Surface deterioration caused by chemical de-icers is not a concrete quality problem, but rather a concrete maintenance issue. Proper use and maintenance of finished concrete products are the end-user's responsibility.

De-icers

Achieving a quality, long-lasting concrete product is dependant on using good materials, proper construction techniques and protection from adverse conditions. Exterior concrete such as pavements, garage slabs, driveways, aprons, sidewalks and gutters are especially susceptible to adverse environmental conditions when de-icing chemicals are used improperly. The use of de-icing salts containing chlorides may cause spalling and degradation of concrete surfaces. This is especially true with new concrete surfaces, and has resulted in a considerable amount of damage to quality concrete within the first winter season.

Once properly placed and cured, the following instructions can minimize spalling and surface degradation caused by the use of de-icing chemicals:

1. Use no de-icing chemicals containing chloride compounds. This includes, but is not limited to, calcium chloride, magnesium chloride, sodium chloride (salt) and potassium chloride. Never use any de-icer that contains either ammonium sulfate or ammonium nitrate.
2. Remove snow and ice manually as it accumulates by shoveling, plowing or other mechanical means.
3. Wash driveways and other concrete surfaces, whenever the weather allows, to remove salts that drip off of vehicles. Many governmental agencies are using chlorides on roads and bridges for de-icing.
4. Be aware that many chemical fertilizer products can be harmful to concrete surfaces.

If you are not the owner of the newly installed concrete, forward this pamphlet to the owner and advise them of the precautions necessary to maintain the quality product you installed for them.

The recommendations presented in this piece are based on current national standards for materials and construction of exterior concrete flatwork. Further discussion and reference to industry recommendations can be found at American Concrete Institute (ACI), Portland Cement Association (PCA), National Ready Mixed Concrete Association (NRMCA) and the Aggregate and Ready Mix Association of Minnesota (ARM).

Disclaimer – This piece is not a complete analysis of every material fact regarding exterior residential concrete flatwork. This information is provided for use by personnel who are competent to evaluate the significance and limitations of the information provided and who will accept total responsibility for the application of this information. The information has been obtained from reliable sources, but Knife River cannot guarantee that it is accurate or complete.

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Owner's Guide for Exterior Concrete

Maintenance Guidelines for Long-Lasting Concrete

Concrete driveways, patios and walkways can greatly enhance the curb appeal and value of your property. Durable concrete does not happen by chance.

Prudence in planning, selecting a quality mix, selecting a professional installer, deciding on the best cure and determining the best maintenance program before installation can produce beautiful concrete that will last for years.

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Homeowners' Guide for Durable Exterior Concrete

What is Concrete?

Concrete is a blend of natural mineral aggregates (sand and gravel), cement and water. Because concrete is made from natural products it may have some natural imperfections.

What Causes Changes in Color?

Uniform appearance is created by following a uniform process during the installation. The subgrade should be uniformly graded Class 5 or sand. All organic matter and clay soils should be removed from the subgrade. Make sure the mix design is the same for every pour and use a consistent water-to-cement ratio. If water is added during the pour, the change in the water-to-cement ratio may change the color of the concrete. Adding a chloride accelerator to speed up the set time may cause a slightly darker concrete. Refinishing a surface may change the water-to-cement ratio and color.

What Causes a Pop-Out?

A pop-out is a hole in the concrete surface left after an aggregate particle has expanded and worked itself loose. A pop-out can be caused by either a physical reaction or a chemical reaction. A physical reaction is when a porous rock absorbs water and freezes, causing the rock to expand and fracture. An example of a chemical reaction is when alkalies in the cement react chemically with the silica found in some fine sands, causing an expansion and a small surface pop-out. Using the materials found locally, it is not unusual to find 15 to 20 pop-outs per square yard. Pop-outs do not in any way decrease the life expectancy of a concrete slab.

What is Concrete Scaling?

Scaling is the localized flaking or peeling of a concrete surface exposed to freezing and thawing. Light scaling does not expose the coarse aggregate. Moderate scaling exposes aggregate (⅛-inch to ⅜-inch deep).

How to Prevent Scaling:

- Do not use de-icing salts such as calcium, sodium or magnesium chloride. Use sand to provide traction on icy surfaces.
- Never use ammonium sulfate or ammonium nitrate commonly found in fertilizers as de-icers. Do not allow them to remain on concrete surfaces.
- Concrete slabs should be constructed for good drainage to prevent water from standing on the surface.
- Timing of the finishing operations can vary greatly depending on the weather. Finishing too early or overfinishing can result in a weak concrete surface that is susceptible to scaling.
- Concrete curing should start immediately after the finishing process and continue for seven to 10 days or longer in cold weather.
  - – Curing controls moisture during these first days by maintaining moisture on the exposed concrete surface or minimizing water loss from the exposed concrete surface.
  - – Curing by maintaining moisture can be accomplished by flooding the slab with water. Minimizing water loss can be done with sprayed-on curing compounds or covering with plastic. Do not let concrete dry out during the curing process.
  - – Protect the concrete from the harsh winter environment with blankets during the curing process.
- Concrete should be allowed to dry for 30 days after curing before applying a breathable sealer.
- Concrete should be protected with silane, siloxane or linseed oil (breathable sealers) before it comes in contact with de-icers.

Sealing Options

When concrete has dried – approximately 30 days – it is important to seal the surface to protect it from becoming saturated with water prior to periods of freeze and thaw. Concrete should be sealed before the first winter and should be resealed periodically as recommended by the sealer manufacturer.

The two types of sealers most commonly used are membrane forming and water repellents. The membrane forming sealers require more frequent reapplications. Like paint, it is sprayed or rolled onto the surface and forms a membrane that prevents water from getting into the concrete. This membrane is easily worn down by driving on it. The membrane sealers are generally compatible with most curing products and can be applied without removing the curing compound. Always check to make sure the specific products being used are compatible.

Water repellents are sprayed or rolled on to the surface and are absorbed into the concrete, making it water repellent. Because these products are not on the surface, they are less susceptible to wear and protect longer. Apply and reapply according to the manufacturers recommendations.

Another commonly sold sealer for concrete is based on linseed oil and solvent. It is effective in sealing concrete but can make the concrete look dark and blotchy.

Problem Causes and Prevention

Problem	Cause	Solution
Cracking	Structural	Concrete should set for a minimum of seven days before vehicles are driven on the new surface. Only passenger and light trucks should be driven on 4-inch thick concrete. In cooler weather, more time should be allowed.
Cracking	Frost heaves	Prevent rainwater from collecting under concrete by using drain-tile rain gutters and good landscaping.
Surface blemishes	Water freezing and thawing numerous times on the surface	Apply a protective, penetrating concrete sealer and caulk all saw cuts and joints. Keep surface clear of snow and ice.
Surface deterioration	Use of de-icers and chemical fertilizers	Avoid de-icing chemicals including salts which can cause surface deterioration of your concrete.