Winter Parking Lot and Sidewalk Maintenance Manual

June 2006
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Acknowledgments

This manual is dedicated to helping Minnesotans protect the environment. Whether you are the plow driver, the building manager or the traveling public, you have an important role to play in protecting our environment.

The Winter Parking Lot and Sidewalk Maintenance Manual is based on the Minnesota Snow and Ice Control Field Handbook for Snowplow Operators produced by the Minnesota LTAP Center and on the training materials for the MPCA parking lot winter maintenance training class. Thanks to the following sponsors and participants for their valuable input in the production of this document.

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Purpose of this Manual

The purpose of this manual is to deliver practical advice to those who manage parking lots and sidewalks. This manual will help you make better proactive, cost-effective choices in winter parking lot and sidewalk management. It will give you knowledge to become a leader in your industry by operating more efficiently and reducing environmental impacts.

A blanket approach will not work for the range of conditions Minnesota experiences; different strategies are needed for different regions and different conditions. We encourage you to continue to test, document, and refine the practices from this manual.

Through the manual you will find environmental tips shown with a fish symbol. These tips will help you reduce environmental impacts from snow and ice control operations.

Through the manual you will find cost-saving tips shown with a dollar symbol.
Good Business Choices

Customer service is the key to success. You can use best practices to keep parking lots and sidewalks safe and also reduce environmental impacts. By taking time to educate your customers on the proper methods of snow removal and ice control (and the value to them), you can create a good and long standing-relationship with them.

Your customers want reliable service. Providing a well-planned and executed winter maintenance program will leave a positive impact on your customer. By using the latest technologies, you will be more reliable. By providing a higher level of service, you are likely to reduce slip and fall exposures.

Your customers want someone educated on parking lot maintenance. You are educating yourself on best practices for winter maintenance, with this handbook.

$\textbf{How to use the right amount of material at the right to use less material, to save time and money.}$

$\textbf{Certification in snow and ice control is a good reflection on you and your organization.}$

Your customers and the public want safe parking lots and sidewalks. By understanding the materials, weather and application rates, you will have a head start on controlling icy, slippery parking lots and sidewalks.

Your customers want clean and neat parking lots and sidewalks. By using less material and increased winter sweeping, pedestrians will track less material into buildings. Proper snow storage facilities make debris removal in the spring easier. Covered storage of deicers will provide a neater parking lot, minimize loss of material and protect water. By preventing vehicle leaks, cleaning up spills and using lower application rates, you will keep parking lots and sidewalks neat.

Your customers want affordable snow and ice control. By using more sophisticated chemicals, you might need a bigger budget up-front. Initially you may have to charge more for using liquids. However, these costs are likely recovered by reduced sweeping, reduced floor and rug maintenance, reduced parking lot striping and reduced snow and ice maintenance time. Companies are willing to pay to keep the dirt out.

Your customers want to protect our lakes and rivers. Educate your customers on the importance of responsible deicing applications.

\textit{The best way to protect our lakes is to use less material. It is difficult to recover salt or sand once applied.}
Lakes, Rivers, Deicers and Abrasives

- Deicers melt snow and ice.
- Abrasives provide traction on top of packed snow or ice.
- Deicers and abrasives work against each other. Do not mix them.
- Deicers dissolve and move downhill to the nearest lake, river or pond. They do not settle out; they stay in our water cycle virtually forever. The concentration of deicers is increasing in our surface and groundwater.
- Abrasives leave parking lots either as dust or move downhill with water to the nearest lake, pond or river. They fill in the bottoms of our lakes and rivers, accelerating the aging process of the water body and disrupting the food chain. Sediment can be removed from our water by dredging.
- Forty percent of Minnesota’s tested lakes and rivers are polluted enough to be put on the federal list of impaired waters.
- Only 2.5 percent of all of the water on this planet is freshwater (not saltwater). Of that, less than 1 percent is available to us. The majority of our freshwater is frozen in the glaciers. (See Figure 1).
- Water is recycled over long periods of time. (See Figure 2).

Figure 1      Available Water

![Available Water Diagram]

Melting more than 1/16 inch wastes material. We only need to melt the bond between the pavement and the snow/ice.

Reduced material on surfaces equals reduced material in lakes and streams.

Less than 3% of the water on earth is freshwater
Figure 2  The Water Cycle

We have a limited supply of water on this planet. Water is reused, recycled and dispersed as illustrated above.
Prepare for Winter Operations

Policies
Start now! Develop a maintenance policy with your customer. A little planning and communication up-front can help you do a better job.

- Schedule training for you, your crew and customer. Check the MPCA website to find out about upcoming training opportunities: www.pca.state.mn.us/programs/roadsalt.html.
- Discuss the maintenance policy with your crew.
- Address customer expectations, the hours and use of the building, priority access points and environmental concerns in your policy.
- Inform your customers of any changes to your snow and ice maintenance program, and why you are making them.
- Include site monitoring in the policy.
- Plan for year round sweeping.
- Document any closed building entrances during the winter. If this is agreeable, it would reduce the amount of chemicals and maintenance time.
- Reduce your risk by having a solid written winter maintenance policy and training program that utilizes best management practices.

Our waters are threatened by policies which are based on fees for material use. This encourages overuse of materials.

Reduce your liability. Establish a maintenance policy with the customer and follow it.

Storage
Storage areas often cause groundwater or surface water contamination.

Snow Piles
- Store in an area where you can recover the solids after the snow melts.
- Locate snow down-slope from salt and sand storage. Prevent snow melt from flowing through salt or sand storage area.
- Avoid pushing snow into lakes, ponds, wetlands, rivers or other natural areas. Reduce chemical contamination and increase the amount of solids that can be recovered after the melt.
- Windrows of snow can be used to guide motorists in parking when they cannot see the parking lines.

Salt Piles
- Store salt where rain, snow and melt water cannot access it.
- Store on an impervious surface.
- Cover all piles, ideally indoors.

Improper storage of salts can lead to groundwater contamination.
• Sweep loading areas back into the pile to reduce leaching.
• Contoured pads (bowl-like) for pretreated salts, reduces runoff from the pile.
• Store away from lakes, rivers, ditches, storm drains and wetland edges.

Salt storage areas are often a source of groundwater contamination. To reduce risk, have a covered storage area on an impervious pad. Take measures to keep salt or salt brine from leaving storage area.

Salt Bags
• Store away from rain or snow.
• Dispose of bags properly.

Liquids
• Understand the freezing point of your liquid. This will determine if it can be stored outdoors or if it must be stored indoors. Salt brine (NaCl) should be stored indoors.
• Some above-ground storage tanks are exempt from regulations:
  o Those with a capacity of 500 gallons or less.
  o Those with a capacity of 1100 gallons or less and not located within 500 feet of Class 2 surface water (Class 2 surface water includes all Minnesota waters that are or may be used for fishing, fish culture, bathing, or any other recreational purpose and where it may be necessary to protect water or plant life as well as the public health, safety, or welfare).
• For more information on storage tanks see www.pca.state.mn.us/cleanup/ast.html, Minnesota Rules Chapter 7151, or call the MPCA Customer Assistance Center at 800-646-6247.
• Label the tank documenting its contents.
• Tanks should be double-walled or have secondary containment.
• Before installing tanks, check on local visual screening ordinances.

Sand piles
• Winter sand is typically mixed with some deicer to prevent freeze-up of the pile. Therefore, sand pile storage should be the same as salt pile storage.
• Do not use leftover winter sand for other uses. Save it under cover for the next season.

Make sure no wells, shallow aquifers or any conduits to groundwater are located near your storage area. Limestone regions with fissures and sinkholes are very prone to groundwater contamination as are sandy soils.

Weather
Knowing existing and potential weather conditions is very important for a successful snow and ice control operation. Monitor the weather closely so that you are available and prepared to act early in storm situations. Check the National Weather Service (website http://www.noaa.gov) local TV station, or Website weather. A Road Weather Information System (RWIS) is available on the Internet at www.rwis.dot.state.mn.us.

Pavement Temperature
You must know the pavement temperature to determine the proper amount and type of material to apply. Most weather stations report air temperature, not pavement temperature, at a height of 30 feet above ground, which can differ substantially from pavement temperatures.

There is a change in pavement temperature from sunny to shaded areas. You will also notice differences between concrete and asphalt surfaces.

You can purchase hand-held temperature sensors from auto part stores for about $100. They are designed to measure engine temperature. Make sure the one you buy has the appropriate temperature range and accuracy for cold weather work. Just stand still and point it at the ground to get a reading. Mirror-mounted temperature sensors are also available; they are less likely to be lost or stolen but do cost more and are generally not available at an auto parts store.
Getting prepared for winter

- Calculate the area of your parking lots, service roads and sidewalks.
- Identify snow storage areas.
- Understand the properties of the various deicers, and then select the type to use.
- Estimate the amount of material you will need using the application rate charts. Order based on your estimate.
- Understand the environmental problems caused by snow, salt and sand storage. Then determine where and how you can best store each item.
- Train your crew on proper application rates.
- Mark islands, fire hydrants and other landmarks obscured by snow.
- Note existing conditions of curbs and other items that might be damaged by winter maintenance.
- Note or mark all catch basins and manholes that may cause a hazard to the plow and the operator.

Drainage

Take time to inspect drainage ways and, remove obstructions to prepare for the spring melt. Never open frozen storm drains with high doses of salt. This is toxic to aquatic life in the receiving waters. Use other methods such as heat to open drains. Look for ways to capture any solids before they enter the storm drain system. Make sure your parking lot does not drain through your salt storage area.

Storm drains lead to the nearest lake, river, pond or wetland. They do not go to a treatment plant.

Calibration

Calibration is an essential procedure to measure the pounds of material applied. No matter how sophisticated or simple your operations, always calibrate each piece of equipment yearly. Purchase equipment that has the capability to deliver low application rates.

You can calibrate any type of equipment. Just find a way to determine how many pounds of material per minute is landing on the pavement or sidewalk over a measured area or distance, and for differing speeds.

If you cannot or choose not to calibrate your equipment, you will need to calculate the size of the parking lot, the surface temperatures and the material you are using. The application rate chart and these three parameters will tell you how many pounds of deicer to apply. Without calibration, it will be up to you to find a way to evenly distribute the recommended amount across your parking lot.

Knowing the pavement temperature will allow you to select the proper amount of material for each situation. See application rate table
Because spreaders vary, calibrate each truck.
Calibrate separately for every type of material you use.
If you don’t have different settings, you can change your application rate by adjusting the gate opening and truck speed.
Place the calibration results in your truck.
For specific calibration directions, contact the manufacturer.

Below are some examples of calibration methods:

Simple Calibration for Conveyor and Auger Spreaders
If your equipment has different settings, you will need to calibrate for each setting. Make sure the auger plate is in place while calibrating. It generally takes three people to calibrate equipment: one to run the truck, one to catch the material and one to count the auger revolutions. Repeat the calibration for different materials.

Step 1: Calculate discharge rate
- Mark the auger or conveyor shaft so you can tell when a revolution has been made.
- Determine how many pounds are discharged per auger/conveyor shaft revolution. Capture in a bucket or tarp the amount of material that comes out for one revolution and weigh it. For more reliable results, do this three times and average the results.
- Count the number of revolutions per minute.
- Pounds per revolution X number of revolutions per minute = discharge rate in pounds per minute.

Example: 5 lbs of dry salt was the average amount dropping in 1 revolution. 10 revolutions occurred in one minute. The discharge rate is 50 lbs.

Step 2: Calculate application rate:

<table>
<thead>
<tr>
<th>Speed</th>
<th>Time to drive 1 mile</th>
<th>Discharge rate Per setting*</th>
<th>Application rate (discharge x time)</th>
<th>Type of material</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 MPH</td>
<td>12 minutes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>10 MPH</td>
<td>6 minutes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 MPH</td>
<td>4 minutes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 MPH</td>
<td>3 minutes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example: 15 MPH</td>
<td>Example: 4 minutes</td>
<td>Example: 50 lbs from setting #1</td>
<td>Example: 200 lbs/mile</td>
<td>Example: Dry salt (NaCl)</td>
</tr>
</tbody>
</table>

Table 5   Calibration Chart for Auger Spreader
*This number is always the same for each setting

Example: We tested setting #1 using dry rock salt (NaCl). We were discharging 50 pounds per minute and at 15 mph the application rate is 200 lbs/mile.
Simple Calibration for Gravity Flow Equipment
Gravity flow equipment is very difficult to calibrate and likewise very difficult to deliver products in a consistent manner. Look for ways to upgrade your equipment. This calibration procedure can also be adapted for use on sidewalk equipment.

Step 1: Calculate discharge rate
- Mark out a 10-foot stretch of road/parking lot.
- Sweep it clean of sand or any other material.
- Drive the truck and start applying material prior to the marked area. When you cross the start point, make sure your speed stays at the desired speed and remains consistent for the 10-foot stretch. Continue spreading material a short distance beyond your marked area.
- Record your vehicle speed.
- Measure the width the material is spread or bounces, in feet.
- Sweep up and weigh the material that is within your marked 10-foot stretch.
- Record the lever position/setting for the gate/chute. If there are no numbers for the positions, make your own permanent marks and numbers on the equipment to identify the positions.
- To improve accuracy, repeat this procedure two more times and calculate the average weight of material applied.

Step 2: Repeat step 1 for different speeds, settings and materials

Step 3: Create an application rate chart to keep in your truck
- Using the information gathered, make an application rate chart to indicate how much material is applied at each setting and speed.
- If you use more than one type of material, repeat the test for each material.

Calculate application rate:
Vehicle: ________________  Material: ________________  Date: __________

<table>
<thead>
<tr>
<th>Speed</th>
<th>Lever position or gate setting</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 MPH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 MPH</td>
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<td></td>
<td></td>
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<tr>
<td>15 MPH</td>
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<tr>
<td>20 MPH</td>
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<tr>
<td>Example 20 MPH</td>
<td>Setting 2 Half-closed</td>
<td>0.4 lbs</td>
<td>13 feet</td>
<td>130</td>
<td>3.1 lbs/1000 sq. feet</td>
<td>196 lbs/mile</td>
</tr>
</tbody>
</table>

Table 6  Example Calibration Chart for Gravity Flow Equipment
Place the completed calibration chart in each truck. You can use it to compare to the recommended application rates.
Example:
- Using sand, driving 20 mph, spreader position half closed.
- 0.4 lbs of sand was recovered in the 10-foot length, spread out to a 13-foot width (the width the sand bounced to).
- Coverage area = width 13 feet by 10 foot length or 130 square feet.
- Since the application rate tables are all in 1000 sq ft units, you can compare this test to the recommended application rate tables.
- To determine how much would be spread in 1000 square feet, divide 1000 by the coverage area and multiply by the lbs. of material recovered 1000/130 x 0.4 = 3.1.
- The application rate delivered is 3.1 pounds per 1000 square feet. If you want to convert it to lbs. per 12 foot lane mile, multiply by 63.4.

Desirable Equipment Features
- Ability to calibrate
- Ability to deliver low application rates
- Control switch in cab

Some fish species are affected by concentrations of less than 1000 ppm sodium chloride, about 1 to 1.5 tablespoons of salt in 5 gallons of water.

Apply wisely. We will never have a chance to recover the chemicals applied.
# Calibration Chart

<table>
<thead>
<tr>
<th>Vehicle or spreader number:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Type:</td>
<td></td>
</tr>
<tr>
<td>Calibrated by:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speed</th>
<th>Lever position or gate setting</th>
<th>Lbs. Material recovered in 10 feet</th>
<th>Spread width in feet</th>
<th>Square feet covered with material ((B \times 10))</th>
<th>Application rate in lbs/1000 ft(^2) ((1000/C \times A))</th>
<th>Application rate in lbs/lane mile ((D \times 63.4))</th>
</tr>
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Table 7  Blank Calibration Chart for Gravity Flow Equipment
How Salt Works

- Salt lowers the freezing point of water from 32 ºF to a colder temperature.
- Salt must be in solution (brine) to work, it won't do anything until it begins to dissolve.
- Salt brine (NaCl) is most effective at a 23.3% solution, just like antifreeze, if it’s too weak or too strong, it won't be as effective.
- The melting power is reduced as more snow falls or melts and the brine becomes less than 23.3%.
- The melting power is reduced as more salt is applied making a stronger ("hotter") mix and the brine becomes more than 23.3%.
- A deicer (salt) will work until the freeze point of the brine equals the pavement temperature. At this point the salt will stop melting and you may experience refreeze if pavement temperatures are dropping.

One application rate will not fit all storms; how long an application lasts depends on:
- Pavement temperature
- Application rate
- Precipitation
- Beginning concentration of the brine

Don’t use road salt below 15º F. You are wasting money and time.

Speed of Melting

Will the road salt (NaCl) you apply have time to work or is it time to switch to a different deicer? This chart will aid you in making that decision.

<table>
<thead>
<tr>
<th>Pavement Temp. ºF</th>
<th>One Pound of Salt (NaCl) melts</th>
<th>Melt Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>46.3 lbs of ice</td>
<td>5 min.</td>
</tr>
<tr>
<td>25</td>
<td>14.4 lbs of ice</td>
<td>10 min.</td>
</tr>
<tr>
<td>20</td>
<td>8.6 lbs of ice</td>
<td>20 min.</td>
</tr>
<tr>
<td>15</td>
<td>6.3 lbs of ice</td>
<td>1 hour</td>
</tr>
<tr>
<td>10</td>
<td>4.9 lbs of ice</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4.1 lbs of ice</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>3.7 lbs of ice</td>
<td></td>
</tr>
<tr>
<td>-6</td>
<td>3.2 lbs of ice</td>
<td></td>
</tr>
</tbody>
</table>

Dry salt is ineffective and will blow away before it melts anything.

Table 8       Speed of Melting
Selection and Use of Materials

Factors to consider
- Cost and availability
- Practical melting temperature
- Environmental impacts
- Ease of use

Environmental Impacts
Deicers are not environmentally safe no matter what the bag says. Do not buy a product based on this claim.

Chlorides:
- Are less effective if applied in concentrations that are too high. The correct concentration is crucial, just like anti-freeze in your car.
- Stay in our water almost forever. Reverse osmosis is the process required to remove salt from our waters.
- Are corrosive to steel unless they have a corrosion inhibitor added.
- Have corrosion inhibitors and anti-caking agents that are often toxic substances.
- Damage vegetation.
- Change the soil structure.
- Are often the least expensive and most available deicer.
- Are not removed by holding or treatment ponds.

About 1 teaspoon of salt can pollute 5 gallons of water forever. This applies to all chlorides.

Acetates:
- Are non-chloride compounds. They have different melting characteristics than chlorides
- Are an organic substance.
- When added to water, compete with aquatic life for oxygen.
- Contribute nutrients which promote algal blooms in our lakes and ponds.
- Cause problems in our waters but tend to be less persistent than the problems introduced by chlorides.
- Are usually safer for vegetation.
- Have less corrosion potential and are often used at airports or in areas with expensive infrastructure such as bridges.
- Have the potential to be treated by holding ponds.

Acetates can have a high biological oxygen demand (BOD), and can contribute to oxygen depletion in soil and water. Use carefully.
Plant-based additives:
- Often corn, beet, molasses or other organic additives are added to salts to improve performance.
- These additives do not contribute chlorides to the water but contribute nutrients (fertilizer) to the water. The impact they have is to increase aquatic plant and algae growth. They also use oxygen as they decompose.
- The impacts are serious but not as long-lasting as chlorides.

Salt- tolerant plants:
- One source of information about salt-tolerant plants is the MnDOT plant selector tool [http://plantselector.dot.state.mn.us](http://plantselector.dot.state.mn.us).

**Protect our landscaping. Chlorides can damage vegetation at concentrations greater than 70 ppm (about 1/3 teaspoon of salt in 5 gallons).**

**Surface salt spray damages trees. One visible symptom is “witches brooming”, a mass of shoots that resemble a broom.**

The best way to reduce impacts, save money and maintain customer satisfaction is to:
- Know what is in your product.
- Know how and when to use it.
- Use the minimum amount needed to get the job done.
- Seek out products that allow for smaller application rates.

**Materials Testing**

Take time to test your materials to ensure that they perform as expected. Do not rely solely on the bag or on the manufacturer’s literature. There are no labeling laws. Manufacturers can choose to label their products in their own way. Labeling can be confusing; some manufacturers list the eutectic temperature while others list the lowest practical melting temperature. The list of ingredients may or may not be included. Often the percentage of each ingredient is not included. The best approach is to test your products and learn how they work.

**One lb. of phosphorus encourages growth of up to 500 lbs of algae. Phosphorus is in plant-based products.**
Lowest Practical Melting Temperature

Be careful when reading the melting temperature on bags of deicers. Often, they list the eutectic temperature, which is the lowest possible melting temperature. At this temperature it would take a very long time to melt ice. Instead, use the lowest practical melting temperatures in the chart below or ask your supplier for the practical melting temperature and the time it takes to melt ice at that temperature. Remember, use pavement temperature, not air temperature.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Lowest Practical Melting Temp</th>
<th>Eutectic Temp</th>
<th>Optimal Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NaCl (Sodium Chloride)</strong> — Delivered as solid rock salt, also can be made into a brine. The basis of most deicing materials. Very corrosive. Inexpensive. Very available. Rarely has a corrosion inhibitor added.</td>
<td>15°F</td>
<td>-6°F</td>
<td>23%</td>
</tr>
<tr>
<td><strong>MgCl₂ (Magnesium Chloride)</strong> — Delivered as a liquid. Often used to wet NaCl crystals to increase adherence to surface and reduce melting points. Corrosive. Higher cost. Often has a corrosion inhibitor added.</td>
<td>-10°F</td>
<td>-28°F</td>
<td>27 to 30%</td>
</tr>
<tr>
<td><strong>CaCl₂ (Calcium Chloride)</strong> — Delivered as flakes, pellets, or liquid. Powerful deicer but extremely corrosive. Sometimes used incorrectly to open storm drains. Higher cost. Often has a corrosion inhibitor added.</td>
<td>-20°F</td>
<td>-60°F</td>
<td>30%</td>
</tr>
<tr>
<td><strong>CMA (Calcium Magnesium Acetate)</strong> — Delivered as a powder, crystals, pellets, or liquid. Liquid CMA is used mainly on automated bridge deicing systems. Non-corrosive, biodegradable. Sometimes added to sodium chloride as a corrosion inhibitor. Alternative for areas where chloride use must be limited. Often higher cost.</td>
<td>20°F</td>
<td>-18°F</td>
<td>32%</td>
</tr>
<tr>
<td><strong>KAc (Potassium Acetate)</strong> — Delivered as a liquid. Often used on automated bridge deicing systems and airports. Use for anti-icing, deicing, and prewetting. Non-corrosive, biodegradable. Alternative for areas where chloride use must be limited. Higher cost.</td>
<td>-15°F</td>
<td>-76°F</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Blends</strong> — Both chlorides and acetates exist in blends. Talk to your supplier and determine the lowest practical melting temperature, the optimal concentration and the basic components in the blend. Most blends are centered on rock salt since it is cheap.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Winter Sand/Abrasives</strong> — Winter sand is sand treated with brine or another blend. It is often used as an abrasive for low-temperature conditions when chemicals are not effective. Sand provides temporary traction and only works when it is on top of the ice.</td>
<td>Never melts — provides traction only</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9   Lowest Practical Melting Temperature
Sidewalk Tips
Always power sweep or plow snow away prior to applying deicers. If you plow first, the chances of refreeze diminish and slush build-up is minimized. For large entrances to buildings where people access the sidewalks directly from streets, move the snow away from the curb and deice these areas as well. Sand build-up on sidewalks can become a hazard and will track into buildings, damaging carpets and flooring.

- Sidewalks are often the most over-salted of all areas in winter maintenance.
- Sidewalks are the area of highest tracking into the building. Extra salt and sand contribute to slippery entryways inside the building.
- Use drop spreaders, not rotary spreaders, for narrower sidewalks. If you are using a rotary spreader, adjust the opening to limit dispersion of deicers to the sidewalk.
- Many slip and fall incidents occur within ten feet of the curb lines.
- If you are not responsible for sidewalk maintenance, consider providing this information to the building occupants to educate them on these best practices for winter maintenance.
- Look for opportunities to close extra entrances during the winter to reduce the need to use chemicals on all sidewalks and steps.
- Focus on aggressive mechanical removal of snow. The less snow, the less deicer required. This will lend to a safer walking surface.

$Salt only needs to melt 1/16 inch to prevent the bond between the pavement and the ice. Save money by applying salt before the ice bonds so you don’t need to melt through it.$

Parking Lot Tips
- It is hard to push shopping carts through salt and sand accumulations in parking lots. Clean up excess, or better yet, apply only appropriate amounts.
- Handicap parking spots should not get excess salt and sand. Excess may cause more harm than good.
- Sand/salt mix isn’t advised but may help in some situations such as freezing rain.
- Always plow before applying chemical.
- You may be able to use a lower rate in high traffic areas. Traffic tends to help mix and melt.

$Sand fills in lake bottoms, accelerating the aging process of lakes. Lakes get shallower as they age, some eventually becoming wetlands.$
Calculating Parking Lot or Sidewalk Size

The amount of deicer needed is based on the size of the parking lot. Here are simple ways to calculate the area of your parking lot.

- Ask the property owner for a scaled map of the facility so you can calculate areas.
- Ask the property owner for the size of the area they want you to treat.
- Go out and measure the parking lot.

The area or square feet of a square or rectangle is

**Length (L) X Width (W)**

The area or square feet of a circle is \( \pi r^2 \)
or \( 3.14 \times (r \times r) \) where \( r \) is half of the distance across the circle.

The area or square feet of a right triangle is

**Length (L) X Width (W) divided by 2**

Measuring your area along with knowing the pavement temperature will allow you to use the application rate charts. This will help you reduce the amount of chemicals you apply.
Take Action to Keep Parking Lots Clear

Snow Removal Basics
All application rates are based on thoroughly plowed surfaces.

- Shovel, plow, sweep or blow snow (mechanical removal) first.
- Place deicers in high traffic areas as you plow. Leave other areas until plowing is complete.
- Limit use of salt and sand during the storm; use only to reduce bonding.
- Do not use salt to burn off snow.
- Use application rate chart.
- Understand the melting properties of your deicers. Do not use them unless you understand how they work.
- Plan and look for ways to anti-ice or use wetted materials.
- Check conditions and formulate the best strategy for those conditions.
- Don’t apply dry salt (sodium chloride) below 15°F pavement temperature. It will not melt fast enough to help and it will blow off the surface into the ditch.
- Below 15°F, use a salt wetted with sodium, magnesium or calcium chloride, other low temperature deicers. For extreme cold, skip melting and use sand.
- Turn off auger when stopped, even briefly.
- Clean up spills.
- Track material use and effectiveness with an in-cab deicing data form. (See Table 13)
- Use only what is needed based on proper application rates for the conditions. Put extra back in salt pile.
- Plow first before applying deicers to avoid dilution of the salt.
- Never plow or blow snow into bodies of water, wetlands, traffic or into streets.
- Remove snow from surfaces as quickly as possible to reduce compaction. Plow during off-peak hours or prior to the facility opening to increase efficiency and reduce conflicts with vehicles and pedestrians.
- Minimize back-up maneuvers to reduce chance of accidents.

*Because it uses less materials, mechanical snow and ice removal is the best strategy for protecting our water.*

Loading/hauling
- Don’t overfill the vehicle: material will spill out as you drive around corners.
- Fill in side gaps in tailgates or equipment with spill shields where materials can escape and spill out.
- Large snow piles may need to be loaded out and removed to another site. Schedule this work when the mall or facility is closed to minimize conflicts with vehicles and pedestrians.
Deicing/Anti-Icing Information

Anti-icing

Anti-icing is the most cost-effective and environmentally safe practice in winter maintenance. You should be heading in this direction.

Anti-icing—a proactive approach—should be first in a series of strategies for each winter storm. By applying a small and strategic amount of liquid or pre-wet deicer before a storm, you can prevent snow and ice from bonding to the pavement.

Anti-icing is like preparing a frying pan. If you add a small amount of a liquid before cooking, the food will not bond to the pan. This reduces the amount of soap needed; scrubbing and time spent trying to clean the pan.

Anti-icing requires about ¼ the material and 1/10 the overall cost of deicing. It can increase safety at the lowest cost, and is effective and cost-efficient when correctly used and approached with realistic expectations.

Anti-icing is quick. You can treat your parking lot in a matter of minutes. It is an excellent strategy for saving time. Charging by the hour is not a desired practice when you move into anti-icing.

Getting started in anti-icing

Here is the basic equipment you will need:

- Pavement temperature sensor
- Storage tank
- Spray truck system
- Transfer pump
- Hoses and fittings

Not including the deicer, the start-up cost is probably $7,000, an investment in more effective snow and ice control.

Guidelines for anti-icing

- It is better to use less than more. Over-application can cause slippery conditions.
- Anti-icing is often effective for heavy frosts.
- Liquids are dispersed by the traffic. If you spray the traffic lanes, liquid will migrate with the tires to the parking areas.
- Some users advise against spraying the service road in front of buildings and instead spray traffic lanes and back service roads to allow the traffic to spread the liquids near the building where foot traffic is higher. This can reduce tracking into the building and over-application in a high-traffic area.
• For service roads on hills, some users recommend applying to only the top half of the hill, relying on traffic to carry it down the hill, to avoid a slippery situation at the bottom of the hill.
• Anti-icing works best when combined with accurate surface weather information.
• Early application is particularly important for frost or light freezing drizzle.
• Liquids are the most efficient and may be applied days in advance of an event.
• Pretreated or prewet materials are not as efficient as liquids for anti-icing; you need more material and they don’t track as well. They will work if applied at very low application rates immediately before the snow event.
• See the Anti-Icing Application Rate Chart in this manual.

**Anti-icing requires less material, and less material means less water pollution.**

**What to do**
• Apply only with stream nozzles to maintain dry areas between sprayed areas to reduce slipperiness.
• Try anti-icing in a low traffic area until you feel confident about its properties.
• Read some of anti-icing guidelines in the reference section of this manual.

**What not to do**
• Don’t re-apply if there is still residue. The residue can remain many days after application if precipitation or traffic wear-off does not dilute the initial application.
• Don’t apply MgCl₂ or CaCl₂ to a warm surface (above 35º F pavement temp.). It can become slippery.
• Do not apply liquids before predicted rain or significant freezing rain. They will wash away.
• Don’t apply too much or the surface may become slippery.
• Less is better. Always follow application recommendations.

**Using less salt doesn’t have to reduce safety, but it does protect our lakes.**

**Equipment**
• Anti-icing unit, i.e., transport vehicle with tank.
• Stream nozzles, minimum 8 holes, 8-inch spacing, bar height 12 to 14 inches from surface, 30 to 35 psi at the bar. These can be purchased or constructed.
• Solid stream. Fan spray is more apt to make slippery conditions.
• A hand held pump sprayer or backpack sprayer can be used for sidewalks. Remember to leave a pattern of wet and dry to reduce the chance of creating slippery conditions.
• There are many ways to retrofit your pick-up truck or ATV with a tank and boom and/or hose reel with sprayer.
• A shutoff switch in the cab is recommended.

Prewetting and Pretreating salt and sand
Prewetting and pretreating both mean getting dry material wet. Salt only melts snow and ice when it is in solution (dissolved). Dry salt does nothing until it is dissolved. Therefore, liquids applied to dry salt jump-start the melting process and penetrate ice and snow pack faster.

![Dry Salt vs. Wet Salt](image)

Figure 10  Dry Salt vs. Wet Salt

• Prewetting (truck treatment) is the process of adding liquid to solids as they come off the truck onto the parking lot.
• Pretreating (stockpile treatment) is the process of adding liquid to solids in the stockpile.
• If you add sodium chloride (NaCl) liquid (brine) to dry salt, it will work faster. A 23.3% solution works best.
• If you use magnesium chloride (MgCl₂) or calcium chloride (CaCl₂) liquid to dry salt, it will work faster and at lower temperatures.
• Prewetting or pretreating a sand stockpile is an alternative to adding dry salt to keep it flowing.
• Wet material sticks to the surface. Less is wasted by bounce and scatter.

Guidelines for pretreating stockpiles
Pretreating is mixing a liquid deicer into the stockpile of salt or sand. Salt brine, calcium or magnesium chloride or acetates may be used as pretreating agents.
Treated Stockpile Application

- You can apply pretreated salt with a pickup truck, a dump truck, a drop or rotary spreader or almost any type of equipment used for dry salt.
- No equipment changes are required.
- Remember to turn down the application rate; you will need 1/3 less material than dry salt.

Cover salt and salt/sand piles and place them on an impervious pad to limit runoff and infiltration of chlorides.

Treated salt stockpile

- Spray the salt stockpile with a liquid deicing chemical. Salt may be purchased pretreated or mixed on site by you or the vendor.
- When treating the stockpile, apply at 6 to 8 gallons/ton. For MgCl₂, rates greater than 6 gallons/ton tend to leach out.
- Because leach risk at a stockpile is increased, proper storage is even more important.
- Be careful not add too much liquid. Follow guidelines.

Covering your stockpile protects the salt from wind, rain and snow and reduces waste.

Treated sand stockpile

- Spray the sand stockpile with a liquid deicing chemical.
- Apply to stockpile at 4 to 6 gallons of salt brine/ton sand.
- Because leach risk at a stockpile is increased, proper storage is even more important.

Generally you can use 1/3 less material if you prewet or pretreat and it works faster than dry salt!

Guidelines for prewetting

Prewetting is adding a liquid to the salt as it comes off of the truck. This can happen either at the spinner or through a soaker pipe in the auger box. While prewetting requires some equipment changes, it provides flexibility to switch the chemical makeup depending on conditions. Salt brine, calcium or magnesium chloride, or acetates may be used as prewetting agents.

Tips

- Remember to turn down the application rate; you will need 1/3 less than dry salt.
- Needs tanks and hoses on your truck.
- Best if you can turn on/off the liquid from inside the cab.
- Best if you can regulate the flow of liquids to be synchronized with the flow of solids so you are getting the proper mix.
• The optimal application rate is 8 to 14 gallons/ton for salt brine, 6-8 gallons/ton for MgCl₂.
• Prewetting with a chemical other than salt brine can reduce the application rate even further.
• Below 15°F, salt brine is less effective than other liquids and has the potential of freezing hoses and valves. Verify it is mixed at 23.3% to reduce freezing risk.
• Prewetting is most practical with a dump truck. Use of a pickup truck may be limited due to material weight.
• Think twice before mixing chemicals to form “hotter” brine. This is where problems often occur.

*Use cautiously. Many deicers contain trace metals including cyanide, arsenic, lead, and mercury.*

*Two common overuses of salt are applying to already wet surfaces and not giving the material enough time to work, but adding more on top of existing salt.*

**Deicing/Traction**

Deicing is a reactive operation where a deicer is applied to the top of an accumulation of snow, ice, or frost that has already bonded to the pavement surface and can no longer be physically removed. Deicing costs more than anti-icing in materials, time, equipment, and environmental damage.

**Deicing**

Removing ice that has already bonded to the pavement is difficult. Removing it mechanically can damage equipment and surfaces. Generally, enough ice must be melted chemically to break the bond between the ice and the pavement, which requires larger quantities of chemical, thus making de-icing much less efficient than anti-icing.

See Table 15 for application rates to help you with deicing. Using them will help you avoid these common problems:

- Over-salting. Most over-salting can be prevented by using calibrated spreaders and good judgment in selecting application rates based on pavement temperatures.
- Trying to melt everything. Don’t try to melt all the snow or ice on the surface with salt. This is an overuse of materials. Apply just enough to loosen the bond between the surface and the ice so it can be plowed off.

**Using abrasives**

Use winter sand and other abrasives when temperatures are too cold for deicing chemicals to be effective. But be aware that sand does not melt anything. It provides temporary traction, and only when it is on top. As a result, avoid sand use as much as possible. When sand is in contact with the pavement, sweep it up. It is no longer useful to you and can only harm the environment. Sand on dry pavement can cause skidding.
Advantages of sand (abrasives)

- Short-term traction: Abrasives can be helpful in areas of slow moving traffic, such as intersections.
- Useful in very cold temperatures when chemicals will not work.

Disadvantages of sand

- Sand is not cheap when you consider handling, clean-up, and disposal costs.
- Sand will be tracked into your lots or buildings. Sweep this up as often as possible and dispose of it properly.
- Used sand is contaminated with various pollutants such as oil, grease, metal and rubber and should not be used for clean fill, should not be reused unless screened, should not be used for sandboxes or beaches, and should not be dumped in wetlands, fields or any natural area.
- Used, unscreened sand should be disposed of in a landfill.
- Do not let children play in sweeping piles.
- Once sand is driven over many times, the particles are much finer and can cause air quality concerns.

$\textbf{If you use a 50/50 salt/sand mix, you’re generally either half right or half wrong. Using a salt/sand mix leads to over application of both materials.}$

\textit{Winter abrasives are an air pollution concern. They get crushed by tires and the tiny dust can become airborne. Use only in slow-moving traffic areas such as intersections and curves.}

\textit{Sand clogs storm sewers, ditches, and streams, and is expensive to clean up.}$
Evaluate the effectiveness of your actions

After the Storm

When snow and ice control operations have ended after the storm, evaluate what was done, what worked, and what could be changed to improve operations.

- Have an after-the-storm discussion with the maintenance crew.
- Have an after-the-storm discussion with the property manager.
- Consider the environmental impacts caused by your deicer/abrasive use.
- Based on all aspects of the storm fighting experience, look for ways to improve your practices.
- Accurately record your material use at each site.
- Clean and check all equipment.
- At the end of the season, clean and maintain the truck, tanks, brine-making systems, and pumps according to manufacturer specifications.
- Do not use deicers at the end of the season just to use them up. Save them for next year. Place all piles on an impervious pad and cover them. This includes salt and salt/sand mixes.

Save extra salt at the end of the season. Do not apply just to get rid of it.

Sweep up sand frequently, after each event if possible. Sand that washes into a stream or lake increases water turbidity, clogs fish gills, inhibits plant growth, and may kill some small aquatic organisms due to smothering.

You can’t manage what you don’t measure.
Documenting and charting

Good documentation leads to reduced use of materials, more effective snow and ice control, reduced environmental impacts, and cost savings. Unless you document and chart, you can’t measure what you are doing.

- Track your material use. Learn to record what and how much you apply at each site, each time you visit. Be prepared to analyze and make adjustments to your process based on what you learn.
- Use forms like those shown in the appendix of this manual to record and track your work and observations.

![Fine tuning your program diagram]

**Figure 11  Fine Tuning Your Program**

**Sweeping**

Sweep the sand from the parking lot areas midwinter as well as in the spring. Trailer-type power sweepers are available that can be hauled behind a pickup truck. Smaller power brooms or sweepers may be used on sidewalks. Workers should wear a dust mask to avoid inhalation of the fine dust particles.

Used sand is contaminated with various pollutants such as oil, grease, metal and rubber. Sweepings may be reused. Before reusing sweepings, trash, leaves and other debris should be removed from them. This is often accomplished by screening, but other methods may also be used. Mix street sweepings with new salt/sand mixture for winter application to roads, parking lots or sidewalks. When screening sweepings for reuse, use a small mesh for the final screening to ensure that all of the larger debris has been removed. (A 3/4-inch mesh will screen out much of the debris.) Dispose of trash and debris removed from the sweepings by recycling it (e.g., aluminum cans), composting it (e.g., leaves) or sending it to a sanitary landfill.

For more information refer to the MPCA fact sheet “Managing Street Sweepings” (Fact Sheet #4.54 September 1997) available at [www.pca.state.mn.us](http://www.pca.state.mn.us).
### Documentation Form For Anti-Icing

#### Anti-icing Data Form

<table>
<thead>
<tr>
<th>Location:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Temp.</td>
<td>Pavement Temp.</td>
</tr>
</tbody>
</table>

Reason for applying:

Location:

Chemical:

Application Time:

Application Amount:

Observation (1st day):

Observation (After event):

Observation (Before next application):

Name:

#### Table 12 Documentation Form for Anti-Icing

- RH - relative humidity
- Dew - dew point
- Sky - sunny to cloudy
### Documentation Form for Deicing

<table>
<thead>
<tr>
<th>Deicing Data Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator:</td>
</tr>
<tr>
<td>Location:</td>
</tr>
<tr>
<td>Event Began:</td>
</tr>
<tr>
<td>Event ended:</td>
</tr>
<tr>
<td>Event type:</td>
</tr>
<tr>
<td>Total precipitation:</td>
</tr>
<tr>
<td>Pavement temp.:</td>
</tr>
<tr>
<td>Air temp.:</td>
</tr>
<tr>
<td>Dew point:</td>
</tr>
<tr>
<td>Temperature Trend:</td>
</tr>
<tr>
<td>Material used:</td>
</tr>
<tr>
<td>Amount used:</td>
</tr>
<tr>
<td>Application rate:</td>
</tr>
<tr>
<td>Observations:</td>
</tr>
</tbody>
</table>

#### Table 13  Documentation Form for Deicing
Develop your own application rates using the guidelines included in this handbook as a starting point. Modify your practices incrementally over time to fit your needs. Make it a goal to reduce application rates and keep surfaces safe.

### Anti-Icing Application Rate Guidelines

These are a starting point only. Adjust based on your experience.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gallons/1000 sq. ft.</th>
<th>Other Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Regularly scheduled applications</td>
<td>MgCl₂: 0.1 - 0.2</td>
<td>Salt Brine: 0.25 – 0.3</td>
</tr>
<tr>
<td></td>
<td>Other Products:</td>
<td>Follow manufacturers’ recommendations</td>
</tr>
<tr>
<td>2. Prior to frost or black ice event</td>
<td>MgCl₂: 0.1 - 0.2</td>
<td>Salt Brine: 0.25 – 0.3</td>
</tr>
<tr>
<td></td>
<td>Other Products:</td>
<td>Follow manufacturers’ recommendations</td>
</tr>
<tr>
<td>3. Prior to light or moderate snow</td>
<td>MgCl₂: 0.1 - 0.2</td>
<td>Salt Brine: 0.2 – 0.4</td>
</tr>
</tbody>
</table>

CAUTION: Too high an application rate may result in slippery conditions or tracking.

**Table 14 Anti-Icing Application Rates**

*How to use the anti-icing rate table above:*
1. Determine your parking lot or sidewalk area in square feet.
2. Calculate size factor: Divide that area by 1000 (chart is based on a 1000 square foot area).
3. Find the application rate: Choose your condition in the first column of the table and follow sideways, stopping at the anti-icing chemical you are using.
4. Determine how many gallons you need: Multiply the application rate by your size factor.

Tip: To convert from gallons to ounces: multiply result from #4 by 128.

*One 50 lb. bag of salt can contaminate over 10,000 gallons of water.*
### Deicing Application Rate Guidelines for Parking Lots and Sidewalks

These rates are adapted from road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates using the guidelines as a starting point and modify them incrementally over time to fit your needs. The area should first be cleared of snow prior to applying chemical.

<table>
<thead>
<tr>
<th>Pavement Temp. (ºF) and Trend (↑↓)</th>
<th>Weather Condition</th>
<th>Maintenance Actions</th>
<th>Application Rate in lbs/per 1000 square foot area</th>
<th>Winter Sand (abrasives)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Salt Prewetted/ Pretreated With Salt Brine</td>
<td>Salt Prewetted/ Pretreated With Other Blends</td>
</tr>
<tr>
<td>&gt;30º↑</td>
<td>Snow</td>
<td>Plow, treat intersections only</td>
<td>0.75</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>1.25</td>
<td>1.0</td>
</tr>
<tr>
<td>30º↓</td>
<td>Snow</td>
<td>Plow &amp; apply chemical</td>
<td>1.25</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>1.5</td>
<td>1.25</td>
</tr>
<tr>
<td>25 - 30º↑</td>
<td>Snow</td>
<td>Plow &amp; apply chemical</td>
<td>1.25</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>1.5</td>
<td>1.25</td>
</tr>
<tr>
<td>25 - 30º↓</td>
<td>Snow</td>
<td>Plow &amp; apply chemical</td>
<td>1.25</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>1.75</td>
<td>1.5</td>
</tr>
<tr>
<td>20 - 25º↑</td>
<td>Snow or Frz. Rain</td>
<td>Plow &amp; apply chemical</td>
<td>1.75</td>
<td>1.5</td>
</tr>
<tr>
<td>20 - 25º↓</td>
<td>Snow</td>
<td>Plow &amp; apply chemical</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>15º to 20º↑</td>
<td>Snow</td>
<td>Plow &amp; apply chemical</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Frz. Rain</td>
<td>Apply chemical</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>15º to 20º↓</td>
<td>Snow or Frz. Rain</td>
<td>Plow &amp; apply chemical</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>0 to 15º↑</td>
<td>Snow</td>
<td>Plow, treat with blends, sand hazardous areas</td>
<td>not recommended</td>
<td>3.0</td>
</tr>
<tr>
<td>&lt; 0º</td>
<td>Snow</td>
<td>Plow, treat with blends, sand hazardous areas</td>
<td>not recommended</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Table 15  Application Rates for Deicing
Instructions for using application rate table if you calibrate your spreaders

1. Using Deicing Application Rate Guidelines for Parking Lots and Sidewalks. Select the row with the appropriate pavement temperature, temperature trend, and weather conditions.
2. Select the column that has the type of material you are using.
3. Find the box where the row and columns intersect to find the application rate.
4. Determine your parking lot area and divide it by 1000 to get the size factor. (The chart is based on a 1000 square foot area.)
5. Multiply the rate found on the Deicing Application Rate Guidelines for Parking Lots and Sidewalks by your size factor to get the recommended application rate for your parking lot.
6. Compare those values to the calibration chart for your truck.
7. Dial the correct setting for the rate calculated.

Example:
2. Deicer: salt pretreated with salt brine.
3. Find the 20 – 25º box. Follow it to the right under the column labeled “Salt Prewetted/pretreated with salt brine.” Read the rate in the box. The box where the column and row intersect shows a rate of 2.0 /1000 square feet.
4. Calculate your parking lot size factor. Divide parking lot size (54,000 square feet) by 1,000 square feet. 54,000/1,000 = 54 The size factor is 54.
5. Use the size factor multiplied by the rate from step 3 to find the amount of material to use for the 54,000 square foot lot. Multiply 2.0 by 54 = 108.
The application amount for the entire lot is 108 lbs. prewetted/pretreated salt brine.

Instructions for using application rate table if you DO NOT calibrate your spreaders

1. Select the row with the appropriate pavement temperature, temperature trend, and weather conditions.
2. Select the column that has the type of material you are using.
3. Determine the size of your parking lot.
4. Look in the chart titled “Number of 50 lb. Bags of deicer needed per area of parking lot” to see how much material you need.
5. Spread that amount of material evenly over your parking lot.
Number of 50 lb. bags of deicer needed per area of parking lot

Using the parking lot size, use this chart to determine how many bags of material you need. Use these numbers as guidelines and adjust according to your experience.

<table>
<thead>
<tr>
<th>Application Rate* (lbs./1000 sq.ft.)</th>
<th>10,000 sq.ft. (.2 acre)</th>
<th>20,000 sq. ft. (.5 acre)</th>
<th>50,000 sq. ft. (1.1 acres)</th>
<th>100,000 sq. ft. (2.3 acres)</th>
<th>500,000 sq. ft. (11.4 acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
<td>1.0</td>
<td>5</td>
</tr>
<tr>
<td>0.75</td>
<td>0.15</td>
<td>0.3</td>
<td>0.75</td>
<td>1.5</td>
<td>7.5</td>
</tr>
<tr>
<td>1.0</td>
<td>0.2</td>
<td>0.4</td>
<td>1.0</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td>1.25</td>
<td>0.25</td>
<td>0.5</td>
<td>1.25</td>
<td>2.5</td>
<td>12.5</td>
</tr>
<tr>
<td>1.5</td>
<td>0.3</td>
<td>0.6</td>
<td>1.5</td>
<td>3.0</td>
<td>15</td>
</tr>
<tr>
<td>1.75</td>
<td>0.35</td>
<td>0.7</td>
<td>1.75</td>
<td>3.5</td>
<td>17.5</td>
</tr>
<tr>
<td>2.0</td>
<td>0.4</td>
<td>0.8</td>
<td>2.0</td>
<td>4.0</td>
<td>20</td>
</tr>
<tr>
<td>2.25</td>
<td>0.45</td>
<td>0.9</td>
<td>2.25</td>
<td>4.5</td>
<td>22.5</td>
</tr>
<tr>
<td>2.5</td>
<td>0.5</td>
<td>1.0</td>
<td>2.5</td>
<td>5.0</td>
<td>25</td>
</tr>
<tr>
<td>2.75</td>
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<td>1.1</td>
<td>2.75</td>
<td>5.5</td>
<td>27.5</td>
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<tr>
<td>3.0</td>
<td>0.6</td>
<td>1.2</td>
<td>3.0</td>
<td>6.0</td>
<td>30</td>
</tr>
<tr>
<td>3.25</td>
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<td>1.3</td>
<td>3.25</td>
<td>6.5</td>
<td>32.5</td>
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<td>3.5</td>
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<td>3.5</td>
<td>7.0</td>
<td>35</td>
</tr>
<tr>
<td>4.0</td>
<td>0.8</td>
<td>1.6</td>
<td>4.0</td>
<td>8.0</td>
<td>40</td>
</tr>
<tr>
<td>4.5</td>
<td>0.9</td>
<td>1.8</td>
<td>4.5</td>
<td>9.0</td>
<td>45</td>
</tr>
</tbody>
</table>

*Find the appropriate application rate from Table 15.

Table 16  How Many 50 lb. Bags per Parking Lot
If you have a 50 lb. bag of a deicer, what pavement area will it treat?

**Treated area per 50 lb. bag**

<table>
<thead>
<tr>
<th>Application Rate* (lbs./1000 sq. ft.)</th>
<th>Square feet treated per 50 lb bag</th>
<th>Equivalent Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>100000</td>
<td>2.3</td>
</tr>
<tr>
<td>0.75</td>
<td>66600</td>
<td>1.5</td>
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<tr>
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<td>50000</td>
<td>1.1</td>
</tr>
<tr>
<td>1.25</td>
<td>40000</td>
<td>0.9</td>
</tr>
<tr>
<td>1.5</td>
<td>33300</td>
<td>0.8</td>
</tr>
<tr>
<td>1.75</td>
<td>28500</td>
<td>0.7</td>
</tr>
<tr>
<td>2.0</td>
<td>25000</td>
<td>0.6</td>
</tr>
<tr>
<td>2.25</td>
<td>22200</td>
<td>0.5</td>
</tr>
<tr>
<td>2.5</td>
<td>20000</td>
<td>0.5</td>
</tr>
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<td>2.75</td>
<td>18200</td>
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<td>16600</td>
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</tr>
<tr>
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<td>15400</td>
<td>0.4</td>
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<tr>
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<td>14300</td>
<td>0.3</td>
</tr>
<tr>
<td>4.0</td>
<td>12500</td>
<td>0.3</td>
</tr>
<tr>
<td>4.5</td>
<td>11100</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*Find the appropriate application rate from “Deicing Application Rate Guidelines for Parking Lots and Sidewalks.” Use the numbers in the chart as guidelines and adjust according to your experience.

Table 17  Treated area per 50 lb. Bag

How large an area will a 50 lb. bag cover?

**From chart:** if your application rate is 1.5 lbs/1000 sq. ft. (1st column), one 50 lb. bag should be spread evenly over 33,300 square feet of pavement (2nd column).

If you choose an application rate not listed on the chart, use the calculation below.

**To calculate:**
- Divide 50 lbs. by the application rate from the guidelines.
  - Multiply by 1000 (1000 is the square footage the application rate covers)

**Example:** Using an application rate of 1.5 lbs/1000 square feet:

50 lb. bag/1.5 (application rate) = 50/1.5 = 33.3

Multiply by 1000. 33.3 x 1000 = 33,300

33,300 is the number of square feet your 50 lb. bag will treat at an application rate of 1.5 lbs/1000 square feet.

* Once chlorides enter the ground or surface water, they never go away.
Resources and Bibliography

Bibliography


Cornell Local Surfaces Program. Calibration Chart. (really an application rate chart but named calibration chart) www.clrp.cornell.edu/techassistance/calibration.chart.pdf

Cryotech Deicing Technology. www.cryotech.com

Dow Chemical www.dow.com


Minnesota Department of Natural Resources: Healthy Rivers CD-ROM http://www.dnr.state.mn.us/publications/cdroms/index.html

Minnesota Department of Transportation
_field Chemical Testing: Anti-icing and De-icing Liquids._
[www.dot.state.mn.us/maint/research/chemical/The Field Book.pdf](www.dot.state.mn.us/maint/research/chemical/The Field Book.pdf)


University of New Hampshire Technology Transfer Center. *Manual of Practice*. 
[www.t2.unh.edu/pubs/manofpractice_1.pdf](www.t2.unh.edu/pubs/manofpractice_1.pdf)

Additional Resources

Training and technical assistance

- Winter Maintenance Voluntary Certification Program. Minnesota Pollution Control Agency, Andrew Ronchak 651-296-3107
  andrew.ronchak@pca.state.mn.us or www.pca.state.mn.us/programs/roadsalt.html
- The Circuit Training and Assistance Program (CTAP), a joint program of Mn/DOT and the Minnesota Local Technical Assistance Program (LTAP), brings training to cities, counties and townships 651-282-2160 or www.mnltap.umn.edu/ctap
- Mn/DOT Winter Maintenance Coordinator: 651-284-3606
- Parking lot training & Power of winter maintenance professionals to protect our water presentations. Fortin Consulting Inc. 763-478-3606. fci@fortinconsulting.com www.fortinconsulting.com
- Storage tank regulation questions – MPCA Customer Assistance Center 651-297-2274 or 800-646-6247.

Other Web resources

- RWIS – Road Weather and Information System. www.rwis.dot.state.mn.us is an Internet weather service provided by Mn/DOT. It gets its information from sensors embedded in the state highways.
- MPCA fact sheet “Managing Street Sweepings” (Fact Sheet #4.54 September 1997) available at www.pca.state.mn.us
- Plant selector tool. Allows you to select plants for many conditions including high salt areas. Minnesota Department of Transportation. http://plantselector.dot.state.mn.us
- Snow and Ice Management Association (SIMA) www.sima.org
- Pacific Northwest Snowfighters. www.wsdot.wa.gov/partners/pns/default.htm
- Salt Institute. Calibration Instructions (with downloadable Excel worksheet) www.saltinstitute.org/snowfighting/6-calib.html
- Salt Institute. Snow and Ice List Serve: www.sicop.net
Material Conversions

<table>
<thead>
<tr>
<th>Yards</th>
<th>Tons</th>
<th>Yards</th>
<th>Tons</th>
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<tr>
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<td>28.0</td>
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<td>21.6</td>
</tr>
</tbody>
</table>

Table 18  Material Conversions

The following formulas and the above quick reference table will help you convert between tons and cubic yards. Weights will vary depending upon moisture content.

1. To convert tons of clean sand to cubic yards: # tons divided by 1.4 = cubic yards
2. To convert cubic yards of clean sand to tons: # cubic yards multiplied by 1.4 = tons
3. To convert tons of winter sand to cubic yards: # tons divided by 1.37 = cubic yards
4. To convert cubic yards of winter sand to tons: # cubic yards multiplied by 1.37 = tons
5. To convert tons of straight salt to cubic yards: # tons divided by 1.08 = cubic yards
6. To convert cubic yards of straight salt to tons: # cubic yards multiplied by 1.08 = tons
Common Conversions

- 1 lane mile (12’ x5280 ft.) = 6336 square feet
- Average size parking spot: 9 x 20 feet or 10 x 20 feet = 180 – 200 square feet
- Driving isles (2-way) = About 25 feet wide
- 1 acre = 43,560 square feet
- 1 ton = 2000 lbs.
- 1 cup of salt (NaCl) = 0.6 lbs.
- Salt (NaCl) weighs 72 – 84 lbs/ft$^3$ depending upon moisture and granule size
- 1 gallon = 128 ounces
- 1 cubic yard of salt = 1.1 ton
- 1 cubic yard of sand = 1.4 tons
- 1 cubic yard = 27 cubic feet
- 1 square yard = 9 square feet

Definitions

°C – degrees Celsius
°F – degrees Fahrenheit
lbs. - pounds
ppm – parts per million
psi – pounds per square inch
mg/l – milligrams per liter
Mn/DOT or MnDOT – Minnesota Department of Transportation
MPCA – Minnesota Pollution Control Agency
mph – miles per hour
sq. ft. – square feet