

Anti-icing and De-icing

Two distinct ice-control strategies make use of chemicals: **anti-icing** and **de-icing**, yet they differ in fundamental objectives.

Anti-icing operations are conducted to prevent the formation or development of a bond between snow/ice and the pavement. It is a preventive activity.



De-icing operations are used to break up snow and ice that has already bonded with the pavement. De-icing activity are reactive, being implemented after the snow/ice has bonded to the pavement.



Road Checks

There is no substitute for the visual observation of weather and road conditions. Visual observations remain an important tool for making operational decisions, even when we have access and experience with technology like Roadway Weather Information Systems (RWIS). RWIS is a weather data gathering and road monitoring systems technology. Use of this technology provides decision-making information for Maintenance Supervisors. Road check patrols can also aid in the decision making process.

Chemical Application before a Storm

Liquid chemicals or pre-wetted solids can be used as an initial anti-icing treatment. Whichever is used, the timing of the application should be consistent with the underlying objective of preventing the development of bonded snow or ice.

Applications, in advance of a storm, are critical in preventing bonded snow-pack. Early applications, when pavement conditions are no worse than wet, slushy, or slightly snow covered will produce the desired results.

Note: *Residual chemicals from previous operations should not be relied upon as a bonding deterrent for initial anti-icing activities.*

Pre-Treatment

For snowstorms, the initial liquid chemical applications should be made as a “pre-treatment” in advance of a storm or soon after the storm has begun.

A pre-treatment can be very effective as long as the storm doesn’t start out with above freezing temperatures where rain may wash the chemical off of the road.

Ideally, the application of salt brine onto dry pavement can significantly slow the bonding process. But, liquid chemicals can be effectively applied to wet, slightly slushy, or lightly snow covered roadways too.

Late liquid treatments, when there is more than a light covering of snow, can result in excessive dilution of the chemical, risking failure.

Pre-treatment should always be coordinated with plowing when conditions warrant.

Benefits from liquid pre-treatments include: Better traction and improved pavement conditions, early in a storm. However, these benefits are usually short-lived. Therefore, subsequent chemical applications should be made. In essence, pre-treatment applications can be thought of in terms of “buying time” at the early stages of a storm.

Salt brine for pre-treatment and for pre-wetting is to be made using rock salt. Pre-treatment at the rate of 44 gallons of brine, per lane mile can delay the need for additional pre-wetted solids by 30 to 45 minutes at the beginning of a storm, depending on the temperature and/or the ferocity of the storm.

Pre-wetting Solid Chemicals

Pre-wetted salt is the most effective and cost efficient way to combat ice and snow, making liquid applications an integral part of MoDOT’s snow/ice removal operations.

Applying dry material to dry pavement, may result in losing up to 80 percent of the material. Therefore, moisture prevents loss of material and can turn solids into a solution form. MoDOT’s new ground speed spreaders will help reduce these problems allowing solids and liquids to be applied simultaneously.

* Pre-wetted Solid Application

The pre-wetting of a solid, such as salt, will enhance its performance by 30 to 50 percent. Pre-wetting a solid increases its ability to adhere to the road surface and is less likely to balance and scatter when spread, begins the brine process more quickly than waiting for another source of moisture, and saves money by lowering application rates. Studies show that 100 pounds of salt per lane mile, pre-wetted with 20 to 25 gallons per ton of salt brine or calcium chloride is more than adequate for most conditions. A minimum application rate of ten gallons per ton based on storm intensity, road conditions, and temperature and should be increased as needed.

Pre-wetting can be accomplished by three methods.

1. Pre-wetting chemicals can be injected into a stockpile at a specified dosage.
2. Liquid chemicals can be shot directly onto the loaded spreader,
3. Onboard spray system, mounted on the spreader or dump body, can add a liquid to the dry solid at the time of spreading.

Pre-wetting, by way of an onboard spraying system, is the most commonly used and efficient method. This pre-wetting equipment is integral part of MoDOT's anti-icing and de-icing operations.

Generally, the onboard spray tanks are made of molded polyurethane and are provided with a replaceable catch screen and shut-off valves.

Note: *The pre-wetting equipment used by MoDOT is not trouble free. Frequent electric pump failures have been reported along with spray nozzles clogging. It's important to monitor the effectiveness of the equipment, during operations.*

Applications During a Snowfall

As with the initial application, treatment during a snowfall should be consistent with the goal of preventing the bond of snow and ice from occurring.

For some snowfalls, an initial anti-icing treatment may be all that is necessary to cope with a light or moderate duration event. Your supervisor will instruct you on the activities you will perform, based on the weather forecast and pavement conditions.

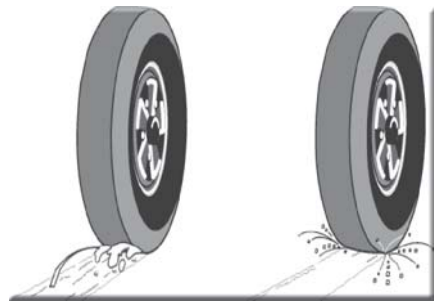
Salt Application Guidelines and Techniques

When applying salt, timing is crucial. Operators must use MoDOT's anti-icing strategy whenever possible.

Pre-treating road surfaces with salt brine is critical. Ideally, pre-wetted salt should be spread as soon as a storm begins to prevent ice and snow from bonding to the road surface. The pavement should have some snow accumulation or at least be wet to keep the salt on the road. The salt will quickly change into a brine solution which keeps the snow or ice in a slushy form, allowing efficient plowing. Applying salt early in a storm allows its melting action to work from the road surface up, preventing precipitation from forming a hard pack.

Apply enough material to do the job, but do not overuse or waste salt. Allow sufficient time for the salt to work. **Do not plow salt off before it has time to work.** Time plowing operations to allow maximum melting of salt. If you were to plow the salt off the pavement before it had time to work, you would just be wasting material and time while increasing snow removal costs.

Know when to plow and when to re-apply salt. Another salt application is needed once you observe snow being kicked out from behind the tires of your truck. If it is slushy and fans out as you drive, the salt is still working. Once the slush begins to stiffen and you start to see it is being thrown directly behind the wheels, it is time to plow and spread more salt.



Road Spray from Tires

Temperature drops can cause this to happen rapidly, especially as nightfalls. (Always be cautious of refreezing as temperatures falls). **Keep an eye on your onboard temperature gauge to stay informed of temperature drops. Drops in temperature don't only occur at night.**

Traffic Factors

Traffic can influence winter operations both positively and negatively.

Vehicles can affect the pavement surface in many ways:

1. Tires compact snow.
2. Tires displace or disperse snow.
3. Heat from tires, the engine, and the exhaust system can add measurable amounts of heat to the pavement's surface.

As described previously, applied chemicals can be blown from the pavement by a passing vehicle

Wind

Wind can cause a number of problems for the operator.

Wind can blow plowed snow back onto the roadway and it can have adverse effects on chemicals applied, blowing them off the road. Wind produces drifts, which can make roads impassible even for snowplows. Drifts can extend snow removal efforts because often, when plowed off the roadway, they may quickly blow back. Sometimes plowing and treating the paved shoulders can help ensure blowing snow collects on the shoulder, instead of the driving surface.



Drifting Snow

If roads are wet, blowing snow may stick to the roads, causing snow pack. Apply salt to high point of the road. The brine will flow down and across the road and provide efficient melting. Whenever possible, allow the salt time to do the maximum amount of work.

When roads are dry with low pavement temperatures and it is blowing snow, it may be best to avoid applying a treatment that will wet the road surface. If you feel that this is the case, consult your shift supervisor for further instructions.

When a decision is made to apply liquid chemicals during windy conditions, adjusting the sprayer bar closer (where applicable) to the pavement can be helpful in achieving the desired results while preventing material waste, or over spray which can harm the nearby vegetation.

Frost Prevention

To prevent frost from occurring, liquid applications should be applied in advance of the expected time the frost or ice will form.

After applying the brine to the dry pavement, the water in the brine will evaporate, leaving heavy concentrations of salt residue on the roadway, serving as an anti-frosting agent.

Studies have shown that salt brine applied to bridge decks can prevent frosting conditions. To be effective at preventing frost, the liquid is applied at a rate of 25 gallons per lane mile at speeds up to 40 mph, depending on traffic and weather conditions, the residual chemical can prevent frosting for about a week on low-volume routes and three to four days on higher volume routes.

Post-Storm Clean Up

Post storm clean up during normal working hours includes continued plowing and treating of second priority routes, bridge flushing and sweeping, equipment cleaning and maintenance, and salt storage housekeeping.

Flaggers and Signing

Appropriate signing and flaggers shall be used during post storm operations when shifting snow, cleaning bridge decks, loading snow, and any other operation that might interfere with normal traffic flow. Appropriate protective vehicles shall also be used if required.

Post Storm Assessment

Lessons can be learned from both the successes and failures of winter maintenance operations. Improvements in operations and equipment can be identified through post-storm assessment.

By assessing snow/ice management activities MoDOT has determined that anti-icing activities can improve our snow/ice management operations while saving money.

Snow removal is not an exact science but by assessing data compiled in the past, we're getting closer. **The weatherman doesn't always get it right, either!** Not every storm is the same, and the methods that worked for one storm may not be appropriate for the next.

It is not unusual for parts of a region to receive different types of precipitation at the same time. Your supervisor will instruct you to use appropriate chemicals for your area's specific conditions.