

# LESSONS LEARNED:

CONSTRUCTION MATERIALS

## OBSERVATIONS AND LESSONS FROM THE SCHOOL OF EXPERIENCE

### PROTECTION OF EXTERIOR CONCRETE FLATWORK IN WINTER

News Flash - Winter weather is here! That means freezing rain, sleet, snow and ice can accumulate on flat concrete surfaces including sidewalks, driveways, and roads. The easy solution – DEICING SALT. As evidenced by the winter of 2014, deicing salt applications, possibly excessive at times, were the apparent answer to winter accident liability. While salt itself does not react with the concrete, the use of salt to lower the freezing temperature to promote thawing of frozen surfaces can affect the concrete durability.

The roller-coaster ride of temperature fluctuations can wreak havoc on exterior flat concrete surfaces due to numerous freeze-thaw cycles in the presence of wet conditions. When the snow or ice melts during the higher temperatures of the day, water can be absorbed into the concrete surface and settle into microscopic pores present in the concrete. When the temperature drops again at night, the trapped water freezes and expands. The expanding ice can exert pressure greater than the strength of the concrete. When the external pressure of the expanding ice exceeds the internal strength of the concrete, scaling and/or spalling occurs on the concrete surface. A damaged surface can eventually result in progressive failure of the concrete.

While air-entrainment in the concrete mix is certainly an advantage to reduce the pop outs from ice damage, it may not be sufficient to resist scaling and spalling. Concrete strength has an effect on the durability of the surface, because a higher compressive strength also means a higher tensile strength that resists the forces being exerted by the ice crystals. Specifying a 4000 psi mix with a sufficient amount of air entrainment for the anticipated exposure would provide greater protection in cold areas than would a 3000 psi mix with no air entrainment. Proper construction techniques such as densifying the concrete surface along with proper curing can improve resistance to scaling. The application of a “breathable” sealer on the concrete surface can reduce the potential for water to enter into the pores of the concrete during thawing.

Concrete flatwork exposed to freezing and thawing cycles is more vulnerable to damage during the first year of exposure. Deicers are particularly damaging to concrete because the salt mixes with water and salt crystals can grow in the pore spaces within the concrete. Most deicers come with a warning not to use on concrete less than one year old. Concrete gains strength over time, but the ultimate strength of the concrete might not be enough to resist the pressure from the ice or salt crystal formation, so deicers should be used sparingly. With proper planning and execution, scale resistant concrete can be achieved for exterior flatwork. A good 2-page resource is CIP 2 – Scaling Concrete Surfaces published by NRMCA. Sand can be used to help with slip issues from snowy or icy sidewalks, driveways, and roads.

If you must use deicing products, sodium chloride based products are generally less damaging to concrete when used in smaller amounts than calcium or magnesium chloride products or calcium magnesium acetate.

We hope this **Lessons Learned** has been informative. If you have questions about this topic, please contact your nearest ECS office.

Respectfully,

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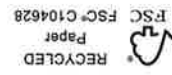
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LEARNED**

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and Lessons of General Interest to

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- Facility Managers**
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