FLORIDA LATH & PLASTER BUREAU

Portland Cement-based plaster (Stucco) is one of the most versatile building claddings. Concrete block is an excellent base for stucco. Stucco applied to concrete block is one of the most successful and popular building systems in Florida.

Technical Bulletin

TB-ST-06-19.1

Cracking of Stucco Over Solid Substrates

Stucco is a durable exterior cladding providing an aesthetically appealing finish to structures of all types and sizes throughout the world. This low cost, low maintenance, fire resistant material is exceptionally strong, impact resistant, and highly durable cladding. The information in this bulletin will cover stucco applied over solid substrate and some of the necessary precautions to minimize the stresses leading to crack development. While exceptionally strong under compression, stucco must be properly applied, cured and protected from both internal and external stresses.

Stresses that exceed the tensile and/or flexural capabilities of stucco can lead to cracking. While there is no viable way to eliminate all stresses and some cracking in stucco systems, proven industry practices can reduce stresses, cracking, and difficult situations that inevitably arise.

External Stresses

External stresses applied to stucco from movement of the structure itself can lead to crack development. Stucco applied over solid substrate is at the mercy of the substrate movements. All buildings go through some natural settlement of the foundations and structural elements. As settlement and movement continues after the application of stucco, evidence of the accompanying stresses can become obvious. Areas typical of solid substrate structural stress cracking include any wall openings such as window and door corners, at interfaces of dissimilar material such as masonry block and wood framing, at intersecting structural elements (columns, beams and block walls) and along concrete block mortar joints.

Because stucco and concrete block are similar materials, properly applied and adequately bonded stucco need only be jointed at the control

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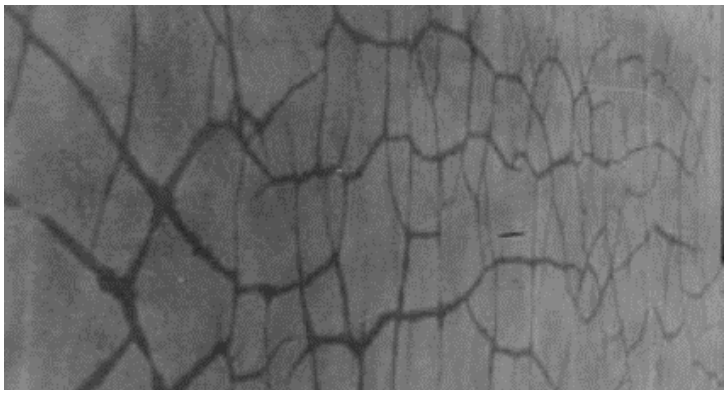
joints in the base wall. Without the proper joint in the stucco at this substrate point, a crack will develop. Where concrete and masonry block walls abut, typically strip lath or a control joint are used to bridge or alleviate the stress at this juncture.

Internal Stresses

Internal stresses within stucco may result in shrinkage cracks during the curing stage, the time when the material's ability to resist these stresses is at its weakest. Shrinkage is inherent in all cementitious materials. As a cementitious material, shrinkage cracks may occur in any stucco applied to framed or solid substrates.

Types of shrinkage cracking associated with stucco include plastic shrinkage, drying shrinkage and craze cracks. Plastic shrinkage cracks occur during the curing process, before the plaster becomes rigid. Drying shrinkage cracks occur as excess water migrates out of the stucco after the majority of hydration has occurred. The exterior face of the stucco experiences greater shrinkage than the inner portion, which is restrained from moving through its bond to the substrate. The tensile forces at the exterior face results in shrinkage cracks. For this reason, shrinkage cracks tend to occur in the outer section of the stucco. Installation of control joints limits the stresses that stucco experiences due to shrinkage and mitigates drying shrinkage cracks.



Crazing is a surface cracking pattern that exhibits a dense set of hairline cracks and forms due to extreme evaporation of water during curing. Crazing typically occurs due to environmental influences such as prolonged elevated wind speeds, high temperature or low humidity but can also occur when admixtures are improperly added to the stucco mix. Performance of stucco veneers is always dependent upon a proper plaster mixture but increased/extended curing may be required depending on ambient conditions to maintain a moist curing of the stucco.

The use of very fine sands in stucco increases the likelihood of shrinkage cracking by increasing the water demand of the mixture. Stucco proportioned with fine sand tends to be cement-rich, which increases the likelihood of shrinkage cracks. Over working stucco during when it begins its initial set can also result in a smaller pattern of craze cracking. Overworking causes fine particles of sand to come to the surface of the stucco and form a layer of particles similar in size, preventing aggregate interlock, thus the stucco cannot bond to itself.

Greater internal stresses are expected at abrupt changes in

stucco finishes such as the corners around wall openings (doors, windows, etc.). Stucco is also expected to experience greater stress at abrupt changes in cross-section. As the exterior plane of the stucco is plumb, abrupt changes in cross-section can be mitigated by maintaining a plumb substrate, whether framed or solid.

Conditions that cause high evaporation rates from the concrete surface, and thereby increase the possibility of plastic shrinkage cracking, include:

- High ambient and/or stucco temperatures
- Increase in wind velocity
- Low relative humidity
- Fine Sand
- Water loss through evaporation

When cracks develop, all parties involved should be included in the evaluation and determination as to whether repair is needed. Hairline static cracks can typically be filled and covered simply by using a quality primer and paint. If the cracks remain active, repair is futile until the movement is identified and fixed or the movement settles on its own. Larger cracks can be filled with stucco or patching material prior to painting. Best industry practices of preparing and protecting stucco walls go a long way in reducing the likelihood of cracking, but all builders and owners should expect some cracking to occur.

Some best practices for minimizing the likelihood of cracking include but are not limited to:

- Only apply stucco to substrates that are properly constructed and prepared.
- Highly absorptive solid substrates need to be properly cleaned and moistened to reduce moisture loss.
- Walls need to be straight and true to minimize thickness variations.
- Adequate curing is needed to reduce evaporation and ensure hydration coinciding with the environmental conditions.
- Proper installation and spacing of control and expansion joints in accordance with ASTM C1063.
- Properly installed weather resistant barriers, flashing, and plaster bases to minimize moisture intrusion and the associated expansion/contraction of wood framed components.
- Install wood sheathing with a 1/8” gap at the edges to all for expansion.
- Load roofs and hang drywall prior to the application of stucco.
- Limit construction vibrations during and after stucco application.
- Embedment of a fiberglass mesh lamina in the brown coat plaster prior to application of the finish coat.
- Heavy textures provide more “hide” and make cracking less conspicuous.

Proper Curing per ASTM C926-18a

X1.5.2.2 In order to provide more intimate contact and bond between coats and to reduce rapid water loss, the second coat should be applied as soon as the first coat is sufficiently rigid to resist cracking, the pressures of the second coat application, and the leveling process.

X1.5.2.3 The amount of water and the timing for curing portland cement plaster will vary with the climatic conditions, the type of base, and use or nonuse of water-retentive admixtures.

X1.5.2.4 Some moisture must be retained in or added back to freshly applied portland cement-based plaster. 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.

X1.5.2.5 Consider the physical characteristics of the structure as well as the previously mentioned conditions when selecting the method of curing. The method can be one or a combination of the following:

(1*) Moist curing is accomplished by applying a fine fog spray of water as frequently as required, generally twice daily in the morning and evening. Care must be exercised to avoid erosion damage to portland cement-based plaster surfaces. Except for severe drying conditions, the wetting of finish coat should be avoided, that is, wet the base coat prior to application of the finish coat.*

(2) Plastic film, when taped or weighted down around the perimeter of the plastered area, can provide a vapor barrier to retain the moisture between the membrane and plaster. Care must be exercised in placing the film: if too soon, the film may damage surface texture; if too late, the moisture may have already escaped.

(3) Canvas, cloth, or sheet material barriers can be erected to deflect sunlight and wind, both of which will reduce the rate of evaporation. If the humidity is very low, this option alone may not provide adequate protection.

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