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SOMETIMES YOU HAVE TO LOOK DEEP TO FIND THE ANSWER
By Bob Cusumano

A large corporate office building was being constructed in the Atlanta area. The architect and owner wanted to have interior walls painted with low sheen paint. For this reason, it was decided that a class 5 gypsum board finish was necessary so that imperfections at seams and nail heads would not be visible. The class 5 finish was achieved by applying a full skim coat of hardcote plaster. The painting specification for wall surfaces was one coat of acrylic bonding primer and two coats of acrylic semi-gloss paint.

After areas of the executive offices were finish painted, it was noticed that masking tape placed on the wall surfaces and then removed, also removed the coating down to the plaster substrate. It was theorized that the paint was not attaining proper adhesion. In an effort to select the correct product and procedure to go forward with the painting work, several samples of various combinations of paint primers and finish coats from different manufacturers were applied to the plaster walls. These sample areas cured for a minimum of 30 days.

These sample areas were tested in the following manner:

The adhesion of the paint to its plaster substrate was tested in general accordance with ASTM D3359, Adhesion by Tape Test, Method A. Incisions were made through the coating in an X pattern. Permacell adhesive tape was firmly applied to the area and then sharply removed. The adhesion of the coating was then evaluated by the amount of material that is removed. The adhesion tests yielded poor results on all of the samples using acrylic primers. Photo 1 shows a typical test result where the paint was removed under the entire area of the tape. The results were somewhat better when alkyd primers were used; however, when these primers received the acrylic finish coats, the results were again poor.

Photo 1

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. Likewise, pH readings increasing from 7 indicate increasingly alkaline conditions. The pH on the surface of the plaster 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 of the bare plaster was found to be in the range of 8 to 9, which is not highly alkaline. pH tests were also conducted on the plaster exposed during the adhesion tests (also shown in photo 1) and were found to be only slightly alkaline.

The amount of moisture present in the plaster was found to be very low when measured with an electronic moisture meter.

All of the adhesion test samples were optically examined using a stereo zoom microscope. It was observed that there was a thin layer of plaster attached to the rear of the delaminated paint in all instances. Adhesion tests were then conducted on unpainted plaster surfaces. Again, a thin layer of plaster was removed with the tape as shown in photo 2.

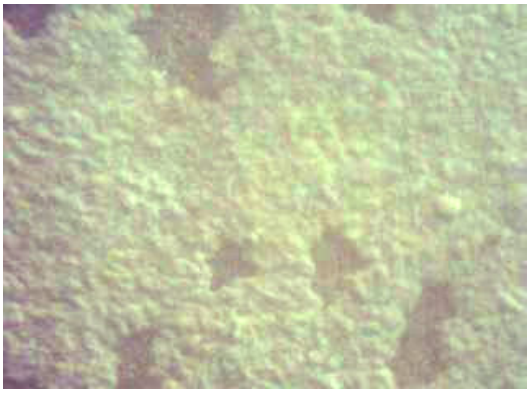

Photo 2

The total thickness of paint and plaster that delaminated during adhesion tests was measured using an electronic coating thickness gauge and a polished aluminum plate. The plaster on the rear side of the delaminated paint was then removed by rinsing with water. The thickness of the

paint only was then measured in the same manner. The thickness of the plaster was determined by subtracting the thickness of the paint only from the thickness of the paint and plaster for each sample. The thickness of the plaster layer attached to the rear of the paint extracted during adhesion tests ranged from 0.9 to 4.5 mils.

A drop of green food dye was placed on the rear of an adhesion test sample. The dye penetrated through the porous plaster and stopped at the paint interface. Photo 3 shows a cross section of the sample where both the plaster layer and coating layer are easily discernable.

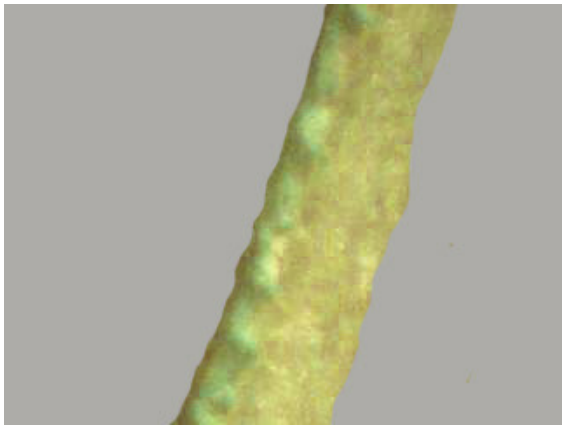

Photo 3

The degree of chalking on the surface of the plaster exposed by the adhesion tests was evaluated in general accordance with ASTM Standards D 4214- 97 Method A. Surface chalk is transferred to a black cloth by rubbing it against the surface being tested. The amount of chalk on the cloth is compared to a photographic standard. In all instances, the surface chalk beneath the delaminated paint was assessed to be "heavy". This heavy chalk is a result of a fracture within the layer of plaster. In fact at one location, a chalk test performed 25 times at the same location continued to have heavy chalk showing that the plaster was “dusting”.

Contrary to the original theory, the cause of the paint delamination at this project is not due to poor paint adhesion. The testing performed indicates that the paint has adhered to the surface of the plaster, but that the delamination is occurring beneath the paint/plaster interface, within the plaster itself. When stress is applied, the plaster fractures. This failure is a cohesive failure of the plaster. Perusal of the data sheets for the hardcote plaster used to achieve the class 5 finish indicates that the product is designed to be applied at a thickness of only 3/32 of an inch. It was determined that on this project, the plaster thickness was far greater, perhaps being a factor in the lack of cohesion displayed. Rather than jumping to conclusions regarding the cause of paint delamination, it is often necessary to look deep below the surface being painted, to determine the cause of the failure.