



STUCCO & MASONRY

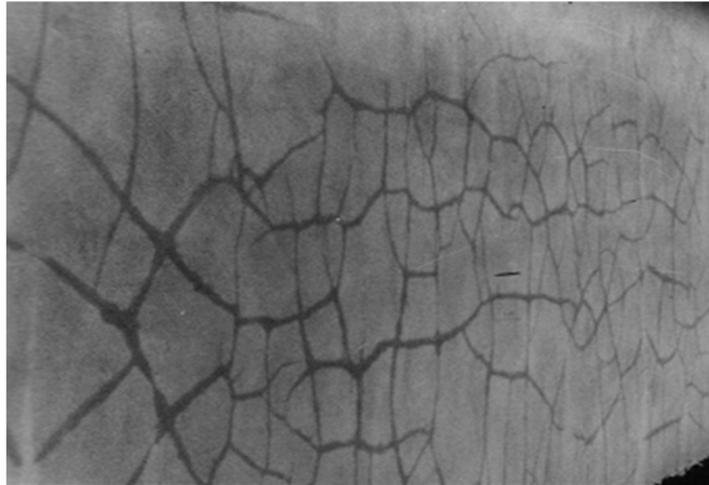
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CRACKS IN STUCCO

Types & Causes

The issue:

Stucco is a durable exterior cladding providing an aesthetically appealing finish to structures of all types and sizes throughout the world. This low cost, fire resistant material, while exceptionally strong under compression, must be properly applied, cured and protected from both internal and external stresses. Stresses that exceed the tensile and flexural capabilities of stucco lead to cracking.



Internal stresses of stucco occur during the initial hydration and curing stages, while its ability to resist these stresses is at its weakest. Stucco, as all cementitious materials do, shrinks as it cures and hydrates. Where stucco is restrained by wall attachments or bonding, shrinkage cracking is possible.

Shrinkage Cracking

There are several types of shrinkage cracking. Crazing, or map cracking often referred to as “alligator-back), occurs when there is a rapid loss of moisture at the surface, causing the signature shapes of the cracks. Cement-rich mixtures, smooth trowelling

or over trowelling can aggravate the cracking. The surface of the stucco should be protected from windy conditions and adequate early moist curing is essential for minimizing crazing cracks. These cracks tend to re-seal themselves during initial curing and become most evident when wetted. The cracks generally only affect the surface coat and cause no long-term deterioration of the wall system.



Plastic shrinkage cracks are similar to crazing cracks but tend to be hairline in width and remain open. They occur during the plastic or hydrating stage of the curing process and may extend through the entire coat of stucco. Caused by environmental conditions when evaporation rates are high, plastic shrinkage cracks are less random than craze cracks, appearing as parallel lines or in larger geometrical shapes. Plastic shrinkage cracks do not typically extend through the entire thickness of stucco and can be sealed and covered with a quality primer and paint. As with craze cracks, plastic shrinkage cracks become

static once the stress is relieved. Increased protection from wind and sun, adequate curing and properly moistened solid substrates will greatly minimize the amount of plastic shrinkage cracking.

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

- High ambient and/or stucco temperatures
- Increase in wind velocity
- Low relative humidity

Lastly, the use of very fine sands in stucco increases the likelihood of shrinkage cracking by increasing the water demand of the mixture. Mixing stucco with fine sand requires more cement to uniformly coat all the sand particles. More cement (a rich mix) then has a higher water demand. More water increases the volume of the mix and significantly increases the shrinkage potential; thereby increasing the likelihood of shrinkage cracking.

Structural Stresses

The term “structural movement cracking” refers to cracking caused by any external stress being applied to the stucco. 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 operations that cause movement and vibration. Structural movement cracks will continue to move and grow until the movement stops and 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.



Both wood and metal framed construction can allow for movement in the wall system. Metal frame systems are affected by thermal expansion and contraction while wood framing is affected by expansion and contraction due to both thermal and moisture variances. Additionally, loads applied to the building during and/or after stucco application can cause deflection movement of the framing members increasing the stresses applied to the stucco. For this reason, drywall should be hung on the interior side of framed walls prior to plastering.

Where wood-based sheathing is used as a backing for stucco walls, a minimum 1/8” gap is required to be included at all panel edges. This includes the edge between sheathing and a masonry wall below and between the sheathing and floor or roof trusses. Wood sheathing expands with moisture and temperature, applying stresses at the framing members and in the field of stucco.

ASTM C1063-22a 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 1/8 in. (3 mm) minimum panel edge gaps, and panel edges shall be offset 4 in. (10 cm) minimum from wall opening reentrant corners.

NOTE 2—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.

Solid Substrate Stresses:

All buildings go through some natural settlement of the foundations and structural elements. As settlement continues after the application of stucco finishes, 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, and at intersecting structural elements (columns and beams) and along concrete block mortar joints.



The photos above represent structural movement. There is another, more common, issue that appears almost identical to this stair-stepping profile. This other stair-step crack is really due to plastic shrinkage of the mortar joint. Concrete block are dry (required) when placed. Wet mortar is applied between them and the block then absorb the moisture and cement paste form the mortar. This is what creates the chemical bond between them. The rapid absorption of the water in the mortar results in a volume loss of the mortar in the joint. At the same time, the sun is coming up causing the wall to heat up and expand. With the joint shrinking and the wall lengthening, this stair-step crack is created. It may take several days or weeks for it to become noticeably visible. This crack must be repaired prior to plastering to prevent its telegraphing through the stucco. Having the mason wet down the wall before leaving the site will aid in preventing this occurrence.

When cracks develop, all parties involved should be included in the evaluation and determination as to whether repair is needed. Fine static cracks can typically be filled and covered with 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. 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 industry 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 substrate needs to be properly cleaned and moistened to reduce moisture loss. **It is vastly more important to wet a masonry wall prior to scratch coat application than it is to moist cure after plastering. However, both are necessary in prevention of non-structural or movement cracking.**
- Walls need to be straight and true to minimize thickness variations.
- Adequate curing to reduce evaporation and ensure hydration coinciding with the environmental conditions. Once the plaster has reached final set (usually within a few hours) wetting it thoroughly in the morning and evening will prevent most shrinkage type cracks in the plaster. Curing, however, will not prevent the telegraphing of cracks or movement cracking due to substrate anomalies.

- Proper installation and spacing of control and expansion joints in accordance with ASTM C1063.
- Properly installed and sealed water-resistant barriers, flashing and lath to minimize moisture intrusion and the associated expansion of wood frame components.
- Install wood sheathing with a 1/8" gap at the edges to allow for some expansion.
- Load roofs and apply drywall prior to the commencement of stucco application.
- Limit construction vibrations during and just after stucco application.
- Heavier textures can be used to make cracking less conspicuous.

For further information, contact In-Spex, LLC at www.in-spexllc.com or (407) 709-9001.