Deep Seal

BENEFITS AGAINST CONCRETE CHEMICAL ATTACK

Environmentally Safe

The susceptibility of portland cement concrete to attack by chemicals generally results from three of its inherent characteristics: permeability, alkalinity, and reactivity. Permeability factor varies in concrete installations; however, even the most extreme quality installation will have some degree of permeability. Permeability factors are greatly affected by water-cement ratios and whether or not concrete is properly cured, and cure method used.

Penetration of liquids into concrete is often accompanied by chemical reactions with concrete constituents, i.e., cement, aggregates, embedded steel, etc. Leaching of cement hydration compounds, or deposition of extraneous crystals or crystalline reaction products also degrade appearance, strength, durability and the integrity of the concrete installation.

The inherently alkaline hydrated portland cement binder of the concrete paste reacts strongly with acidic substances. This reaction is usually accompanied by formation and / or removal of soluble reaction products, resulting in concrete integrity disintegration. When the reaction products are insoluble, deposits may be formed on the concretes surface or on the inside of the concrete causing a reduced reaction rate. Usually the rate and extent of chemical attacks will be increased by increased concentration of aggressive agent(s) in solution. The pH of a solution indicates whether the solution is alkaline, neutral, or acidic. The pH value of a neutral solution is about 6.5-7, an acidic solution has a pH value of less than 6.5 and an alkaline solution will have a pH value of more than 7. Subsequently, as the pH value of a solution decreases to less than 6.5 the solution transforms from neutral to acidic and becomes more acid as the pH value gets even lower, becoming increasingly more aggressive in its attack on the concrete.

The physical state of the attacking agent is significant. Dry non-hygroscopic solids do not attack dry concrete. A moist or wet, reactive solid will attack concrete, as will aggressive liquids or solutions. Aggressive dry gases can attack concrete internally when coming into contact with sufficient moisture present within the concrete, i.e., carbon dioxide, sulphuric gases, etc.

Temperature also affects the rate of attack in two different ways. The common affect is that chemical activity usually increases exponentially, approximately doubling with each 18°F (10°C) rise in temperature. Temperature may also affect the rate of chemical attack indirectly, since, as temperature rises moisture content of affected concrete becomes reduced, making it drier and more permeable to additional fluid due to expansion. On the other hand, as temperature falls, contraction may sometimes cause sufficient shrinkage to create small open cracks, allowing greater penetration of liquid into its interior. Furthermore, in addition to measuring the rate of attack, it may be desirable to determine how extensive the attack might be. For example, a concrete installation may have been coincidentally placed in an acidic soil, but if the acid source is not somehow replenished, the available acid will quickly neutralize with little or no damage to the concrete.

Alternate wetting and drying is harmful mainly due to the fact that alkali aggregate reaction is an increased possibility under such conditions. Also, dissolved substance particles can migrate more readily through the concrete and be deposited and re-crystallize at or near the surface from which evaporation occurs. This effect may be seen in the phenomenon called "efflorescence" sometimes seen on concrete, brick or stone. Salt solutions can also be more disruptive to concrete subjected to freezing and thawing than water alone. This is commonly observed later on by visible and apparent damages following application of deicing salts to pavements.

In addition to individual organic and mineral acids which may attack concrete, acid-containing or acid-producing substances such as acidic industrial wastes, silage, fruit juices, sour milk, salts of weak bases, and some untreated waters may also cause deterioration of concrete integrity. Most ammonium salts are destructive because in the alkaline environment of concrete they release ammonium gas and hydrogen ions. These are replaced by dissolving calcium from the concrete causing a leaching action, much like an acid attack.

Animal wastes contain substances which may oxidize in air to form acids which attack concrete. The saponification between animal fats and the hydration products of portland cement consumes these hydration products, producing salts and alcohols in a reaction analogous to that of acids.