CONSIDERATIONS FOR COASTAL COATINGS

PART II OF III

By Joseph "Cris" Crissinger, CCS, CCCA

INTRODUCTION

This article is presented in three parts. Part I, published in the March 2007 issue of *Interface*, provided an analysis of types of paints and coatings. In this section, Part II, surface preparation and application will be discussed. In Part III, suggested painting/coating systems for coastal environments will be examined.

PART TWO - SURFACE PREPARATION

Part I of this series, published in the March issue of *Interface*, examined the different types of protective coatings and the characteristics of each. The three key points from Part I are:

1. There are many different types of paints and protective coatings.
2. Each paint and protective coating has its own personality.
3. There is no panacea for all coating situations.

This, Part II of the series, will examine surface preparation of common substrates.

There is a lot to be said for selecting the proper coating to meet the specific need. However, the overall success and performance of that coating can be determined by how well the substrate is prepared. True, primers and finish coats have been improved significantly over the years. With the advent of rust-penetrating primers and direct-to-metal (DTM) finishes, coatings can be a little more forgiving than in the past. The general consensus among coatings and corrosion professionals is that coatings are not a substitute for good surface preparation and proper application of the suitable primer.

General Preparation

Improper surface preparation is probably the most frequent contributor to protective coating failures. The importance of surface preparation cannot be overemphasized, especially in coastal environments. However, it is important to note that not all preparation techniques are applicable to every situation or substrate. Instead, the method should be determined by:

- Substrate (steel, wood, masonry)
- Substrate condition (corroded, rough, smooth, previously painted)
- Painting environment (coastal, industrial, commercial, interior, exterior)
- Coating generics (alkyd, acrylic, epoxy)
- Budget

As might be suspected, not all levels of surface preparation cost the same; you usually get what you pay for.

Many coatings require a rough surface profile that provides something for them to bite into as they cure. In other words, a substrate can be too smooth for proper adhesion. This is why hard, glossy coatings should be abraded prior to applying a topcoat. Typically, coatings shrink during curing. This shrinkage creates a mechanical bond to the rough surface. When a topcoat is applied to an undercoat that lacks sufficient bond, the topcoat's shrinkage as it forms a bond during curing can cause the undercoat to curl and delaminate. This is a common problem when painting over poorly prepared surfaces or by using incompatible coatings.

Surface preparation is the foundation for a strong coating system, just as strong footings are the foundation for a stable building. Product data sheets or coatings containers usually mention surface preparation for various substrates. There may be additional information in the product manual. The suggested surface preparation should be considered as the minimum required.

Although surface preparation is crucial, there can be too much of a good thing. For instance, when preparing metal for priming, if the surface profile produced by the abrasion is too deep, the peaks of the surface profile can extend above the primer as shown in *Figure 1*. These exposed peaks can wick moisture under the primer to the metal and lead to undercutting the primer (a frequent problem when steel fabricators use economy primers that have a thin film

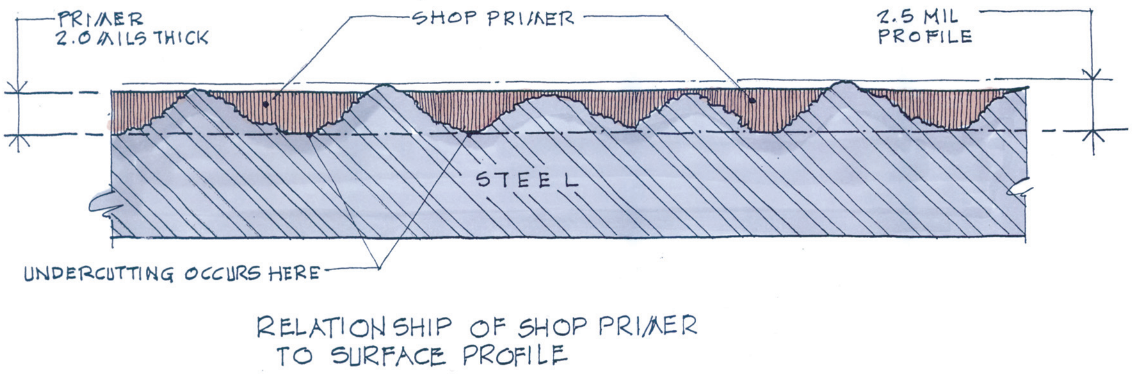

Figure 1

build over steel that has been heavily abraded to commercial blast grade or heavier). Metal arriving at the construction site in a rusted condition is a common occurrence that can be prevented by ensuring the surface profile depth is less than the primer's dry-film thickness (DFT) and by using the proper primer. It can be helpful to specify a white primer so that dirt and rust will stand out. Rust and dirt (especially the red clay found in the Piedmont of South Carolina) can blend in with red primers.

Improper surface preparation or application usually results in one of the following failures as illustrated in *Figure 2*:

- **Adhesive:** When the coating separates cleanly from the substrate.
- **Cohesive:** When the coating separates within the film, but not between coats or substrates.
- **Adhesion:** When there is a cohesive failure within the substrate, but the coating remains intact.

Barrier coats can also be considered a part of surface preparation because they are actually preparing an existing painted surface for painting. Sometimes referred to as "tie coats," these products can be used when it is desirable to upgrade an existing coating or to prime an unknown paint that is to be covered with a different coating. Many manufacturers produce a "universal primer" that can be used as a barrier coat or as a primer when a finish coat has not been determined.

Some manufacturers also produce primers that can be applied to marginally prepared surfaces. These primers are formulated to penetrate tightly bound rust and mill scale down to the steel. They can work reasonably well in noncorrosive, as well as in most urban and rural environments when rust and mill scale are tightly adhered to the steel. However, they are not recommended for coastal, marine, or corrosive environments. To be safe, there is no substitute for proper surface preparation. Good surface preparation can extend the life of a marginal coating. Poor preparation can shorten the life of a superior coating.

Surface Preparation and Conditions by Substrate for the Coast

Wood

1. Surfaces should be smooth and free of dirt, oil, and other foreign substances.
2. Knots should be seasoned, clean, dry, and sealed.
3. All holes and imperfections should be filled with putty or plastic wood filler and sanded smooth.
4. Edges, ends, faces, undersides, and backsides should be back-primed.
5. Surfaces should be free of sanding media, such as steel wool and carborundum.

Ferrous Metals

1. When abrasive blast methods are used, a surface profile of approximately 2 mils is usually specified. Surface profile and manufacturer's recommended primer thickness should be coordinated. Surface profile is the depth that the abrasive material penetrates the steel. Thus, when the primer is applied, it should be to a DFT

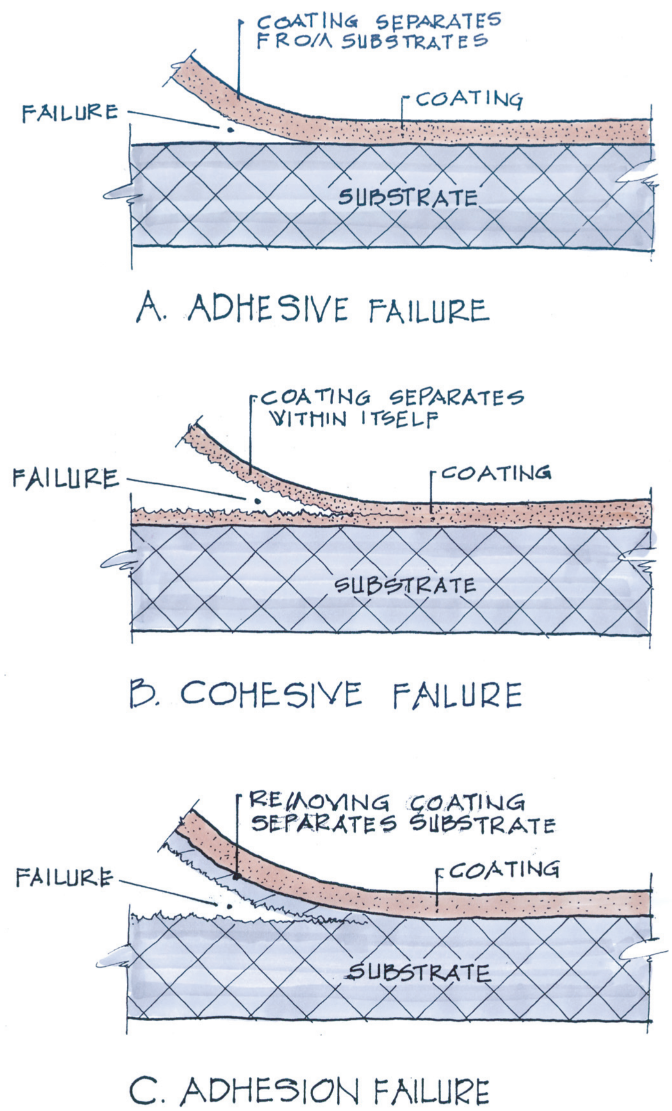

Figure 2

SURFACE PREPARATION IS THE FOUNDATION FOR A STRONG COATING SYSTEM, JUST AS STRONG FOOTINGS ARE THE FOUNDATION FOR A STABLE BUILDING.

greater than the profile. If not, the peaks in the surface profile will be above the primer, and they will receive a minimum primer coating and not be completely protected.

2. To judge the level of surface preparation necessary for ferrous metals in a coastal or corrosive environment, the National Association of Corrosion Engineers (NACE) and the Steel Structures Painting Council (SSPC) recommend that:
   a. There should be no dirt, grease, residue, loose mill scale, rust, or foreign material;
   b. There should be a surface profile in the metal created by abrasive means, such as sandblasting or wheel abrader; and
   c. There must be extensive traces of white metal.

Galvanized Surfaces

1. Surfaces should be free of all soil, cement spatter, weld flux and spatter, oil, grease, grime, and other surface dirt.
2. Damaged galvanized surfaces should be treated with high-zinc-content, cold-galvanizing repair.
3. New galvanized surfaces should be etched.

Cementitious Materials

1. Substrate should have cured for at least 30 days.
2. Surfaces should be free of all traces of efflorescence, chalk, dust, dirt, grease, oils, and release agents.
3. Concrete should be roughened, with all gloss and traces of hardeners or sealers removed.
4. Substrate should be sufficiently dry. This can be determined with the polyethylene test described in ASTM D-4263. Tightly tape an 18-inch square of 8-mil clear polyethylene over the substrate to prevent the escape of moisture. If droplets appear on the underside of the polyethylene within 24 hours, the substrate is too damp to paint.
5. Substrate should be within the pH parameters of the primer or block filler. This can be determined by an alkalinity test. If there are no parameters, then pH should be between six and nine.

Brick Masonry

Brick masonry can be difficult to coat successfully. For that reason, many professionals do not recommend it, even though it is done frequently and the Brick Institute is beginning to accept painting. There may be times when a coating is requested to change color, improve aesthetics, or to reduce moisture intrusion. In these instances, use coatings that are specifically formulated for masonry, such as alkali-resistant primers. Using these products in conjunction with the following preparations will improve the chances for success:

1. Brick should be free of manganese to prevent reaction with components of the paint.
2. Substrate should have cured for at least 30 days.
3. Substrate should be sufficiently dry. This can be determined with the polyethylene test described in ASTM D-4263. Simply tightly tape an 18-inch square of 8-mil clear polyethylene over the substrate to prevent the escape of moisture. If droplets appear on the underside of the polyethylene within 24 hours, the substrate is too damp to paint.
4. Surfaces should be free of all traces of efflorescence, chalk, dust, dirt, grease, oils, and release agents.
5. Brick must be allowed to weather one year before efflorescence is removed.
6. Substrate should be within the pH parameters of the primer or block filler. This can be determined by an alkalinity test. If there are no parameters, then pH should be between six and nine.

Previously Painted Surfaces

Painting over previously painted surfaces can be especially tricky because it is often difficult to determine the generic of the existing coating. Often, the existing painted surfaces are taken for granted. To increase the odds of success, the following are recommended:

1. All grease, oil, dust, grime, and loose dirt should be removed.
2. All surfaces should be sufficiently abraded and roughened to provide a sound base for anchoring the new coating.
3. Where rusting conditions exist on ferrous surfaces, all rust should be removed and surfaces should be properly primed.
4. Where knots in wood are exposed or have damaged or discolored the finish, they should be scraped clean and primed with knot dressing.
5. Where the existing coating is missing, damaged, or dented, or where the substrate is exposed, all surface contamination should be removed, all edges feathered to zero, and surfaces should be sanded smooth and primed.

Additionally, all coatings that are loose or are not otherwise tightly adhered to the substrate must be removed back to sound paint and down to the substrate; and all edges should be feathered to zero. When approximately 40 percent or more of the paint or coatings on a given substrate is loose, damaged, or otherwise unsound, all the paint or coating should be removed down to the substrate.

A new coating should be tested on the existing surface in an inconspicuous area before full-scale painting is conducted. A test area should be prepared by applying the topcoat over the existing finish. Application should be to the manufacturer's recommended thickness and allowed to cure for the manufacturer's published time to recoat. If the existing finish blisters, puckers, wrinkles, dissolves, or delaminates, the existing and new finishes are not compatible. This would be a good time to consider a tie coat or barrier coat.

Wood

Wood may very well be one of the most complex materials to coat because of the following three reasons:

1. Wood is hygroscopic – it readily absorbs moisture, and there is plenty of moisture in various forms around the coast. Even after drying and installing as an exterior trim, wood can contain from 8 to 20 percent moisture by weight.
2. Wood absorbs and dissipates moisture continually, with the amount determined by ambient humidity and temperature conditions. This is sometimes referred to as "breathing" and can cause blisters and bubbles in the coatings film.
3. Because it breathes, wood expands and contracts.

Additionally, there are different species of wood, with some requiring different surface preparation methods. For example, certain wood species (e.g., cedar and redwood) expel resin and oils that can dissolve primers or cause blisters. However, these resins are a wood's natural protection, retarding rot and decay much like aluminum oxide retards further corrosion of aluminum. The coating must bond tenaciously to the substrate for the life of the coating without blistering, flaking, peeling, or any other form of delamination. Additionally, when a coating does not breathe, the moisture causes blistering or delamination. The coating must be able to react to the natural expansion and contraction as the wood reacts to the changes in moisture content. Without this flexibility, a coating will crack and allow contaminants to enter the system. Consequently, epoxies and polyurethanes are not usually recommended for wood because they tend to trap moisture within the wood and are not flexible enough to move in unison with the wood.

Because coastal climates produce higher moisture conditions than other areas, mold can be another concern. Due to its residual moisture content and cellulose composition, wood can be a natural spawning ground and home to mold or mildew. At minimum, a mildew-resistant coating can separate the mold spores from food (such as the organic wood) and internal moisture. However, since the resins and pigments in many oil-based paints may also provide food for mold, they only need surface moisture to promote mold growth. There are commercially prepared additives offering some short-term protection from mold and mildew. However, the additives are often toxic, the amount used per container is limited by the U.S. Environmental Protection Agency (EPA), and the additives' effects are usually temporary and diminish with exposure to ultraviolet (UV) rays and weather.

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ACKNOWLEDGEMENTS

I extend my sincere gratitude to Charlie Martin, AIA, of McMillan Smith & Partners Architects for creating the graphic sketches; to Angela Napolitano of McMillan Smith & Partners Architects for adding computer graphics; to Nick Galizia of our Charleston office for several photos and figures; and to my wife, Linda, for editorial review. Their time and contributions to this article are truly appreciated.

COMING IN PART III:

SUGGESTED PAINTING/COATING SYSTEMS FOR COASTAL ENVIRONMENTS

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Realistic Roofing Tax Treatment Act

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The "Realistic Roofing Tax Treatment Act" was introduced in both the Senate and the House in 2005. The National Roofing Contractors Association (NRCA) took the lead in sponsoring this legislation with the support of numerous trade associations.

This legislation would shorten the tax depreciation schedule for commercial roof systems from the current 39-year schedule to a more realistic 20-year schedule.

It has the support of every segment of the roofing industry because it would stimulate capital investment, create jobs, boost small business and the manufacturing sector, as well as improve demand-side energy efficiency.

The current 39-year schedule is not a realistic measurement of the lifespan of a commercial roof and is a disincentive for property owners to replace failing roofs. A 2003 study by the industrial research firm Ducker Worldwide reinforces this argument. This study concluded that the average commercial roof life span is 17 years. Thus, shortening the 39-year schedule would give owners the incentive to replace failing roof systems in their entirety instead of by piecemeal repair. Also, this study indicated that a 20-year schedule would stimulate economic activity, generating approximately 40,000 new jobs. Moreover, it found that 90 percent of building owners upgrade to a more energy-efficient roof system when they replace their roofs.

NRCA anticipates substantial strides in moving this legislation forward in the current 110th Congress in the coming months. In all likelihood, Representative Stephanie Tubbs Jones (D-Ohio) will lead the charge in the House, and Senator Jim Bunning (R-Kentucky) will reintroduce companion legislation in the Senate. Also, NRCA has been informed that several legislators in both Houses and both sides of the aisle are in support of this legislation.

NRCA's strategy for getting this legislation passed and signed by the President centers on attaching it to any appropriate tax package that comes down the pike. Typically, small tax bills, such as the roofing depreciation legislation, do not advance as stand-alone measures. Instead, they get folded into a larger omnibus-style package in which numerous changes in tax law move together in a single piece of legislation. Hence, NRCA will be keeping its eyes open for any legislative measures to which it can attach the bill.