



Connecticut Best Management Practices

Green Snow Pro: Sustainable Winter Operations

A Guide for Municipalities

This Guide was adapted from New Hampshire's Best Management Practices Guide and developed in partnership with the following agencies:



Training and Technical Assistance Center

**Connecticut
Transportation
Institute**



CLEAR

Center for Land Use Education & Research





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!

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. Alternatives include potassium acetate, and calcium magnesium acetate (CMA), — all of which are considerably more expensive than sodium 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.



Save \$\$, Time and the Environment

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. In Connecticut, more than 400 wells have been found to have elevated chloride and/or sodium levels. See CT application rate charts for recommended rates.

Be efficient in your operations - plan ahead to where you place snow and save callbacks and refreezing conditions which lead to additional applications. **PLOW** and blow snow to the downhill sides of parking lots and sidewalks so the snow melt does not flow back over parking and walking area. **CLEAR** catch basin drains and drainage leak-offs to ensure a path for snow melt. **CHECK** to make sure building roof gutters are not directed onto pedestrian pathways. **PLAN AHEAD** - establish environmentally reviewed snow dump locations and prepare them for service prior to the start of the winter season so you are ready for severe storms.



GET OUT EARLY

Typically anti-icing is most effective if applied 1-2 hours before the precipitation begins however if using brine, it can be applied two - three days 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 or mitigates 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 and assists in MS4 permit compliance.



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 salimeter (~\$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 three days 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 if event starts out as plain rain.



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.



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 in case 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.

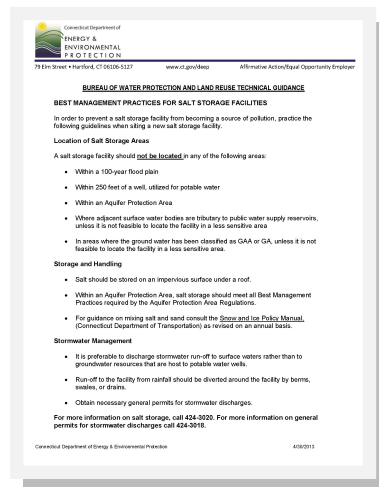


Liquid Storage

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

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.



DEEP Salt Storage Facility BMP

This guidance outlines the basic required specifications for salt and chemical storage facilities as well as Storage and Handling of salt and Stormwater Management considerations.

For additional information, please contact the Bureau of Water Protection and Land Reuse at (860) 424-3020

For more details on Winter Operations Guidance and Requirements in the MS4 permit visit:

<https://nemo.uconn.edu/ms4/basics/permit.htm>



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

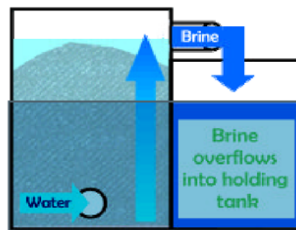
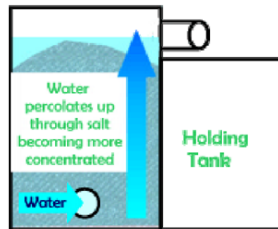
Sodium chloride brine costs about 7¢ / gallon (assuming \$58/ton for salt) after you have your equipment setup.

MULTIPLE USES

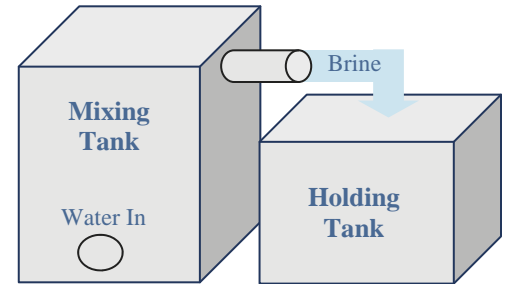
Brine can be used directly for anti-icing, for prewetting salt as it is dispensed from your truck, or to pretreat salt before it is loaded into your truck. Brine can be safely stored for up to a year, however, the concentration should be tested before use.

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

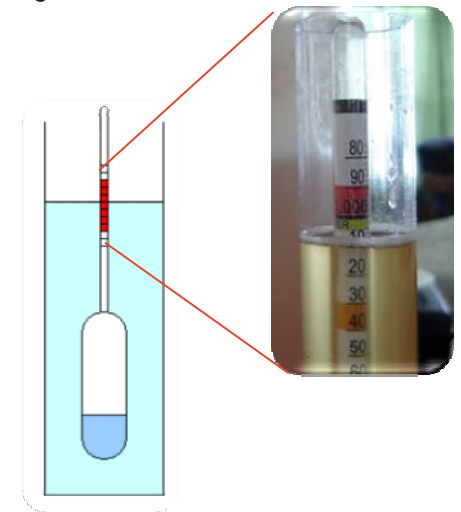
Add Salt: Add about 2.5 lb of salt per gallon of water you plan to add. Make sure your mixing tank has a large opening to make adding salt easy.

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.



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?

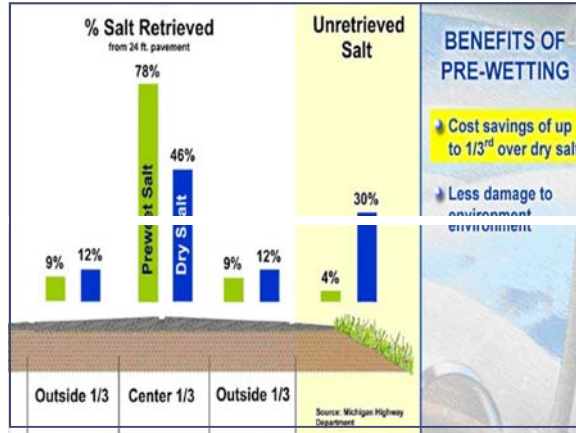
De-icing chemicals must form a brine before they can begin melting ice. Pre-wetting your chemicals accelerates the brine making process, which improves the melting action of the material. Pre-wetting also reduces bounce and scatter of material during spreading, and reduces the total amount of de-icer 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 8-14 gallons of sodium chloride liquid for every ton of de-icer. For other chemicals, such as magnesium chloride, consult your supplier for application rates.



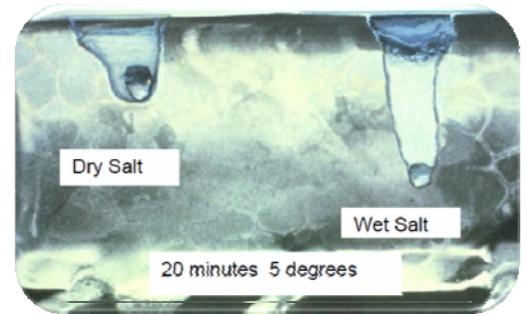
Pre-wetting Liquids

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 and 30% magnesium chloride solution are also used, as well as several other patented products.

Common Prewetting Agents	Typical Application Rate: gallons per ton
Salt Brine	8 to 14
Calcium Chloride	6 to 12
Magnesium Chloride	6 to 8

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

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.





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 spreader 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 performed 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 do your calculations.

Step 1: Load the Spreader

Partially load the material spreader. Half of a load should be more than adequate for calibration purposes.



Step 2: Set Your Controls

Lever Position or Gate Setting: Set the opening to its lowest practical setting (approximately 1" to 1.5"). After the spreader 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. If your equipment does not have markings for settings, make your own permanent marks or numbers on the equipment to identify the positions.

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

Step 3: Measure Spread Width (B)

Spread out a 10 foot long tarp or mark a distance of 10 feet on the ground. Drive over the tarp or marked area at plowing speed. Measure the width of the deposited material and record to the nearest half of a foot. Multiply this width by the 10 foot length to get the square footage of coverage.

Step 4: Collect & Weigh Material (A)

Collect the deposited material from each pass and weigh the sample. Record your results.

Step 5: Perform Calculations

Complete steps 3 and 4 three times for each setting to calculate average spread width and weight. Record those averages in the chart provided. Multiply spread times 10 to get coverage in square footage (C). To determine how much would be spread in 1000 square feet, divide 1000 by the coverage area (C) and multiply by the lbs. of material recovered (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 in case the original is damaged.

Calibration Chart

Calibration Chart for Gravity Flow Equipment						
Vehicle or spreader number:					Date:	
Material Type:			Calibrated by:			
		A	B	C	D	E
Speed	Lever position or gate setting	Lbs. Material recovered in 10 feet	Spread width in feet	Square feet covered with material (B x 10)	Application rate in lbs/1000 ft ² (1000/C x A)	Application rate in lbs/lane mile (12' width) (D x 63.4)

Taken from Minnesota Winter Parking Lot and Sidewalk Maintenance Manual



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CALCULATIONS:

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Once all of the necessary data is recorded, head back inside and warm up!



Step 2: Prepare Auger or Conveyor

Mark shaft end of auger or conveyor and dump salt on auger or conveyor.

Step 3: Count Revolutions

Rev truck engine to operating RPM (at least 2000 RPM). Count the number of shaft revolutions per minute at each spreader control setting and record

Step 4: Collect & Weigh Material

Collect salt for one revolution and weigh, deducting weight of container. For greater accuracy, collect salt for several revolutions and divide by this number of turns to get the weight for one revolution. This can be accomplished at idle or very low engine RPM.

Step 5: Calculate

Multiply shaft RPM (Column A) by discharge per revolution (Column B) to get discharge rate in pounds per minute (Column C), then multiply discharge rate by minutes to travel one mile at various truck speeds to get pounds discharged per mile.

For example, at 20 MPH with 30 shaft RPM and 7 lb. discharge - $30 \times 7 = 210 \times 3.00 = 630$ lb per mile.

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 in case the original is damaged.

Step 1: Warm and Load the Truck

Warm the truck's hydraulic oil to normal operating temperature with spreader system running. Partially load the truck. Half of a full load should be more than adequate for calibration purposes.



CALIBRATION CHART (US)

Agency: _____
 Location: _____
 Truck No: _____ Spreader No: _____
 Date: _____ By: _____

Gate Opening _____ (inches) (Hopper Type Spreaders)			DISCHARGE RATE (pounds discharged per mile)									
Control Setting	A	B	C	TRAVEL SPEED AND COMPUTATION MULTIPLIER ()								
	Shaft RPM (Loaded)	Discharge per Revolution (pounds)	Discharge per Minute (lb) (A x B)	5 mph (x 12.00)	10 mph (x 6.00)	15 mph (x 4.00)	20 mph (x 3.00)	25 mph (x 2.40)	30 mph (x 2.00)	35 mph (x 1.71)	40 mph (x 1.50)	45 mph (x 1.33)
1											-	-
2											-	-
3											-	-
4				-	-	-	-	-	-	-	-	-
5				-	-	-	-	-	-	-	-	-
6			-	-	-	-	-	-	-	-	-	-
7			-	-	-	-	-	-	-	-	-	-
8			-	-	-	-	-	-	-	-	-	-
9			-	-	-	-	-	-	-	-	-	-
10			-	-	-	-	-	-	-	-	-	-
11			-	-	-	-	-	-	-	-	-	-

THE ACTUAL APPLICATION RATE (POUNDS PER LANE MILE) ON THE HIGHWAY IS THE DISCHARGE RATE DIVIDED BY THE NUMBER OF LANES BEING TREATED

SPREADER CALIBRATION PROCEDURE

Calibration is simply calculating the pounds per mile discharged for each control setting at various travel speeds by first counting the number of auger or conveyor shaft revolutions per minute, measuring the weight of salt discharged in one revolution, then multiply the two to obtain discharge per minute, and finally multiplying the discharge per minute by the time it takes to travel 1 mile. Most spreaders have multiple gate openings; so you must calibrate for specific gate openings.

Equipment needed:

1. Scale to weigh salt
2. Salt collection device
3. Marking device
4. Watch with second hand

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CALIBRATION OF AUTOMATIC CONTROLS

Automatic controls may be calibrated using the following steps:

1. Remove, by-pass or turn of spinner.
2. Set control on given number.
3. Tie sack or heavy canvas under spreader discharge area.
4. Mark specific distance on a highway or other paved area, such as 1000 ft .
5. Drive that distance with spreader operating.
6. Weigh salt collected.

