



FLORIDA LATH & PLASTER BUREAU

Portland Cement-based plaster (Stucco) is one of the most versatile building claddings. Stucco's versatility for use on framed substrates is prevalent in Florida. Versatility allows for various detailing configurations and aesthetics.



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Technical Bulletin

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Cracking of Stucco Over Framed 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 framed substrates 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.

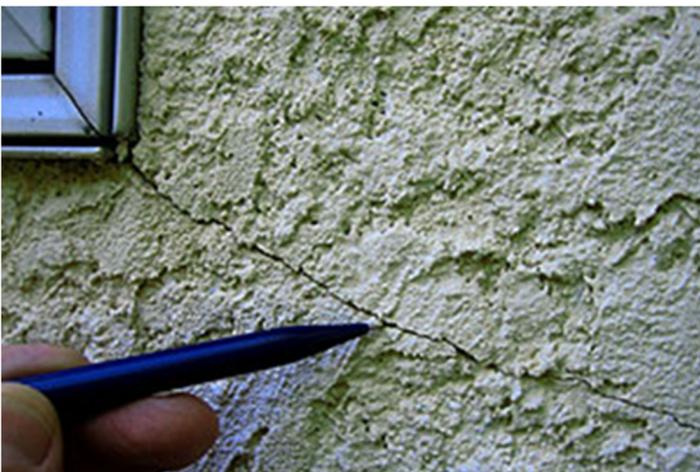


Stresses that exceed the tensile and/or flexural capabilities of stucco can lead to cracking. While there is no viable way to eliminate all stresses and some cracking in stucco systems, proven industry practices can reduce stresses, cracking, and difficult situations that inevitably arise.

External Stresses

External stresses applied to stucco are stresses emanating from movement of the structure itself which may also lead to crack development. Stucco applied over a framed substrate is attached to the structure via the lath and accessories. Stresses initiating from the structure itself will be released into the stucco through these connections. Stresses emerging from the building structure can form from a multitude of causes. Wood framed structures expand and contract both thermally and with moisture entering or exiting the wood members. Providing a water-resistant building envelope (flashing and water resistive barriers) and keeping the framing dry is paramount to reducing stresses. In regions of high humidity climates such as Florida, moisture is a constant opponent.

External stresses can come from movement of the framing and sheathing, movement at the interface of dissimilar structural elements, settlement, wind, building loads (both live and dead) and any construction practices that cause movement and vibration. Structural movement cracks will continue to move and grow across panels or entire walls, until the movement stops, or the stress is relieved. The cracks tend to follow the line of stress in long straight lines and can continue throughout the full thickness of the stucco. Typical points of stresses occur at window and door corners but will occur anywhere the stress exceeds the stucco tensile or flexural strength.

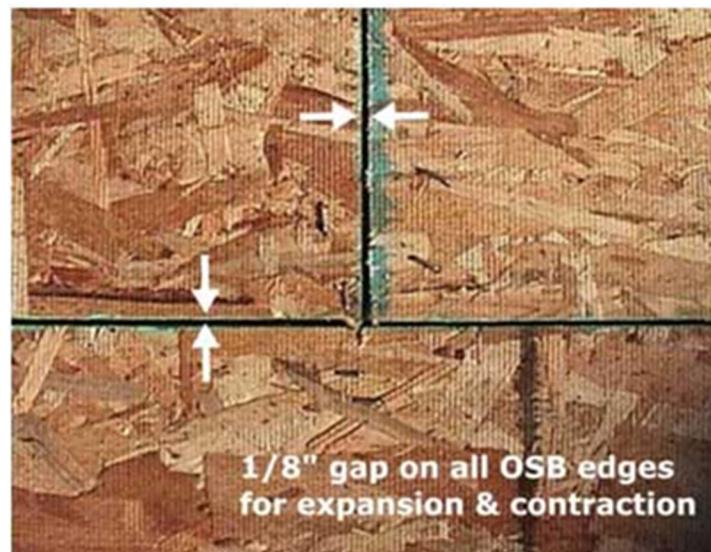


Metal framed systems are affected by many of the same stresses of wood framed systems and may also incur movement from thermal expansion and contraction. Many metal framed systems are designed for larger scale construction and the additional loads applied to the building during and/or after stucco application can cause deflection of the framing members increasing the stresses applied to the stucco.



ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster:

6.1.4 Plywood and oriented strand board sheathing panels shall be installed with with 1/8-in. (3mm) minimum panel edge gaps, and panel edges shall be offset 4 in. (10cm) minimum from wall



opening reentrant corners.

NOTE —This 1/8-in. (3 mm) gap is intended to accommodate expansion. Linear expansion that is not accommodated by an expansion gap can cause stress on the stucco membrane resulting in stucco cracks.

Where framed and solid base walls meet a minimum 1/8" gap between the wood sheathing and the concrete masonry is required.

All stucco over framed substrates require the attachment of lath and proper installation of control joints adhering to the Specifications outlined in ASTM C1063, Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

ASTM C1063 states:

7.4.10.2 Install control joint lathing accessories at locations to delineate cement plaster panel areas of 144 ft² (13 m²) maximum for walls and 100 ft² (9 m²) maximum for horizontal installations, that is, ceilings, curves, or angle type structures.

7.4.10.3 Install control joint lathing accessories at locations to delineate cement plaster panel areas of 18 ft (5 m) maximum

dimension, in either direction, or a maximum length-to-width ratio of 2 1/2 to 1.

7.4.10.4 Install a control joint lathing accessory at locations where the ceiling framing or furring changes direction.

Code requirements for minimizing the likelihood of cracking include but are not limited to:

- Framing member deflection shall not exceed L/360 (0.33" in 10')
- Only apply stucco to framed substrates that are properly constructed and prepared.
- Walls need to be straight and true to minimize thickness variations.
- Adequate curing to reduce evaporation and ensure hydration coinciding with environmental conditions.
- Proper installation and spacing of control and expansion joints in accordance with ASTM C1063.
- Properly installed and sealed weather resistant barriers, flashing, and plaster bases to minimize moisture intrusion and the associated expansion of framed substrate components.
- Install wood sheathing with a 1/8" gap at the edges to allow for expansion.
- Wood products moisture content: At the time of plaster application no more than 19% for wood framing members and plywood sheathing and oriented strand board (OSB). In hot and humid climates like Florida, mold growth can occur in moisture contents above 15%.

Best Practices for minimizing the likelihood of cracking:

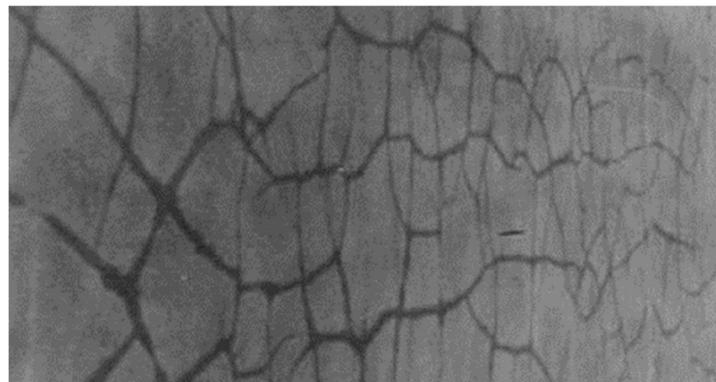
- Load roofs and hang drywall prior to stucco application.
- Limit construction vibrations during and after stucco application.
- Embedment of a fiberglass mesh lamina in the brown coat plaster prior to application of the finish coat.
- Note—Heavier textures provide more "hide" and make cracking less conspicuous. Not a requirement.

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 shrink-

age 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 result 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 cementitious 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.

Proper Curing per ASTM C926

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 re-

wetting 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.*

Maintenance & Repairs:

Portland Cement-based Plaster (Stucco) provides you with one of the hardest and most durable exterior finishes available. Stucco, along with paint and sealant, comprise your first line of defense from water intrusion. Please follow the FLAPB Tech Bulletin "Stucco & Building Exterior Maintenance" for annual inspection including cleaning, sealants, paint, and cracking repair. This and other Tech Bulletins are available at www.flapb.com

For further information please contact us at www.flapb.com or email us at info@flapb.com.