Seal / No Seal GROUP

Tech Brief

Use of Silanes for Sealing Joints in Concrete Pavements

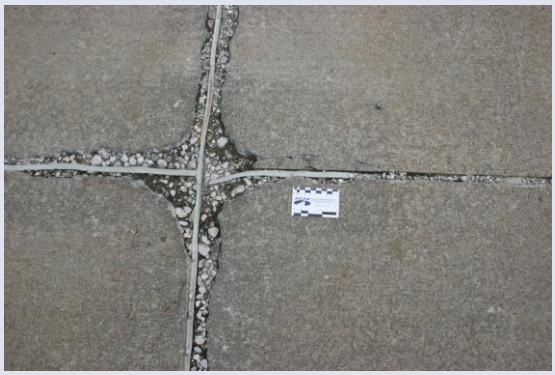

Figure 1 Joint Associated Distress in Parking Area

Introduction

Traditionally, sealing of transverse and longitudinal joints in concrete pavements has been accomplished through the use of formed in-place or compression type sealants installed shortly after pavement construction or during rehabilitation efforts. The common sealant types are hot pour, silicone, and neoprene compression seals placed in varying geometric joint designs.

In recent times, concern has developed regarding joint associated distress that is evident in some wet-freeze states. The distress oftentimes begins at a joint and progresses outward as the deterioration increases. Figure 1 is a photo of a parking area with this type of distress in advanced stages. This distress is presumably a function of freeze thaw damage.

Concerns regarding this type of distress have fostered interest in the use of concrete sealers to better protect the concrete from ingress of water at the surface and into the joint.

Concrete Sealers

Concrete sealers have been in use in the highway industry since at least the 1980s, mainly as a preventive maintenance treatment on bridge decks.

Sealer technology has steadily improved and sealers generally can be classified as two types as shown below:

1. **Non-Reactive Sealers**
    a. Petroleum-based
    b. Silicone Oils
    c. Lin Seed Oil
2. **Reactive Sealers**
    a. Siloxanes
    b. Silanes

Non-Reactive Sealers coat the concrete surface but do not react with the concrete itself. They typically have a finite life (3 – 5 yrs) and hinder bonding of other materials to the concrete. The sealers used in bridge decks in the 80s were probably organic sealers (non-reactive) and were not ozone or UV stable and were only effective for a few years.

Reactive Sealers penetrate the concrete and react with it chemically. This reaction occurs quickly and the by-product of the chemical reaction is alcohol which evaporates. The two most common reactive sealers are siloxanes and silanes.

Silanes are functional monomeric Si-compounds with four chemical attachments. These tend to have a low viscosity facilitating penetration into the concrete and quicker chemical reactions. Siloxanes are linear Si-O-Si polymers with a wide range of viscosities (ranging from thin to oil like substances) and may be either reactive or not with concrete, depending on the functionality.

Silanes are typically high VOC materials and some agencies prefer to use them as a water-based material. Silanes may contain solvents.

Silane sealers are a single-component sealer that once they penetrate into the concrete, form a bond with the concrete and each other to form a resin network which may be as strong as the concrete itself. Because the sealer penetrates into the concrete, it is not affected by UV and weathering and has a very long life. They are typically considered a permanent sealer (15 yrs).

Impact of Applying Silane Sealer Before Silicone Joint Sealant Installation

Silanes can rely on alkalinity to kick off their reaction (chemical cure) or a catalyst may be added to speed up the reaction. During curing of a silane sealer, alcohol evolves as a byproduct of the chemical reaction. During this time, the evolution of alcohol could interfere with the bonding of the silicone sealant to the concrete.

When cured, the silane should not look wet; but there are no tests for determining when a silane sealer has cured.

To avoid issues, the installer should allow a dry/cure time prior to silicone sealer installation as described in the subsequent paragraphs.

New Concrete

Ninety per cent of the chemical reaction between the concrete and the silane sealer occurs within one hour because of the high alkalinity environment of the concrete (pH of 13 - 14). Once the chemical reaction is complete, the silane should not affect the bonding of silicone sealants or other sealant materials.

One day of cure time for silane sealers installed on new concrete should be sufficient to have no interference with most sealants ability to bond to concrete. *This is a general guideline and the sealant manufacturer should be consulted prior to applying the sealant to ensure sealant compatibility and drying time of the silane.*

Older Concrete

For older concrete, the alkalinity usually is reduced due to weathering, which may slow down the silanes reactivity, and it is possible for dirt and organics to have filled the pores of the concrete. This debris can absorb the silane and retain it for a while longer without it curing. So 2 to 3 days should be allowed for curing of the silane sealer when installed on existing concrete. Temperature also plays a major role. Colder temperatures results in slower reaction times, and silane retention, while higher temperatures speed up the reaction and evaporation rates. *As before, the manufacturer should be consulted for project specific requirements.*

Impact of Silane Sealers Applied After Joint Sealant Installation

If a silicone sealant is already installed and a silane is sprayed on top of it, there should be no impact to the sealant installation. The only concern would be that the concrete beneath the sealed joint would receive no benefit from the silane treatment.