Coatings Consultants Inc.

Telephone 561-775-7151

A consulting firm specializing in:
Testing of Paints & Coatings
Quality Assurance Inspections
Specification Writing
Failure Analysis
www.coatingsconsultants.com

8211 Needles Drive, Palm Beach Gardens, Florida 33418

UNSTICKY SITUATIONS

By Bob Cusumano

If you read this column very often, you'll know that I frequently stress the importance of performing adhesion tests. I don't mean to nag, but some of you are not listening. The sad part is that I see so many costly failures that could be limited in scope and corrected relatively inexpensively had they been recognized early on. Instead, the job was completed before the problems were recognized and then a costly repair was required. In this article, we'll discuss three cases that have different causes of poor coating adhesion and illustrate how performing adhesion tests could have saved a great deal of money.

The first case involves the original painting on the exterior of a new furniture store. The exterior walls were constructed of tilt up concrete panels. The painting specifications called for the application of one coat of primer and two coats of high build acrylic semi-gloss coating. According to the painting foreman, the walls were patched by others before and after pressure cleaning occurred. After applying the primer, more patching was performed. Even after applying the first finish coat, some patching was done.

Before the job was accepted by the owner, some blisters began to appear as shown in photo 1. Several blisters were cut open and no water was found inside of them. However, in all instances, there was a layer of patching compound adhered to the rear side of the paint. This is visible in photo 2. Several adhesion tests were then performed. Wherever there was patch under the coating, the test results were poor. At locations where the entire paint system was applied directly to the concrete, the adhesion was good.

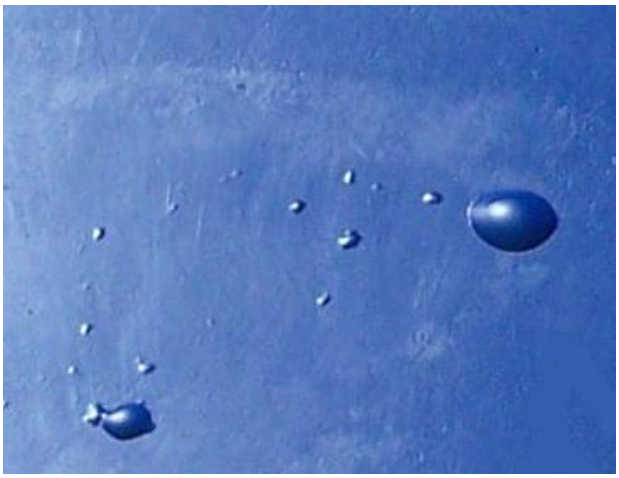

Photo 1

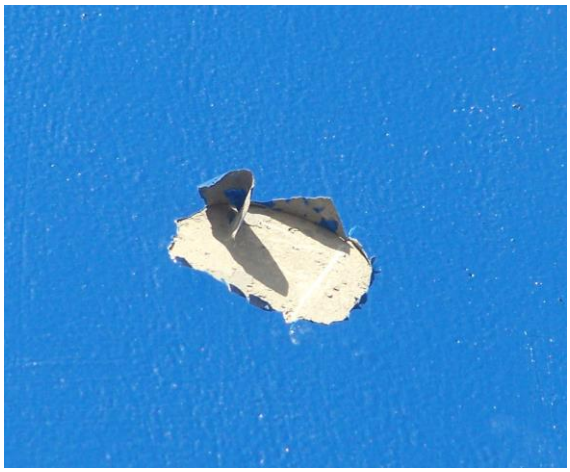

Photo 2

The cause of the blistering was a cohesive failure of the patching material, that is, the failure occurred within the patching material itself. Concrete retains a high level of moisture after its placement. When the heat of the sun strikes the dark colored coating, then the moisture migrates outward. Since the coating system was relatively thick with a "tight" film since it was a high build semi-gloss, moisture could not easily escape and blisters formed where the patching material sheared. Had a coating sample been applied over the patching material and adhesion tests performed, it would have been discovered that the patch was friable. At that point, an acrylic resin hardener might have given the patch sufficient cohesive strength and solved the problem. In this case, another contractor's problem became one for the painting contractor.

An elementary school was built with large areas of metal siding and fascia. The metal had a twenty year factory finish of Kynar coating. During construction, the finish on the siding was scratched at many locations and the responsible contractor touched up the damaged areas with a paint that was matched to the original color. However, since the touchup paint was not a Kynar coating, within two years it had chalked and faded leaving unsightly spots all over the siding. Specifications were written and a painting contractor was hired to pressure wash, apply a coat of bonding primer and DTM acrylic to the metal siding. Within six months after completion of the painting, several areas began to spontaneously delaminate and blister as shown in photo 3. Cross hatch adhesion tests were performed and poor results were obtained as shown in photo 4 where the failed coating exceeded the area that had been cut.

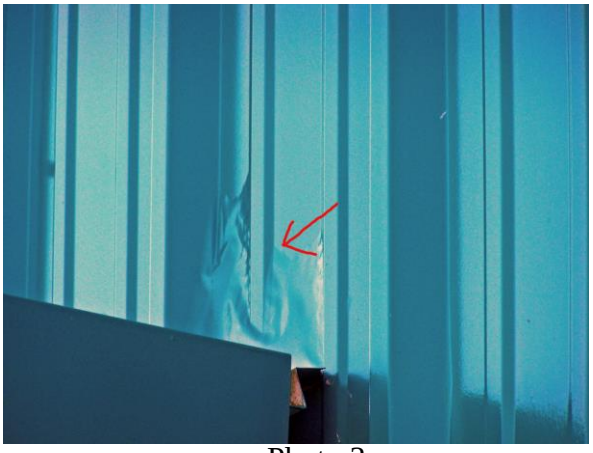

Photo 3

Photo 4

The cause of the delamination and blistered coating was the selection of the primer. Factory applied Kynar coatings are extremely hard and slick and the primer used in repainting must establish excellent adhesion. The adhesion tests performed indicate that the waterborne primer used did not establish substantial adhesion on the Kynar. Initially, the painting contractor was blamed because the data sheet indicated that glossy surfaces should be sanded, even though impractical on metal siding of this configuration and magnitude. However, testing showed that the adhesion was poor even after the factory coated surface was sanded. If the painting contractor had painted a small sample area and performed adhesion tests, the poor adhesion would have been discovered and the change to another primer would have prevented this widespread failure.

In the last case, a contractor signed a contract with a high-rise condominium to perform various remodeling services including painting the interior entrance doors to all units. There were formal specifications for the project written by a third party which indicated that wood doors were to be lightly sanded, dusted, and painted with two coats of gold colored latex semi-gloss enamel. Before the project was completed, some chipping and peeling of the paint occurred on the doors as shown in photo 5.

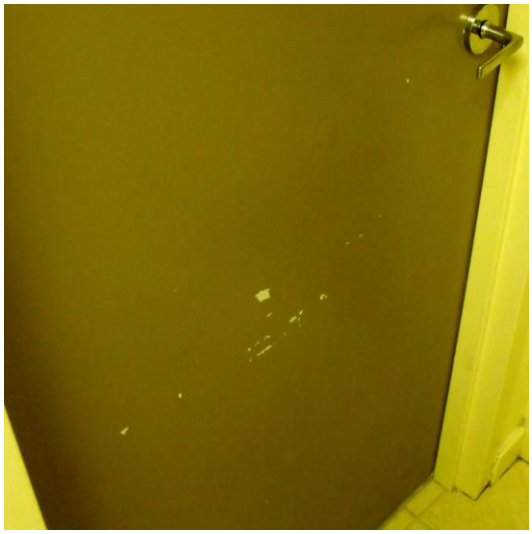

Photo 5

Adhesion testing was performed which indicated that the paint coats applied by the contractor are well adhered to the paint that was previously applied to the doors. However, delamination failure occurs when previously applied gray latex paint disbonds from previously applied gray alkyd paint. Alkyd paints have very different properties than latex paints. Alkyd paints form very hard, brittle films, whereas latex paints have softer, more elastic films. Latex paints tend to lay on the surface to which they are applied without penetrating. Therefore, when latex paint is applied over a hard alkyd paint film, the surface must be scarified to provide some mechanical adhesion to aid with adhesion. A bonding primer should also be used.

Unfortunately, when the existing gray alkyd paint was over coated with the gray latex paint, the surface was neither sanded nor a bonding primer used. However, when only one thin coat of gray latex paint was applied to the doors, very little spontaneous delamination occurred because the stress of the applied paint was minimal. However, when our contractor applied approximately four mils of additional primer and gold colored latex paint, the applied weight and stress increased greatly and the previously applied gray latex paint delaminated from the existing gray alkyd paint. Photo 6 is a photomicrograph showing the cross section of the delaminated paint. The two coats of gold paint are visible over the single coat of gray latex that delaminated.

Photo 6

The project specifications stated "Clean surfaces of all dirt, dust, or other contaminants that affect adhesion of paint". Clearly, this was accomplished as the paint applied by the contractor adhered well to the existing paint to which it was applied. The problem is that the previous party that applied the gray latex paint over the gray alkyd paint did not sand the alkyd paint to establish good adhesion and did not use a bonding primer. This condition should have been recognized by the author of the specifications by performing adhesion tests. Had that been done, then stripping of the existing top coat of paint would have been specified. Unfortunately, there is no topical solution to this problem. That is, any poorly and marginally adhered gray latex paint and the gold latex applied over it must be stripped before the surfaces are repainted. Here again, even though the failure is not the painting contractor's fault, the contractor becomes involved with the problem. Had a sample door been painted and adhesion tested, this problem would have been recognized before all four hundred doors were painted.