

Salt BMP List - Detailed

Note: this list of BMPs was assembled by reading through 12 different resources, which were mostly BMP manuals for operations. The BMPs were then categorized into 1) Equipment/Tools 2) Before Winter 3) Before the Storm 4) During the Storm 5) After the Storm 6) Deicers and then further broken into practices for winter maintenance in “General”, for “transportation” and for “Parking lots, sidewalks, and properties” under each of the major categories (1-6). This document contains more details on each practice, whereas the accompanying document maintains the format and simply lists the practice.

- Salt Institute 11 Excellent Management Practices (From 5/24/18 Training – [PPT presentation](#) & [video](#))
Note, color coding for Fundamental 5 (green) versus the Second 6 (blue) is used throughout the document to highlight other ways of presenting these best practices

- Fundamental 5:

1. Calibration
2. Measurement
3. Accountability
4. Level of Service
5. Training

- The second 6

6. Variable Application Rates
7. Forecasts
8. Cold Temperature Usage
9. Liquid Usage
10. Pre-wetting
11. Anti-icing

1. Equipment/Tools

- General

- Identify the equipment you ultimately will need and develop a long-range plan to get there.
- Maintenance Decision Support System
- Plows
 - Side wing plows (to increase plow-able area per truck)
 - Make use flexible or sectional blades
 - Other equipment opportunities to maximize plowable area
- Spreaders
 - Electronic spreaders where possible – can lock in specific application rates and can be used to collect data
 - Spreaders that can deliver very low rates of granular products
 - Ground Speed Controllers/Speed-synchronized spreaders
- Anti-icing
 - Stream nozzles (minimum eight holes), 8-inch spacing, bar height 12 to 14 inches from surface, 30 to 35 psi at the bar.
- For Brine
 - Salimeter or hydrometer for liquids (measures the salinity or density of water, respectively)
 - Brine of 23% salt (NaCl) =

- 1.176 with a hydrometer
 - 86% with a salimeter
 - Open top mixing tank
 - Holding tank
 - Small pump
 - Secondary containment and/or double walled tanks (storage BMP)
- Transportation
 - **Road Weather Information System**
 - Mounted temperature sensor (infrared thermometers) that accurately measure in cold temperature range (you must verify this)
 - Use a chute to reduce bounce and scatter
 - Set spinners lower to the ground
 - Automated Vehicle Location (AVL)
 - Tracks position, spreader, plow
 - Can show results live to other plow operators
 - Can report to a database
 - Precision Deicing (being piloted by Oak Ridge National Laboratory in Knoxville)
 - Integration of LIDAR data, road condition index (severity based on road angles/curves and solar radiation), precipitation data, AVL, and automated spreaders
 - Dynamically adjusts application rates of chemicals/liquids based on road conditions and characteristics
- Parking lots, sidewalks, and properties
 - Outfit sidewalk push spreaders with shields to better direct the spread pattern or use drop spreaders on sidewalks.
 - Hand-held temperature sensors (infrared thermometers) that accurately measure in the cold temperature range (you must verify this).

2. Before Winter

- General
 - **Winter Maintenance Planning**
 - Develop a Salt Management Plan
 - Identify salt sensitive areas
 - Establish Levels of Service
 - Inventory resources, techniques, and technologies
 - Select types of winter materials
 - Evaluate storage practices and seek room for improvement
 - Establish goals for achieving reduction in impacts of salts
 - Select BMPs that can reach goals
 - Monitor and report
 - Continual improvement process
 - Develop implementation timeline for improvements
 - Build in fine-tuning your program
 - Use Application Rate Guidelines and Best Practices
 - Check Weather and Pavement Conditions
 - Treat
 - Adjust rates and methods
 - Track and evaluate

- Repeat
- Review the Winter Maintenance Plan with crew and managers
- **Accountability at every level**
 - Pre and post event meetings
 - Data gathering and review
- **Record keeping and annual reports**
 - Maintain records on salt usage and other objectives/performance measures
 - For each event and for each season
 - Learn to record what and how much material is applied each shift
 - Recorded for the individual applicator
 - This can be done manually by tracking the number of loads (e.g., buckets, bags, etc.) a spreader takes or by weighing it, OR it can be done through instrumentation.
 - Consider using a storm severity index (both by event and seasonally) to normalize
 - Measurement ensures operator accountability to policies and plans put in place by management
- **Calibrate your equipment**
 - Standardize application rates across equipment types
 - Calibrate application rates for minimum required salt output
 - Establish a calibration process for all salt application equipment that takes into account flow settings, conveyor/auger and spinner speeds, ground speed, and material (size/density etc.)
 - Document settings, rates, and maximum salt output in manuals, site binders, and include in training
 - Calibrate equipment in the preseason, mid-season, and any time changes are made to equipment or change is made to the material (including dry salt to pretreated/pre-wetted salt).
 - Calibrate solid and liquid dispensers
- Test material
- **Train staff**
 - Should train all staff (managers, operators, contract, seasonal, etc.)
 - The plan should teach:
 - managers and operators about agency planning and policies
 - understanding weather and weather
 - tools
 - how materials work
 - what materials to select for the given conditions
 - how to store materials properly
 - proper snow and ice removal
 - the use of proactive approaches
 - liquids use
 - calibration of equipment
 - equipment choices and maintenance
 - environmental impacts
 - data collection and analysis
 - It would include both classroom and hands on training
- Transportation
 - Know the level of service for your routes
 - Inform citizens of policies
 - Plan your routes

- Parking lots, sidewalks, and properties
 - Develop a maintenance policy or plan and review it with the crew
- Know the level of service for your different properties and discuss it with property managers
- Walk the property with the property manager
- Inspect the property for drainage issues
 - For clogged storm drains
 - For other drainage issues like roof that drips on steps, downspout directed at a sidewalk, and low spots/collection areas that can be fixed prior to the winter
 - Inventory drainage issues and report to property manager for repair

3. Before the Storm

- General
 - Weather
 - Forecast things to know
 - Start of precipitation
 - Type of precipitation
 - Total precipitation expected/storm intensity
 - Expected event length
 - Wind conditions (speed, gusts, directions)
 - Temperature Trends
 - Anti-icing – treatment prior to precipitation to prevent ice-pavement bond
 - With liquids – most efficient
 - Can be done more in advance (up to 2 days), and with much less salt
 - Liquids are the most efficient
 - With solids
 - Better if event starts as rain or freezing rain since they can last longer
 - Also good choice when it is damp
 - Good practice is to pre-wet the solid salt
 - Pretreated or pre-wetted salts can also work at the lowest possible setting
 - Pretreating – treating salt or sand with a liquid (can include brines)
 - Helps material stick to surface
 - Allows for 1/3 less material to be used
 - Speeds up melting process
 - Pretreating
 - Salt stockpile
 - Sand stockpile – to keep it flowable
 - Storage
 - Liquids
 - Know the freezing point and avoid its occurrence
 - Tanks should be double walled or have secondary containment
 - Salt piles:
 - Storage piles shall be enclosed or covered to prevent exposure to precipitation and situated on an impervious surface.
 - Should implement good housekeeping
 - Need to have stormwater diversions
 - All runoff from the pile, and runoff that comes in contact with salt, including under drain systems, shall be collected and contained within a bermed basin

lined with concrete or other impermeable materials, or within an underground storage tank or tanks

○ Parking lots, sidewalks, and properties

▪ Storage

• Salt and sand piles:

- Store on impervious surface
- Cover pile
- Store indoor where possible
- Sweep loading areas back into the pile
- Store away from lakes, rivers, ditches, storm drains, and wetland edges

• Salt bags:

- Protect from precipitation
- Dispose of bags properly
- Seal all open bags

4. During the Storm

○ General

▪ Weather – Things to know upon treatment time

- Pavement temperature

▪ Plow as quickly as possible and prior to deicing regardless of compaction (i.e., no burning off 2 inches of fresh snow)

▪ Do not relocate/dump snow into bodies of water/wetlands or infiltration/retention stormwater best management practices

▪ **Variable application rates:**

- **Deicing application rates should be at recommended rates based on the following factors:**

- **Pavement temperature, precipitation rate and type, level of service, and cycle time/bare pavement regain time.**

- **Requires more training**

▪ Utilize spread patterns that reduce waste/over application

▪ **Use Pre-wetted salt – Adding liquid to the salt as it is being applied**

- **Allows for 1/3 less material to be used**

- **Speeds up melting process**

- **Using Pretreated or pre-wetted salt allows for:**

- **Efficient treatment in very cold temperatures.**

- **Allows the salt to stick on roads better (helps in high winds or high trafficked areas as well as reducing bounce/scatter)**

▪ **Use pretreated salt**

▪ Use abrasives only...

- During freezing rain events
- In slow-moving traffic areas
- When deicers are ineffective because it is too cold
- Sweep up sand as soon as possible after event

▪ Loading/hauling

- Load under cover and on level surface
- Maintain loading area
- Don't overload – avoiding spilling

- Spilled salt should be collected and returned to the pile.
- Cover salt in truck/spreader
- Transportation
 - Plowing/Application
 - On multilane highways use a plow train to remove as much snow as possible in one coordinated sweep. Requires training so that salt is applied in areas that won't be plowed up by trucks behind the lead trucks.
 - Coordinate plowing activities to prevent plowing off another operator's material
 - Reduce application rate on successive passes
 - Drive 17-25 mph to keep material on road
 - On high-speed roads, apply deicers in center of road or high side of curve
 - Turn off auger when stopped, even briefly
- Parking lots, sidewalks, and properties
 - Sidewalks
 - Use drop spreaders or rotary spreaders with shields
 - Stairs
 - Use a hand-held spreader
 - Look for opportunities to close building entrances
 - Parking lots
 - Store snow downhill from salt storage areas
 - Calculate the area. With that and pavement temperature and appropriate application rate, the total salt mass to be applied can be determined

5. After the Storm

- General
 - Clean equipment and contain wastewater
 - Accurately record material use at the end of shift/site
 - Record what and how much is applied at each shift/site for each event.
 - Standardize the process to measure salt output
 - Use technology to accurately automate the process of tracking and reporting salt application data
 - Evaluate what was done, how well it worked, and what could be changed to improve operations
 - Hold a post-storm meeting to evaluate operations
 - With maintenance crew
 - With management/property manager
 - Evaluate how to improve operations
- Parking lots, sidewalks, and properties
 - Sweep up excess salt/sand
 - Do not use deicers at the end of the season just to use them up

6. Deicers

Chemical	Lowest Practical Melting Temp.	Eutectic Temp.	Optimal Concentration
NaCl (Sodium Chloride) —Delivered as rock salt, can be made into a brine. The basis of many bagged blends. Corrosive. Inexpensive. Very available. Most commonly used without a corrosion inhibitor added, but corrosion inhibited products are available.	15° F	-6° F	23%
MgCl ₂ (Magnesium Chloride)—Delivered primarily as a liquid, other forms available. Used for anti-icing, pre-wetting and stockpile treatments. Corrosive. Higher cost. Often has a corrosion inhibitor added. Often added to salt brine.	-10° F	-28° F	27 to 30%
CaCl ₂ (Calcium Chloride)—Delivered as flakes, pellets, or liquid. Corrosive. Most effective ice melter at very cold temperatures. Sometimes used incorrectly to open storm drains. Higher cost. Often has a corrosion inhibitor added. Often added to salt brine.	-20° F	-60° F	30%
CMA (Calcium Magnesium Acetate)—Delivered as a powder, crystals, pellets, or liquid. Liquid CMA is used mainly on automated bridge deicing systems. Non-corrosive to steel, biodegradable. Alternative for areas where chloride use must be limited. Higher cost.	20° F	-18° F	32%
KAc (Potassium Acetate)—Delivered as a liquid. Often used on automated bridge deicing systems and airports. Use for anti-icing, deicing. Non-corrosive to steel but corrosive to galvanized, biodegradable. Alternative for areas where chloride use must be limited. Higher cost.	-15° F	-76° F	50%
Blends— Both chlorides and acetates exist in blends. Talk to the 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.			
Winter Sand/Abrasives—Winter sand has salt mixed in it to keep it from freezing. Abrasives should be used for cold temperatures when deicers are not effective. Want to minimize salt % in sand.	Never melts—provides traction only		