



PROTECTING CONCRETE FROM CHLORIDE ION DIFFUSION

WisDOT proves that PoreShield™ provides long-term protection from chloride ion diffusion

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## PROTECTING CONCRETE FROM CHLORIDE ION DIFFUSION

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Details	
Location:	Select sections of Wisconsin Interstates 94, 41 and 39
Date:	June 8, 2020
Application Type:	Joint application: saw-cut faces of concrete pavement joints
Applicators:	Wisconsin Department of Transportation



### Project Overview

One of the leading culprits of concrete highway damage is chloride ion diffusion. This is most often a result of deicers applied to highways, meant to keep roads safe from snow and ice. Common deicers such as Calcium Chloride (CaCl<sub>2</sub>), are effective at melting ice and snow at lower temperatures. However, CaCl<sub>2</sub> doesn't go away after the ice melts.

While deicers are primarily used in the winter months to keep pavements safe for travel, these chemicals are absorbed, and ions diffuse into the pore network of concrete where they build up over time. In the warmer temperatures of spring, summer and fall months, these ions react with the calcium hydroxide that exists in the pores of all concrete. This reaction forms a product called calcium oxychloride, which expands and causes damage year-round.

For a decade, the Wisconsin Department of Transportation (WisDOT) has been applying various penetrating sealers like silanes, siloxanes and others to the saw-cut faces of concrete pavement joints. These products are meant to improve pavement joint performance by reducing fluid absorption and minimizing ionic diffusion. Until recently, however, there was little data proving these penetrating sealers were protecting joints.

To measure the effectiveness of different treatments, WisDOT funded a comprehensive study to analyze the protection of concrete joints in highways. Its findings were released in March 2020.

- The study evaluated conventional penetrating sealers, as well as a new concrete durability protection product, PoreShield™, also known as soy methyl ester-polystyrene (SME-PS). PoreShield is not a penetrating sealer. It is a long-term concrete durability enhancer protecting new and old concrete from premature damage that begins on the inside, caused by fluid absorption, deicing chemicals and freeze/thaw conditions. PoreShield is often compared to penetrating sealers because it, too, can be applied topically. However, it performs very differently. It is a long-term durability enhancer that fills pores.
- It does not undergo a chemical reaction or solidify.
- It remains fluid and does not leave any film on the surface.
- It creates a flexible, self-healing, hydrophobic barrier that is both preventative and curative.
- It is a durability enhancer when applied in admixtures as well.

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- PoreShield does not need to be reapplied for 10 or more years and it increases service life to concrete five times (in concrete with fly ash) to nine times (in concrete without fly ash) longer, as determined by this study.

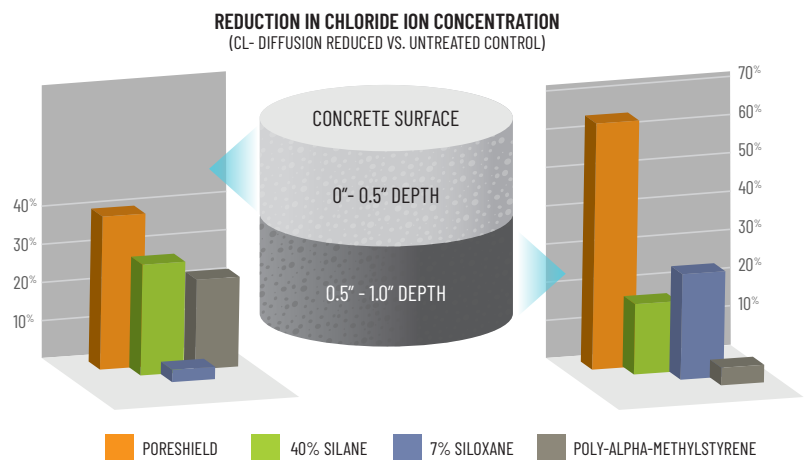
WisDOT evaluated seven products: standard penetrating sealers (versions of silane, siloxane, poly-alpha-methylstyrene and lithium silicate) and PoreShield Concrete Durability Enhancer. The study demonstrated that PoreShield was more than twice as effective as the penetrating sealers in reducing chloride ion diffusion when measured at least 0.5 inches below the surface.

Because PoreShield fills the concrete pores, it blocks the absorption and diffusion of ions and keeps deleterious ions, such as CaCl<sub>2</sub>, at the surface. This deters many forms of damage, including the formation of calcium oxychloride, reducing long-term damage from salt in all seasons.

In addition to being high performance, PoreShield is renewable and sustainable - derived from soy with a 93% bio-content. Its non-toxic profile provides confidence in safety for workers and the environment.

PoreShield can be used on all densities of concrete whether vertical or horizontal in many applications including highways, bridges, precast and other structures.

This research was funded through the Wisconsin Highway Research Program by the Wisconsin Department of Transportation and the Federal Highway Administration.



**What Is PoreShield™?**

**PoreShield SME-PS is not a penetrating sealer. It is a revolutionary CONCRETE DURABILITY ENHANCER.** With one application (liquid or admixture), PoreShield protects concrete from premature deterioration and corrosion for 10+ years. PoreShield is a non-hazardous, high performance and cost-effective technology that protects all densities of new/old, vertical/horizontal concrete.

PoreShield extends the service of concrete five-to-nine times longer by protecting concrete from damage that begins on the inside, caused by water, salt, deicing and freeze/thaw conditions. Because PoreShield can be applied topically, it is often compared to penetrating sealers. However, it performs very differently.

- It is a long-term durability enhancer that is absorbed deep into the pores.
- It does not undergo a chemical reaction or solidify.
- It remains fluid and does not leave any film on the surface.
- It creates a flexible, self-sealing, hydrophobic barrier that is both preventative and curative.
  - Defends concrete from moisture ingress
  - Blocks ion transfer into concrete: Ca, Cl, Mg, etc.
  - Arrests Calcium Oxychloride and ASR (Alkali-Silica Reaction) deterioration
- It is a durability enhancer when applied in admixtures as well, showing dramatic reductions in fluid absorption with little negative influence on the set time, strength or shrinkage.

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PoreShield is a sustainable and cost-effective investment. It is high performance, non-toxic to human health and the environment, and has earned the USDA BioPreferred® seal due to its renewable soy-derived technology. The low VOC of PoreShield (43.3 g/L) meets national standards for EPA VOC, as well as CARB, SCAQMD, OTC and AIM. The nontoxic profile of PoreShield means no PPE or specialized training is required.