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## SCHOOLS TAKE COAT OFF AFTER IT SHOWERS

By Bob Cusumano

The paint material itself is rarely the cause of a paint failure. More commonly it's a reaction of the paint to a defective substrate, or to unusual environmental conditions, or an application error, or even a poor specification. But sometimes, the failure is due to defective paint material and this is one of those cases.

A general contractor received a contract to build classroom additions on ten schools. The exterior walls of the additions were either concrete block with cement plaster or tilt up concrete. The all exterior walls of the buildings were painted with an alkali resistant primer and a white textured acrylic finish coat that was to be applied at a dry film thickness of 15 to 20 mils. When an accent color was desired, a coat of tinted 100% acrylic semi-gloss paint was applied over the texture. Four different painting contractors were awarded the painting subcontracts on the various sites. Before the construction warranty period had expired on any of the jobs, the general contractor was notified by the school board that there was peeling paint on all of the building exteriors.

A site inspection of the schools revealed that there was delamination on all elevations of each classroom building and the delamination included both walls constructed of concrete block and stucco as well as tilt up concrete walls. In some instances, the delamination was localized and minor as shown in photo 1.



Photo 1

At other locations, the peeling was extensive as shown in photo 2.



Photo 2

Delamination occurred on areas that received the primer and texture, as well as where the texture had been overcoated with the accent acrylic (photo 3). In all instances where delamination occurred, the primer remained intact on the wall. Only the textured coat and the texture coat plus accent acrylic had peeled.



Photo 3

Exterior walls which were protected by overhangs had no peeling visible as shown in photo 4.



Photo 4

The adhesion of the coating was tested on walls where no delamination was evident. The test performed was ASTM D 6677 – 07 “Standard Test Method for Evaluating Adhesion

by Knife”. The test involves using a sharp knife to make two cuts are made into the coating with a 30 to 45 ° angle between legs and down to the substrate which intersects to form an “X.” Employing the point of the knife and beginning at the vertex of the angle, an attempt is made to lift up the coating from the substrate or from the coating below. The adhesion is rated by how easily the coating can be lifted and by the extent to which it is lifted. There is a rating system that ranges from zero to ten, with zero being the poorest adhesion and ten the greatest.

The adhesion tests showed that the adhesion of the textured coat to the primer was poor or marginal at most locations tested, but good at some locations. However, the adhesion of the primer at all locations was very good to either the concrete or cement plaster to which it had been applied. This type of failure is called intercoat adhesion failure, where one paint coat peels from another.

The pH on the surface of the primer from where coating delaminated was also determined. 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 exposed primer was measured by marking the area with a pH pencil, moistening the area with distilled water, and comparing the color to the pH chart in photo 5. The pH on the surface of the primer was found to vary from location to location. While at some places it was highly alkaline with a pH of 12, at other spots it was nearly neutral with a pH of 8.



Photo 5

The thickness of the textured coating was measured optically by viewing a cross section through a microscope with a reticle. The thickness of paint chips that had spontaneously delaminated was found to average 21 mils DFT. At locations where the textured coating had not delaminated, the average thickness was 12 mils.

The fact that the paint failure occurred on ten different schools, painted by four different painting contractors, with the application on two different substrates, pointed a finger at the textured coating which was the common denominator at all of the schools.

Rilem tubes are plastic cylinders with graduated marking that are used to measure water penetration over a period of time. In this instance, they were used to assess the water sensitivity of the textured coating that had been applied. Several locations were selected where adhesion tests indicated that the coating was well adhered. Rilem tubes were attached with a special putty and filled with water as shown in photo 6.



Photo 6

After 30 minutes of exposure, the Rilem tubes were removed, the surface was dried with a cloth, and adhesion by knife tests were performed. In all instances, the adhesion became very poor and the textured coating easily separated from the primer when lifted with the knife blade as seen in photo 7.



Photo 7

Based on our observations and the tests conducted, it was shown that the cause of the delamination on these schools is that the textured coating absorbs water which causes it to lose adhesion. Although the Rilem tests show that the coating was softened regardless

of the thickness, the delamination occurred at areas where the coating was thicker due to the thicker coating retaining moisture for a greater period of time and the fact that the additional weight and stress of the thicker coating would exceed the adhesive strength and result in delamination. At locations where the accent acrylic was applied over the textured coating, "tight" film of the topcoat retards moisture evaporation and would exert a high degree of stress to the underlying textured coating. Unfortunately, there is not a topical remedy for this condition. Therefore, the defective coating must be removed and replaced with a coating that is not water sensitive and whose adhesion will not be compromised when it gets wet.

Paint manufacturers do a terrific job of product testing and quality control of the paints that they produce, realizing that they are dependent upon their raw material suppliers to provide consistent components. However, once in a while, some things fall through the crack.