



## Snow and Ice Control Treatments – Brine plus Salt

Winter weather events present roadway agencies responsible for Snow & Ice removal with options on treatment materials to improve roadway safety. Due to budgetary or equipment-related limitations, some smaller local agencies might not be able to take full advantage of available treatment materials/options (see page 5). In this Route of Navigation (RON) technical update, we address the scenario where brine might be the main material being used at the local agency for treating a roadway.

### Material Types:

#### **Brine**

Brine is made by mixing salt in water to approximately a 23% solution by weight (23% salt / 77% water). Brine is commonly used in anti-icing operations and for pre-wetting solid rock salt. Recently it has been used for deicing snow and ice.

The proportion of salt to water is critical to the effectiveness of the brine. Too much or too little salt affects the freezing point depressing qualities of the brine. The proper brine mixture is 23.3% at which the freezing point is  $-6^{\circ}\text{F}$  **Caution:** If the solution of brine dilutes below its effective concentration, you will not achieve any reduction of ice bonding to the pavement.

Brine is widely used because it is:

- Readily available (easy to produce)
- Very economical
- Effective for events occurring at moderate subfreezing temperatures

Green brine is recommended to be used as much as possible. It is the salty water runoff from washing snow plow trucks after each snow storm which is collected in an onsite storm water retention pond that also collects storm water from the salt barn(s), loading area, and remaining site area. This water is beneficially reused by transferring it to a tank specially designed to mix brine.

EPA regulations must be met when using this green brine. This usually means running the wastewater through an oil-water separator, collection and storage, and filtration of heavy metals. Contact your local Ohio EPA office when considering this alternative.

#### **Salt**

Salt is sodium chloride, NaCl, a white crystalline substance with its characteristic taste found in natural beds, in seawater, etc. The mineral form is *halite*, also called “rock salt”. Salt used for winter maintenance operations is sometimes referred to as “road salt”.

Salt was first used to treat snow and ice covered roads in the mid-1940s, but its use wasn't fully embraced until the fifties. Use increased as more agencies became aware of the higher level of service salt could provide in addition to plowing and as the North American road system expanded.



### **Treating Asphalt, Brick, and Concrete Surfaces:**

If conditions and timing allow, operators should apply anti-icing materials to the road prior to a snow fall.

**Anti-icing** is the application of a deicing material to the roadway prior to a snowfall event to prevent the bond from occurring between the snow and the roadway. In this case brine would be the anti-icing material to be used. Anti-icing practices can also be used to prevent the formation of black ice on roadways. It is usually not cost-effective to apply brine alone at pavement temperatures below 15 degrees Fahrenheit.

**Deicing** is the application of a deicing material to the roadway after a snowfall event has occurred and the snow has bonded to the roadway. Always plow before applying treatment material to a snow covered roadway. Plowing is the most cost effective means of removing snow and ice from the roadway. Reversing the order will result in plowing deicing material off the roadway. It is usually not cost-effective to apply brine alone at pavement temperatures below 15 degrees Fahrenheit.

Note that the Ohio Department of Transportation may sell brine to local government agencies at local sites where brine is produced. Contact your local ODOT facility for more details.

Use a liquid application unit in streams, at controlled amounts, in an application that leaves the surface merely damp and good judgment in selecting application rates and truck speeds. Apply just enough material to prevent or loosen the bond between the road and the snow or ice so it can be plowed off.

These guidelines are a starting point. Reduce or increase rates incrementally based on your experience according to your local conditions.

**Direct Liquid Application (DLA)** is the act of directly applying liquid treatment material – typically either regular salt brine, or a brine enhanced with additive(s) – to the roadway surface during or after a storm event. DLA is sometimes supplemented with granular application. *DLA treatment must be reapplied every two hours during a snowfall to prevent black ice from forming.* Every winter storm is different. For some storm event types, DLA has proven to be the most effective. DLA can help us:

- Optimize material usage producing cost savings.
- Minimize necessary post-storm cleanup, allowing us to “get done earlier” producing time savings and often better (and quicker) post-storm level of service which reduces accidents.
- Because it is the most effective application in some storm conditions, it helps us maintain a more continuous target level of service for a wider variety of conditions.
- “Instantaneous” effect (no solid to liquid phase change) producing results.

Under favorable conditions, DLA has been found to require 50% less salt. Areas using DLA often find that they generally are “done earlier” after the storm.

DLA has been used by some agencies as a proactive approach when working with environmental organizations. Some regulations require street and shoulder sweeping to remove all salt after storm events. DLA can satisfy this requirement by not leaving salt granules on the street or shoulder after a storm.



DLA is a relatively recent concept as a possible treatment option for winter maintenance. One important consideration is **pavement temperature**. It should be noted that most of the published case studies regarding use of DLA have been based on *pavement temperatures above 20° F*. Caution should be used when considering DLA for lower pavement temperatures, as liquid brines become less effective and more susceptible to freezing or black ice formation during colder conditions – particularly if the brine solution becomes diluted. A future RON update will discuss salt brines enhanced with additives to help improve performance at lower temperatures.

**When to use DLA?**



Parameter	Most Favorable For DLA	Consider DLA
Pavement Temperature	25°F or above	20°F or above
Storm Intensity (inches/hour)	0.5 inches/hour or below	1.0 inches/hour or below
Moisture Content	Ordinary	Dryer Snowfall (consider plow-only)

Source: ClearRoads DLA Presentation – 2010.

**Application Rates:**

The following brine application rates are for typical 24’ two-lane roads, during the specified pavement temperatures, with the listed precipitation.

**IMPORTANT** – All roadways must be reapplied every **two hours** during a snowfall to prevent black ice from forming. This is critical – do not treat more miles than you can cover in **two hours** during a storm including reloading time.

<b>Dry Pavement, Light Snow Less Than 0.5”/Hour</b>					
Above 32° F	30° F to 32° F	27° F to 30° F	24° F to 27° F	21° F to 24° F	Below 21° F
Bridges and Icy Spots	Acceptable	Recommended	Recommended	Recommended	
Plow and treat @ 35 gallons/mile	Plow and treat @ 35 gallons/mile	Plow and treat @ 40 gallons/mile	Plow and treat @ 45 gallons/mile	Plow and monitor conditions	Plow and monitor conditions
<b>Wet Pavement, Light Snow Less Than 0.5”/Hour</b>					
Above 32° F	30° F to 32° F	27° F to 30° F	24° F to 27° F	21° F to 24° F	Below 21° F
Bridges and Icy Spots	Acceptable	Recommended	Recommended	Recommended	
Plow and treat @ 35 gallons/mile	Plow and treat @ 35 gallons/mile	Plow and treat @ 40 gallons/mile	Plow and treat @ 45 gallons/mile	Plow and treat @ 50 gallons/mile	Plow and treat @ 60+ gallons/mile**
<b>Dry Pavement, Medium Snow 0.5” to 1”/Hour</b>					
Above 32° F	30° F to 32° F	27° F to 30° F	24° F to 27° F	21° F to 24° F	Below 21° F
Bridges and Icy Spots	Acceptable	Recommended	Recommended	Recommended	
Plow and treat @ 40 gallons/mile	Plow and treat @ 40 gallons/mile	Plow and treat @ 50 gallons/mile	Plow and treat @ 60 gallons/mile	Plow and monitor conditions	Plow and monitor conditions



Wet Pavement, Medium Snow 0.5" to 1"/Hour					
Above 32° F	30° F to 32° F	27° F to 30° F	24° F to 27° F	21° F to 24° F	Below 21° F
Bridges and Icy Spots	Acceptable	Recommended	Recommended	Recommended	
Plow and treat @ 40 gallons/mile	Plow and treat @ 40 gallons/mile	Plow and treat @ 50 gallons/mile	Plow and treat @ 60 gallons/mile	Plow and treat @ 70 gallons/mile	Plow and treat @ 90+ gallons/mile**
Dry Pavement, Heavy Snow More Than 2"/Hour					
Above 32° F (Rising)	Above 32° F (Falling)	25° F to 32° F	20° F to 25° F	15° F to 20° F	Below 15° F
Bridges and Icy Spots	Acceptable	Recommended	Recommended	Recommended	
Plow and treat @ 50 gallons/mile	Plow and treat @ 50 gallons/mile	Plow and treat @ 70 gallons/mile	Plow and treat @ 90 gallons/mile	Plow and monitor conditions	Plow and monitor conditions
Wet Pavement, Heavy Snow More Than 2"/Hour					
Above 32° F (Rising)	Above 32° F (Falling)	25° F to 32° F	20° F to 25° F	15° F to 20° F	Below 15° F
Bridges and Icy Spots	Acceptable	Recommended	Recommended	Consider enhanced brine***	DLA with non-enhanced brine is not recommended for low pavement temperatures.***
Plow and treat @ 50 gallons/mile	Plow and treat @ 50 gallons/mile	Plow and treat @ 70 gallons/mile	Plow and treat @ 90 gallons/mile	Plow and treat @ 110 gallons/mile**	

\*\* Note: these tables are based on pavement temperature. If the *air temperature* is below 21° F, increase by 10 gallons/lane mile for each 10° F. If the *air temperature* is below 10° F, reapply liquid or apply 50 to 100 pounds of salt per lane mile with the liquid to maintain surface from refreezing.

\*\*\* Low pavement temperatures may require enhanced brine with additives; see future RON update.

Freezing Rain					
Above 32° F	30° F to 32° F	27° F to 30° F	24° F to 27° F	21° F to 24° F	Below 21° F
Bridges and Icy Spots	Recommended	Recommended	Recommended	Recommended	Recommended
Plow and treat @ 40 gallons/mile	Plow if needed and treat @ 60 gallons/mile	Plow if needed and treat @ 70 gallons/mile	Plow if needed and treat @ 80 gallons max/mile	Plow if needed and treat @ 110 gallons/mile**	Plow if needed and treat @ 150+ gallons/mile**
Black Ice					
Above 32° F	30° F to 32° F	27° F to 30° F	24° F to 27° F	21° F to 24° F	Below 21° F
Bridges and Icy Spots	Recommended	Recommended	Recommended	Recommended	Recommended
Apply anti-icing material prior to the formation of black ice^	Apply anti-icing material prior to the formation of black ice^	Apply anti-icing material prior to the formation of black ice^	Apply anti-icing material prior to the formation of black ice^	Apply anti-icing material prior to the formation of black ice^	Apply anti-icing material prior to the formation of black ice++

^ - Apply anti-icing brine @ 20 to 40 gallons/lane mile

++ - Do not apply liquid anti-icing material when the pavement temperature is below 20° F.



**Additional Treatment Materials:**

For information about additional treatment materials commonly used for winter roadway maintenance, please refer to the separate RON technical update on *Snow and Ice Control Treatments – Popular Materials*.

[http://www.dot.state.oh.us/Divisions/Planning/LocalPrograms/LTAP/Documents/RON Popular Materials for Snow and Ice Treatments.pdf](http://www.dot.state.oh.us/Divisions/Planning/LocalPrograms/LTAP/Documents/RON_Popular_Materials_for_Snow_and_Ice_Treatments.pdf)

**Information Sources:**

Federal Highway Administration – [www.fhwa.gov](http://www.fhwa.gov)

Ohio DOT – [Maintenance Operations | Ohio Department of Transportation](#); Scott Lucas, Office of Maintenance Operations – 614-644-6603

Minnesota Local Road Research Board – [www.lrrb.org](http://www.lrrb.org)

DLA Presentation, Ohio DOT (2016) – <https://www.apwa.net/library/meetings/snow/10389.pdf>

**DISCLAIMER:** *This RON Technical Update is provided for purposes of general information. Interested persons should refer to the resources referenced herein for additional information as needed.*

