Chapter 3

PREWET

This chapter presents recommendations for successful prewetting practices. It presents information that will assist in the development and the implementation of a prewetting program. The chapter is organized into six sections to give recommendations and procedures from the time a prewetting program is started to a postseason analysis of the program.
The six sections in this chapter are:

1) Getting Started
2) Preseason
3) Prestorm
4) During the storm
5) Poststorm
6) Postseason

3.1 Getting Started

The prewetting of a solid before applying it to the roadway can improve the effectiveness of the solid in most situations. Listed below are a few advantages of prewetting salt.

- The solid chemical is spread more uniformly with less waste from materials bouncing beyond the traffic lane (although not all waste is eliminated);
- Granules adhere to the road surface better;
- There is a faster and longer-lasting effect;
- In some cases the road surface dries more quickly.
- Reduce/eliminate sand usage
- Allows salt to work at lower temperatures
- Application rate of prewet salt can be reduced by 25% to 50% as compared to traditional dry salt.

3.1-A Methods

Prewetting of stockpiles

This method consists of injecting the liquid chemical into a salt stockpile using spray nozzles that can penetrate into the pile. Typically, the liquid is hauled to the site in a tanker truck and the stockpile wetting is performed by a vendor. The advantages of this method are 1) there is no spray equipment to purchase or maintain, 2) no installation of liquid storage tanks, however, rain or snow on a wetted stockpile will dilute the liquid and cause it to migrate through the pile. It is essential that stockpiles be covered and placed on impervious asphalt or concrete floors. Also, it is difficult to ensure that all the salt is covered with an equal amount of liquid.

Batching

This method is essentially the same principle as prewetting the stockpile, just on a smaller scale. Typically enough salt to last through a storm is mixed up and stored until needed. When this stockpile runs out another batch will be made. One problem with this method is that it is possible to run out of stockpiled prewet salt before the storm is over. When this happens crews either

have to be pulled off the roads to make another batch or the garage will have to use regular salt until another batch can be made.

Prewetting a loaded truck

This method of prewetting consists of spraying liquid chemical onto a loaded truck by an overhead spray bar with nozzles that dispense the liquid. The driver pulls his truck loaded with dry chemical beneath a timer-controlled overhead spray bar system. A timer button activates a pump which sprays the loaded truck with the recommended amount of liquid chemical..

There are other variations to this second method. For example, operators can spray the liquid onto each bucket of salt as they load the truck. Some highway agencies opt to use a conveyor system, spraying liquid chemical on the salt as it travels up the belt to the truck. The equipment is very modestly priced.

The one notable disadvantage of this method is that it can have a more corrosive effect on the equipment than dry road salt. Also, it is very difficult to get uniform particle coating with this method as the liquid can channel through the load to the truck bed without coating segments of the dry chemical.

Prewetting by spreader spray systems

Another method of prewetting is through the use of an on-board spray system. A truck equipped for prewetting can apply liquids directly to the material being spread. The prewetting equipment can be an integral part of the spreader design or it can be a system added to an existing truck. Crews can modify an existing truck relatively easily.

As with all spreaders, crews should periodically calibrate the equipment. Operators should investigate any radical deviation in spreader output compared to the control setting (for example, running out before the route is completed, or having material remaining). They should also check for uniform spreading of material. Although a recommended speed of about 35 mph is achievable, drivers should select a speed that yields uniform material distribution. Also, agencies should consider ground-speed controls to achieve as uniform a distribution as possible. These systems modulate the material flow rate as a function of vehicle speed to obtain constant area coverage.

Premixed "enhanced" salt

In some locations, a vendor will offer salt already premixed with an anti-icing chemical. There are several advantages of this method.

- There is no spray equipment to purchase or maintain,
- No installation of liquid storage tanks,
- Reduced corrosion of the equipment since it will contain a corrosion inhibitor.

The one disadvantage of this method is that it is more expensive than regular salt. But, because the salt is prewet, less salt can be used to achieve the same level of service.

3.1-B Equipment

Prewetting the Pile

No special equipment is needed because this method is typically done by a contractor.

Prewetting a load

The equipment is modestly priced. The basic components for all truck-load systems are a storage tank, a centrifugal pump, piping, an open spray area, a metering device, and the necessary wiring. The cost of a basic truck-load application system with all new components is between $8,000 to $10,000.

Figure 3: Prewet unit setup for prewetting an entire truck load at a time.

Spreader spray systems

Generally the on-board spreader tanks are made of molded polyethylene and are provided with a replaceable output-line screen strainer and shut-off valves. Saddle tank capacity is between 60 to 125 gallons. Both electric and hydraulic spray systems have been used. An electric system consists of a 12V DC electric pump rated at up to 3 gal/min., in-cab controls, one to three nozzles, hoses, spray tank(s) and necessary fittings. A disadvantage of this method is the high upfront cost.

Enhanced Salt

No special equipment is needed for this method.

Tanks and Pumps

Tank walls should be rated 12 pounds per square inch or be capable of handling liquid with a specific gravity of up to 1.6. All tanks should be installed according to manufacturer's

recommendations. All fill and discharge openings in the storage tank should be three inches (3") in diameter and accept cam lock fittings. The tank should be vented and labeled with the name of the liquid being stored inside. If the tank is to be filled from the top, an anti foam agent needs to be mixed in the liquid to prevent foaming while filling. It is not recommended that the tanks be made of any type of metal due to the corrosiveness of some prewetting liquids.

Pumps should be constructed out of corrosive resistant materials and be capable of pumping liquids with a specific gravity of 1.6 or greater.

3.1-C Chemicals/Material

Solid materials and gradation

Sodium chloride (rock salt) is the solid material most commonly used in winter operations. When deicing, the goal is to get the salt particle to move rapidly through an ice or snow layer to the pavement surface. A larger particle will have greater weight and therefore greater success in penetrating this layer. But if the salt particles become too large it is possible that the salt will damage vehicles traveling behind the salt truck. A salt gradation needs to be specified when purchasing deicing salt to ensure that the salt being purchased is large enough to cut through ice and snow but not so large that it can do damage to vehicles.
The salt gradation suggested by MDOT is attached as Appendix 3.

Prewetting solutions

Five chemicals have been used for liquid prewet treatments nation wide: sodium chloride (NaCl), calcium chloride ($CaCl_2$), magnesium chloride ($MgCl_2$), potassium acetate (KA) and any of the chloride products combined with an Agricultural Bi-Products (ABPs). Some important properties of these chemicals are given in Table 2: Properties of Prewet Chemicals. Not all products/suppliers are listed in Table 2.

Table 2: Properties of Prewet Chemicals

Liquid Category	Minimum freeze point, °F (for storage characteristics)	Concentration (Percent)	Ice Melt Capacity at 15 °F (grams ice melted per gram deicer)	Performance Ratio (24% salt brine = 1.0)
Magnesium Chloride Based Liquids				
Magnesium Chloride Brine	-27	22 %	0.58	2.1
	-6	26 %	0.72	2.6
Caliber M-1000	-79	30 %	0.60	2.2

Calcium Chloride Based Liquids				
Calcium Chloride Brine	-60	30 %	0.35	1.3
	+30	36 % (dust palliative)	---	Don't Use !!
LiquiDow Armor	-40*	30 %	n/a	n/a
Ice Ban CM-80	-67*	28 %	n/a	n/a
Sodium Chloride (Rock Salt) Based Liquids				
Salt Brine	-6	24 %	0.28	1.0
Other				
Potassium Acetate (KAc)	-70	50 %	0.9	3.2
CMA	-10	30 %	0.0	0.0

* Agitation is required!

3.2 Preseason

3.2-A Calibrate Equipment

A truck's salt distribution system will not work efficiently if it is not properly calibrated. Calibration is important, because tests have shown that operators cannot accurately estimate the amount of materials being applied by watching it hit the ground through a rear view mirror. The truck's speedometer must be working properly to accurately control the amount of material being applied.

The application rate is variable depending upon the choice of dial settings and speed of the truck. During the calibration process and while applying the material the hopper box gate opening must remain at the same height. Calibration should be done on an annual basis to adjust for any changes in the truck's hydraulic system output. In many cases after calibration, a calibration chart must be filled out and a copy of it attached to the visor of the truck. The calibration chart must contain the vehicle number, various dial settings, and vehicle speeds for applying selected pounds of material per lane mile. MDOT has a separate calibration workbook which explains the step-by-step process of calibrating the solid distribution equipment. This workbook is available from the Maintenance Support Area, Region Support Unit.

3.2-B Order Materials

Prewet liquids and salt, along with other prewet related items, need to be ordered and delivered before the winter season starts. In Michigan direct maintenance facilities as well as counties and

cities that have maintenance contracts with the state can purchase salt and plow blades from the DMB contract. Generally the prices from this contract are cheaper than what would be paid if the counties or cities purchased these items on there own.

3.2-C Training

It is essential to have trained personnel before starting a prewet program. The crews performing prewet should receive training pertaining to: when to apply and when not to apply, proper application rates for different conditions, how to track their results using a TAPER log, and how to operate the new equipment.

Personnel trained in the details of prewetting are essential for an effective program. Prewet techniques and operations are new to many operators and managers. Detailed training shows the value of the new program and thereby banishes old ideas. A prewet program will require more information for making an informed decision and may involve different methods and materials than do conventional methods.

3.3 Prestorm

3.3-A Special Considerations

Deployment of personnel

Use of modern weather forecasting information will provide more time in advance of a storm to plan operations. With better information, maintenance teams can more efficiently determine standby status and inform personnel with more lead time. Timely weather information is essential when making effective crew call out decisions.

Information assembly

Several pieces of information need to be assembled upon first notice of a winter storm. The information includes weather forecasts, color weather radar data, and where available, RWIS data. Special attention should be paid to the areas in your vicinity that may have already been affected by the approaching storm. The information can be used to estimate locally when and where the event will begin, its extent, severity, and impact.

Decision point

After reviewing the information, managers must decide when to initiate a treatment and what type of treatment to apply. They make their decision based on a combination of many factors:

- When precipitation is expected to start
- Form of precipitation
- The probable air and pavement temperatures
- The anticipated trend of the temperatures
- The expected sky conditions
- The wind speed and direction
- The intended timing of the treatment
- Traffic considerations and timing

Wind

Experience has shown crosswind speeds in excess of about 12 to 15 MPH may cause drifting across a pavement and retention of snow if the pavement is wet. The threshold wind speed at which this becomes a problem will vary widely with the road site and other conditions. Highway maintenance personnel should be alert to the conditions that may cause interception of snow and incorporate the information in their operations.

Safety and handling of liquids

Liquids stored in unheated tanks could reach temperatures much less than freezing. Therefore, skin contact with the liquid chemicals at these temperatures can result in "instant" frostbite.

Goggles or face shield protection and rubber gloves with long gauntlets should be worn, consult the product's Material Safety Data Sheet (MSDS) for exact handling instructions. All storage and dispensing tanks should be labeled "Liquid prewetting chemical," as well as using the name of the specific liquid. All loading and off-loading should be performed in a safe manner, as close to ground level as possible. Liquids containing chlorides are especially harsh on leather articles of clothing.

3.4 During Storm

See Charts in Appendix 4.

3.5 After Storm

Careful recording of conditions and the steps taken in response will provide the basis for fine-tuning the program for specific service levels and conditions.

3.5-A Assess effectiveness

To improve both the effectiveness and efficiency of a prewet program, the agency should evaluate the performance of its crews and equipment as well as the chemicals. All levels of the agency should be involved in this assessment. Many times, what a supervisor observes during a storm is not readily seen by an operator, and vice versa. Managers should also track the cost and effectiveness of the prewet program, and, if possible, compare the results to conventional snow and ice control operations.

To develop valid results, cost data of a storm or weather event must include all costs for materials (chemicals and abrasives), labor, and equipment employed in operations. For chemicals, this includes the purchase price, transportation to storage site, storage, truck loading, handling and mixing of solid chemicals, and solution preparation. For abrasives it should include both material costs and any clean-up costs. Other costs should be considered, such as the cost of dispatchers, costs of specialized equipment, and cost of patrols.

Agencies should measure the costs and effectiveness of the prewet and conventional operations separately for specific highway sections or routes. Analysts can then calculate the cost per lane mile for each type of operation, and accurately evaluate their relative success. Most importantly, prewet techniques provide the potential for maintaining roads in the best conditions possible

during winter storms. Systematic prewet practices might or might not reduce overall costs. Cost savings will depend on the current practice: for example, what LOS governs what materials it uses, whether it is more deicing than anti-icing, and the agency's information sources. Examples of success include providing the same level of maintenance effectiveness at less cost, or providing a higher level of maintenance effectiveness at the same cost. To evaluate the costs or success of anti-icing operations, an agency should examine both costs *and* level of maintenance effectiveness

3.6 Post Season

3.6-A Evaluate and improve program for next season

Lessons can be learned from both the successes and failures of snow and ice control operations. Prewetting is no exception. Improvements in operations and equipment can be identified and implemented through post-season assessment of practices and treatments.

Therefore, report anti-icing/ deicing using liquid chemicals for snow and ice control in the daily TAPER log.

The costs and effectiveness of the team section and district's snow and ice control operations can be evaluated based on comparison of the TAPER logs for anti-icing efforts and MDOT's FANCY report for standard snow removal efforts.

Pre-wetting with liquid chemicals is expected to result in improved service to motorists and may translate into a substantial financial savings with regard to materials and time necessary to return the pavement to before-storm conditions.

3.6-B TAPER Logs

- **T** Temperature of pavement
- **A** Application rate
- **P** Product (chemical) applied
- **E** Event (storm) amount and type of precipitation
- **R** Result of snow and ice control activities