

HOW TO ACHIEVE THE BEST ICE AND SNOW CONTROL WITH THE LEAST COST TO YOUR BUDGET AND THE ENVIRONMENT

By utilizing proven concepts to achieve and maintain safe road surfaces at the least cost to budgets and the environment, ice and snow control can be an opportunity for street and highway departments to shine.

○ The common materials for ice and snow treatment are as follows:

➤ Salt (NaCl)

- Because of its inherently lower cost per pound of product, ready availability, and ease of handling and storage, salt is the predominant chemical used for ice and snow treatment.

➤ Calcium Chloride (CaCl₂)

- As early as 1950, flake and pellet forms of CaCl₂ were added to allow the NaCl to work faster at lower temperatures.
- In 1968, the largest producer of flake CaCl₂ faced a breakdown in its production process. This shortage of flake CaCl₂ forced some agencies to experiment with 32% Liquidow™ which was available from the DOW terminal in Chicago. The ease of applying the liquid versus the bags of dry CaCl₂ started the trend to “prewet” salt.

➤ Salt brine and blends with CaCl₂

- Salt brine is a 23.3% solution of NaCl and H₂O. It is applied to the road surface in anticipation of an ice and snow event to resist the bonding of the precipitation to the roadway. It is also used as DLA(direct liquid application during an ice and snow event).

➤ Abrasives and mixes with salt and CaCl₂

- Abrasives are used on unpaved roads and in a mixture with NaCl and/or CaCl₂ to provide traction on surface of hardened or compacted ice and snow when salt alone does not work quickly enough.

○ Anti-icing versus Deicing

➤ Anti-icing

- Definition

- ❖ Anti-icing refers to all the preparation methods used to prevent moisture from bonding to roadways during an ice and snow event. The most common choice for anti-icing is salt brine. The 23.3% solution is applied at approximately 50 gallons per lane mile thru “pencil nozzles”, and it is expected that the H₂O portion of the brine will evaporate leaving a line of NaCl₂ on the pavement.

- Problems following application of salt brine

- ❖ If the ambient and pavement temperature are at or below approximately 22°F, the H₂O fraction of the solution may freeze instead of evaporating.
- ❖ If the H₂O does evaporate, the resulting NaCl₂ on the roadway must re-liquify under the ice and snow in order to spread on the road surface and be effective. Tests show it can take up to one hour for salt to liquify and form a brine. This explains why sometimes a brine application does not perform as expected.

- Help from Liquidow™

- ❖ Many agencies now blend Liquidow™ with their salt brine to alleviate this problem. As little as 5% by volume of salt brine and 32% Liquidow™ allow users to spread their blended brine at temperatures as low as 10°F without freezing. The blended brine speeds up the salt re-liquifying for better performance.
- ❖ Blending Liquidow™ with salt brine raises the cost of each gallon of the blend; however, it easily pays for itself. If \$100.00 per ton salt plus \$1.00 per gallon 32% Liquidow™ are blended at 5%, the 23.3% brine \$0.141 plus equipment, labor and utilities brings the cost of the brine up to \$0.22 per gallon. \$1.00 per gallon for 32% Liquidow™ added at 5% of brine equals \$0.05 to the \$0.22 equals \$0.27 per gallon of the blend.
- ❖ Blended brine can be applied at lower rates and 28% reduction was used by Iowa DOT starting in about 1990. Therefore, \$0.22 per gallon times 50 gallons per lane mile equals \$11.00 brine cost per mile. Blended brine at 36 gallons per lane mile equals \$9.72 per lane mile. The largest cost of the brining process is the spreader, labor, and equipment which can now cover 28% more lane miles per load.

- ❖ Users of blended brine adjust their rate of application to consider the following conditions: time before the storm, air and pavement temperature, the severity of the storm, type of precipitation at the start of the storm, texture of the road surface, manpower and equipment to cycle routes during the storm, and time of day and the day of the week. As an example, Naperville, Illinois uses only 25 gallons per lane mile.

- Summary

- ❖ The addition of the CaCl_2 and reduced rate of application means more dependable results at no extra cost.

➤ Deicing

- Definition

- ❖ Deicing refers to the process of spreading salt on the ice and snow after accumulation has already started.

- Problems following application of plain salt

- ❖ Plain salt is slow to dissolve and become effective. Tests show approximately one hour is required at 25°F for a salt crystal to dissolve and bore thru ¼" of ice to begin delaminating the bonded ice.

- Help from Liquidow™

- ❖ In the 1970s, a test by Midwest Research showed the addition of 2% CaCl_2 by dry weight would allow salt to bore thru the ¼" plate of ice in one hour at 0°F. 2% by dry weight is equal to 12 gallons of 32%, 8 gallons of 42% or 9 gallons of 38% liquid CaCl_2 per ton of salt. These dosage rates vary by results desired, method of dosing, time and temperature, etc.
- ❖ To combine Liquidow™ with the salt, truck mounted tanks can dispense the Liquidow™ onto the spinner with 32%, or the 38% and 42% solutions can be mixed into the stockpile prior to loading to spread.
- ❖ The 32% Liquidow™ has a crystallization temperature of -17°F and is the strongest concentration that can be safely stored outdoors in non-insulated tanks. If sub -17°F temperatures are common, 29.6% Liquidow™ is the low eutectic for CaCl_2 solution at -60°F. Weaker than 29.6% starts raising the freezing temperature of the entire solution as it further diluted down toward 0% or plain H_2O and a 32°F freeze point.

- ❖ The 42% Liquidow™ has a crystallization temperature of 69°F. This means when the 42% is mixed with the cold salt in winter, the 42%, delivered at approximately 90°F and above, cools down and coats the salt particles as the 42% hits 69°F. This happens with the 38% at 48°F. Once crystallization occurs around the salt particles, the CaCl_2 does not recrystallize if left under the roof thru the summer. If salt brine is made from stockpile wetted salt, the brine will already be blended.
 - ❖ If the 2% by weight performance is not needed, 1% will be sufficient for warmer conditions and if slower action is desired. Currently, the salt suppliers sell a treated salt that has 1% of MgCl_2 per ton. The salt companies use MgCl_2 because they “own” the source at the Great Salt Lake in Utah.
 - ❖ As opposed to the 5% blends for anti-icing, DLA blends are usually in 10% and 15% range. Refreezing of the melt water on the road is caused by the dilution of the melt water as the temperatures drop during and after the storm. The higher the amount of CaCl_2 in the blend, the longer the delay can be to refreeze as the CaCl_2 portion dilutes down its freeze curve to 29.6% and -60°F before further dilution can take it up to 0% CaCl_2 which equals water at 32°F. It is during the further dilution that refreezing or black ice can occur if this diluted melt water is left on the pavement.
 - ❖ VDOT and KDOT both experimented with DLA as a deicer in January of 2014. Two weeks before the experiments, a severe storm passed through the area and subsequent temperatures were below 0°F every night. While priority routes were serviced, secondary roads were not. An untreated secondary road was chosen to apply 15% blended brine at 50 gallons per lane mile using pencil nozzles at 11:00 AM on a snow packed hard surface road with road surface temperature at 10°F and air temperatures have risen up to 12°F. 40 minutes later the pavement was visible, 55 minutes later clear pavement showed through, and 2 hours and 45 minutes later all accumulation had drained off the surface. This experiment shows if DLA can deice in this situation, if applied during the storm when the precipitation is not yet solid, success is assured.
 - ❖ Two benefits are that already being liquid, the blended brine works faster and at 50 gallons per lane mile which is 120 pounds of salt plus 7.5 gallons of 32% Liquidow™ is two to three times less salt per land mile than spreading sold salt at 250 to 400 pounds per lane mile. Another example of the benefits of blended brine and **direct liquid application**, DLA, is a KDOT study that showed of all 12 highway districts the one which used the most Liquidow™ in blended brine for anti-icing and DLA had the most total lane miles to treat in the state but used the least tons of salt.
- Summary
 - ❖ Deicing with CaCl_2 improves performance and lowers cost.

Please contact Sicalco with your questions regarding the cost and benefits of your specific location.