternoon)
 - In December and January, the pavement temperatures typically do not warm up as much during the day with the sun at a lower angle in the sky, so more materials may be needed.
- For cold end of the pavement temperature range use the higher rates
- For warm end of the pavement temperature range use the lower rates
- If you have anti-iced, use the low end of the chart if more melting is needed.
- After your first pass, applications of less product are often effective, so try using somewhere between half and all of your initial application rate.

Product Tips

All deicers have impacts. None are safe for the environment.

Liquid

- Liquids melt faster than granular products. They also help jump-start the granular products if used in combination.
- Pre-wet rates assume 6-12 gallons per ton. If you apply liquid at a higher ratio you can further reduce your rates and increase your speed of melting.
- “Rock Salt wet with other liquids” column in the chart covers a range of products, thus producing a wide range of results. It is intended to be a column that provides ice melt capability at lower pavement temperatures than the “Rock Salt wet with Salt Brine” column.

Granular

- Granular products have more melting power than liquids.
- Salt with a coarser gradation will penetrate compaction better than finer salt.
- Salt with a finer gradation will work faster than coarser salt.
- “Winter Sand” does not melt snow or ice.
- “Winter Sand” contains just enough salt to keep the pile from freezing.
- Stockpiles \geq 1000 lbs of salt or salt/sand mix ($>$ 5% salt), see Trans 277 storage guidance.

Other Chlorides

- Magnesium Chloride ($MgCl_2$) and Calcium Chloride ($CaCl_2$) do not melt as much snow and ice as rock salt, but melt faster than rock salt at colder temperatures.
- $MgCl_2$ and $CaCl_2$ are hygroscopic. They pull moisture from the air to the pavement. If over-applied or applied in warm or humid conditions, they may create a slippery surface.
- Potassium Chloride (KCl) works at a similar temperatures as rock salt.

For Compacted Snow and Ice

- For black ice, sleet, freezing drizzle, or freezing rain, use high end of recommended rates and apply more frequently.
- For frost or frost prevention, liquid applications are most efficient.
- If you have compacted surfaces you have lost the battle. Low rates will no longer work. Figure out what went wrong and adjust for the next event. Do not try to melt all of the compaction. Attempt to get melting under the compaction so that you can physically remove snow/ice.

This is an incomplete list of strategies. For more information visit: www.wisaltwise.com

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Deicing Application Rate Guidelines

Deicing Application Rate Guidelines for Parking Lots, Sidewalks and Trails

For best results remove as much snow and ice as possible before applying deicers

Pavement Temp. (°F)	Application Rate in lbs/per 1000 square foot area					
	Rock Salt *	Bagged Blend Mostly Sodium Chloride	Bagged MgCl ₂ or CaCl ₂	Rock Salt wet with Salt Brine	Rock Salt wet with other liquids	Winter Sand **
28 ° to 32 °	2.3	2.3		1.6		
23 ° to 28 °	2.3-4.5	2.3-4.5		1.6-3.2		
15 ° to 23 °	2.3-6.8	2.3-6.8		1.6-4.8		
0 ° to 15 °			2.3-6.8	3.2-4.8	3.2-4.8	Spot treat as needed
-5° to 0°			6.8		4.8	
< -5°	Plow Only					
SPEED of melting	AVERAGE The colder it is the slower it works	Faster than rock salt if the gradation is finer	ABOVE AVERAGE	FAST	FAST	NONE

* Dry rock salt is not recommended. It is slow to melt and leads to over-application.

**Winter sand contains ≤ 5% salt. It will not melt snow or ice.

For subsequent passes use 1/2 rate to the full initial rate.

For an interactive version of this chart visit: www.wisaltwise.com

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The Future of Winter Maintenance Involves Liquid Only Strategies

Liquids: the future of snow and ice control

Liquid deicers have been very popular in winter road maintenance. They are also an innovative approach to sidewalk, trail and parking lot maintenance. Stay ahead of the competition by adding liquids to your winter maintenance plan.



Faster: liquids can melt snow and ice faster than granular salt



Lessens Environmental Impact: the lower salt concentrations of liquid deicers are less damaging to our lakes, rivers and groundwater



Cost Effective: less time and less salt can lower costs of winter maintenance if done correctly



Stays on Target: liquids eliminate bounce, scatter and tracking problems associated with granular products

What to know before trying liquids:

- Liquid has less melting power than granular products
- Proper training, chemicals and equipment are necessary to integrate liquids into your maintenance program
- Learn about training offered in the Dane County area at www.wisaltwise.com



Wet/dry spread pattern example



Parking lot equipment example



Wet/dry spread pattern equipment example; make double pass to get more lines

How to Use Liquids in your Winter Maintenance Program

Beginner:

Anti-icing before a storm is an easy first step to adding liquids in a winter maintenance program.

Before the Storm (Anti-icing)

Applying only liquids before a storm is an effective step in weakening the bond of snow to the pavement. This preventive measure will melt a thin layer between the snow and the pavement, making removal easier and in some cases unnecessary. Anti-icing with liquids is helpful in many situations but should not be used on very cold pavement or in areas with blowing or drifting snow. For safest results apply liquid in a wet/dry pattern (*see front page for spread pattern example*).

Anti-Icing Application Rate Guidelines for Parking Lots, Sidewalks and Trails		
Anti-icing is a proactive practice intended to reduce the bond between the pavement and the snow and ice		
Predicted Weather	Recommended Rates	
	Salt Brine (NaCl) 23.3% gallons/1000 sq.ft.	Other Products
Frost/Sleet	0.3	Follow manufacturers' recommendations
Black Ice	0.5	
Freezing Rain	Not recommended	
Light Snow (<1/2in./hr.)	0.5	
Moderate or heavy snow (≥1/2 in./hr.)	0.6	

*Maximum rates can be calculated by increasing recommended rate by 0.15 gal/ 1000 sq.ft.

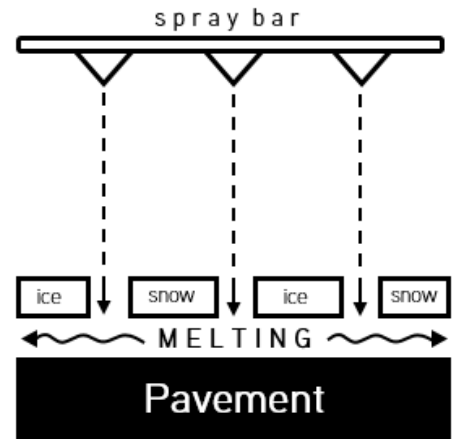
Advanced:

Applying straight liquids during or after a storm is an advanced technique offering much promise for the future. Do not try this unless you are very familiar with liquids.

During or After the Storm (Deicing)

The technique of applying only liquid deicer during or after a storm event is called direct liquid application (DLA). DLA is an advanced technique and requires proper training, equipment, liquid selection, and strategies.

DLA is especially effective at removing frost or thin layers of ice. With spray nozzles, streams of liquid can penetrate through and spread out under compacted snow and ice to break the bond with the pavement (*right*). Caution: If done incorrectly, DLA can act like a Zamboni and create a layer of melting/refreezing on the surface of compacted snow and ice.



DLA example

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