

## **REDUCING SALT IN WINTER MAINTENANCE**

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In 1996 at the 66th Annual Michigan Turfgrass Conference, I had the opportunity to present "Economic Impacts of Chemical Deicers". At that time, efforts were underway at the University of Michigan to develop a program to reduce salt used in winter maintenance. That effort was based on the realization that existing salting practices were causing excessive damage to infrastructure and the environment and that change was possible. In the last 7 years significant progress has been made toward those initial project goals and many other agencies across the State of Michigan are rapidly advancing new salt reduction strategies.

Today, those entities responsible for snow and ice control still face a double-edged sword. Too little salt and liability issues may arise; too much salt and customers are angry because of infrastructure and environmental damage. Newly emerging "best practices" in snow removal and ice prevention are the means to finding that balance, while also reducing overall operational costs. For the sake of this discussion salt will be assumed to be rock salt, sodium chloride.

It is true that old habits are hard to break. Salt's low purchase price and general effectiveness (still the best weapon in the arsenal), has led to its misuse and over applications. Look at any new exterior structure after a few winters and the signs of premature depreciation are very evident. Accelerated depreciation of infrastructure is adding to the burgeoning future price tag of replacement. (Deferred maintenance) The signs are also too evident that misuse of salt is damaging the environment; vegetation, soils, trees, and aquatic resources. There is an old expression, "If you always do what you've always done. You'll always get what you've always got". Our current snow removal practices are getting the job done but at too high a cost and change is needed.

What are these new innovations?

### **Anti-Icing**

The practice of anti-icing is being effectively employed in a number of snow removal programs across Michigan. Anti-icing is a pro-active strategy where a liquid deicing chemical is applied to pavement ahead of anticipated precipitation. Anti-icing provides benefits in four ways. First and most importantly, anti-icing helps you buy time in the early stages of a snowstorm. This is a critical point as getting crews out fighting the storm takes time and customers remain safe before crews are on site. Second, is aiding the prevention of snow and ice from bonding to paved surfaces. Much greater chemical usage is required to break the bonds of snow and ice (reactive) rather than preventing them (pro-active). Third, liquids can provide residual effectiveness that can prevent frosts and possibly some light black ice formation. And finally, liquid anti-icing

applications can reduce total material and labor costs for battling a specific storm, start to finish.

### Pre-wetting

An additional practice that is demonstrating positive results is pre-wetting of salt. Since brine is what actually melts snow and ice, solid rock salt must first create brine before it goes to work. In the absence of heat, sunlight, friction, or in low available moisture levels, solid salt is slower to go to brine and then to work. Road salt (sodium chloride) has an effective temperature range above 20-25 degrees Fahrenheit. When temperatures drop to around 10 degrees F. or below, road salt has significantly reduced melting capacity. The addition of a liquid chemical to salt enhances its ability to provide safe levels of service by increasing the speed at which salt creates brine to melt snow or ice. Greater chloride efficiency is achieved when liquid chemicals are added to salt by lowering the "effective" temperature range of the salt, and reducing bounce and scatter which wastes money and damages non-targeted areas.

There are many methods in place to pre-wet salt. Some agencies have sprayed liquid chemicals over loads in the spreaders creating a "hot load". This method does not uniformly coat all the salt in the spreader and often runs out the back. Some liquid chemicals can "fuse" the salt in the spreader if not emptied, thereby adding to maintenance headaches and clumps in the salt. Some folks apply a given amount to each loader bucket prior to loading in the spreader. This method is somewhat more effective than direct over the top applications. Salt is now available and delivered pre-treated. Generally, somewhere between 4 to 10 gallons of the liquid chemical is applied per ton. The addition of refined agricultural products to those liquids increases the adherence to salt in the stockpile and also increases its flow ability while preventing clumping. Some agencies are now specifying salt without anti-caking agents if it is pre-treated. Salt can also be treated on site with a pug mill. This method has been proving to be less expensive when larger quantities are to be treated. New conveyor equipment is now being marketed that can treat salt with a specified amount of liquid while also stacking in salt storage facilities. There appears to be quick "pay back" potential for this new equipment.

### Direct liquid applications

Liquid chemicals are being applied directly over small amounts of snow when conditions warrant. Keep in mind that most liquid chemical blends have anywhere from two to three pounds of actual salt dissolved in them. A general rate of application for a 1/2 to 1 inch snow might be anywhere from 40 to 100 gallons per lane mile depending on which chemical is chosen. What is nice about this practice is the absence of excess salt residues after the snow has melted. This practice can result in reduced tracking into buildings, less turf and plant material damage, and less clouds of salt dust. It is also important to note that all liquid chemicals have differing freeze curves and some may have a greater potential to re-freeze. Liquid chemicals are also being applied post broom or plow to "burn off" any remaining snow. This practice minimizes the amount of chemical needed

and often results in the "anti-icing" application for the next storm. Liquids can also play a significant role in the prevention of ice formation that results from melt and re-freezes. All chemicals act as freeze point depressants and have differing freeze points that correlate with dilution with water. Depending on the quantity of moisture on the pavement and ground temperature, a liquid chemical can be applied to wet pavement and prevent ice from forming. Melt and refreeze problems often result in slip and fall situations as re-freeze generally occurs at night when pavement temperature drop below freezing. One "slip and fall" can pay for a whole lot of prevention.

## Inventory and Analysis

The first steps involve decisions as to which new tools (anti-icing, deicing, pre-wetting, and stockpile treatment) can be easily adapted to an existing program. These decisions are based on a thorough inventory of equipment, facilities, and personnel and assessment of customer needs. Perhaps there are problem prone areas in parking lots or parking structures, shaded walks, plazas built with sensitive materials, steps and handicapped ramps, or a bridge that always seems to freeze up. Or perhaps there are areas where turf and plant materials are being excessively damaged and the customer is demanding change. Improving the levels of service and increasing profits always seems to be a good rationale.

Most entities responsible for landscape and grounds management already have many of the tools required for these new practices. Chemical sprayers, water tanks, dust control equipment, hydro-seeders, flusher trucks, fuel and milk tankers, backpack sprayers, and many other devices have been successfully retrofit for liquids applications. Just like with any chemical sprayer or fertilizer spreader, both liquid and solid equipment used for winter maintenance must first be properly calibrated. Proper calibration and application technique is likely the greatest first step towards reduced salt use and greater efficiency. When evaluating an existing program or process against a new one, proper equipment calibration is essential to ensure that accuracy in the outcome is attained.

As everyone knows, timing is everything when it comes to snow removal. Knowing how to sort through the weather forecasts and successfully navigate internet weather resources improves decision making processes in allocating human resources, equipment, and materials in a pro-active mode. If you can get out before a storm hits or before melt water re-freezes, the potential to reduce both chemical and labor inputs is greater. For instance, suppose the forecast is calling for a 70 % probability of 2 inches of snow to hit around mid morning and the temperature is expected to be in the low 20's. An anti-icing application of 20-30 gallons per lane mile (LM) or (50-100 oz/1000 sq.ft) prior to rush hour might get your customers safely through rush hour and minimize operations after snow fall. A number of agencies are spraying 30-40 gallons/LM after plowing or brooming to burn off any snow that might remain or to prevent any melt water from re-freezing. The beauty of this approach is that, in the absence of a later rain, those paved surfaces have already been anti-iced for the next storm.

Melt and refreeze is also a major liability issue. During those winter days when the temps get above freezing the temperature of the pavement (perhaps as little as a 1/4 in deep) may have temperature readings near 40 and obviously, snow or ice on or near the pavement melts forming water. Once a deep frost has set in there is generally around 3 foot of ice under paved surfaces and as soon as the sun goes down the little heat that has been absorbed in the pavement quickly radiates out and naturally refreeze occurs. If a chemical freeze point depressant liquid can be sprayed over those wet areas prior to freezing, ice formation can be largely prevented by lowering the freeze point of that water to a temperature lower than the pavement. Liquids are easier to spot apply and tend to stay where they are put. Once again, less chemical is required to prevent a bond than to break one, but more importantly is reduced exposure for slip and fall accidents.

### Parking Lot Challenges

Who would argue that parking lots are a greater challenge than a mile of interstate? Well that depends of course, but generally parking lot snow removal and ice prevention presents difficult challenges. It seems as though Mother Nature often seeks revenge by making snow during the night or rush hours. Most contracts call for parking lots to be cleared of snow or ice prior to business' opening. In parking lots, time is the enemy when it comes to customer safety and satisfaction. Since it is well known that salt works better when the sun is out, what do you do in the middle of the night? After plowing the parking lot, direct application of liquids (typically sprayed at 30-40 gallons/LM in 4-6" bands from streamer nozzles) or the use of salt pre-treated with a liquid can increase the effectiveness of salt by initiating the melting process. Some folks are pre-treating their salt in the stockpile by applying 6 to 8 gallons of Caliber M1000 per ton of salt. Stockpile treatment can be easily accomplished by a number of means. Stockpile treated salt will not clump like untreated salt. Additionally, no added equipment needs to be installed on the spreaders to apply the liquids at the spinners. Many folks are however, successfully using pre-treating on-board sprayers and there are a number of companies that have them available. Either way, a pre-treated salt will work at a much lower effective temperature range than straight salt and that can be the difference between a satisfied or unhappy customer.

### From here to tomorrow

As the demands of increasing expectations, reduced operating costs, improved stewardship of customer's investment in facilities, and sensitivity to environmental concerns press forward, so must we embrace change. Snow removal is six months of annual seasonal operations for most agencies and emphasis on planning, training and implementation should be given equal importance to summer activities. All those already underway will attest, "you have to crawl before you walk and walk before you run". Budgets are indeed tight and snow removal contracts will always be competitive, but with surprisingly minimal investment and ingenuity, many folks are successfully retrofitting existing equipment to get evaluations and programs off and running. Today, in response to expanding demand, many companies now offer inexpensive equipment that has

already been "debugged" and is now very reliable. This equipment, unlike conventional salt spreaders, has year round function, hence providing a better return on investment. Likewise, liquid chemicals have gone through their own evolution and have also become less costly and are effective, reliable, and easy to use.

Through shared knowledge and experience the journey can be made easier for those getting started. Since I began work on this subject at the University of Michigan back in 1995, information transfer within the State of Michigan has been weak. All too often we were forced to seek information from neighboring states and out West where most of the advances were taking place. If in-state agencies are discovering successful alternative strategies and those technologies can be implemented by public and private contractors responsible for the maintenance of parking lots and structures, walks, steps, and plazas, then sharing the success is the obvious solution. To correct this apparent shortcoming it is my hope that additional programs, modeled after the Michigan Turfgrass Conference, can be created to develop better mechanisms to share advancing technologies and techniques. In my opinion, poor winter maintenance techniques have been ruining our state for too long and it is time to advance greater professionalism in this vital service that we provide. Once again, I am grateful to the Michigan Turfgrass Foundation for the opportunity to present here today.

Good luck this winter-Let it snow! Let it snow! Let it snow!

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