FORMULA FOR DISASTER

IT'S A LITTLE-KNOWN PHENOMENON, BUT OSMOTIC

BY CHRIS WATTS

Imagine your client just spent thousands of dollars laying down a new concrete floor for his company's new headquarters. Your company installed the new floor, coating it with the latest decorative epoxy finish. But just days after the application, blisters start appearing and the tiles start lifting. Tragically, the floor is ruined.

Welcome to the costly effects of osmotic blistering, a little-known phenomenon in the construction industry.

People may remember osmosis from high school chemistry class. It's the phenomenon by which solutions try to reach equilibrium across a semi-permeable membrane. Water flows from a more diluted solution to a more concentrated one when separated by a semi-permeable membrane. Such membranes allow for the passage of water but not dissolved substances. When osmosis occurs in construction, the results are usually disastrous.

"We see a lot of cases of osmotic blistering in new construction because the bond interface of the newly coated concrete slab acts as a semi-permeable membrane, one of the key elements needed for osmosis to occur," Marc Schroeder, president of Liquid Plastics, Inc., a company that specializes in the formulation of protective coatings and membranes, says.

The osmosis process continues until either equilibrium is met or until the hydrostatic pressure generated by the increase in volume of the more concentrated solution equals that of the osmotic pressure. "In the case of a coated concrete floor, the pressure builds up at the interface between the coating and the concrete and causes blistering and progressive disbondment," Shroeder says. "The pressure generated by the osmosis can be as high as 3,000 pounds per square inch (psi), which is much greater than the bond of epoxies and other flooring systems to concrete substrates."

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Three construction materials must be mixed for osmotic blistering to occur. First is a semi-permeable membrane, which, in most cases, is the bond interface or the extreme upper layer of the concrete. The second is a concentration of water-soluble material (organic or inorganic), which can be anything from the resin ingredients in the epoxy coating to the material that can form at the surface of concrete when it is acid-etched or when workability or air-entraining admixtures (purposeful addition of air bubbles) are added to the concrete. Adding to the problem is the fact that Portland Cement has a naturally occurring soluble salt content that can act as a catalyst for osmotic blistering.

The third item needed to form osmotic blistering is water. "Even when we think