2018

Pass the Salt: Efficient Snow & Ice Management

axiomatic

Anti-Icing

NH Best Management Practices

GET OUT EARLY

Typically anti-icing is most effective if applied 1-2 hours before the precipitation begins however it can be applied up to 24 hours in advance.

TRY IT FIRST

Trying anti-icing for the first time? Make a 23.3% brine solution and before a storm spray pavement on your own property using a masonry/ plant sprayer. Use this experiment to determine how best to use it with your clients.

LEAVE SOME PAVEMENT BARE

It's always best to use stream nozzles instead of fan tip to avoid creating a slippery condition. If the anti-icing liquid freezes the bare pavement will still provide a traction surface.

USE A FILTER

Having a filter in your liquid dispensing system will reduce clogs in your nozzle. Automotive in line fuel filters work quiet well. If your liquid dispenser is not functioning properly be sure to check the filter first.

A Proactive Treatment

Anti-Icing before a storm is very similar to using a non-stick spray on a pan before cooking. Just like a non-stick spray prevents food from bonding to the pan, anti-icing prevents snow and ice from bonding to the pavement so that it can be plowed away. Anti-icing can save you money as it costs 50% less than reactive deicing.

Make Your Own Salt Brine

When making brine it is important to add enough salt to produce a 23.3% solution which freezes around 0°F. Roughly 2.5lb per gallon of water will produce a 23.3% solution. You can verify using a salometer (~$20) a 23.3% solution will have a specific gravity of 1.176, or 85% salinity. Consult the Brine Making BMP sheet for more info.

How Much Should I Use and When?

You can apply brine up to 24 hours in advance of the storm. Typical application rates range from 0.5 to 0.75 gallon per 1000 sq.ft. (10' x 100' area). Other chemicals such as magnesium are also available—consult your supplier for application rates. Anti-icing is not advised prior to freezing rain events.

Getting Started

Try making your own salt brine by putting 13 lb of salt in 5 gallons of water to get a 23.3% salt brine solution. Mix the brine until all of the salt is dissolved. Using a masonry sprayer apply the liquid several hours before a storm. Start by applying about 0.25—0.5 gallons to a 10' x 50' area. Adjust the application rates based on your experience. Being careful not to over apply and cause a slippery condition.

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire DOT

Technology Transfer Center
New Hampshire LTAP at UNH

Pre-wetting

NH Best Management Practices

PRE-WETTING?

Pre-wetting is the process of coating a solid de-icer with a liquid before it is spread on a roadway.

WHY PRE-WET?

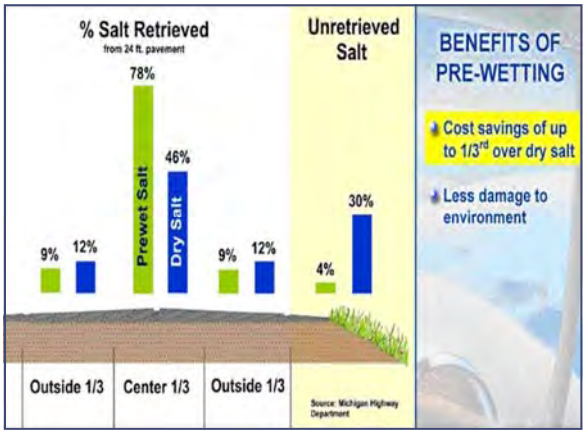
De-icing chemicals must form a brine before they can begin melting ice. Pre-wetting your chemicals accelerates the brine making process, which improves the melting action of the material. Pre-wetting also reduces bounce and scatter of material during spreading, and reduces the total amount of de-icer needed to obtain the desired results.

REDUCED RATES

If you are pre-wetting, don't forget to reduce your application rates accordingly. Reductions in the range of 15-20% are typical.

HOW MUCH LIQUID?

A good rule of thumb is to use 8-10 gallons of pre-wetting liquid for every ton of de-icer. For other chemicals, such as magnesium chloride, consult your supplier for application rates

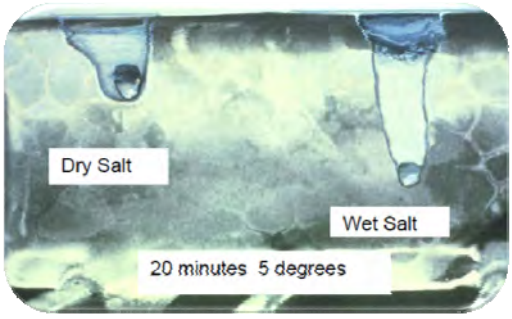


Pre-wetting Liquids

You have a few options for pre-wetting liquids. The most commonly used is a 23% sodium chloride brine solution. Calcium chloride at 32% solution is also used, as well as Magic Minus Zero™ and other patented products.

Getting Started

Wet the pile! There are two ways to pre-wet your de-icing chemicals. The easiest way to get started with pre-wetting is to spread your salt pile, spray it with pre-wetting liquid, mix it around, and re-pile it. More advanced truck mounted pre-wet systems can be installed on your trucks if you decide to make the investment.



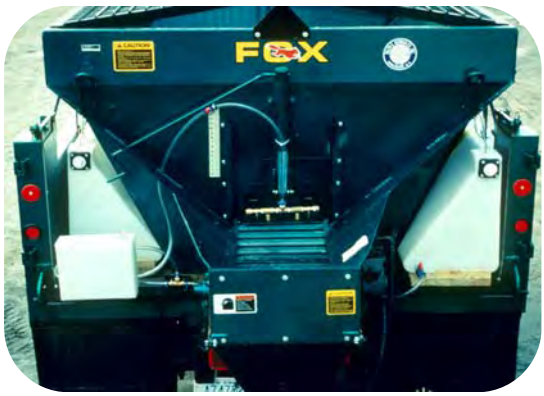
Source: Wisconsin DOT Transportation Bulletin

Spraying the Pile

This is the easiest and most cost effective way to get started in pre-wetting. The first step is to spread your salt pile on a flat, impermeable surface. Next, spray the salt while it is spread out, and mix it around to ensure adequate and consistent liquid coverage. After the salt is sufficiently covered, re-stack the salt in your storage shed for later use.

Truck Mounted Systems

These systems are mounted in the truck bed and coat the de-icer with liquid as it comes off the conveyor/auger onto the spinner. These systems have the benefit of applying liquid only to the material you use as you use it. However, these systems must be installed on every truck that will be used to spread pre-wetted material.



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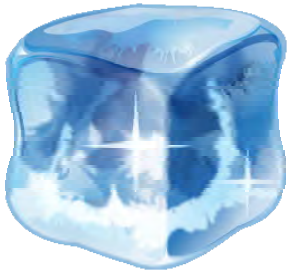
How Salt Works

NH Best Management Practices

How Do We Melt Ice?

Ice can be melted by increasing the temperature, or lowering the freezing point of the water. It's not cost effective to use heat to melt ice on our roads so we use chemicals to reduce the freezing point—anything that will dissolve in water will work, including: salt, sugar, even alcohol!

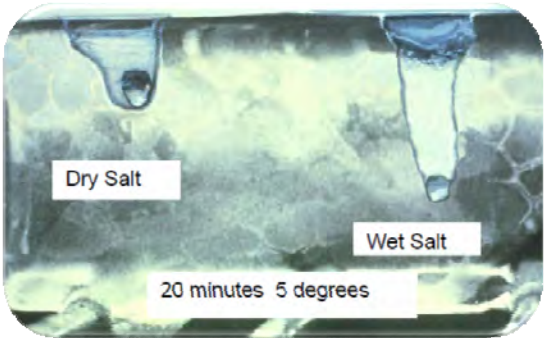


Why Use Salt?

Salt (Sodium Chloride) is the cheapest and most readily available chemical that efficiently melts ice and can be easily applied to our roadways and parking lots. However salt does corrode our cars and bridges, contaminates drinking water and pollutes our streams. Alternatives include potassium acetate, and calcium magnesium acetate (CMA), — all of which are considerably more expensive than calcium chloride, and have their own environmental concerns.

Brine Makes It Happen

The first step in melting ice is the formation of a brine. Salt crystals pull water molecules out of ice formation which creates a brine with a lower freeze point. Once the brine is formed melting is greatly accelerated. Save time and money by pre-wetting your salt with a brine before it hits the pavement to jump start melting! See the Pre-Wetting fact sheet for more information.



Source: Wisconsin DOT Transportation Bulletin #22

BE PROACTIVE - ANTI-ICE

Anti-icing is the proactive method of preventing snow and ice from bonding to pavement. It can be more than 50% more efficient than deicing. See the NH Anti-Icing Factsheet for more information.

PRE-WETTING FOR FASTER ACTING SALT

Adding brine to salt before you apply it to pavement jump starts the melting process which means your pavement will be clear sooner. See the Pre-wetting Fact Sheet for more information.

KNOW YOUR LIMITS

Dry salt becomes ineffective below 15°F if possible wait until the temperature rises before applying salt. At 30°F 1 lb of salt can melt 46.3 lb of ice in 5 minutes. At 15°F 1 lb of salt can melt 6.3 lb of ice in 1 hour.

PLOW FIRST

Always plow before applying any kind of chemical deicer to avoid pushing it away!

Save $$ and the Environment

In New Hampshire there are over 40 watersheds currently contaminated from road salt. As the pavement temperature drops more salt is required. As the pavement temperature rises less salt is required. Save money and the environment by using only what is needed to do the job. See NH application rate charts for recommended rates.

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Material Storage and Housekeeping

NH Best Management Practices

IMPERMEABLE SURFACE STORAGE

Store salt and liquids on an impermeable surface to prevent groundwater contamination.

COVERED STORAGE AREAS

If possible, store your salt in a covered shed to prevent runoff. If there is not a shed available, cover your salt pile well with an impermeable membrane or tarp.

SECONDARY CONTAINMENT

Keep your liquids in an appropriate storage container. Secondary containment should be used incase a leak develops in the primary container.

PROPER DRAINAGE & COLLECTION

Protect your ground water supply! A drainage system should be in place to collect runoff from your salt pile, as well as to collect any liquids that may escape containment. Remember, the collected liquid can be used as a base for salt brine.

Proper Material Storage

Proper storage of materials (especially chemicals) is essential. If impermeable surfaces are NOT used in your storage facilities and brine infiltrates the ground or groundwater, you need to register with the DES under the Groundwater Discharge Permit and Registration Rules, Env-Wq 402. It is a free registration used for tracking potential contaminant sources.

Secondary Containment

Secondary containment for your liquid storage is a HIGHLY recommended technique to help reduce soil and groundwater contamination. If a tank Begins leak, the secondary containment prevents liquid from seeping into sensitive environments.

Liquid Storage

Brine stored using holding tanks must be managed so that there are no releases to drains, groundwater or surface water.


ENVIRONMENTAL
Fact Sheet
Environmental Services

Storage and Management of Deicing Materials

NHDES Fact Sheet DWGB-22-30

This fact sheet outlines the basic required specifications for salt and chemical storage facilities. For additional information, please contact the Drinking Water and Groundwater Bureau at (603)271-2513 or dwgbinfo@des.nh.gov, or visit their website at: http://des.nh.gov/organization/divisions/water/dwgb/index.html. *The Salt Storage Handbook* contains more information and guidelines that should be referenced.

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Pony Motor-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration card *will* be different than the sand calibration card).

Calibrations should be preformed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration. Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.

Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting to start (approximately 1" to 1.5"). After the truck is calibrated for the lowest gate setting, calibrate for each 1/2" increment greater than the lowest setting. Continue until all gate settings you use are calibrated.

Engine Speed: Set the pony motor speed to the maximum setting, or to the setting you would normally use.

Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each gate setting you are calibrating. Round your numbers to the nearest half foot and record them in column "**W**" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each gate opening that is typically used. Average these three values together and record in the orange column in the calibration chart.

Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and gate setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration card in the truck you just calibrated. Also, leave a copy of the calibration card in the office so you have a copy incase the original is damaged.

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Calibration Chart (Pony Motor Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Gate Opening	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1”												
1.5”												
2”												
2.5”												
3”												
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each gate setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable “**C**”. The “**C**” value for each travel speed is shown in red under that given speed. Multiply column **B** by the “**C**” value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

Hydraulic-Run Spreader Calibration

NH Best Management Practices

WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration chart *will* be different than the sand calibration chart).

Calibrations should be preformed annually, or after a spreader is serviced.

CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration. Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.

Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

Step 2: Set Your Controls

Gate Height: Set the gate height to its lowest practical setting (~ 2"). This should be kept constant throughout the calibration process. If you find that not enough material is dispensed with this setting, try 2.5" to 3".

Engine Speed: Warm the truck up and run the engine at the typical rate seen during spreading (approximately 2000 rpm).

Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each conveyor/auger setting you are calibrating. Round your numbers to the nearest half foot and record them in column "**W**" of the calibration chart (see reverse side).

Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each conveyor/auger setting that is typically used. Average these three values together and record in the orange column in the calibration chart.

Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and conveyor/auger setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration chart in the truck you just calibrated. Also, leave a copy of the calibration chart in the office so you have a copy incase the original is damaged.

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Calibration Chart (Hydraulic Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Conveyor or Auger Setting	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1												
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EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each conveyor/auger setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "**C**". The "**C**" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "**C**" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

Brine Making

NH Best Management Practices

GET THE LOWEST FREEZE POINT

When salt brine is 23% salt (measured with a hydrometer: 1.176, or with a salimeter: 85%) it has the lowest freeze point possible (about 0°F).

BRINE STORAGE

23% brine solution may be stored outside, however if temperatures get below 0°F the brine may freeze. A circulator pump will reduce the risk of freezing. If possible store brine indoors to eliminate risk of freezing.

COST OF BRINE

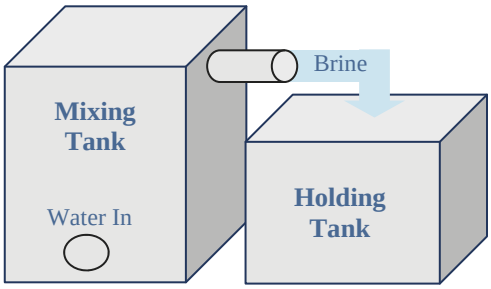
Calcium chloride brine costs about 7¢ / gallon (assuming $58/ton for salt) after you have your equipment setup.

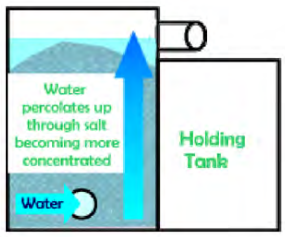
MULTIPLE USES

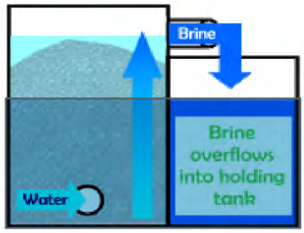
Brine can be used directly for anti-icing, for prewetting salt as it is dispensed from your truck, or to pretreat salt before it is loaded into your truck. Brine can be safely stored for up to a year, however, the concentration should be tested before use.

What Do You Need?

Brine making is a fairly simple process—the only ingredients are salt and water, and the only equipment you'll need is an open top mixing tank, a holding tank, a small pump, and a salimeter.





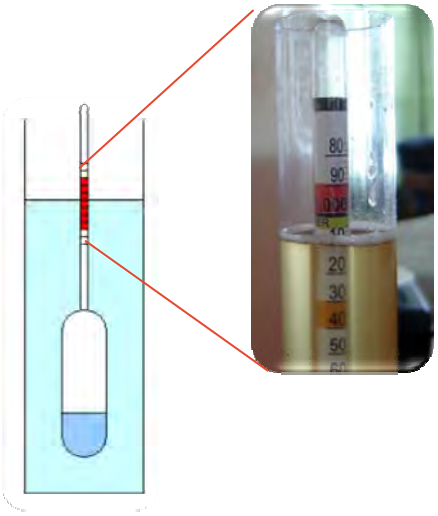


Images courtesy of Iowa DOT

Step 1: Fill Mixing Tank

Add Salt: Add about 2.5 lb of salt per gallon of water you plan to add. Make sure your mixing tank has a large opening to make adding salt easy.

Add Water: Slowly add water from the bottom of your brine mixing tank. This will allow it to percolate up through the salt and overflow into the holding tank.



Step 2: Check Concentration

Float a hydrometer or salimeter directly in your holding tank and read the value at the surface of the water. The number should be either 85% or 1.176 depending on the units of your device.

If the values are too low, pump some brine from your holding tank back into the mixing tank and allow it to overflow. If values are too high simply add some fresh water

Quality Control & Documentation

Make sure that you record the date when you create each batch of brine and document who mixed it and checked the concentration. It is also a good idea to note the final concentration. These records should be kept for at least two years to protect your group in the event of litigation.

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New Hampshire LTAP at UNH

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	4.5	4	4.5	Not recommended
	Frz. Rain	Apply chemical	5.75	5.25	6.5	Not recommended
30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	7	6.5	8.25	10.5
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	7	6.5	8.25	10.5 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	5.75	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	7	7.5	10	10.5
15 - 20 ↑	Snow	Plow and apply chemical	7.5	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	8.75	7.5	10	10.5
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	8.25	7.5	10	10.5 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	10	Not recommended	13 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	23	Not recommended	13 and spot-treat as needed

Table 19. Application Rates for Deicing

The format and methodology are based on (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per lane mile)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	150	125	150	Not recommended
	Frz. Rain	Apply chemical	175	150	200	Not recommended
30 ↓	Snow	Plow and apply chemical	175	150	200	Not recommended
	Frz. Rain	Apply chemical	200	175	225	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	200	175	225	Not recommended
	Frz. Rain	Apply chemical	225	200	225-275	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	250	200	275	Not recommended
	Frz. Rain	Apply chemical	275	250	275-300	450
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	275	275	275-300	450 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	275	250	300-325	Not recommended
	Frz. Rain	Apply chemical	300	275	325-400	450
15 - 20 ↑	Snow	Plow and apply chemical	300	275	325	Not recommended
	Frz. Rain	Apply chemical	300-375	275-350	325-400	450
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	325	300	350	450 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	300-350	Not recommended	600 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	350-500	Not recommended	600 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only				Not recommended
	Frz. Rain	Apply chemical				Not recommended
30 ↓	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				Not recommended
25 - 30 ↑	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				Not recommended
25 - 30 ↓	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				3.25
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical				3.25 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				3.25
15 - 20 ↑	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				3.25
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical				3.25 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended		Not recommended	5.0 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended		Not recommended	5.0 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates & table format are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

Pavement Temp. (°F) and Trend (↑ ↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per lane mile)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only				Not recommended
	Frz. Rain	Apply chemical				Not recommended
30 ↓	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				Not recommended
25 - 30 ↑	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				Not recommended
25 - 30 ↓	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				450
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical				450 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				450
15 - 20 ↑	Snow	Plow and apply chemical				Not recommended
	Frz. Rain	Apply chemical				450
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical				450 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended		Not recommended	600 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended		Not recommended	600 and spot-treat as needed

Table 19. Application Rates for Deicing

These rates are based on road application guidelines (Mn Snow & Ice Control Field Handbook, Manual 2005-1). Develop your own application rates by adjusting your current rates incrementally downward toward these guidelines. Where temperature categories overlap, select the rate most applicable to your situation.

Winter Maintenance Guidelines for Porous Pavements





Maintenance Guidelines

- Road surfaces, porous and non-porous, are commonly not treated and plowed until 2 or more inches of snow accumulation.
- Plow after every storm. If possible plow with a slightly raised blade, while not necessary, this will help prevent pavement scarring.
- Up to ~75% salt reduction for porous asphalt can be achieved. Salt reduction amounts are site specific and are affected by degree of shading.

  USE SALT REDUCTION NUMBERS WITH CAUTION!!!
- Pervious concrete salt reduction will vary and is heavily dependent upon shading. For shaded areas, pervious concrete may not achieve salt reduction.
- Apply anti-icing treatments prior to storms. Anti-icing has the potential to provide the benefit of increased traffic safety at the lowest cost and with less environmental impact.
- Deicing is NOT required for black ice development. Meltwater readily drains through porous surfaces thereby preventing black ice.
- Apply deicing treatments during, and after storms as necessary to control compact snow and ice not removed by plowing.
- Sand application should be limited since its use will increase the need for vacuuming
- Vacuum porous areas a minimum of 2-4 times per year, especially after winter and fall seasons when debris accumulation and deposition is greatest.
- If ponding water is observed during precipitation cleaning is recommended.

Winter Maintenance Challenges

- Mixed precipitation and compact snow or ice is problematic for all paved surfaces, but is particularly problematic for porous surfaces. This is corrected by application of excess deicing chemicals.
- De-icing chemicals work by lowering the freezing point of water. Generally, the longer a de-icing chemical has to react, the greater the amount of melting. Meltwater readily drains through porous surfaces thereby reducing chemical contact time. This is corrected by excess salt application.
- Excess salt application in these instances is offset by the overall reduced salt during routine winter maintenance and salt reduction.

Additional Resources

- The UNH Stormwater Center: http://www.unh.edu/erg/cstev/
- Pennsylvania Asphalt Pavement Association (PAPA) Porous Asphalt Pavements Guide: http://www.pahotmix.org/PDF/porous1.pdf
- National Asphalt Pavement Association (NAPA) Porous Asphalt Pavements for Stormwater Management Revised 11/2008, Information Series 131

Calibration Chart (Hydraulic Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Conveyor or Auger Setting	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1												
2												
3												
4												
5												
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each conveyor/auger setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "**C**". The "**C**" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "**C**" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

Calibration Chart (Pony Motor Type)

Material: _____ Truck/Spreader ID: _____

Date: _____ Performed by: _____

Tarp/Canvas/Bucket Weight: _____

Gate Opening	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate *((Run1 + Run2 + Run3)/3)*	Pounds of Material Discharged per 1000 square ft. *(D = B × C ÷ A)*					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1”												
1.5”												
2”												
2.5”												
3”												
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each gate setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable “**C**”. The “**C**” value for each travel speed is shown in red under that given speed. Multiply column **B** by the “**C**” value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

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Pass the Salt: Efficient Snow & Ice Management Refresher

Presenter:
Patrick Santoso

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Program Overview

- Chloride Impacts Review
- Pre-Season Preparation & Calibration
- Pre-Treatment: Before the Storm
- During The Storm Activities
- Record Keeping & Salt Accounting System

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We Are the Experts!

- Each and every storm provides a unique situation
- The benefit of education is work to together and share our knowledge & Determine How we can best use all of the tools at our disposal

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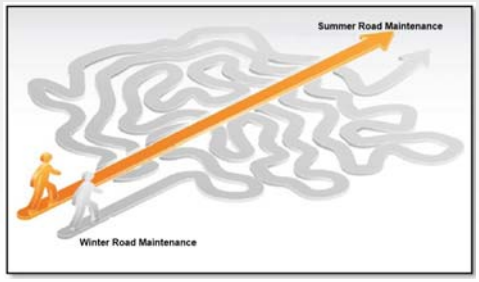
The Most Challenging Season!



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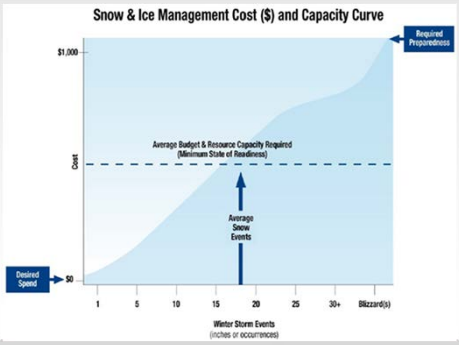

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Chloride Impacts Review

- Salt has hidden infrastructure costs
  - Concrete & Steel Structures Big & Small
- Salt Negatively Impacts Life:
  - Plants
  - Fish/Aquatic Life
  - Humans Health
- Chloride Contamination Develops from Winter Maintenance
- No Viable Clean Up Solution

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Impacts of Winter Sand/Abrasives Use

- Impacts of Sand are generally **WORSE** than those of chloride based deicers
- Sand is generally not recommended for temperatures above 15°F
- Sand that is applied must be cleaned up
- Even after cleanup 50-90% remains in the environment

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Basics of Sand Contamination

- Clogs roadside drainage structures
  - Ditches
  - Culverts
  - Drains
- Causes sedimentation of rivers and streams
- Reduces water quality as regulated by EPA via the clean water act!

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Too Much Material?

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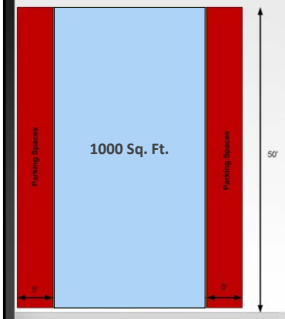
Calibration



- Measure & Mark Test Grid
- Drive over the test grid at a typical application speed
- Sweep up material and weigh to determine application rate
  - Settings to keep track of:
    - Gate Height
    - Auger/Belt Speed
    - Pony Motor RPMs

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Test Grid Layout in Owatonna, Minnesota—June 2008

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Traditional Field Calibration

- Set Gate Height & Auger/Pony Motor speed
- Discharge and Record Spread Width
- Run spreader for 30 seconds & capture salt to weigh.
- Perform calculations!
- Mark the gate height settings!

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Spreader Example

Tarp/Canvas/Bucket Weight:

Gate Opening	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate ((Run1 + Run2 + Run3)/3)	Pounds of Material Discharged per 1000 square ft. (D = B × C ÷ A)					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
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Gate Opening	W	A	Discharge Rate (lb/min.)			B	D					
	Spread Width (ft.)	5.28 × W	Run 1	Run 2	Run 3	Average Discharge Rate ((Run1 + Run2 + Run3)/3)	Pounds of Material Discharged per 1000 square ft. (D = B × C ÷ A)					
							5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)
1"	12	5.28 x 12 = 63.36	70	71	68	(70 + 71 + 68)/3 = 69.67	12 × 69.67/ 63.36 = 13.93	6 × 69.67/ 63.36 = 6.97	4 × 69.67/ 63.36 = 4.64	3 × 69.67/ 63.36 = 3.48	2.4 × 69.67/ 63.36 = 2.79	2 × 69.67/ 63.36 = 2.32
1.5"	11.4	5.28 x 11.4 = 60	92	84	86	(92+84+86)/3 = 87.33	12 × 87.33/60 = 17.47	6 × 87.33/60 = 8.74	4 × 87.33/60 = 5.82	3 × 87.33/60 = 4.37	2.4 × 87.33/60 = 3.5	2 × 87.33/60 = 2.91
2"	11	58.08	106	112	99	105.7	21.83	10.92	7.28	5.46	4.37	3.64
2.5"	10.75	56.76	120	128	129	125.7	26.57	13.28	8.86	6.64	5.31	4.43
3"	10.75	56.76	140	150	143	144.3	30.51	15.26	10.17	7.63	6.10	5.09
EX	14	5.28 × 14= **73.92**	87	92	93	(87+92+93)÷3= **90.67**	12 × 90.67 ÷ 73.92= **14.72**	6 × 90.67 ÷ 73.92= **7.36**	4 × 90.67 ÷ 73.92= **4.91**	3 × 90.67 ÷ 73.92= **3.68**	2.4 × 90.67 ÷ 73.92= **2.94**	2 × 90.67 ÷ 73.92= **2.45**

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Calibration Discussion

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Plow Route Site Inspection

- Drive your Plow Route Early
  - Note Steep inclines
  - Sharp Curves
  - Areas which are shaded by Trees or Buildings
  - Broken or missing snow fences

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Porous Pavement in Winter Maintenance

- Porous Pavement allows water to drain through
  - Winter maintenance performance is highly dependent on sun exposure & traffic (reduced salt *is likely NOT* possible)
  - **Sand should not be used**
  - Should be vacuumed 2-4 times annually to prevent clogging

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Porous Pavements

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Automatic Vehicle Location (AVL)

- Tracks Your:
  - Position
  - Spreader
  - Plow
- Can report to a database
- Can show results live to other plow drivers
- Extremely useful in urban areas

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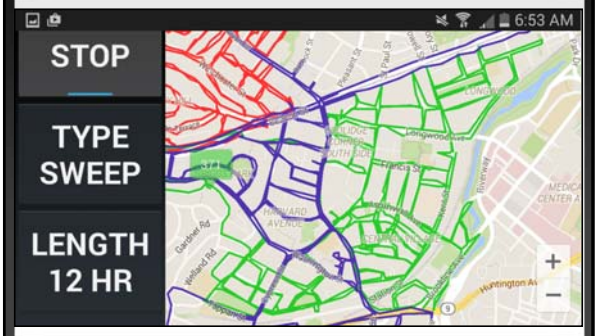

Pre-Season Review

- Calibration saves material & money
  - Know how much material you're applying
  - Keep calibration charts in the truck
  - Allows you to prescribe the correct application rate for the conditions
- Review your sites & technologies

Before The Storm Activities: Pre-Treatment

- Anti-Icing why do it?
  - Science of anti-icing
  - Cost savings & improved results
- Anti-Icing chemicals
- Brine making & storage (Demonstration)
- Application methods
- Application rates
- Tips & getting started

Pre-Treatment: Anti-icing

- "A strategy in which a chemical is applied directly to a roadway surface before a storm begins or before any snow or ice has bonded to the pavement."
- Proactive approach to winter maintenance
- Forms a "bond-breaker" between the road surface and the snow/ice layer (just like greasing a pan before cooking)
- Jump starts the melting process

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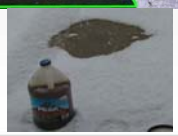
Anti-icing

- Reduces the amount of time required to clear pavement
- Up to 75% material reduction
- Up to 90% cost savings
- Improved results because snow/ice bond never forms with the pavement



Source: http://www.icenator.com/liquid-deicer.htm T2

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Why Not Pretreat? A Parallel Example:

"Stick" Frying Pan

Cook Without Butter or Oil

Effect:

Cleaning Time?

Soap & Water?

Would You Ever Do This?

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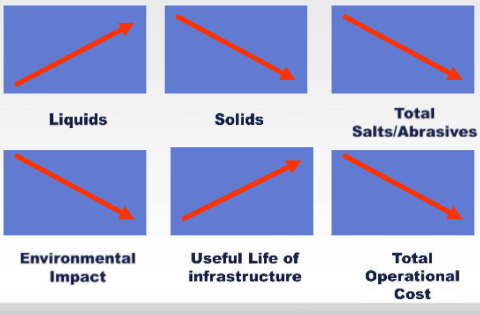
Effect of Anti-Icing



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Chemical	Working Temp	Eutectic Temp	Form	Application Rate	Cost	Comment
Sodium Chloride (Salt -DRY)	+20° F	-6° F	Solid Brine 23%	4-23lb /1000 sqft	$30-$40 Ton	Most Common De-Icer
Magnesium Chloride	+5° F	-28° F	Brine 25%-35%	Liquid .25-.55 gal/1000 sqft Prewet 8-10 gals/ton	$.45-$.75/ Gal	Need Periodic Agitation
Calcium Chloride	-20° F	-51° F	Flake Brine 25%-35%	Anti-Ice .25-.55 gal/1000 sqft Pre-Wet 8-10 gal/ton	Flake= $258.97/ton Brine= $.82 gal	Corrosive Flake hygroscopic

Source: Steve Gray, NHDOT Rett2

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Chemical	Working Temp	Eutectic Temp	Form	Application Rate	Cost	Comment
Calcium Magnesium Acetate (CMA)	20° F	-18° F	Pellets Liquid	Anti-Ice .25-.4 gal/1000 sqft De-Ice .5-1 gal/1000 sqft Dry 4-23lb /1000 sqft	Liquid $1.30/gal Dry $1,000/ton	No Chlorides Liquids needs agitation
Potassium Acetate	-23° F	-76° F	Liquid 50%	Anti-Ice .16-.25 gal/1000 sqft De-Ice .25-.5 gal	$3.00/gal	Insufficient storage life No agitation needed No chloride

Source: Steve Gray, NHDOT Rett2

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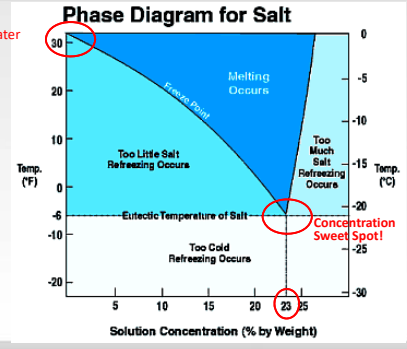
Straight Water



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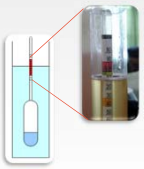
Hydrometer / Salometer Chart for Salt Brine (59°F)

% Salt	Salometer Using 0 - 100%	Hydrometer Specific Gravity	Eutectic Tempature
0	0	1	32
1	4	1.007	31
2	7	1.014	30
3	11	1.021	29
4	15	1.028	27
5	19	1.036	26
6	22	1.043	25
7	26	1.051	24
8	30	1.059	23
9	33	1.067	21
10	37	1.074	20
11	41	1.082	19
12	44	1.089	17
13	48	1.097	15
14	52	1.104	13
15	56	1.112	12
16	59	1.119	9
17	63	1.127	7
18	67	1.135	4
19	70	1.143	2
20	74	1.152	0
21	78	1.159	-2
22	81	1.168	-4
23	85	1.176	-6
24	89	1.184	2
25	93	1.193	16
26	96	1.201	30
27	100		32

23% Salt Brine:
2.5 lb. Salt Per Gallon

hydrometer



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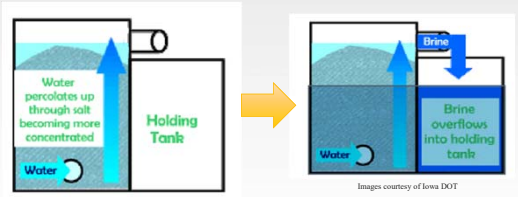
Simple Salt Brine Making



Images courtesy of Iowa DOT

Note: Test brine & recirculate through salt if not at 23%

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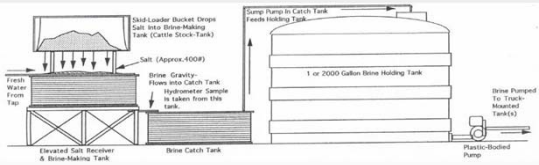

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Brine Maker: Home Made Unit

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Brine Maker: Commercial Unit

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Liquids Material Storage

- NHDES Fact Sheet WD-DWGB-22-30
- Use double walled tanks, or appropriate secondary containment.
- Locate storage tanks at least 500 feet from any Class 2 surface water used for fishing, fish culture, bathing, or any other recreational use
- Tanks should have good surveillance for inspection and must be tamper proof
- Contents of tanks must be properly displayed on tanks

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Liquids - Secondary Containment

- Secondary containment must be completely impervious and should be able to contain at a minimum 100% of the largest tanks capacity or 10% of all tank volumes in the containment area.
- All necessary pipes, hoses, valves, and pumps should be within the containment area.
- Top loading and unloading pipe is recommended.

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Liquids Material Storage

What's Wrong:

No Labels

No Secondary Containment – MAYBE Okay if Double Walled

No Tamper Proofing

Good Visibility for Inspection!

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Liquids Material Storage

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Application Rates & Guidelines

- Apply only when above pavement temperature is between 15°F & 35°F
  - **DO NOT APPLY MAGNESIUM CHLORIDE OR CALCIUM CHLORIDE ABOVE 35°F IT CAN BECOME VERY SLIPPERY!!!**
- Apply 1-2 hours prior to the storm (Still works up to 24 hrs. in advance)
- You can apply brine up to 24 hours in advance of the storm.
- Typical application rates range from 0.5 to 0.75 gallon per 1000 sq.ft. Other chemicals such as magnesium are also available—consult your supplier for application rates.
- Anti-icing is not advised prior to freezing rain events.

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Application Methods

- ¼" streamer nozzles with a 10" spacing
- Leave some bare pavement
- AVOID OVER APPLYING – less is more & safer!
- If you're applying at above 20 mph drop hoses are advised
- Anti-Icing may only be necessary in travel lanes – tires will transport it to parking spaces

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City of Detroit—Jefferson Avenue—Winter 2005

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Various Anti-Icing Setups






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Other Anti-Icing Alternatives


Earthway's Walk behind sprayer

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Practical Tips:

- Remember to Calibrate your sprayers!
- Large half full tanks can have SERIOUS slosh effects – consider:
  - Baffled Tanks or "Baffle Balls"
- Also – Beware of Clogging!!

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Always Installs Filters to Prevent Clogs

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Be Cautious Applying Around Doorways

May track and become SLIPPERY

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What About Anti-Icing With Solids?

- Does it work? – YES, it CAN but:
  - Application time is key – apply as soon as possible after precipitation has fallen
  - Use only in low-speed areas to reduce material loss
  - When you plow you can remove a significant portion of your material – making it ineffective.
  - It is not very effective in areas with little or no traffic
  - Ideally use a finer gradation salt for anti-icing purposes.

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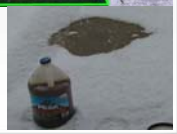
Getting Started: Experiment!

- Mix a small batch of salt brine
  - Say 11 lb of salt in a 5 gal. bucket
- Check concentration using hydrometer (23% solution) – see links to purchase on your CD
- Use a small handheld sprayer to apply brine to a low traffic area – preferably on your own property (Remember less than 1 gallon for 10'x100' area!)
- Document your results and refine your techniques before using commercially!



Source: http://www.icenator.com/liquid-deicer.htm T2

Before The Storm Review

- Anti-Icing is proactive and can significantly reduce time and costs!
- Anti-Icing prevents snow and ice from bonding to pavement
- Brine is most effective at 23% solution – ALWAYS check concentration before applying
- Anti Icing with Magnesium Chloride & Calcium Chloride to pavement above 35°F
- Anti-Icing with Sodium Chloride (Salt) brine is most effective between 15-35°F
- Stream-type nozzles leave some dry pavement which can provide traction in the event of a slippery condition

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During the Storm Activities

- Plowing
  - Discussion of plow blade options
- Deicing alternatives
- How Salt works
- Pre-wetting/Pretreating
  - Application rates
  - Bounce & Scatter
  - Savings
- Salt application rates, timing & effective temperatures
- Application rate examples and calculations
- Material Storage

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Plowing

- Plowing is the most cost effective way to remove snow with least environmental impact
- Plow early & often to avoid compaction
- ALWAYS PLOW BEFORE APPLYING SALT
- NEVER BURN SNOW OFF WITH SALT – Mechanically Remove it

Image Source: www.excavservices.com

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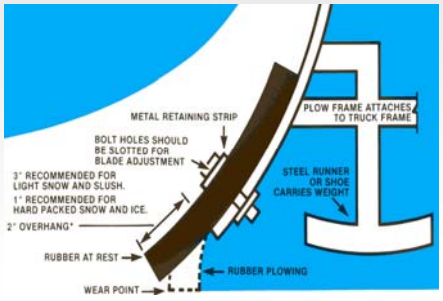
Types of Plow Blades

- Steel (most common)
- Carbide Inserts (cost 2x more but last 3-5 times as long)
  - Can break with obstacles
- Rubber blades
- New Joma sectional blades

T2

Rubber Blades



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Underbody Plow

- Useful for removing hard pack & Ice
- Use only on high quality pavements
- Not commonly used at this time for parking lots

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Multi-Edged Plow Blades

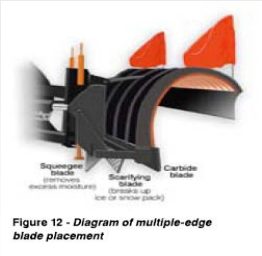

Figure 12 - *Diagram of multiple-edge blade placement*

Being Tested in Indiana, Iowa, Wisconsin, and Ohio

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Chemical	Working Temp	Eutectic Temp	Form	Application Rate	Cost	Comment
Sodium Chloride (Salt - DRY)	+20° F	-6° F	Solid Brine 23%	4-23lb /1000 sqft	$30-$40 Ton	Most Common De-Icer
Magnesium Chloride	+5° F	-28° F	Brine 25%-35%	Liquid .25-.55 gal/1000 sqft Prewet 8-10 gals/ton	$.45-$.75/ Gal	Need Periodic Agitation
Calcium Chloride	-20° F	-51° F	Flake Brine 25%-35%	Anti-Ice .25-.55 gal/1000 sqft Pre-Wet 8-10 gal/ton	Flake= $258.97/ton Brine= $.82 gal	Corrosive Flake hygroscopic

Source: Steve Gray, NHDOT Rett2

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Chemical	Working Temp	Eutectic Temp	Form	Application Rate	Cost	Comment
Calcium Magnesium Acetate (CMA)	20° F	-18° F	Pellets Liquid	Anti-Ice .25-.4 gal/1000 sqft De-Ice .5-1 gal/1000 sqft Dry 4-23lb /1000 sqft	Liquid $1.30/gal Dry $1,000/ton	No Chlorides Liquids needs agitation
Potassium Acetate	-23° F	-76° F	Liquid 50%	Anti-Ice .16-.25 gal/1000 sqft De-Ice .25-.5 gal	$3.00/gal	Insufficient storage life No agitation needed No chloride

Source: Steve Gray, NHDOT RetT2

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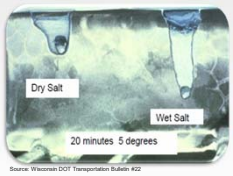
How Salt Works

- Salt molecules pull water molecules out of ice formations – to form a salt brine with a reduced freezing temperature.
- Once the brine is formed the melting process is greatly accelerated
- The Effectiveness of salt changes with temperature!



Source: Wisconsin DOT Transportation Bulletin #22

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Melting Capacities of Salt

Pavement Temp (F)	1 lb. salt will melts this amount of ice	Time it takes to melt this amount of ice
30	46.3 lbs.	5 mins.
25	14.4 lbs.	10 mins.
20	8.6 lbs.	20 mins.
15	6.3 lbs.	60 mins.
10	4.9 lbs.	ineffective
5	4.1 lbs.	"
0	3.7 lbs.	"

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USE PAVEMENT TEMPERATURE

Truck Mounted Thermometer

Cab Display

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Influence of Pavement Temperature

Temperature – **DOWN** Rates – **UP**

Temperature – **UP** Rates – **DOWN**

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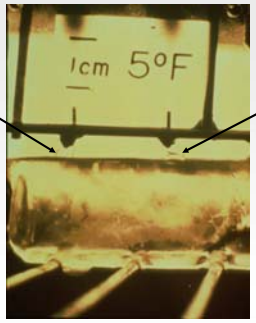
Salt



Pre-wet Salt

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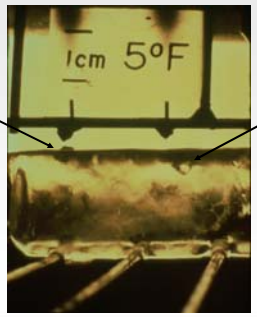

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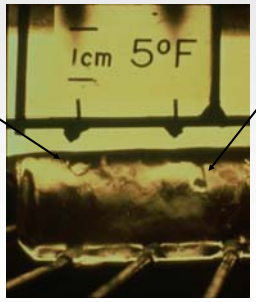

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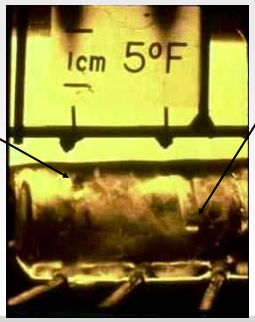

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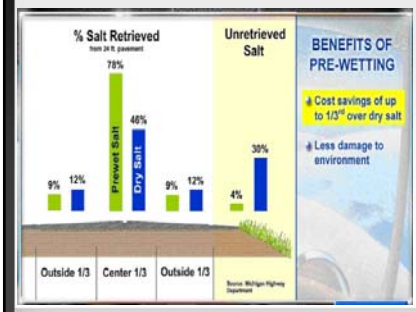
Other Reasons To Pre-Wet Salt With Brine



REDUCED BOUNCE

& SCATTER!!

Allows you to use ¼ less material!

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How to Use Brine: Pretreating

- Pre-Treating
  - Wet salt with brine before application – at pile, or in loader bucket
  - Easy to implement, minimal new equipment needed
  - Use 6-10 gallons per ton for salt brine (23% Solution!!)
- TIP:
  - Apply dye to your brine so that you know which salt has been pre-wet!

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Pretreating Overhead Shower

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Do It Yourself:

Spread it!

Spray it!

For 23% Salt Brine: 6-10 gallons/ton

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Over Application = Leaching

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Pre-Wetting

- Uses special equipment to spray salt with brine as it leaves the spinner
- Brine is stored on saddle tanks and automatically sprayed on at the spinner
- Efficient and effective way to wet salt
- Allows rates to be easily adjusted on the fly
- Use 8-14 gallons/ton of 23.3% salt brine

T2

Pre-wetting at the spinner

Use 8-14 gallons/ton of 23.3% salt brine

T2

Parking Lot Application Rates

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	4.5	4	4.5	Not recommended
	Frz. Rain	Apply chemical	5.75	5.25	6.5	Not recommended
30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	6.5	5.75	7	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	5.75	5.25	6.5	Not recommended
	Frz. Rain	Apply chemical	7	6.5	8.25	10.5

T2

Parking Lot Application Rates – (Continued)

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	7	6.5	8.25	10.5 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	5.75	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	7	7.5	10	10.5
15 - 20 ↑	Snow	Plow and apply chemical	7.5	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	8.75	7.5	10	10.5
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	8.25	7.5	10	10.5 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	10	Not recommended	13 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	23	Not recommended	13 and spot-treat as needed

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Road Application Rates

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per lane mile)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
>30 ↑	Snow	Plow, treat intersections only	150	125	150	Not recommended
	Frz. Rain	Apply chemical	175	150	200	Not recommended
30 ↓	Snow	Plow and apply chemical	175	150	200	Not recommended
	Frz. Rain	Apply chemical	200	175	225	Not recommended
25 - 30 ↑	Snow	Plow and apply chemical	200	175	225	Not recommended
	Frz. Rain	Apply chemical	225	200	225-275	Not recommended
25 - 30 ↓	Snow	Plow and apply chemical	250	200	275	Not recommended
	Frz. Rain	Apply chemical	275	250	275-300	450

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Road Application Rates – (Continued)

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per lane mile)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	275	275	275-300	450 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	275	250	300-325	Not recommended
	Frz. Rain	Apply chemical	300	275	325-400	450
15 - 20 ↑	Snow	Plow and apply chemical	300	275	325	Not recommended
	Frz. Rain	Apply chemical	300-375	275-350	325-400	450
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	325	300	350	450 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	300-350	Not recommended	600 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	350-500	Not recommended	600 and spot-treat as needed

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Application Rate Example 1:

- At 5pm Pavement Temperature is 23°F
- It is snowing and it should get colder over night.
- What application rate should you select for:
  - A.) Salt Pre-Wet with Salt BRINE
  - B.) Dry Salt
- Roughly how much total salt would you expect to use if the parking lot was ~5000 Square Feet?

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Parking Lot Application Rates – (Continued)

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	7	6.5	8.25	10.5 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	5.75	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	7	7.5	10	10.5
15 - 20 ↑	Snow	Plow and apply chemical	7.5	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	8.75	7.5	10	10.5
15 - 20 ↓	Snow or Frz. Rain	Plow and apply chemical	8.25	7.5	10	10.5 for frz. Rain
0 to 15 ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	10	Not recommended	13 and spot-treat as needed
< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	23	Not recommended	13 and spot-treat as needed

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Calculate Total Amount To Be Used

- For Dry Salt: 5 x 9.5 = **47.5lb ~ 50lb**
- For Salt Pre-Wet with Brine: 5 x 5.75 = **28.75lb ~30lb**
- This gives you a rough guideline of how much salt to apply

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Example 2

- Pavement temperature is 8°F at 9am
- It should be warming up during the day
- What application rate should be used for dry salt?
- What is the total amount of dry salt that should be used?

T2

Application Rates – (Continued)

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate (lbs/per 1000 sq.ft.)			
			Salt Prewetted/Pretreated with salt brine	Salt Prewetted/Pretreated with other blends	Dry salt	Winter sand
20 - 25 ↑	Snow or frz. Rain	Plow and Apply chemical	7	6.5	8.25	10.5 for frz. Rain
20 - 25 ↓	Snow	Plow and apply chemical	5.75	7.5	9.5	Not recommended
	Frz. Rain	Apply chemical	7	7.5	10	10.5
15 - 20 ↑	Snow	Plow and apply chemical	7.5	7.5	9.5	Not recommended
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< 0	Snow	Plow, treat with blends, sand hazardous areas	Not recommended	23	Not recommended	13 and spot-treat as needed

T2

Application Rates Bottom Line

- You might not be able to calibrate your equipment to these precise rates
- Use the blank sheet provided to determine your own rates (using our suggested rates as a guide)
  - Make sure as temperature goes up you use less
  - As temperature goes down you use more
- Maximum rate of ~24lb per 1000 square feet is fairly well established for freezing rain – generally you should not exceed this

T2

Salt Storage Guidelines

- All De-Icing materials should be stored on impervious surface
- Surface flooring should be sloped to prevent run-off
- Deicing materials should be covered minimally with a water-proof tarp
- Load equipment as close to salt pile as possible to reduce spillage
- Spillage should be swept and returned to stockpile
- See NHDES Storage & Management of Deicing Materials: WD-DWGB-22-30 for more information (included in your course packet)

T2

During The Storm Activities - Review

- Plowing is the #1 winter maintenance activity! Mechanical removal of snow and ice is preferred
- Salt does not begin melting until a brine is formed
- Pre-wet salt is more efficient and effective than dry salt
- Salt be used to loosen the ice/pavement bond – NOT to 'burn off' the ice
- Salt application rates vary with PAVEMENT temperature
- Know how to use the application rate chart!
- Cover deicing materials, store on an impervious surface, and control Drainage

T2

Chloride Impacts Review

- Salt has hidden infrastructure costs
  - Concrete & Steel Structures Big & Small
- Salt Negatively Impacts Life:
  - Plants
  - Fish/Aquatic Life
  - Humans Health
- Chloride Contamination Exists in NH
- No Viable Clean Up Solution

T2

Pre-Season Review

- Contracts & policies make expectations clear and can protect you in the event of a lawsuit
  - Remember to have your attorney review or draft a contract for you
- Calibration saves material & money
  - Know how much material you're applying
  - Keep calibration charts in the truck
  - Allows you to prescribe the correct application rate for the conditions

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Before The Storm Review

- Anti-Icing is proactive and can significantly reduce time and costs!
- Anti-Icing prevents snow and ice from bonding to pavement
- Brine is most effective at 23% solution – ALWAYS check concentration before applying
- Anti Icing with Magnesium Chloride & Calcium Chloride to pavement above 35°F
- Anti-Icing with Sodium Chloride (Salt) brine is most effective between 15-35°F
- Stream-type nozzles leave some dry pavement which can provide traction in the event of a slippery condition

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Application Rate Example 1:

- At 5pm Pavement Temperature is 20°F
- It is snowing and it should get colder over night.
- What application rate should you select for:
  - A.) Salt Pre-Wet with Salt BRINE
  - B.) Dry Salt
- Roughly how much total salt would you expect to use if the parking lot was ~5000 Square Feet?

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Application Rates – (Continued)

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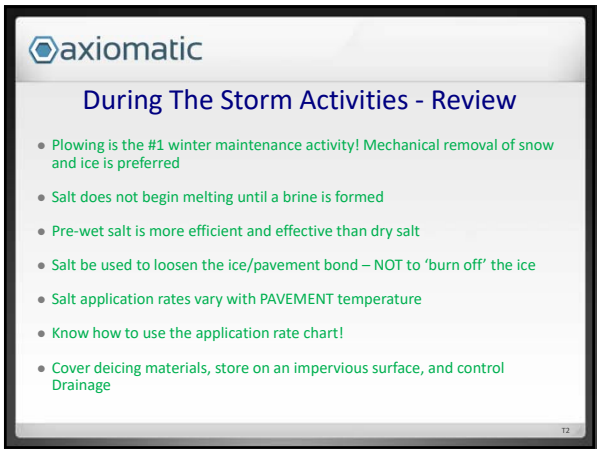
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