

STUCCO



Ten Tips for Great Stucco

From framing to finishing, craftsmanship makes the difference

BY BRUCE BELL

I've been in the plastering industry for almost 50 years. I started out as a hod carrier, worked for 18 years as a journeyman plasterer, served as the Executive Director of the Sacramento Valley Bureau for Lath and Plaster, and served on the Northern California Apprenticeship Committee. Although I'm retired from those positions, I still work as a consultant to architects, contractors, and the Wall and Ceiling Alliance and Wall and Ceiling Bureau covering the Northern California area.

Before I talk about quality control, I'll start with a quick overview of how to apply and finish Portland cement plaster. The process of applying starts with mixing enough material for the job. The plasterer sets up mud boards so that he can put mud on his hawk, take

mud off his hawk with his trowel, and smooth it on wire lath with enough material and pressure to bed the lath and provide enough material on top of the wire for a superior "scratch coat."

The scratch coat is the first coat of plaster applied in any plaster system. It's the structural component to a stucco wall, and it provides the most strength to the plaster lamina in a three-coat system. The plasterer scarifies or scores ("scratches") this coat to create grooves into which the "brown coat" will adhere. Once applied, the scratch coat is moist-cured morning and evening for 48 hours.

The brown coat, the second coat of plaster, brings the plaster out to the thickness of the trim at the base of the wall and the edges of the doors and windows. The worker spreads plaster on the wall, and

Photos by Bruce Bell



After the scratch coat has been moist-cured for at least 48 hours, the brown coat is applied with firm pressure to create a strong mechanical and chemical bond between the coats. The brown coat should be rodded flat with a darby and straightedge, then moist-cured and checked for hardness.

uses a darby to smooth the material as flat as he can while it is still plastic. When the brown coat sets, the wall is “rodded”: The plasterer takes a long straightedge, or “rod,” and works it over the wall to knock down high spots, fill in low spots, and ensure flatness. He then “floats” a rubber float across the surface to compress the material and to knock off any minor high spots and fill in minor flaws. This coat is then moist-cured morning and evening for 48 hours in preparation for the finish coat.

Taken together, the scratch coat and brown coat are called the “base coat.”

The third step in a three-coat stucco system is the finish coat. If stucco finishing is done using a trowel, the walls need to be cool and moist with no standing water. Another common option is a “dash coat,” which is produced with a machine that sprays a fine, tight texture on a wall using a soft slurry of stucco material. The texture is sand-finished, without float marks, and needs a well-prepared base coat. If the finish is a dash coat, the area around the walls needs to be covered to protect it from overspray.

If the plasterer is using a crack-reduction lamina, he spreads acrylic adhesive in a tight skim coat and trowels in fiberglass netting. He then applies additional trowels of material to embed the mesh completely.

Quality-control issues abound in the stucco industry. The bullet-point takeaways are that stucco cracks, it’s not flat, and it leaks. But over the last decade, the plastering industry has made progress

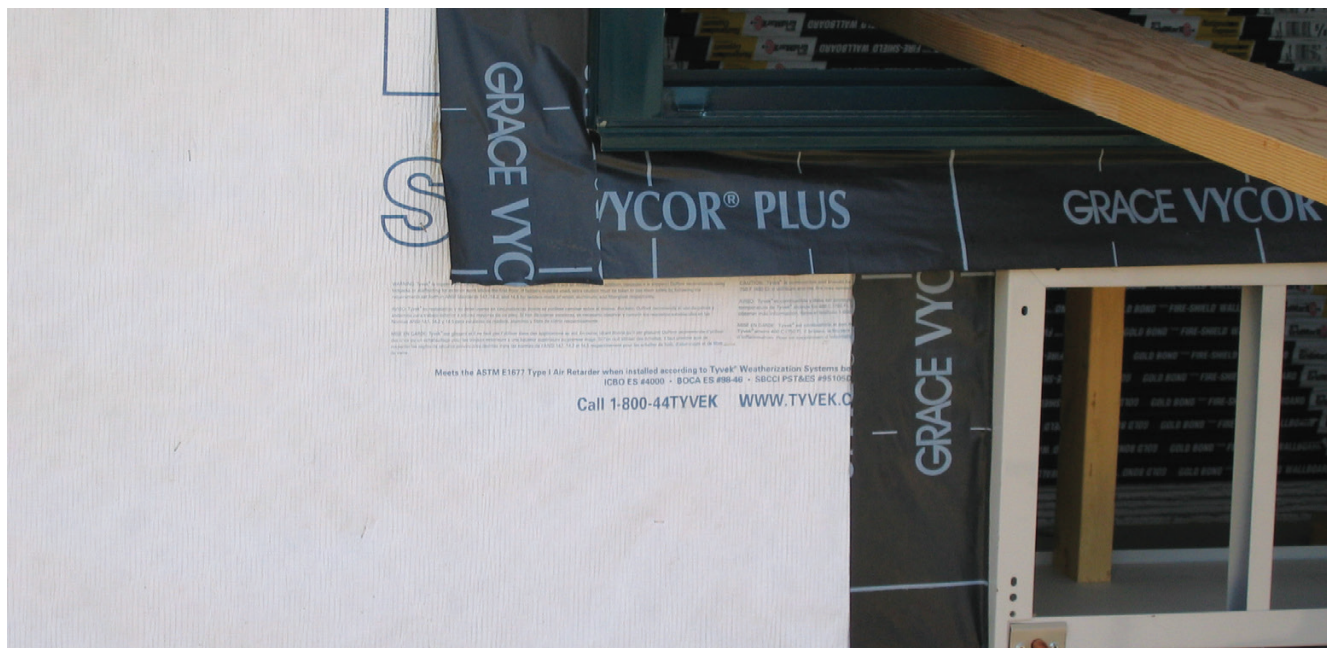
in developing protocols for Portland cement plaster that produce flat, nearly crack-free panels. Here are the top 10 keys to achieving a great stucco job.

START WITH GOOD FRAMING

Concrete masonry or brick is the ideal foundation for plaster and is the most common substrate for stucco in Europe. But in the United States home-building industry, wood framing predominates. To get good performance from stucco over wood framing, you need to take steps to minimize movement of the substrate.

Three-coat cement stucco weighs in at about 10 pounds per square foot; when framing is set without any dead load, adding stucco adds significant weight to the structure. As the framing settles, the weight of the plaster helps compress the joints of the framing. Then, as the wood dries out, volumetric shrinkage occurs: All your lumber loses length and width. As a result, when the plaster that was spread over one area of wall dries, it ends up covering a smaller area. This creates stress that can cause cracking in the base coat.

Making sure that the framing meets the engineering requirement of $L/360$ maximum deflection is a start. In addition, the framing needs to be constructed of wood products with no greater than 19% moisture content. Framed walls can rack if shear resistance is insufficient for the loads and floor framing can twist, shrink, or deform, and the plaster reflects the way the framing behaves. If the framing is solid, the plaster will have minimal cracks.



Flashing should be applied so as to direct water out and down on the drainage plane. Weep screeds at the bottom of the wall allow any water that soaks into the plaster to escape.

Framing and flatness. The code-specified maximum variation in the plane of the base coat is $\frac{1}{4}$ inch in 5 feet. A reasonable tolerance for the final product is $\frac{1}{8}$ inch variation using an 8-foot straightedge. In Northern California, that is what the architects I work with specify. Good, flat framing makes it easy to create a flat wall; conversely, variations in plane in the framing can end up being reflected in the plaster panel.

MAINTAIN THE DRAINAGE PLANE

A good drainage plane is essential for allowing the plaster to manage moisture during wet weather. The weather resistive barrier (WRB) is the paper behind the lath that moisture hits before it migrates down the wall, keeping the interior safe and dry. We insist on a continuous weatherboard-fashion (shingle-fashion) installation of any WRB to ensure that the plaster weeps incidental moisture down the wall and out at the weep screed.

FLASH CORRECTLY

Flashing of penetrations should incorporate one guiding principle: All the flashing should be installed weatherboard style (shingle style) so that moisture will slide down the wall away from the windows, doors, electrical boxes, vents, and pipes.

One of the mistakes we see all the time is not detailing a horizontal condition to drain to the outside. Heads of windows and doors need Z flashing extending past the vertical jambs to kick moisture

in the wall out onto the surface of the plaster. Horizontal reveal screeds need to be attached gingerly to keep from compressing the spine of the trim into the WRB and creating a dam.

MAINTAIN THE PROPER FURR

The furr, which is the amount of space beneath the field of the lath, should be at least $\frac{1}{4}$ inch. The object is to make sure that enough plaster can get behind the wire to create a good foundation for the brown coat. There is an easy test for correct furr: Take a pencil with an eraser, push it against the wall, and look at where the lath meets the eraser collar. If they match, the lath has been installed with enough furr to allow for full embedment.

SAND-TO-CEMENT RATIOS

The wrong ratio of sand (aggregate) to cement can mess up a good job without the general contractor even being aware of it. I was called out to a school built during the summer, and the maintenance guy who asked me to check the ceilings and walls wondered why the stucco was falling off a brand-new elementary school. The sand-to-cement ratio was 7 sand to 1 cement. In checking the plaster keys in the ceiling, I brushed my palm against some plaster that turned to powder, and a chunk of the ceiling fell down. It was a beautiful job, but there wasn't enough cement to bind the sand together or enough moisture to harden the cement if there had been enough of it. All the plaster had to be removed.



Wire or mesh lath should stand proud of the drainage plane by $\frac{1}{4}$ inch. This allows space for the scratch coat of plaster to fully embed the lath. The scratch coat should cover the lath by another $\frac{1}{8}$ inch.

ASTM Standard C-926, “Standard Specification for Application of Portland Cement-Based Plaster,” specifies that for the scratch coat, one part Portland cement should be mixed with $2\frac{1}{2}$ to 4 parts aggregate by volume, and for the brown coat, one part Portland cement should be mixed with 3 to 5 parts aggregate by volume. The principle is to have just enough cement to coat each granule of aggregate to bind it into a solid mass. Too much cement and the plaster mix is too rich and is prone to shrinkage cracking. Too little cement and the mix is too lean—there isn’t enough cement to coat each grain of aggregate and the material will lack strength.

Counting the number of shovels of sand in a batch of plaster is one way to ensure that you get a good sand-to-cement ratio. Thirty-two #2 shovels per 90-pound bag of cement is a good gauge while watching a hod carrier mix mud.

BASE-COAT THICKNESS

The thicker the scratch coat, the better the overall strength characteristics of the finished plaster panel. According to ASTM C-926, this means that enough material should be applied on the lath “to embed the metal base, and with sufficient thickness of material over the metal to allow for scoring the surface.” The furr should be at least $\frac{1}{4}$ inch. The amount of material needed to fill that void and cover the metal base is approximately $\frac{3}{8}$ inch of plaster. Using sufficient pressure ensures that enough material is pushed under and over the metal base, which we define as “embedment.”

Covering the wire and being sure to apply a good scratch-coat thickness is critical for a successful stucco job. Scarifying (scoring) or grooving the surface of an unset plaster coat to provide a key for the subsequent coat then ensures that the mechanical bond, as well as the chemical bond, between the scratch coat and brown coat is strong.

PREPARATION OF THE BROWN COAT

According to ASTM C-926, “the second (brown) coat shall be applied with sufficient material and pressure to ensure tight contact with the first (scratch) coat and to bring the combined thickness of the base coat to the nominal thickness ...” and “... shall be brought to a true, even plane with a rod or straightedge, filling surface defects in plane with plaster.” Then, “the surface shall be floated uniformly to promote densification of the coat and to provide a surface receptive to bonding of the finish coat.”

One of the ways to achieve a superior stucco job is to make sure that the float used prepares the brown coat for the type of texture and finish that your customer demands. That means that if you want a sand finish texture, your brown coat need only be floated with a hard rubber float or a shingle float. If you are going to apply a dash-coat finish, you need to float the brown coat with a green float, or rod, skim, and float it to ensure that you fix any voids or humps prior to the dash-finish application, because the dash coat will reflect every variation in the plane.



Above left, an inferior scratch coat does not fully cover the wire lath and has not been properly cured, allowing the coat to scale away from the wall. Above right is a superior scratch coat that fully covers the lath and has been scored (scarified) to create grooves that will provide a mechanical bond with the brown coat.

MOIST CURING THE BASE COAT

In the 1940s, when my father was plastering, curing was never done. There were instances where the brown coat was so soft, the finish would pull off the surface of the brown coat during finish application. Now we know that curing the scratch coat and brown coat is essential to developing the strength characteristics that assure the stucco will last.

After the scratch coat is set, the plasterer uses a hose with a misting nozzle to soak the newly plastered wall right before going home. In the morning when he arrives on site, he soaks the wall again to return the moisture that has evaporated from the wall or soaked into the building paper. Forty-eight hours of moist-curing morning and evening normally does the trick, but during the winter, curing or hardening slows, so it takes longer. On the other hand, when it is scorching hot, you may have to continually moist-cure the walls so they don't flash dry out, and in foggy situations, you might have to wait a week for the plaster to dry out, harden, and cure.

When the plaster dries out without enough moisture to cure, the wall stays uncured until enough moisture is added back. I have cured walls that were soft six months after application just by adding moisture.

Plaster takes a long time (some say years) to fully cure. The majority of the strength comes during the first 30 days of application, and with premium cements, like Omega Super Cement (omega-products.com), a well-cured wall can be achieved in less than 30 days. Cur-

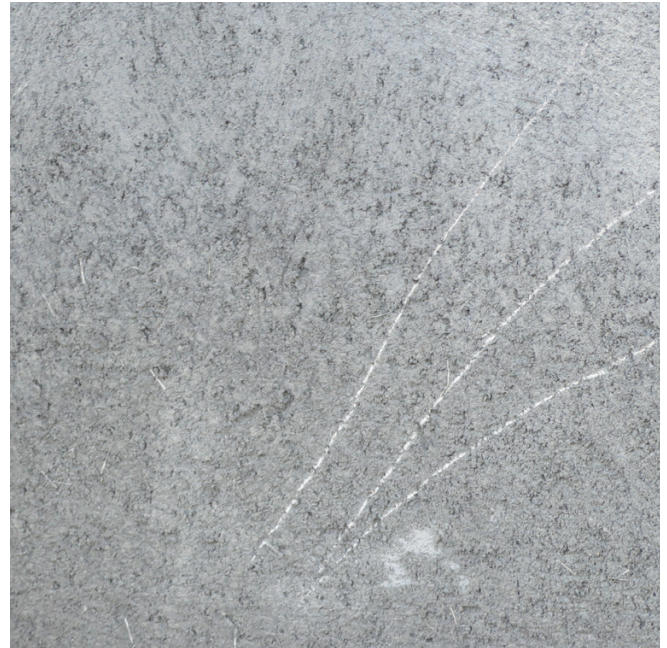
ing is a function of time and moisture; without both, the process stops. Curing slows as the temperature drops, so curing during the winter in wet weather can take longer than during the summer. Drying is as critical to hardness as adding moisture. A good stucco job needs the right balance of both.

The Mohs Hardness Test confirms the cure. Any GC can do the test at any time during a workday: Take a penny and scratch the surface of the plaster. If the wall scratches the penny, the wall is cured; if the penny scratches the wall, it needs more curing. Mohs compares the hardness of substances, talc being a 1, and a diamond being a 10. Plaster panels should be in the 4 to 5 range, whereas a penny is a 3. So if the wall scratches the penny, you have prima facie proof of the cure.

LEVELING COAT

Using a leveling coat creates a flatter wall than almost any other way of preparing a brown coat. The process can include skimming in a thin layer of stucco right after floating the wall to fill minor voids in the panel, if you are machine-applying a finish coat. It can include rodding the brown coat and letting it set, but prior to moist-curing, skimming a tight coat of acrylic bonding material to fill aggregate voids and capture all the moisture in the panel so there is no evaporation. This creates a hard, shell-like finish that has no suction, a perfect base for an acrylic finish.

Finally, you can moist-cure the floated brown coat, let it dry,



Above left, a well-applied brown coat has been smoothed flat with a straightedge (“rodde”) and floated with a green sponge trowel to bring out the sand aggregate. Above right, a brown coat has been scratched by a penny, indicating that the cure is incomplete. Curing should continue until a penny will not scratch the cured cement plaster.

trowel fiberglass netting into a bed of acrylic bonder, skim the netting with another layer of bonder, and create a lamina that minimizes cracking by a huge factor. Some manufacturers will provide a warranty period for this application.

FINISH-COAT PREPARATION

Taking care with the stucco finish is one of the best ways to ensure a successful stucco job. If you are applying three-coat stucco with a lime-based finish, making sure that the wall you’re plastering is moist ensures that you won’t have cold joints (hard, discolored joints where the plaster above meets the plaster below at the scaffold line). This might mean you start wetting the wall an hour before you start finishing the wall.

Having enough workers to keep a wet edge is also critical. If you are smooth-troweling a wall, the wall must be wet without standing moisture, so you need enough workers to scratch and double back, applying a skim coat of stucco material into which the second coat of finish aggregate can be compressed. Some of the most beautiful plaster jobs are smooth-troweled stucco with a good paint coat to bridge the fine, tight cracks that occur with that method. Those cracks, which we call “alligator cracking,” are a performance characteristic of this type of finish coat. If you are sand-finishing a wall, having enough foam floats to create an even sand finish is also critical.

For a synthetic finish coat, you don’t wet the wall before you start plastering, but you do need to keep a wet edge during application.

In this case, rolling on a coat of primer would be your first step. The primer does two things: It kills the suction from the brown coat that dries out the edge, making it easier to keep a wet edge; and it ensures that floating the aggregate that creates the texture does not produce blackheads (small, unsightly pinholes in the finish).

With cement stucco finishes, you can fill minor voids in the brown coat by scratching and doubling back with the same material. But synthetic finishes reflect every variation in the plane, and also sometimes need a rolled-on prep coat to ensure full coating of the color.

The Cadillac treatment is to float the brown coat, cure the brown coat, embed fiberglass netting into the base with an acrylic-modified cement adhesive, and then apply your acrylic finish coat. Called a crack-reduction coat, this creates a surface with significant tensile and flexural strength, which minimizes building movement stress-related cracking.

It doesn’t take magic to produce a great stucco job, but there are a few things that you can’t skimp on: watching to make sure you have good framing and lathing; using good materials; assuring that the application of the material is done by well-trained lathers and plasterers; watching and checking to ensure that the material gets hard; and using good finishing techniques. Follow all those steps, and when you’re done, you’ll have a great stucco job.

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