

Coatings Consultants Inc.

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ONE FROM COLUMN A By Bob Cusumano

This case involves a large addition to a mansion on the Florida coast. Part of the job included the construction of a long colonnade walkway that led from the main house to the pool. The roof of the walkway was supported by columns constructed of poured concrete (photo #1).



Photo 1

The owner wanted the appearance of wood, but the durability of concrete, so the concrete columns were formed using plastic laminate and treated with butcher's wax to ensure a smooth surface.

After the installed columns had cured for a couple of months, the painting contractor reportedly acid etched all surfaces. Imperfections, being voids or "bug holes", were patched with an exterior water based spackling compound. The columns were primed with an alkyd based bonding primer and finish painted with two coats of exterior acrylic semi gloss.

Approximately three months after the columns were painted, some localized peeling was noted. The painting contractor scraped and touched up those areas. Soon thereafter, however, more widespread delamination was evident.

At the time we examined the columns, there was bubbling and wrinkling of the paint at some locations (photo #2) and at other locations, the paint had either already delaminated or been scraped off (photo #3).



Photo 2



Photo 3

Adhesion tests were performed at locations where no peeling was evident in an effort to determine if the problem was localized or more widespread. Incisions were made through the coating in an X pattern using a razor blade. Permacell adhesive tape was firmly applied to the area and then sharply removed.

Nearly all tests yielded "poor" results with large pieces of paint being removed with the tape.

Whenever paint delaminates, it is important to determine where the delamination has occurred. In some instances, where the adhesion was poor, the delamination occurred back to bare concrete as shown in photo #4. The surface of the concrete was found to be very smooth at these spots. In other instances, the delamination occurred within the layer of patching material as shown in photo #5.



Photo 4



Photo 5

pH is a measure of the acidity or alkalinity of a substance. A pH of 7 indicates neutrality. pH readings decreasing from 7 indicate increasingly acidic conditions. Similarly, pH readings increasing from 7 indicate increasingly alkaline conditions. The surface pH of properly cured cementitious products, like concrete, is in the range of 8 to 10. Higher numbers could indicate an improper mix or cure, or the presence and migration of moisture.

The pH of the substrate exposed by the adhesion tests was measured by marking the area with a pH pencil, moistening the area with distilled water, and comparing the color to the pH chart. The pH was found to be extremely alkaline at all locations tested, being either 12 or 13. This suggests that moisture has migrated to the rear of the paint carrying alkaline salts.

The amount of moisture present in the concrete substrate was measured using an electronic moisture meter. The moisture content was found to be elevated at nearly all locations tested, being in the range of 80% to 100%.

The majority of this moisture is likely retained water in the poured concrete that has been "trapped" by the application of a non-breathing alkyd base paint. Some of the moisture may be attributed to saturation from rainfall and improperly directed lawn sprinklers.

Based on the conditions found, the delamination and poor adhesion on the columns is due to a combination of moisture, an alkaline condition, and paint application to a very smooth concrete surface.

Saponification is one cause of the paint delamination. Saponification is the chemical degradation of a coating due to high alkalinity and moisture. The coating becomes "sticky", then brittle when dried and loses its adhesion. Alkyd and oil base paints are particularly prone to this problem and should not be utilized when moisture and alkali are present. The moisture and alkali have also affected the patching material, causing it re-emulsify and suffer a cohesive failure.

Another contributing factor to the poor adhesion of the paint to the concrete columns is the lack of mechanical adhesion. A large percentage of paint adhesion is achieved by its mechanical bond to the surface to which it is applied. When that surface is rough and porous, then good adhesion is established. When that surface is smooth and glossy, as it was found to be in this instance, then adhesion is compromised.

Unfortunately, no topical solution to this problem exists. More paint applied over the top will only worsen the problem. Therefore, the following remedial actions were recommended.

1. All paint and patching material should be removed. Unfortunately, large areas of the columns were patched, not just the voids. Scraping is probably the most effective method.
2. All bare concrete surfaces should be acid etched to roughen the surface similar to 120 to 80 grit sandpaper. If the acid does not fizz when applied, then the butcher's wax is interfering with the chemical reaction and must first be removed using solvent. After acid etching, surfaces must be thoroughly flushed with clean potable water, neutralized if necessary, and allowed to thoroughly dry.
3. All pores, voids, and "bug holes" should be patched with a high strength cementitious patching compound, taking care to only fill voids and to remove any excess patching material.
4. Columns should be primed with an exterior acrylic bonding primer and finished with an acrylic latex house paint in the desired sheen.

Sprinklers should be checked to ensure that they are not spraying directly on columns. The top of these columns should be sealed, caulked and painted to eliminate any possible water intrusion at that location.

In this instance, a well intended paint job failed due to insufficient surface preparation and the selection of an improper primer for the conditions to be encountered.