EPOXY MOISTURE CONTROL

Reducing bond failures caused by moisture vapor transmission

Coating concrete with impermeable coatings or other floor surfacing's that do not breathe requires special considerations to prevent failure. When protective coatings are applied to steel substrates, there are basic rules to follow to assure good adhesion throughout service life. Clearly defined standards for surface preparation and cleanliness of steel have been established so coating adhesion and performance are predictable.

With concrete surfaces, however, each slab has its own chemistry and profile of performance. It is this variance in concrete formula, placement, finishing, curing, and subsoil conditions that makes predictability of coating adhesion very elusive. This article will outline steps to avoid bond failures not associated with surface preparation. We are assuming that good preparation is well established and that concrete surfaces are cleaned properly and well profiled (roughened) for maximum surface area and good adhesion. Surface preparation methods are well outlined in the ICRI Technical Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

Shop for concrete coatings

Excess moisture in or below the concrete slab is the cause for a large percentage of coating failures on concrete. While moisture in concrete during the application of floor surfacing's is an important criterion, it is not the ultimate cause of failure months or years later. Many epoxy materials can tolerate and bond to a concrete slab with a relatively high moisture content. It is the flow of moisture or moisture vapor, better described as moisture vapor transmission, that causes most adhesion problems. There are reported cases of bond failures on above grade slabs, but almost all are related to

moisture vapor transmission rather than moisture content. The real area of greatest concern is concrete slabs-on-grade and how to dry out and/or minimize the vapor transmission.

Photo 2 - Moisture Vapor Transmission through Polyacrylate Terrazzo Joints

Photos #1 and #2 show the effect of moisture vapor transmission on impermeable and permeable floor systems. Photo #1 is an epoxy terrazzo surface (impermeable) which has completely lost bond and has water lying in the exposed area. Photo #2 is also a

terrazzo surface, but in this case, it is a permeable, cement-based system. Moisture migration is plainly visible around the panels of terrazzo defined by zinc divider strips. Moisture is transmitting along the path of least resistance but is not affecting the bond or adhesion of the terrazzo to the concrete substrate.

Concrete Moisture Test

There are a multitude of tests used to establish moisture content and moisture vapor transmission.1 These include the Plastic Sheet Test (ASTM-D-4263), Calcium Chloride Test, Gravimetric Testing, Radio Frequency Test, Nuclear Density, and Electro-conductive Testing (moisture meter). Most of these tests are designed to determine the moisture content or locate areas of excessive moisture. Only two, however, determine the transmission of moisture.

The Plastic Sheet Test2 (ASTM-D-4263) will give a qualitative, wet/not wet answer and the Calcium Chloride Test3 will provide a quantitative value. The Plastic Sheet Test (ASTM-D-4263) is an eighteen inch by eighteen-inch square of clear plastic sheeting that is sealed to the concrete surface with tape on all four sides. After sixteen hours, if any condensation is found on the underside of the plastic or if the concrete surface is darkened, the concrete is considered too wet. In cooler conditions, the test may not work and the reliability of the results can be influenced by differences in the temperature. An obvious appearance of moisture, however, will always indicate excessive moisture flow.

The Calcium Chloride Test uses a small dish of calcium chloride under an impermeable clear cover. By weighing the dish before and after a seventy-two-hour exposure, you can quantify the amount of moisture flow in pounds per one thousand square feet per twenty-four hours (Kg per sq m per twenty-four hours). A value of three pounds (1.4 kg) or less is believed to be acceptable to most flooring and coating manufacturers. Values

on extremely wet floors have been recorded showing greater than ten pounds per one thousand square feet per twenty-four hours (4.5 kg per 90 sq m per twenty-four hours).

It is important to understand the difference between moisture vapor transmission and moisture content. You may have low moisture content and have a bond failure at some point in the future due to vapor transmission through the slab. A high moisture content in the slab will usually not cause a problem unless conditions are right to cause movement of that moisture to the surface. So, its moisture transmission to the surface whether its from high moisture content in the slab or under the slab that causes the problem.

Water or, more importantly, water vapor will migrate to the surface when there is a higher vapor pressure in the concrete than in the air above the surface.4 In many cases, testing for moisture vapor transmission on new buildings is done prior to enclosing the building to allow the flooring contractor to proceed. Since the building is not enclosed, the conditions above the slab are similar to the slab itself and there is little moisture attraction to the surface and the test reads dry. When the building is enclosed, the air conditioning lowers the humidity and the temperature which lowers the vapor pressure causing a gradient and creating a vapor drive.