Associated Plastering & Lathing Contractors of San Diego

TECHNICAL BULLETIN #1

CRACKING IN PORTLAND CEMENT PLASTER

Stucco, make up of sand Portland cement, and water is a protective coating but is not of itself a waterproofing product. The lathing paper which is applied behind the plaster acts as a water barrier allowing any water which penetrates the plaster skin to run down the paper and out through the weep screed at the bottom of the stucco.

Portland cement plaster is applied in the form of wet mud which then slowly dries to a hard protective coating. This coating will develop cracks if it is subject to stress greater than the strain capacity of the plaster material. In the process of hydration and the subsequent loss of free moisture of mix, stress is generated through the shrinkage of the plaster material. This stress can lead to cracking of the plaster skin.

In addition to shrinkage stress, stress may be generated from other causes such as:

A. Stress transfers from the structure
B. Thermal shock
C. Wind, seismic, vibration or impact stresses
D. Warping and twisting of underlying wood framing or sheathing
E. A blow from an external source

It is not possible to control stress and thereby eliminate cracking in Portland cement plaster. Indeed, hairline cracks are the rule rather than the exception and will frequently be found radiating out from corners of doors, windows, and other openings in the plastered surface. These hairline cracks in no way compromise the integrity of the plaster coat nor shorten the useful life of the product. Patching of hairline cracks is not recommended as it will detract from the natural beauty of the stucco and will serve no useful purpose.

Drying time is a factor in the development of cracks. While the UBC allows the application of the finish coat seven days after the brown has been applied, the ideal curing time is a minimum of fourteen days to allow the normal hydration cracks to develop and break through the finish coat.

The type of finish selected affects the visibility of hairline cracks. Cracks are most noticeable in smooth finishes and sand finishes. The more textured finishes such as Spanish lace, frieze, or Arizona tend to camouflage cracks so they are rarely noticeable.

To repair excessive stucco cracking on existing walls, the APLC recommends the application of a base and mesh system also known as a lamina system. This system is designed to mitigate surface cracking in the new and existing plaster systems by integrating woven fiberglass mesh into a polymer modified base coat prior to applying the finish. When properly applied the mesh reinforces the stucco and helps reduce the appearance of cracking. Follow the manufacturer's recommendations.

*The words stucco and plaster are used interchangeably in this document

TECHNICAL BULLETIN #2

MOIST CURING OF PORTLAND CEMENT PLASTER

Moist curing refers to the process by which moisture is either retained or added to plaster as a means of controlling drying conditions. Moisture is a key ingredient in the hydration of Portland cement plaster creating strength and durability. The need for adding moisture must be determined on a job by job basis.

The most critical period for moist curing of exterior Portland cement plaster is the 48 hours immediately subsequent to the application of both the scratch coat and the brown coat, a fact noted in building codes. The need for the scratch coat to moist cure and the relatively short period of time between scratch and brown should not alter the fact that the surface of the scratch coat must be sufficiently rigid to properly receive the brown coat.

It is recommended that a fine fog spray of water be applied as frequently as required, generally twice daily in the morning and evening to exterior Portland cement plaster when hot, dry conditions are present during the first 48 hours of the curing stage. Soaking the plaster with water during this period is not necessary and could cause erosion damage. When conditions exist that promote water retention in plaster, application of a fog spray of water to aid in moist curing may not be necessary. According to ASTM C926, Section X1.4.2.4 "…if the relative humidity is relatively high (above 75%) the frequency for rewetting a surface may be reduced. If it is hot, dry and windy, the frequency of rewetting must be increased." Such conditions as low temperature and building/wall orientation that protects plaster from elements that cause rapid drying may also make fog spraying water unnecessary.

The addition of admixtures in the plaster mix design that foster moisture retention can also lessen the need to fog spray additional water during the curing stage. Acrylic-modified Portland cement plaster often requires air curing, *not moist curing.* It is important that for each individual mix design the specific manufacturers' requirements and recommendations be understood and followed so as to produce optimal results.

As the plaster brown coat sets and cures prior to the application of the finish coat, shrinkage cracks will develop. These cracks are the result of volume loss that occurs as moisture in the plaster is reduced through evaporation and absorption. Shrinkage cracks (not to be confused with structural cracks) often are small, short and centralized in the wall or panel and normally are filled with the application of the finish coat.

Fog spraying water onto a Portland cement stucco finish coat can lead to color and appearance irregularities and is rarely recommended except in extremely hot, dry, windy conditions.

Portland cement plaster continues to cure and gain compressive and tensile strength long after the period for moist curing. Products such as paint and sealers applied over plaster can limit the amount of moisture the plaster receives and should only be used after consideration of the long-term nature of the curing process for Portland cement plaster.

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Our industry is of the opinion that Portland cement plaster should have a minimum of 10 – 14 days to adequately cure before application of the stucco finish coat. However code states only a minimum of 7 days elapse before applying the finish coat.

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TECHNICAL BULLETIN #3

CHARACTERISTICS OF SMOOTH TROWEL FINISHES

Smooth hard troweled finishes (including Santa Barbara Finish) are achieved by using regular stucco or a special blend of stucco containing a finer grade of sand. This material is hand troweled to produce a flat, very smooth, hard finish. Santa Barbara finishes should not be confused with Mission finishes which have a slightly rougher texture and an undulating surface.

Smooth trowel finishes are the most unforgiving of any finish. Imperfections are inherent to the finish and should be expected. Common problems are:

A. Blemishes (such as pock marks or trowel marks.
B. Uneven coloring
C. Burn marks (areas of dark grey or black caused by the troweling process)
D. More pronounced lap joints and scaffold levels
E. Cracks are more noticeable

Cracking is the most offensive problem. The compaction of the stucco necessary to attain the desired hard, smooth finish makes for a brittle surface that will crack with the slightest movement. Movement of the plaster can have many causes; causes over which the plaster may have little or no control:

A. Earth movement
B. Stress transfer from the structure
C. Wind, seismic, vibration or impact stress
D. Warping and twisting of underlying framing or sheathing
E. A blow from an external source

In applying a smooth trowel finish, the plastering contractor should make sure there is sufficient curing time before the application of the finish coat. A minimum of fourteen days (preferably longer) after application of the brown coat, to allow for the normal hydration cracks to develop in the brown coat, should pass before application of the finish coat. Also, the Association does not recommend fog coating any smooth finish.

This Association recommends before applying a smooth trowel finish the plastering contractor advises the customer in writing before beginning the job that cracking, burn marks, uneven color and blemishes are the rule rather than the exception.

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TECHNICAL BULLETIN #4

EFFLORESCENCE

Efflorescence is naturally occurring condition that manifests itself on porous wall materials such as concrete, masonry and cement plaster (stucco). Efflorescence should not be confused with mold or algae.

Efflorescence appears as a white, crystalline powder on the material's surface. It is actually alkaline salts that are a natural integral component of Portland cement, sand and other aggregates that make up the base materials. The salt compounds can be sodium, calcium, chloride, potassium and other water soluble minerals. Water must be present to dissolve and carry the salts to the surface. Sources of water can be rain, sprinklers spraying water on the wall, improper roof drainage or simply the water used to mix the plaster. Salt-bearing water, upon reaching the surface, evaporates leaving the salt deposits, sometimes called whiskers. These whiskers will continue to grow as long as there is moisture present to carry the salts to the surface or until removed.

Efflorescence can appear and reappear throughout the life of the structure and there is no assurance that removal of the initial deposits will eliminate future efflorescence. It must be emphasized that water will dissolve salts within the cementitious materials and transport them to the surface. Humidity and foggy weather can both be a contributing factor. Design factors such as roof drainage or landscape sprinklers should be considered to eliminate as much exterior water penetration as possible. Care should be taken that landscaping does not cover the weep screed at the base of the plaster. Runoff is also an uncontrollable factor.

Efflorescence is not considered a defect in the system nor is it a phenomenon which is controllable by or the responsibility of the plastering contractor or manufacturer. The contractor can, however assist in the remedy. Walls can be pressure washed with water or a mild solution of vinegar or citric acid. Note, however, that washing adds water back to the surface which was contributing factor in the first place. Stubborn areas can be brushed (do not use a wire brush). After the removal, a fog coat may be applied, if needed, to bring the stucco color to uniformity. Removal of efflorescence is never included in a plastering contractor's or manufacturer's original bid price or guarantee. Therefore the owner should expect to compensate the contractor for such services rendered. Occasionally after re-stuccoing a house, efflorescence may appear in some areas especially along the foundation. This is not the fault of the plastering contractor and sometimes takes weeks or even months to dry out and evaporate.

SOURCES OF EFFLORESCENCE

Salts also leach from the soil and migrate into a building substrate

When the condition appears on stucco it is important to realize that the white crystalline bloom is not the result of faulty stucco or improper application by the plastering contractor, but rather a deposit of mineral salts from a variety of possible sources most probably from soil laden with salt.

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There are many sources for water-soluble salts with some salts more soluble than others. The movement of groundwater into building foundations by capillary action, wicking upwards into the stucco walls and foundations are very often the cause of efflorescence. In the case where soil conditions exhibit water soluble sulfates, precautions should be taken to preclude the passage of this sulfate-bearing water to the structure. Low absorption (water control) is the best assurance against efflorescence. Controlling the amount of water is the most important thing a home owner can do to help combat the ground laden salts.

Hydrostatic pressure may also be present under below-grade slabs and behind below grade walls. If no vapor barrier is installed, ground water can move upward by the process of capillary action. This migration of water is also referred to as wicking. Ground water may carry salt crystals leached from the soil. These salt crystals, within the stucco substrate, will then be released into crystal form causing deterioration of your stucco walls.

Evaporation of the salt bearing water usually takes place before reaching the surface when exposed to a drying atmosphere. The hydroxides are converted by reaction with the carbon dioxide of the air to alkali and calcium carbonates. Efflorescence in the form of alkali chlorides and sulfates are formed when the structure is surrounded, exposed, or in contact with salt-bearing soil and appears as white or whisker-like crystals we know as efflorescence.

The alkali sulfates in salt laden soils are dissolved by water then absorbed up into the stucco walls in a liquid state, creating a solution of alkali sulfates (salts) which then moves through the natural pores in the stucco walls. The solution migrates to the surface of the wall where the water evaporates, depositing the salts on the wall and generates the white powder we know as efflorescence.

Some sources of efflorescence or (salt) may be deposited on stucco walls. Practically any building materials in direct contact with the earth are potential sources for water-soluble salts. This fact has been recognized by the various producer of building materials and steps have been taken to reduce their presence to a great degree.

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TECHNICAL BULLETIN #5

FOG COAT APPLICATION

Fog coat is a fine-powdered, cementitious product composed of Portland cement, lime and mineral pigments used to help in the repair of stucco discoloration. The product is mixed with water and then spray-applied to the stucco which is then absorbed by suction into the stucco. Unlike paint, which covers the stucco surface only, fog coat blends into and becomes a part of the stucco.

Although it can be used on almost all stucco textures and surfaces, fog coat is not always a standard procedure in the application of a color coat. Additionally, fog coat will not solve stucco appearance problems that are the result of texture irregularities. For instance; in a sand float finish the aggregate is floated in different directions which produce variations in the appearance that are not correctable by fog coating. Smooth and similar type textures are not ideal candidates for fogging because the suction has been minimized; therefore the fog coat may not adhere as well as it would on other textures. Fog coat on some textures may leave a chalky residue which does not destroy the integrity of the product. Fog coat should never be applied to painted or sealed stucco surfaces.

Another item to be aware of is that most stucco surfaces have very subtle variations in the color, which adds to the character of stucco. By applying fog coat, a uniform color will be created which may give the appearance of paint rather than natural stucco. If the intention of fogging is for concealing stains on the stucco, fogging may not entirely cover extremely dark stains.

Applying extremely dark stucco colors on a building is not recommended because most manufacturers will not produce fog coat for a dark color. Since that is the case, *this association recommends that the plastering contractor provide notice to the client informing them that fog coat may not be available and that any color discrepancies, whether caused by normal stucco application or otherwise, will not be repairable.* Because there are many factors which dictate the shade of stucco color (see TECHNICAL BULLETIN #7) fog coat is subject to these same factors and rarely will come formulated to match the exact color on any given building.

Fog coat is *not* an exact science and should not be expected to produce a perfect stucco surface. *This Association does not recommend fogging unless the possible results, such as the ones noted above, are more tolerable than the currently existing condition.*

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TECHNICAL BULLETIN #6

COLOR VARIATIONS IN STUCCO

Colors in stucco should not be confused with colors in paint. They differ in many ways. Stucco color moistures are a cementitious, minerally pigmented product that is directly affected by several factors including weather and job conditions. It is applied as a thin coat of wet material which will dry as the water evaporates. Some conditions which could affect stucco colors include:

A. Hot weather such as Santa Ana conditions
B. Variations in substrate surfaces
C. Textures
D. Differences in dates and times of application
E. Curing or drying time
F. Shaded areas of the colored surface
G. Light reflection variations

Custom colors are sometimes requested but it is not always possible to obtain the desired color. Consistent colors can best be achieved by staying within the range of the manufacturer's standard colors. Regardless of the color, some variation can be expected. Fogging* the finish coat can blend and make the overall appearance more uniform. However, it is not always possible to obtain an exact match fog coat due to the manufacturing process.

**See TECHNICAL BULLETIN #6 on Fog Coating*

SYNTHETIC FINISHES

Acrylic and synthetic finishes over Portland cement base coats are becoming more popular as an alternative to conventional finishes. Such products, which come premixed, can be directly applied over suitably prepared substrates.

Some of the advantages over stucco of these products include:

A. Wider range of colors
B. Uniformity of colors
C. Greater elasticity or elongation
D. Greater stain resistance
E. Greater durability and slower fading

Disadvantages over stucco of these products include:

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A. More costly
B. Some textures are more difficult or even impossible to achieve
C. Slightly longer cure time of base coat is required before application

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TECHNICAL BULLETIN #7

CONTROL JOINTS

Control joints are not to be confused with expansion joints which isolate structural movement. Control joints divide or limit the size of the plaster panel and are installed to provide stress relief of a plastered area. By creating an artificial separation in the plastered area, control joints help to dissipate the stresses that cause plaster to crack.

While control joints help to reduce the possibility of cracks occurring in the plaster, they do not eliminate all of the variables which can cause cracking. Control joints also function as a screed for a more uniform thickness and level surface of the plaster.

The strategic location of control joints helps to predetermine and pre-align with the joint most cracking caused by volume changes. Various recommendations will be found calling for control joints to create panels of approximately 100 square feet for soffits to 144 and 150 square feet for walls. For example in the *Plaster and Drywall Systems Manual, Metal Lath and Furring* section 10.24, page 125, it says, “For exterior Portland cement plaster, install control joints to create panels no larger than 144 sq. ft. with no dimension exceeding 18 ft., or a length to width ratio of 2 ½ to 1.” In the same manual, however, on page 293, it calls for control joints to be installed to form a square of less than 150 sq. ft.

Thus it is apparent there is no consensus of the layout for control joints so the need for and placement of control joints in a particular project should be determined by the architect or designer.

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TECHNICAL BULLETIN #8

WEATHER RESISTANT BARRIERS

Water infiltration is one of the most common causes of call backs on exterior work. Most often the cause is something other than the lathing or plastering, but the proper choice and application of the lathing paper or equivalent is extremely important. Codes and specifications may call for grade "D" or grade "B" paper. Each has a place in the industry depending on the particular exposure to which the plastered surface may be subject.

Type "B" paper is more water resistant but breathes less. It is most commonly used in wet areas although is now being specified for some exterior commercial applications. Grade B paper should not be exposed to the direct weather any longer than absolutely necessary (maximum 14 days) to avoid shrinkage and rippling of the paper. Such shrinkage and rippling will cause the paper to dry out, crack or pull away from staples and nails, thereby creating holes through which moisture can find its way thus defeating the purpose of the lathing paper. *Grade "B" paper is not recommended for use over sheer panel walls or other exterior applications.*

Type "D" paper is the most commonly used weather barrier. It is water vapor permeable to avoid a buildup of moisture inside the wall and sheds excess water. There are several kinds of Grade "D" paper such as 30 minute, 60 minute, two ply, etc. Care should be taken to follow the specifications for the particular project. If necessary, the contractor may recommend the use of a different type paper but the final decision should rest with the architect or designer.

Paper must be applied "shingle fashion" horizontally with each succeeding layer lapping the one below by 3". End laps should be lapped 6" and staggered. Paper must be continuous around corners and angles and behind joints and should fit snugly around mud rings, vents, door frames and other orifices. Care should be taken that nailing or stapling does not create holes in the paper through which moisture can enter.

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