11 The Repair of Coating Failures

It is a very difficult task to provide universal guidelines on how to repair coating failures. There are several reasons for this, not the least of which is the seemingly endless variety of coating failures and the multitude of factors that can cause them. Furthermore, a repair recommendation to fix a blistered vinyl coating may be totally inappropriate for fixing a blistered epoxy coating. In addition to technical constraints, there may be economic ones as well. If the coating on a 20-story building in an urban metropolis is failing because of defective primer, the 'technically correct' repair procedure may be to blast clean all of the coating off and start over. However, this is not an economically sound solution. Therefore, the most that can be put forth in this chapter are some general guidelines and considerations.

One of the first things to consider in developing a repair plan, after first establishing the reason for the failure, is the *extent* of the failure. If the failure is small and localized, spot repair or touch-ups may be adequate. This can usually be accomplished by using simple equipment such as hand or power tools, as opposed to abrasive blast cleaning. If the areas are small, touch-up may often be carried out by brush or roller (provided aesthetics is not a primary concern). Spot repair by such methods, at least on large structures, has the added advantage of minimal environmental impact. This can be a major concern if the coating being repaired has hazardous metals, such as lead or chromium, contained in it.

When carrying out spot repairs, it is common practice to remove all failing coating until an area of sound coating is reached, and then to feather the edges of the sound coating. Failure to do this can result in additional failure in the worst case, and in the best case is simply unattractive. It is also important to choose a repair coating system that is compatible with the existing system in order to avoid failures in the overlap areas.

If the failure area is 10 % or more of the surface area, it usually makes sense to carry out a complete repair rather than a spot repair. It is very important

when estimating the % failure, to also include those areas that have not yet spontaneously failed, but which show clear signs of impending failure. If the failure mode is one of peeling, for instance, it may be that the obvious peeling comprises less than 1 % of the surface areas. However, if adhesion testing is done at randomly selected 'good' areas, one may find large areas of very poorly adherent coating that simply have not had a chance to fall off yet.

Depending on the type of failure, it is not always necessary to remove the entire coating system, even if the extent of coating failure is massive. If the topcoat is peeling from a primer because the former is defective (perhaps it is too thin, too thick, 'mis-mixed', or simply defective paint), it may make sense to remove only the topcoat and leave the primer intact. Not only does this save money on repainting (it is cheaper to apply one coat than two), but it spares exposing the substrate to the environment. Such a scenario might involve high-pressure water blasting to remove the loose topcoat, or the use of non-aggressive (soft) abrasive media.

If the failure is cosmetic (such as discoloration) rather than structural (such as peeling or blistering), the repair may simply be to cover it up. After cleaning to remove dirt or other contamination, a fresh coat of topcoat may be applied, provided that it is compatible with the existing coating.

The astute reader has probably noticed how many warnings have been given concerning 'compatibility'. This is a key issue when repainting old or failed coatings. In some cases, lack of compatibility is obvious. One would not, for instance, topcoat an acrylic latex with a solvent-based two-component epoxy. The combined effects of solvent and curing stress would be likely to lift the solvent-sensitive acrylic.

Sometimes, compatibility issues are not so obvious. Could a coal tar epoxy be repaired by coating it with the same coal tar epoxy? Surely the two coats would be compatible. Unfortunately, aged coal tar epoxies are difficult to re-coat, even with themselves. This is due both to their very hard nature, and to surface deterioration as a result of sunlight exposure.

At a minimum, when contemplating a re-coating, one should obtain the opinion of the coating manufacturer. It is also good practice to apply a test patch prior to wholesale re-coating of a large structure. This test patch should be applied via the same technique that will be used on the whole structure. It should also be given adequate time to fully cure before it is assessed for adhesion (rarely will a defective test patch simply 'fall off' – it needs to be stressed for proper assessment).

A common objection to test patches is that they take too long to evaluate. At a minimum, the newly applied coating should be allowed to cure for a week prior to evaluation, and ideally for several weeks. The properties of a coating, especially a two-component coating or one that cures by air oxidation, can change substantially over time. A coating that displays good initial adhesion may become poorly adherent as it cures and embrittles. The longer one can wait to examine a test patch, the better.

One of the most difficult types of failures to repair is a coating that, for whatever reason (usually improper catalysis or mixing), has remained soft and gummy. This author was involved in one such failure on several thousand square feet of concrete floor, which was the result of the contractor trying to extend a short pot life by cutting the catalyst level in half.

Soft, gummy coatings are extremely difficult to remove by blast cleaning. Either laborious hand tool methods are required, or when odor is not a concern, chemical strippers can be used. If the substrate is porous (such as a concrete floor), chemical stripping may result in uncured coating residues penetrating into the substrate. A final scouring, such as by blast cleaning, may be required in order to ensure cleanliness.

When the extent of the failure justifies total removal, the removal method itself must be given careful consideration. Things to be considered include cost, environmental impact, damage to the substrate, and damage to nearby machinery. Using a paint stripper and sanding to remove a defective furniture lacquer makes sense, while adopting the same procedure on a bridge would be an economic, and perhaps an environmental, disaster.

An example of a repair that could damage the substrate would be removal of defective coating from coil coated galvanized roof panels. Normal abrasive blast cleaning would be efficient, but it could also remove substantial amounts of the protective galvanizing, as well as potentially deform the relatively thin-gauge steel. The use of high-pressure water blasting, or a soft abrasive such as crushed walnut shells, would be a better choice.

It is usually important to know why something has failed before trying to fix it, so as not to make the same mistake twice. A water tank that has blistered because the epoxy primer contained water-soluble solvents will blister again if the same type of coating is applied under the same conditions.

The investigation of coating failures can be a fascinating pursuit. It requires knowledge of application methods, service environments, coatings chemistry, analytical methods and logic. Unfortunately, it sometimes requires things that the investigator may have little control over, such as accurate, detailed background information and good samples. Hopefully, this book has provided the reader not only with some of the tools needed to decipher coating failures, but also a sense of the enjoyment that such a challenge can bring.