XTREME CONCRETE SOLUTIONS
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Vapor Trails

Battling Water Vapor in Concrete

By Floyd Dimmick

Good news for flooring professionals. Most vapor transmission problems within concrete slabs can be corrected — and at affordable prices for clients.

In the past, such slab problems were sources of disputes between flooring contractors and building owners when coatings failed. New technologies have helped ease those tensions.

Now, systems used to overlay concrete such as coatings, polymer concrete overlays and thin-set cement — when properly selected — can provide years of wear surface protection for either decorative commercial or extreme industrial use applications after corrective treatment of problem concrete. The first step is to identify and tackle the problems.

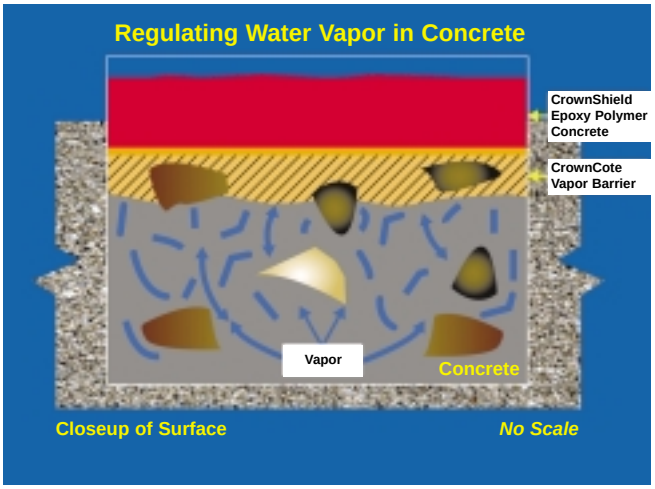
Effects of Vapor Transmission to the Protective Wear Surface

Vapor transmission may cause delamination of coatings and polymer concrete overlays, modified cement mortar thin-set overlays, and cement mortar tile beds. When loss of adhesion occurs, surface defects in the overlayment system may create dangerous hazards such as unsafe floor surfaces to walk or drive on, mildew, and growth areas for harmful bacteria and odors. Measured in monetary terms, these conditions may cause accidents and health issues, damage to products, reductions in productivity, and a decrease in potential corporate profits. Perhaps more importantly, they can lead to call backs for flooring contractors. With such high stakes involved, it makes sense to evaluate prior to application.

Vapor Damage Leaves Concrete Clues

Visual evaluation is a valuable tool in identifying the potential of vapor transmission. The inspection of the concrete surface may also require sounding of the surface to determine whether defects are present, such as: cracks, holes, soft and porous concrete, hollow plain delamination, honey combing, and sand streaking. Other clues may include low surface areas, reinforcement steel or mesh near the surface, rust stains, leaking control joints, expansion and isolation joints. If any of these defects are present, they will need to be properly repaired before testing for vapor transmission.

Other visual signs to look for on the concrete surface include loss of adhesion of the existing floor overlayment, coating peeling, loose tiles, moisture or water on the



Transmitted water-vapor damage is evident in concrete *(top)* **even after the original overlay was removed. But modified epoxy penetrates deep below the surface** *(above)***, creating a barrier that stops vapor and strengthens the concrete. When compatible polymer systems are used, the overlay and concrete become a monolithic structure.**

Continued on back.

surface, salts and powder from the concrete, stains, mildew, odors, and slippery surfaces.

Moisture Source: Condensation or Vapor?

If there is doubt about the source of the surface moisture present, a simple plastic sheet test can help. This test is commonly known as ASTM D4263. Tape a plastic sheet over a dried concrete surface and check it in 24 hours. If moisture is present between the plastic sheet and the concrete surface, vapor or liquid is passing through the concrete, which may cause a coating-adhesion problem. Vapor testing should be the next test to determine the amount of moisture passing. However, moisture on the outer exposed surface of the plastic sheet is indicative of condensation, not moisture passing through the slab. A contractor typically addresses such condensation problems by changing airflow patterns within the structure.

Vapor Testing with the Calcium Chloride Method

A common test method for vapor transmission through slab-on-grade concrete consists of placing a small disk of dry calcium chloride atop the slab. Calcium chloride absorbs moisture transmitting through the floor. By measuring the material before and after the test, contractors can determine how much moisture was absorbed over a given period of time.

The procedure consists of concrete surface preparation, placing a disk containing calcium chloride on the floor, and covering the area and taping the plastic sheet to the concrete. All materials needed to perform the test are provided in test kits available from most polymer floor manufacturers and other suppliers.

The test results may vary depending upon whether the tests were taken during the wet or dry season. If possible, test during the wet season to obtain the worst-case transmission results. From this data, the best possible assessment can be made to select a protective system to satisfy the customer's floor requirements. Re-test after the treatment to determine if the vapor transmission has been stopped before applying the entire overlayment system.

Battling Vapor Transmission Through Product Selection

Historically, the flooring industry has relied upon two basic approaches to stop vapor transmission. Both are remedial. One approach has been to increase the thickness of the epoxy polymer overlay to create more weight and use epoxy formulas that are not sensitive to moisture during cure to obtain the best possible adhesion.

The second approach consists of using various polymer formulas. For instance, epoxy formulas out-performed other polymers because of their excellent adhesion properties to alkaline materials. The technology started with solvent cut systems that would penetrate into the concrete.

Two major problems troubled these early formulas. First was solvent entrapment, which in turn prevented the proper curing of the epoxy. Second was overall performance. Only small improvements were made in slowing down vapor transmission because when the system cured, polymer shrinkage left voids in the cured system.

But from these failures and successes came the technology of 100 percent solid formulas containing no solvents. These products are capable of penetration deep into the concrete, can cure without shrinking, and require no heat or other chemical inducements to cure.

Epoxy formulas used as vapor barriers are near the consistency of water when applied. They are applied directly onto the cleaned concrete surface with squeegee and rollers. The modified epoxy penetrates into the cement and fills voids and micro cracks in the area of treatment. Typically, a single application is sufficient to stop vapor transmission with rates up to 14 lbs. / 1,000 ft^2. A second application of product has been shown to stop vapor transmission at rates up to 19 lbs. / 1,000 ft^2. The drawback is that these vapor-stopping systems cannot be used as wear surfaces and require the appropriate overlayment to protect them.

With vapor barrier laid, aggregate is broadcast, followed by an intermediate pigmented polyurea coating and clear skid-resistant topcoat. Concrete substrate, vapor barrier, and wear surface now combine to create a protective floor system.

Providing a New Wear Surface and Protecting the Vapor Barrier System

The selection of the concrete floor overlayment must be capable of sustaining the expected loads and the frequency of those loads to protect the vapor barrier portion of the floor just installed. The vapor barrier and the new wear surface combined together create the completed protective floor system. Typically, epoxy coatings and epoxy polymer concrete overlayments are used on most industrial projects. Epoxy systems with polyurea or polyurethane topcoats are used when UV resistance is required for commercial and other decorative applications. CP

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