True Grit

Concrete Floor Coating Challenges

Peeling paint reveals a coating system failure in a commercial hallway.

Dave Lick,
Paint Quality Assurance Inspector

Planning and preparation are essential to the success of any painting project, but when it comes to coating concrete floors, even more care and consideration is required to avoid systems failures.

Among the factors to consider, you must account for the pH level of the substrate, the existence of any previously applied treatments, the texture of the concrete slab, and the adequacy of the moisture barrier beneath the concrete slab in order to ensure a successful floor coating project.

A couple of years ago, I was called in to examine a concrete floor that had experienced massive systems failure with loose pieces of paint flaking off in large amounts.

Getting Down to Business

The subject of this investigation was a concrete floor located in a hallway of a commercial building that led to one of the building’s exit doors. The concrete floor had been painted roughly 10 years prior to my inspection, with no available records of coating history. Further examination revealed that the current system had most likely consisted of two coats of a gloss alkyd floor coating, and I found no primer or other type of coating beneath lifted film.
The coating exhibited extensive flaking and appeared to have little adhesion to the substrate in the exit area where the system was likely exposed to greater foot traffic. The system had such poor adhesion that even light scraping could remove the existing coating down far enough to expose the bare concrete beneath it.

To determine the extent of the system failure, I performed three adhesion cut tests on the surface according to ASTM D3359 Method A: X-Cut Tape Test. One adhesion cut test was done near the exit door where the system showed severe failure, while the other two tests were completed farther away from the exit where the coating appeared to be sound.

The test results showed the coating had no adhesion to the underlying substrate at any part of the floor. After further evaluating the exposed concrete, I was able to determine that the coating did not adhere to the substrate because the surface of the concrete was very smooth and had an oily feel when touched.

Interpreting the Findings
If the surface of the concrete slab is very smooth, it will be difficult for any coating system to adhere to the surface. In these instances, muriatic acid is recommended to etch the surface of the concrete. Other means of mechanical abrasion could also be used to roughen the surface and provide a profile to which the coating system can adhere.

In addition to the surface having a very smooth finish, the presence of oily residue on the surface of the concrete floor was
Resolving the Problem

From these observations, I was able to conclude that the delamination of the coating from the substrate was not caused by excessive or aggressive abrasion but resulted from typical foot traffic that occurred in the hallway. The coating exhibited absolutely no adhesion to any part of the concrete floor, even where the coating appeared sound.

In order to remediate the systems failure and to prevent similar defects from recurring, the existing system needs to be completely removed by scraping and sanding.

After the existing failed system is completely removed, the surface should be washed with a suitable detergent or an emulsion cleaning solution and then thoroughly rinsed with clean water in order to remove the remnants of the curing compound from the surface.

To test if the surface is free of contaminants, apply a muriatic acid solution to various areas of the surface to see if any likely to have contributed to the coatings failure.

After the troweling process is complete, curing compounds are often used on concrete floors in order to slow down the rate of water evaporation and improve hydration and curing of the slab. This improves the strength, hardness, and physical and chemical properties of the concrete slab.

Typically, curing compounds are made from low-strength resins that do not provide sufficient adhesion or film strength to function as either a primer or sealer in a coating system. Because of this, they should be removed prior to applying a new system.

The oily residue found on the surface of the substrate was likely the remnants of a concrete curing compound that was not properly removed from the substrate prior to the application of the gloss alkyd coating.
reaction occurs. If there is no bubbling, spitting or foaming where the solution is applied, it means that the surface is not sufficiently clean for painting, as the acid solution cannot penetrate through the curing compounds. If this is the case, the washing and testing process needs to be repeated in order for the new coating system to adhere to the concrete.

Once the surface is sufficiently clean, the floor should be etched with a mild solution of muriatic acid and water to etch the floor and provide an anchor pattern for the coating to adhere to. Additionally, a wash of muriatic acid helps to neutralize the alkalinity of the substrate, which can be chemically destructive to oil-based or alkyd paints.

Once the concrete is dull, gray and gritty to the touch, the surface should be thoroughly rinsed with water and then allowed to fully dry. A pH test should be conducted to ensure that the pH level is within an acceptable range for the selected coating system.

Due to the amount of foot traffic and the absence of sub-slab moisture issues with the concrete floor, a water-based epoxy system is recommended, as it provides good durability for the exposure environment.

If sub-slab moisture was an issue with this concrete floor, a more permeable coating system would be recommended (such as latex). The low permeability of an epoxy coating does not allow moisture to pass through the film of the coating, which can cause hydrostatic pressure to build and ultimately can result in blistering and delamination of the coating system.

About the Author
Dave Lick is a paint quality assurance inspector for the Master Painters and Decorators Association. In addition to performing inspections, writing specifications, and providing failure analysis and consultations for contractors, architects and property management companies, Dave is also a key contributor in the development of the Master Painter’s Institute’s Training Programs.
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