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# GUIDELINES FOR DEICING EFFECTS

A Guide for Deicing Salts and the Effect on Concrete Surfaces

Good concrete can be adversely affected by the use of chemicals, especially deicing salts and fertilizers. Even properly placed concrete, concrete with low water-cement ratios and properly cured concrete is often affected by the use of these chemicals. Because of this, neither deicing salts nor fertilizers should be used on concrete for the first year after placement. Unfortunately, however, cities use salts and chemicals on public roadways. The chemicals can be picked up by tires, boots and undercarriages of vehicles and can be released back onto concrete surfaces. Care should be taken to properly protect concrete. If weather allows, inform snow removal contractors to remove as much of the snow and ice as possible and to not just let it melt away. It is too often the practice of such contractors to remove the minimum amount of snow and ice, over-salt and quickly move on to their next job.

## DEICING CHEMICALS

There are four main types of deicing chemicals used throughout the U.S. today:

- Sodium Chloride is the most widely used. It is also referred to a rock salt. It will keep ice and snow melting until the temperature is around 15°F. This type is also very high in chloride ions, which leads to early rebar corrosion.
- Calcium Chloride will continue to melt snow and ice until the temperature is around 0°F. It will also lead to a chemical attack on the concrete.
- Potassium Chloride is not used as much as others, but can still be found. It will not work unless the temperature is above 18°F.
- Magnesium Chloride is used at airports and will work when the temperature is as low as -10°F. This chemical melts snow and ice very quickly.

Each year new products come out with a label that says 'safe for concrete.' Read this label carefully! If it contains any of the above products, and/or sodium, use with extreme caution. Avoid products with ammonium nitrite or sulfate. Some fertilizing products can also be used, however these can be damaging to the surface of the concrete. If traction is needed on the roadway, use sand instead.

**What do deicing chemicals do and are they harmful to concrete?**

- Deicing chemicals lower the freezing point of water. Liquid that normally freezes at 32°F might now not become a solid until the temperature is between 18 and 25°F. This allows the water, in the liquid form, to enter the concrete's surface and then re-freeze.
- Deicing chemicals can attack reinforcement in the concrete and lead to corrosion of the rebar or steel.
- Many times during weather with ice and snow, the surface of the concrete may not drain properly. When the temperatures get above freezing, ice or snow build-ups on flat surfaces act like a dam. This allows the water containing the chemicals to sit on the concrete too long.

8329 Monticello Road, Suite E, Shawnee, KS 66227 · (913) 422-4443 Phone · (913) 422-8882 Fax
www.dcs-ks.com Email: info@dcs-ks.com

- Most deicing chemicals are overly applied so they do not perform as they are designed to and they lay on the surface and attack the concrete surface.
- Salts are, by nature, a corrosive material that can alter the PH level of the concrete surface. The salt can interact with the concrete in a chemical reaction as well. This is in the form of carbonation. The penetration of chloride ions and ettringite formation will affect the concrete's ability to withstand freeze-thaw cycles, even when the concrete has the proper air entrainment. Any cracks or control joints will allow the reaction to reach deeper into the concrete, thus the permeability (concrete's ability to repel and withstand such conditions) will be compromised. Larger pavement and concrete slabs that are exposed to both weather and heavy traffic flow should consider joint sealing and a program that maintains said sealing of construction joints.
- Deicing chemicals aggravate and speed up scaling and reduce the resistance abilities of the concrete with air entrainment admixtures to withstand the effects of freeze-thaw cycles.
- When combined with water from the snow and melting ice, deicing salts slowly make their way into the concrete matrix through cracks or control and construction joints. Once in the concrete, they can attack both the concrete and reinforcing steel.
- While deicing salts do their job during the sunny or warmer part of the day, when the sun begins to set, or temperatures begin to drop, the water will re-freeze on the concrete. This makes for slick spots and aids in repeated freeze-thaw cycles.

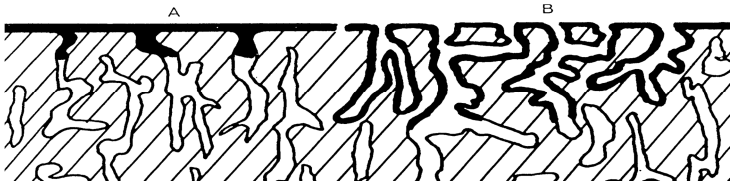
A sealed concrete surface will not allow water or damaging salts to enter the concrete. Sealers also make the concrete much easier for snow and ice removal. Only experienced contractors should apply sealers. Even coverage is a must. It is recommended that a spray and back-roll method be used to achieve the best results. Two coats will need to be applied.

There are several types of sealers to choose from based on what application the concrete is being used for:

- Water based
- Solvent based (ASTM C 1315 classifies many of these as a cure and seal, meaning they can do two things at different stages in the concretes age)
- Penetrating sealers, such as silane or siloxane

Both water based and solvent sealers react with the concrete in a physical reaction, forming a membrane on the concrete surface. They will darken the appearance of the concrete, much like it looks when it's wet. Depending on use and wear, sealers can last from 6 months to 5 years. Always check with the manufacturer for both coverage and expected wear time. Also note that weather conditions play a part in application. Avoid water based sealers when freezing temperatures are expected within 48 hours of application. Sealers offer excellent protection from not only salt damage, but from oil, gas spills and fertilizer damage.

Penetrating sealers seal by lining the pours and capillaries in the concrete, making them hydrophobic in nature. These types of sealers are able to repel water and breathe and also aid in eliminating moisture that can lead to rebar corrosion. The figure below shows how sealers work and repel water. Figure A is a normal cure and seal product, whereas figure B is a siloxane sealer.




Use of concrete sealers can add to life cycle of concrete, and avoid costly replacement. Concrete as a building material is a great value but care must be taken to ensure it properly cures and will be able to withstand harsh conditions it may be exposed to.

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