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DEALING WITH A STICKY SITUATION

By Bob Cusumano

A national company that owns personal storage facilities around the country recently built a three story building in a southern coastal community. The building was constructed of concrete block and stucco with metal pan ceilings and poured concrete floors.

Interior concrete floors had been in place approximately four months before preparation and painting of the floors was initiated. The originally specified coating system for floors was two coats of a silicone acrylic concrete stain. In an effort to achieve better durability, the specification was changed to one coat of clear alkyd primer followed by a finish coat of alkyd floor enamel. The preparation reportedly consisted of abrading the surfaces using a floor sander with a coarse disk, followed by vacuuming and wet mopping.

The work was initiated on the third floor and proceeded to the second and first floors thereafter. As the first floor was being painted, it was noticed that the coating on the third floor had become "sticky" in some areas and began to delaminate. At that time, our firm was asked to assess the severity of the problem, determine its cause, and recommend remedial action.

At the time of our inspection, scraping off of the existing applied coating had begun as shown in photo #1. Photo #2 shows the condition of first floor areas prior to scraping; where large areas of paint delamination are visible.

Photo 1

Photo 2

Much of the coating on the second floor appeared to be intact with no delamination. However, at some locations a color and gloss difference was noted which are the initial signs of saponification. On the third floor, delamination was prominent at many areas as typified by photo #3. At some locations there were distinct variations in color and gloss and the coating had become soft and sticky as shown in photos #4.

Photo 3

Photo 4

The testing performed included pull-off adhesion tests, measuring the pH of the concrete substrate immediately beneath the coating, and determining the moisture content of the concrete.

The adhesion tests performed indicated that the existing coating was poorly adhered at all floors and locations of the building. Adhesion pull-tests to failure of a properly adhered coating to a properly prepared concrete substrate should result in a cohesive failure of the concrete. That is, the adhesion between the coating and the concrete should exceed the cohesive strength of the concrete itself. The tensile strength at failure of the 23 samples was found to be very low, varying from 25 PSI to 300 PSI, with 14 of the samples failing at 150 PSI or lower.

Examination of the samples revealed that there were three distinct causes of coating delamination at this facility including:

1. Adhesive failure of the alkyd enamel to the clear alkyd sealer

The data sheet for the sealer states that when used as a primer, the product is to be thinned with 1 to 2 quarts of xylene per gallon. The purpose of thinning is to encourage penetration into the concrete and avoid the establishment of a glossy surface. Coatings do not adhere well to a smooth glossy surface as no mechanical adhesion is attained. At this facility, the sealer was applied too heavy, resulting in the top coat of alkyd enamel not establishing good adhesion to the sealer. Photo #5 shows that the rear of the delaminated enamel is extremely smooth. Photo #6 shows that the sealed concrete surface from which the enamel topcoat delaminated is also very smooth with only a few scratches visible from the sanding performed as surface preparation.

Photo 5

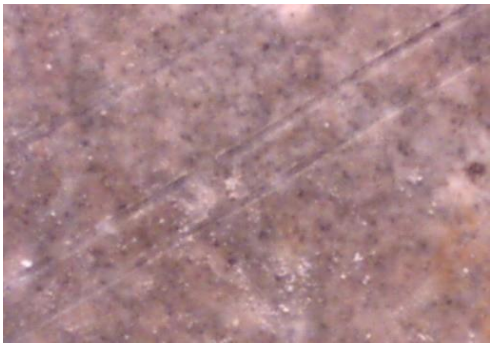

Photo 6

2. Adhesive failure of the sealer to the bare concrete.

At some locations the sealer lost its adhesion to the bare concrete floor. Photo #7 shows the heavy buildup of sealer with stress cracks visible on the rear of an adhesion test sample. Optical examination of the surface of the concrete at many areas revealed that the surface was extremely smooth and slick. At these locations, the sanding performed was not sufficient to adequately roughen the concrete surface to establish a mechanical adhesion to the substrate. This is supported by many of the pull test results where failure occurred at relatively low pressure removing both the topcoat and the sealer. The floors have a smooth troweled finish. As stated on the sealer data sheet, acid etching of the concrete is recommended in these situations.

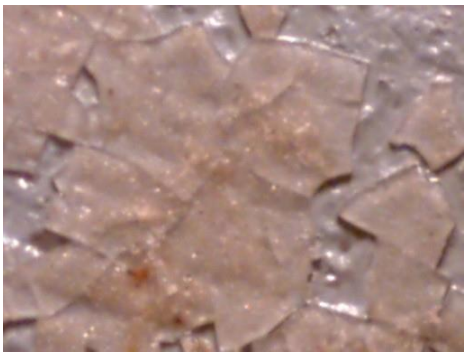

Photo 7

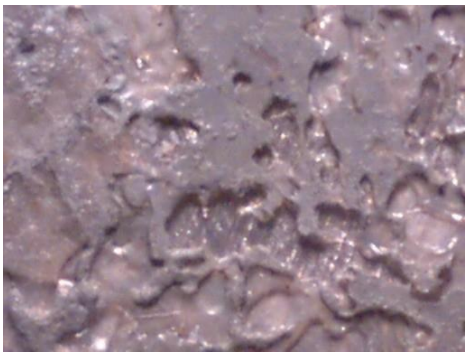

Photo 8

3. Saponification of both the sealer and the alkyd enamel.

On the third floor, some of the existing coating had become wet and "sticky". This is due to a phenomenon known as saponification that occurs when a combination of moisture and a highly alkaline condition resulting in total chemical degradation of the coating. The high moisture and pH readings at many locations support this contention. Color and gloss changes occur as a part of saponification. Photo #8 shows the deformation to the paint film that occurs.

The causes of coating delamination at this facility include poor adhesion of the sealer to the bare concrete caused by inadequate surface preparation, poor adhesion of the top coat to the sealer caused by not thinning the sealer and applying too heavy a coat, and degradation of both the sealer and top coat by saponification due to moisture and high alkalinity. At some of the samples,

one mode of failure was identified, while at many locations the delamination was due to a combination of the above causes.

Some coating resins are more susceptible to saponification than others. The use of a silicone acrylic stain, as originally specified, would have reduced the likelihood of saponification.

Prior to recoating these floors with either a stain or an epoxy system, all existing coating had to be removed. The surface of the concrete should be roughened, preferably by shot blasting. The pH and moisture levels should be monitored prior to recoating.

This is an instance where a poor specification and inadequate surface preparation have resulted in an expensive fix and an unhappy customer.