Stucco:
The Return of the Best

Whether Natural or Manufactured, Stucco Use is Gaining in Popularity in New Areas and Markets: Columbus (OH) Mall Pins Success to Natural Stucco

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We haven’t found too many contractors who aren’t sold on the merits of stucco, or Portland Cement-based plaster. In this country, its track record dates back several hundred years; in the ancient world, to man’s earliest structure. And stucco has rightfully earned its time-tested reputation for economy, ease of application, durability, and versatility but, unfortunately... cracking.

As many contractors know, there’s a real art to stucco application. Proper training and talent are a must. We couldn’t agree more. Yet there’s more to a good-looking stucco job than what meets the eye. The truly skilled craftsman who creates the aesthetics of the final coat also knows how to make his stucco material, substrate and environmental conditions work together to control stucco cracking and other problems.

In the past ten years as stucco usage has grown, manufacturers have made significant strides in new stucco technologies. Contractors are no longer limited to only conventional three-coat stucco systems.
Stuccoes are now available in polymer-based and polymer-modified formulas that are often fiber and fabric-reinforced for reduced cracking, improved workability and quicker, easier applications. The new synthetic stuccos have demonstrated reduced surface checking and crazing. And even the conventional three-coat systems are now greatly improved.

Contractors today who understand all the available options and can utilize “preventive medicine” on the job will undoubtedly increase quality job performance.

The most important advice we can offer a contractor is to recognize that each job has its own set of variables that affect the final outcome. Causes of stuccocracking are not always easy to identify once they happen. The problem could be related to improper lathing, stud rotation or buckling, varying application thicknesses or improper curing, to name a few. More complicated than identifying the actual causes are all the various solutions proposed in the industry (some of which are ongoing subjects of debate).

First of all we should say that not all stuccoes are alike—that’s why individual manufacturer’s guidelines vary. Secondly, the building itself must be soundly con-
structured or problems are inevitable. And finally, weather conditions should be conducive to proper curing. If the guidelines set by individual stucco manufacturers, the Portland Cement and Stucco Associations and ASTM-C926 guidelines are followed, many cracking problems can be headed off.

**Identifying Cracking . . .**

The following checklist will help identify many stucco cracking causes before they start:

**The Formula** — First consideration for successful stucco applications is preparing the right formula. The ratio of sand to cement will determine the degree of strength, resistance to shrinkage and cracking, and density.

Stucco is simply a mixture of portland plastic and/or masonry cement (with or without lime), sand and water. The cement usually comprises one part of the formula; sand either three or four parts; with the amount of water determined according to the required degree of workability. Lime is often added to portland cement mixtures to improve water retention and workability; plastic and masonry cements already contain lime or plasticizers.

In addition to proper curing and uniform thickness of the application, the ratio of sand to cement determines stucco’s resistance to cracking. A practical rule is to apply the base coat with a trowel.
of thumb is that the higher the quantity of sand (aggregate), the lower the density, and therefore, less shrinking and cracking. To add less sand (more cement) increases density and strength, but also the potential for cracking.

In a three-coat system, the skilled applicator may elect to use higher-strength formulas for the base coat (both scratch and brown) and a lower strength, more crack-resistant formula for the finish coat. The stucco formula may be altered to achieve greater cost effectiveness, but product performance should dictate the final ratio.

**Outside Temperatures and Weather** — Stucco mixtures should ideally be applied when outside temperatures are above 40 degrees Fahrenheit (4.4 degrees Celsius). If water freezes in the mixture, the stucco will expand dramatically. To work around winter’s demise, some contractors will heat the mixing water to 130-140 degrees F (54-60 degrees C) and mix with cold (but not frozen) sand. This creates a workable stucco mixture in the 70-100 degrees F (21-38 degrees C) range which also lets the stucco resist freezing.

It should be noted that the addition of small air bubbles into the stucco mix (called air-entraining admixtures) can decrease strength slightly, but can improve material workability and freeze-thaw durability—which helps control cracking.

**Bases and Bonds** — Nothing substitutes for a good base and a good bond, even though stucco can be applied over most anything. Expanded metal or woven wire laths will form a solid base or reinforcement for less rigid or smooth bases. Stucco dash coats will remedy smooth (or glazed) walls to increase bond. Generally, the rougher the base, the more absorptive it is to water and will form a stronger bond. And if the base is not cracked and the bond is strong, the stucco itself should not crack.

Yet of more importance is creating a base coat on a relatively even plane. Variations in the plane can cause cracking—since moisture evaporation during curing will vary according to the application thickness—but careful rodding will help eliminate high spots, and fillers and additional rodding will solve low spots.

Loosely fitting metal lath also causes uneven stucco application and cracks. Lath should form a continuous base without gaps and be attached with nails or screws with a corrosion-resistant coating. Uneven plaster between studs will also cause cracks at the stud locations.

**Framing** — Generally, stucco systems are not designed to be load bearing, and improper framing and wind loads can transfer weight that often causes cracking. If studs are not properly anchored or spaced or the gauge is too light, load transfer to the stucco is possible. Two common problems are stud rotation and buckling caused by stresses such as high wind loads that quickly put improper framing to the test. Since a different trade may handle the framing, the stucco contractor often inherits the situation.

**Base Warping** — Temperatures and moisture variations in the stucco application can cause warping of wall surfaces, such as plywood sheathing, and therefore stucco cracking. Warping can also be caused by overly high-strength finish coats (more cement/less sand) or excessive pressure during trowelling. Also, to help prevent moisture buildup in plywood and gypsum sheathing bases, moisture barriers should be used. Expansion and contraction can cause cracking. Plywood may require two layers.

**Tensile and Compressive Strengths**—Contractors must also be aware of achieving strong tensile and compressive strength in their stucco mixes—this relates to proper curing methods. So long as the application is even and moisture is present during the early stages of curing, the tensile strength will increase—which, of course, means better resistance to both shrinking and cracking.

Compressive strengths are simply the ability of the stucco to hold its own dead weight (without falling off the wall) and accept wind loads and other services such as signage, decorative accessories and other attachments. The objective is not to achieve the highest possible compressive strength—this means a brittle coat. The objective is strength without cracking. Contractors who add cement to premixed stuccos to achieve higher compressive strength often create cracking problems.

**Proper Curing** — The importance of curing is often overlooked. Procedures...

“The elastomeric final coat can be spray applied, further accelerating a relatively rapid construction technology.
What makes the new synthetic stuccoes such a delight to owners is the final attractive appearance as demonstrated on the Mobile Festival Center, Mobile, AL.

should adjust to the conditions of the particular job. The objective again is to cure slowly which increases strength and crack resistance. If weather conditions are hot, dry or windy, uniform fogging and use of plastic coverings will be needed to hold the high-moisture content in. Cement admixtures may be needed to increase water retention or freeze-thaw resistance.

As stucco cures, it will naturally undergo shrinking as the water evaporates out. If stucco cures too fast, cracks are inevitable. Common practice is keeping moisture in the scratch coat for the first two days, in the brown coat for seven additional days and finishing thereafter. Another school of thought is applying each coat as soon as the previous coat will support the weight and cure all layers as a single unit. Then if an integrally colored stucco is used, special attention to avoiding quick curing will help avoid color variations or efflorescence (white salt deposits on the surface).

Control Joints — We also can’t say enough about control joints to minimize cracking during and after curing. Since stucco expands and contracts in response to temperature and humidity levels, properly placed control joints will not only reduce these natural stress problems, but combat vibrations, foundation settlement and other building movement.

Since no two stucco formulas are alike, there is no completely accurate guideline for the proper placement of control joints. One traditional method calls for control joints to be spaced 10 feet apart to form a surface area less than 150 square feet — yet this will not work in all situations. Contractors have to take individual building requirements into consideration and place control joints where cracks most likely can occur — at doors, windows or floor lines.

Control joints placed to provide a work break for the applicator or for aesthetic reasons may have little effect on crack control. Existing control joints should be extended through any new stucco coating, whether metal lath is used or not. If lath is used, it must break at the new control joints. It is generally recommended that control joints be placed first on the structure followed by lath. Another point to remember is that double studding behind control joints is the best application so as to avoid restricting movement of the control joint. Attaching both sides to one stud restricts movement and can cause cracking. Control joints also must be kept free of stucco material to aid movement.

The New Synthetic, or Modified, Stuccos — As Building Design and Construction reports, EIFS (exterior insulation and finish systems) with the new synthetic stuccoes “offers energy efficiency, economy and insulating factors that stand out from the others (cladding choices).” And, because of these advantages, EIFS has demonstrated impressive growth and acceptance among architects and specifiers. And at present, there are essentially three classes of EIFS systems as defined by the Exterior Insulation Manufacturers Association, utilizing unconventional stucco protective coatings — polymer-based, polymer-modified and mineral-based. EIMA also classifies three types of systems — external reinforced, cloth and lath; internal reinforced, random fibers; and unreinforced.

Basically, polymer-modified stucco systems are applied continuously, requiring few control joints; whereas, polymer-based systems have required control joints.

A major advantage of synthetic-stucco EIFS is the reduction of stresses that often create moisture and thermal cracks in the outside coat. Since the insulation is external, meaning outside the framing/studs, less expansion and contraction of other system components occurs.

Nevertheless, to minimize cracking, contractors will want to observe the following industry guidelines: (1) check manufacturer’s recommendations for suitable building surfaces for attachment of EPS board; (2) follow manufacturer’s recommendations for attachment of the system to the building; (3) building surfaces must be relatively smooth and straight for proper attachment; (4) door and window corners must be reinforced; (5) insulation joints should be filed smooth; (6) flat surfaces around doors and windows must slope to avoid standing water; (7) base coat should be even and smooth; and (8) insulation should be tightly butted.

One-Coat Systems — According to the Stucco Manufacturers Association, popularity of the relatively new one-coat, or fiber-reinforced, stucco system is no longer restricted to the Southwest. The reinforcing fibers in this 3/8-inch (minimum) stucco improve flexural strength and resist cracking. Advantages are that the coat is usually applied over expanded metal or woven wire lath and comes integrally colored. Laboratory tests have demonstrated a significant increase in stucco crack resistance when 1/2” glass fiber reinforcement is used.

According to a recent article in The Construction Specifier, over the centuries, stucco (plaster) “has been a part of every civilized society . . . [T]he skills and techniques passing from one generation to the next ensured that the craft would survive.” True, each generation has accumulated more knowledge and has developed new technologies to ensure the survival of stucco, but survival has been more a result of quality.