

Preparing for Winter

All winter maintenance organizations should have a written winter maintenance plan. This plan, if followed, will help protect you legally. It will also help you run a smooth and well-thought-out winter maintenance operation. Each year, in advance of winter, take time to review and update your maintenance procedures. A little planning up-front can help you do an excellent job in keeping the roads safe and decrease the required application of salt throughout the season.

Winter Maintenance Plan

- Develop a winter maintenance plan, and be prepared to follow it.
- Share the plan with all involved staff.
- Define levels of service for all of your snow routes. Your level of service may be based on average daily traffic, environmental concerns, safety, mobility, economics, and other factors.
- Communicate the relevant portions of your winter maintenance plan to your customers so they understand their role and what to expect. See Appendix A for examples of how to reach out to your customers with information on winter maintenance activities.

Route Preparation and Planning

These activities can be done by operators and supervisors, as appropriate, during the fall to lay the groundwork for efficient winter operations.

- Inspect and clear ditches, culverts, and other water channels.
- Remove potential snow traps, such as tall grasses along the road that will catch and deposit snow on the road.
- Assign routes to operators; better performance is achieved when operators have an assigned route throughout the season.
- Drive all routes prior to winter to identify critical or problem areas.
- Understand the target level of service for various areas of a route.
- Inventory all the areas prone to drifting and develop a plan to manage them. Consider installing snow fences.
- Explain the best ways to manage blowing and drifting snow with new operators.

Snow Fences

National research has found that it is 100 times more expensive to plow snow than to trap it with a snow fence.⁶ A snow fence can be permanent or seasonal, living or structural. Using vegetation as a snow fence takes long-term vision, as it can take five to ten years before the plantings are of sufficient size to create the desired effect. The economic benefits of using snow fences in winter maintenance operations include savings from: reduced overtime, less need for contract equipment and services, reduced operating expenses, and reduced sand or chemical usage for ice control. See Appendix D for more resources on snow fencing.

Storage and Handling Systems

Proper storage and handling of deicers is a primary way to reduce groundwater contamination from salt. Stored salt needs to be covered, as do sand piles which contains more than 1% of salt. This applies to all piles greater than 5 tons. The DEQ has produced a document to guide the proper storage and handling of road salt. See Appendix D.

The best method to store granular salt and sand/salt mix is in a covered, water-tight building with doors. Having a salt shed with doors greatly improves protection from the elements. The salt and salt/sand mix needs to be stored on an impervious pad such as asphalt. If your impervious pad is constructed out of concrete it should have a sealer applied to it. The surrounding outdoor pad should be sloped and curbed to direct runoff water into a collection area.

Currently, the outdoor storage requirements in Michigan indicate that liquid storage should be in double-walled tanks or that secondary containment should be around single-wall tanks. Secondary containment should be such that if the tank leaks, all of the contents of the tank can be contained and recovered on site. This applies to all liquid deicers over 1000 gallons under the present Part 5 rules. These requirements may change during the Part 5 stakeholder process, so check the DEQ website for the most current information.

The feasibility of outdoor liquid storage is limited based on the eutectic temperature of the liquid product. The eutectic temperature is the freeze point of a liquid at the optimal concentration. Figure 12 lists the eutectic temperature for some of the common liquids.

Key points for salt storage and handling:

- Ensure salt storage is at least 50 feet from the waters of the state (natural wetlands, ponds, lakes, rivers).
- Provide indoor storage for salt and sand that has an impervious floor.
- Use double-wall tanks or secondary containment for liquid deicers.
- Handle salt shipments and loading operations indoors.
- Sweep pad, for outdoor loading, after receiving shipments and after loading.

Storage requirements under Part 5 rules are under review. Check with MDEQ for the most current requirements.

Snow Disposal Sites

Suitable sites for snow disposal should be established prior to the winter season. The optimal sites are those where the debris can be easily recovered in the spring. Snow should not be plowed directly into ponds, rain gardens, lakes, rivers, or wetlands. DEQ draft guidance recommends that snow storage be at least 75 feet from non-community

water supply, 50 feet from private water supply and 200 feet from community water supply wells. This recommendation may change, so keep informed of all local regulations, policies, and guidelines for Michigan water quality protection. See Appendix F for a reference to this draft document.

Calibration

Before the beginning of each snow fighting season, salt trucks must be calibrated to measure the amount of material applied at various settings. The salt discharge should fall within your agency's guidelines. If the automatic controller is not applying the material at the correct application rate per your agency's guidelines, it must be adjusted. The calibration should be rechecked if there are any mechanical adjustments or changes throughout the remainder of the winter season.

By calibrating your equipment, you can be sure your application rates will be accurate and you will know how much product is actually being applied to the roadway. This alone can result in salt cost savings, by avoiding unintentional over-salting. Calibration should be done for all equipment that dispenses liquid or granular material. All granular materials (salt, prewet salt, sand, etc.) flow differently, so calibrate for each material.

With manual-controlled systems, the operator must have a copy of the calibration worksheet in the cab of the truck. This allows the driver to cross-reference the desired material application rate with the speed of travel, and then choose the setting that gives the desired result. A calibration worksheet example is in Appendix C along with other calibration resources.

Key points for calibration

- Calibrate all new equipment prior to use.
- Calibrate all equipment at least once a year or if the truck has had any major service.
- Calibrate for each type or blend of granular material.
- Calibrate liquid application systems, both anti-icing and prewet systems.
- Follow the manufacturer's guidelines for calibration, and contact the manufacturer for training if necessary.
- Put the auger plate in place during calibration for dump trucks. Calibration won't be accurate if the material is gravity-flowing during the calibration process.
- Place a calibration worksheet in each truck and a copy in the shop for those with manual-control spreaders.



Calibration
saves you
salt and
money.

Investment in Equipment

Investing in equipment that can make your organization's winter maintenance more efficient is money that is repaid quickly. Investment in controllers, liquids and blades are areas that that often give a good return on investment. Top performing organizations integrate new practices and equipment to increase their efficiency. The



Clear Roads online cost benefit analysis toolkit can help provide insight into new practices, equipment and operations. See Appendix D for this resource.

Plow early and often to reduce hard pack.

- Mechanical Removal

Mechanical removal (blading or plowing) is the most effective strategy to remove snow, from a cost and efficiency standpoint. The Clear Roads Pooled Funds Study has an evaluation of plow prototypes. You can find this in Appendix D, under blades and plows.

- One trend in the industry is towards segmented blades. These offer more flexibility for blading on uneven surfaces, less vibration for the operator, and will wear more evenly and scrape better. Clear Roads has produced some research on cutting edges. This is in Appendix D, under blades and plows.
- Underbody blades are very common in Michigan; they allow more down pressure and are helpful at removing compaction. The more snow you remove mechanically, the less salt you will need to keep roads safe.
- The use of wing-plows for winter operations in Michigan has increased over the past few years. Using wing-plows can make a winter operations program more effective by providing a more effective means of mechanical removal. With a wing-plow, operators can clear an entire lane plus a few feet of the shoulder in one pass, a job that usually takes two passes or two trucks working together.
- In Michigan and other snow-belt states, the tow plow has been tested and proven to be an effective method of snow removal.
- Brooms can be very efficient at removing light snow. These are common tools at airports and for sidewalks.



Electronic closed loop controls are easier to operate and are a potential money saver!

- Controllers

The ability to control the application rate of deicers is vital. By improving the accuracy of your controllers, you will be able to achieve a more efficient operation automatic controllers and manual controllers. All agencies should work toward replacing manual controllers with electronic closed-loop controllers.

Automatic controllers self-adjust the flow of salt to match the target application rate regardless of the truck speed. When the snowplow speeds up or slows down, the controller automatically speeds up or slows down the salt delivery rate so that desired application rate is maintained.

Manual controllers are not as accurate as automatic controllers. Manual controllers do not self-adjust to meet a target application rate. Application rates are difficult to hold constant with manual controllers because the speed of the truck is often changing. Although accuracy is low, calibration is essential so your organization can attempt to follow application guidelines. Without calibration, you cannot attempt to deliver a specific amount of salt per lane mile.

With manually-controlled systems the operator must have a calibration worksheet in the truck. An example of a calibration worksheet is located in Appendix C along with other calibration resources.

The calibration of the controllers should be completed annually, at a minimum. Calibration should also be completed anytime major truck repairs are done, or if the operator notices that it is not working properly. It is also important to remember that the gate opening must be set and marked during calibration.

Weather Data

Basic, up-to-date weather information is critical for winter maintenance planning and effective response during an event. The means to acquire this information should be in place prior to the start of winter. Information that should be gathered before an event, and tracked throughout, includes:

- Start of precipitation and expected event length
- Type of precipitation expected
- Total precipitation expected/event intensity
- Wind conditions (speed, gusts, directions)
- Temperature trend (rising or falling during the event)
- Pavement temperature trend (rising or falling during the event)
- Dew point



Pavement
Temperatures
should guide
your
application
rates.

Weather information can and should come from a variety of sources, and there are many from which to choose. Many services provide weather forecasts, condition trends but fewer provide pavement temperatures.

The dew point describes the temperature below which water will condense into liquid water at the same rate at which it evaporates. Condensed water is called dew. The dew point is the critical ingredient in predicting the formation of frost on roads. When the pavement temperature falls below the dew point, if that pavement temperature is equal or below freezing, then frost will form. By monitoring the dew point and other weather factors, you can predict frost and be out in front of it. Wind speed and absolute humidity are the other variables which play a role in how quickly the frost forms and how thick the layer will be.

Dew point can be obtained from commercial weather services or the Michigan RWIS system. MDOT's RWIS system started in 2010, and now includes more than 50 stations around the state. The system is made up of a network of sensors, to measure air and road surface temperatures, barometric pressure, wind, salt concentrations on the road surface, frost depth and dew point. You can access MDOT's RWIS system by visiting <http://mdotnetpublic.state.mi.us/drive/>. Figure 4 is a sample of the information you can get from their RWIS stations.

Pavement Temperatures

Keep in mind that most weather services measure temperature and other conditions in the air, above the ground, which means that the reported conditions can differ substantially from pavement temperatures. It is extremely important to use the pavement temperature, not air temperature, to determine what material(s) to use and the appropriate application rate of your chemicals.



Air Temperature: 61°F
Maximum Daily Temperature: 76°F
Minimum Daily Temperature: 42°F
Relative Humidity: 70.7%
Average Wind Speed: ENE 5 MPH
Maximum Gust Speed: ENE 11 MPH
Barometric Pressure: 29.27"
Precipitation: No Precipitation
Precipitation over the last 24 hours: 0"
Dew Point: 52°F
Visibility: 10 miles

Figure 4: RWIS example (I-75 @ South of M-48 overpass)

Pavement temperature can be measured several different ways. One way is by hand-held temperature sensor guns that can be purchased at any automotive store for under \$100. Truck-mounted systems are another alternative. Truck-mounted systems are better than hand-held sensors in that they display in the cab a continuous reading of the air and pavement temperatures. Truck-mounted systems may be incorporated into your spreader controller or can be purchased independently of your controller.

There are many influences on pavement temperature. For example, you will notice changes in pavement temperature first on bridge decks and ramps; pavement temperatures will also be lower in shady areas. The pavement's color and texture, and the type of material in the layer underneath the pavement, all influence its temperature as well. You cannot substitute air temperature for pavement temperature; you must know the pavement temperature before making a decision on application rates. **All of your application rate charts should be based on current and trending pavement temperature.**

Automatic Vehicle Location (AVL) and Maintenance Decision Support Systems (MDSS)

Many organizations are now using computer technology in the form of AVL systems and/or MDSS to further improve the efficiency of their winter maintenance responses.