

BRINE FACT SHEET

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APWA Winter Maintenance
Sub-Committee



Anti-icing involves placing a layer of brine on the surface of the pavement **before** a winter storm has begun to prevent snow and ice from freezing to the road. **Deicing** uses pre-wetted rock salt to break the bond **after** snow has frozen to the road.

Anti-icing delivers the same level of service, but it uses one-quarter to one-fifth as much salt as deicing.

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What is salt brine?

Salt brine is a solution of salt (typically sodium chloride) and water. It has a freezing point lower than pure water and, as such, is a useful tool in reducing the adhesion of snow and ice to road surfaces. In addition to brine made with sodium chloride, some winter maintenance agencies also use brines made with calcium chloride or magnesium chloride. Nonetheless, these brines are solutions of salt and water, with a freezing point lower than the freezing point of pure water. The freezing point of brine is a function of the salt being used in the brine (sodium chloride, calcium chloride, or magnesium chloride) and the percentage by weight of that salt in the solution.

Why is salt brine important?

Rock salt, or solid salt, is simply crystals of sodium chloride. Until it has gone into solution—that is, until it has formed brine—it will do nothing to stop snow from freezing to the pavement surface. Agencies that use rock salt in their winter maintenance activities are doing so to create brine on the road surface. Therefore, brine is an integral and critical part of winter maintenance activities.

What is the difference between anti-icing and deicing?

Anti-icing is a proactive approach taken to decrease the likelihood of snow and ice bonding to a pavement surface. Additionally, anti-icing can prevent frost from forming on pavement surfaces. Anti-icing involves placing a layer of brine on the surface of the pavement before a winter storm has begun. This layer prevents the snow and ice from freezing to (or icing onto) the road. The alternative—which is called deicing—is to let the snow bond/freeze to the road, then apply pre-wetted rock salt to break the bond between the snow and the pavement.

Studies have shown that anti-icing will achieve the same level of service on a road or highway using between one-quarter and one-fifth the amount of salt used in deicing. Typically, anti-icing is performed using trucks carrying tanks, which have pumps to spray the brine onto the pavement surfaces. In many places lines or stripes of brine can be seen on a road before a given event. Some people call these safety stripes! Usually, brine is applied at rates of between 30 and 50 gallons per lane mile.



Even in avalanche areas snow has been easily removed due to anti-icing.

Are all those liquids pure salt brine?

No, they are not. Increasingly, agencies are blending brines to take into account the particular storm conditions they expect to deal with. Blends often use by-products from a variety of processes applied to natural materials. Organics might include by-products from cheese whey and sugar beet or similar ingredients. The purpose of organics is to increase the longevity of the brine on the pavement surface. Evidence has been presented that organics may reduce corrosion of vehicles and infrastructure. Usually, the concentration of organic additives in brine ranges from 5 to 20 percent. One typical mixture is 85% salt brine, 5% calcium chloride brine, and 10% organic.

What is pre-wetting, and where does it fit into all of this?

As discussed above, rock salt does not reduce the freezing temperature of the pavement surface until it has created a brine. Rock salt is typically pre-wetted while it is being applied to the pavement surface. Rock salt can be pre-wetted in many ways. The general idea is to get the rock salt wet as it leaves the plow truck. This not only jump-starts the freezing temperature reduction process (and thus gets the salt “working” more quickly) but it also helps the rock salt stay on the road after it is spread. When rock salt is not pre-wet, as much as 30% may end up bouncing straight into the ditch or gutter. Pre-wetting is normally done at rates of around 8 -10 gallons of brine per ton of solid material, but some agencies are now working on

using slurries of rock salt, which has as much as 50 gallons of brine per ton of solid material.

What about corrosion, isn't brine more corrosive than rock salt?

As previously noted, if an agency is using rock salt to its best advantage, it is employing brine. So, rock salt and brine are just two sides of the same coin. That said, yes, chlorides can cause corrosion in metals, and if not treated properly this can cause damage to vehicles and infrastructure. Some organic additives may have corrosion-resistant benefits. Certainly, laboratory studies show that some of the organics reduce corrosion substantially. However, the best way to reduce or avoid corrosion is to take the extra precaution of rinsing off any residue from the road salt or the brine the road salt has become.

So, does putting down a liquid on a cold road just freeze to the road?

Brine does have a lot of water in it. For example, sodium chloride brine is typically 23.3% sodium chloride when it is applied. That means that it is 76.7% water. But, the salt is in a solution in the water, and that solution has a lower freezing point than pure water, as noted earlier. In particular, when salt brine is applied at a 23.3% concentration, it will freeze

(without any additional dilution) at about -6° F. Unless the road surface is extremely cold, the brine will not freeze to the road. Of course, as it melts snow and ice, it becomes more diluted and—unless additional treatments are made or the road is cleared of snow and ice by plowing—the road will refreeze eventually. But the short answer to this question is NO – the brine will not freeze on the road when it is applied.

So, the brine won't freeze, but will it make the road slippery some other way?

There have been concerns about this slippery issue since the early days of using brines in the US. Indeed, AASHTO (the American Association of State Highway and Transportation Officials) considered this issue back in the 1990s. They concluded there might be an issue of slipperiness with some brines, but it would only occur in very unusual circumstances. These circumstances could be avoided by simply not applying brine when pavement temperatures were warm, or when the air humidity fell within certain ranges. Provided those restrictions are followed, brines do not cause slippery roads at all—rather they enhance road safety and mobility during winter weather and are a clear benefit to the traveling public.



Anti-icing roadways prior to an event in McHenry County, Illinois. (Photo courtesy of Mark DeVries)