Stucco on Solid Base

Prepared
For
The Masonry Workshop

Presented by:
G Michael Starks
Chairman
Florida Lath & Plaster Bureau

FLORIDA LATH & PLASTER BUREAU

MASONRY ASSOCIATION OF FLORIDA, INC. 1987 Building a Better Florida with Masonry STRENGTH • BEAUTY • DURABILITY

2

This is a 1 hour Webinar

This session :

Review the BASIC RULES for stucco applied on a SOLID BASE MATERIAL to assure that the stucco will meet the Code Standards and will perform well.

KEY THOUGHT: Ensure PERFORMANCE

3

What are the Rules?

The Rules are the Building Code

*** Florida Building Code**
ASTM C 926
ASTM C 1063
ASTM C 932
ASTM C 847

KEY THOUGHT: Ensure PERFORMANCE

4

The Florida Building Code

KEY THOUGHT:
Ensure PERFORMANCE

The Florida Building Code at 2510.3 refers the reader to:

ASTM C926 "*Standard Specification for Application of Portland Cement Based Plaster*"

ASTM C1063 "*Standard Specification for installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster*"

ASTM C 932 "*Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering*"

ASTM C 897 "*Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters*"

5

This session will cover:

A. Defining Solid Base
B. Understanding the Problem
C. Evaluating the Problem
D. Eliminating the Problem

6

A. Define Solid Base

Solid Base is defined in ASTM C 926 @ 3.2.35 solid plaster base, n-

Substrates that do not require a metal plaster base, include:

A. cast in place and precast concrete,
B. concrete and stone masonry,
C. clay brick and tile.

Note: Other bases such as wood, wood siding, osb, dens-glass, ICFs, etc. are not considered "solid" and they do require a metal plaster base such a metal lath.

KEY THOUGHT: Ensure PERFORMANCE

7

B. Understanding the Problem

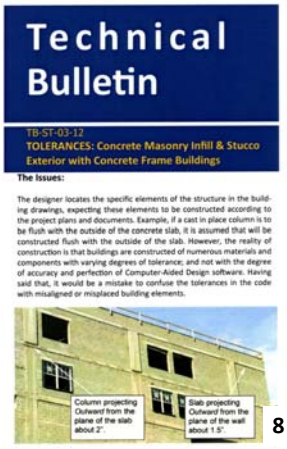
The three primary problems with stucco application on solid substrates are:

1. **Cracking**

2. **Debonding/Delaminating**

3. **Substrate out of Tolerance (out of alignment)**

Column extending 2" outward from the slab. Slab protruding 1.5" outward from the slab.



8

Cracking

First of three slides on Cracking

Assessing Cracking:

The ACI 524R Guide to Portland Cement-Based Plaster and the PCA Portland Cement Plaster (Stucco) MANUAL both provide pertinent information on the cause for cracking.

ACI @ 14.2 classifies cracks as follows:

14.2.2 *Shrinkage cracks, check cracks, and craze cracks*—Shrinkage cracks, check cracks, and craze cracks are created from volume changes that occur within the fresh plaster matrix due to hydration and moisture loss as a plaster sets and dries.

Check cracks are typically reversible, resealing themselves, and are generally considered only a cosmetic problem. These cracks tend to close or seal shut with cement hydration byproducts, primarily calcium hydroxide, during the curing period.

Check cracks, though closed, absorb water at a faster rate than the overall plaster matrix, allowing the crack to become temporarily visible until the plaster surface is saturated or dries again.

Shrinkage, check, and craze cracks are more noticeable on smooth textures such as the hard-trowel finish. These cracks can appear open if, before their resealing, dust or dirt is trapped within the cracks.

Generally, this does not affect the performance of the plaster and is not considered a failure of the plaster. Crazing cracks and shrinkage cracks can also remain open.

Shrinkage cracks, check cracks, and craze cracks can be remedied.

NOTE in section D we will discuss means to eliminate or minimize these cracks.

KEY THOUGHT: Ensure PERFORMANCE

9

Cracking

Second of three slides on Cracking

Assessing Cracking:

The ACI 524R Guide to Portland Cement-Based Plaster and the PCA Portland Cement Plaster (Stucco) MANUAL both provide pertinent information on the cause for cracking.

PCA Manual @ page 25 discusses cracks as follows:

16. Plaster Cracks in craze pattern and is convex. Brown coat is harder than scratch coat o finish coat harder than base coat.

18. Cracking due to poor consolidation.

20. Cracking due to early moisture loss.

NOTE in section D we will discuss means to eliminate or minimize these cracks.

KEY THOUGHT: Ensure PERFORMANCE

10

Cracking

Third of three slides on Cracking

Assessing Cracking:

The ACI 524R Guide to Portland Cement-Based Plaster @ 14.2.4 Structural movement cracks or tensile stress cracks: Structural movement cracks or tensile stress cracks are significant cracks that either extend through the entire thickness of a plaster coating or through the delaminated or debonded portion of a plaster coating.

Structural movement cracks can continue growing in length, width, or number until movement stops in the underlying structure or structural member. Structural movement cracks and tensile stress cracks typically follow the stress pattern that the crack relieved. Structural movement cracks tend to be long and straight and can extend across multiple panels or sections. Structural cracks are generally not found in great numbers. A single structural crack can relieve the stress of an area.

Structural movement cracks and tensile stress cracks can be active cracks or inactive cracks. Active cracks are the result of ongoing structural movement or fluctuating tensile strain that continually opens, closes, slides, lifts, or lowers the plaster along the fracture. Inactive cracks do not exhibit further movement. Active and inactive structural movement cracks and tensile stress cracks can be repaired.

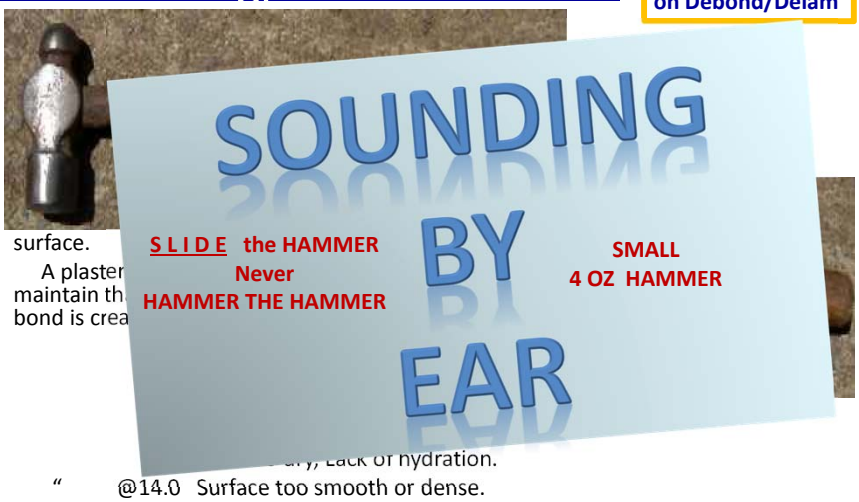
NOTE: Remediation will be discussed in section D

KEY THOUGHT: Ensure PERFORMANCE

11

Debonding/Delamination

First of four slides on Debond/Delam



surface.

A plaster
maintain th
bond is crea

" @14.0 Surface too smooth or dense.

" @15. 0 Surface covered with dirt or other contaminant.

NOTE in section D we will discuss means to eliminate or minimize these problems.

KEY THOUGHT: Ensure PERFORMANCE

12

13

14

Debonding/Delamination

Second of four slides on Debond/Delam

Assessing Debonding/Delamination :

ACI 524R @ 14.4: Debonding & delamination:

14.4.1 *General*—Debonding and delamination are both separations.

A plaster debond is a separation that occurs between a single hardened coat of plaster and an undercoat, solid substrate, bond coat, or other coating or substrate material.

A delamination is a separation that occurs within a single hardened coat of plaster and generally involves the nominal 1/8 in. (3 mm) upper layer of the plaster finish surface.

A plaster coating that has achieved proper mechanical bond will generally maintain that bond throughout the service life of the plaster. A proper mechanical bond is created by forcing the plaster into the open, roughened, etched, or scratched surface of the substrate, thereby keying or interlocking the two surfaces.

PCA Portland Cement Plaster (Stucco) MANUAL @ page 25:

@13. "Poor bond to concrete or concrete masonry substrate".

Problem: @ 13.0 Base too dry, Lack of hydration.

" @14.0 Surface too smooth or dense.

" @15. 0 Surface covered with dirt or other contaminant.

NOTE in section D we will discuss means to eliminate or minimize these problems.

KEY THOUGHT: Ensure PERFORMANCE

13

Debonding/Delamination

Third of four slides on Debond/Delam

Assessing Debonding/Delamination :

ACI 524R @ 14.4: Debonding & delamination:

14.4 Debonding of a plaster coat can be due to one or more of the following:

1.Surface carbonation on the undercoat or on a solid substrate

Like CO_2- It is good and bad for Concrete. Reduces Alkalinity- Increases Strength- Too much can cause faster Rebar Corrosion. Can measure depth of carbonation.

2. Surface efflorescence or surface laitance on an undercoat or solid substrate

Reduces Stucco Bond to the substrate. Laitance and efflorescence must be removed.

3. An overly smooth or dense solid substrate surface or undercoat.

ASTM C 90 years back specified block being stuccoed must be "ROUGH".

4. An overly dry solid substrate or undercoat having a high rate of absorption, resulting in rapid moisture loss from the fresh plaster and causing premature drying or stiffening before the fresh plaster being absorbed or forced into the pores of the substrate or undercoat. Substrate must be dampened to be:" Saturated Surface Dry".

5. A solid substrate or undercoat that is saturated or overly wetted. Water occupying the open texture or pore spaces of a plaster base and restricting mechanical bond or absorption of plaster into the plaster base.

NOTE: in section D we will discuss means to eliminate or minimize these problems.

KEY THOUGHT: Ensure PERFORMANCE

15 **14**

Debonding/Delamination

Fourth of four slides on Debond/Delam

Assessing Debonding/Delamination :

ACI 524R @ 14.4: Debonding & delamination:

14.4 Debonding of a plaster coat can be due to one or more of the following:

6. An overly thin coat of plaster with little to no tensile strength to resist shrinkage stress. Cement based products are not known for high tensile strengths – they do have good or high compressive strengths, but not high tensile strength – when placed too thin, the stucco has no tensile strength to resist shrinkage and is prone to cause debonding.

8. Certain contaminants on the substrate such as form release agents, oil, dirt, or loose debris

9. A scratch coat, brown coat, or other plaster coat that was not properly scratched, scored, notched, or otherwise prepared to receive a subsequent plaster coat.

10. Improper usage or application of a bonding agent.

ACRYLIC: Stucco must be applied to an Acrylic Bonding agent, while it is "tacky". If it dries out, it becomes a DE- BONDER. It will prohibit the stucco bond.

PVA – Poly Vinyl Acetate – will re-emulsify if moisture gets to it after it has dried out and it will "release" the stucco, and it becomes a debonder if it gets wet.

NOTE: in section D we will discuss means to eliminate or minimize these problems.

KEY THOUGHT: Ensure PERFORMANCE

16 **15**

3. Substrate out of Tolerance (out of alignment)

First of one slide on Out of Tolerance

Assessing Out of Tolerance/Out of alignment problem :

Background:

Probably the most popular design for high rise office buildings and multistory condominiums are building them with concrete columns and floors and cmu walls.

During the "fast" pace construction of the ambitious construction periods in Florida history, and possibility due to the lack of ample labor force, often times, columns were formed over the edge of the slabs and slabs extended beyond the walls that they rested on. These elements oftentimes were built beyond the TOLERANCES allowed for Concrete and Masonry Construction.

Stucco Standard ASTM C 926 @ Table 2 explains that Stucco on the solid substrate should be ½" thick or 5/8" thick. When the substrate is out of tolerance by 2" + 1.5" for a total of 3 ½", it is impossible to apply the stucco in accord with the Stucco Standard. These out of tolerance and out of alignment issues are probably the major cause for both cracking and delamination on Solid Bases.

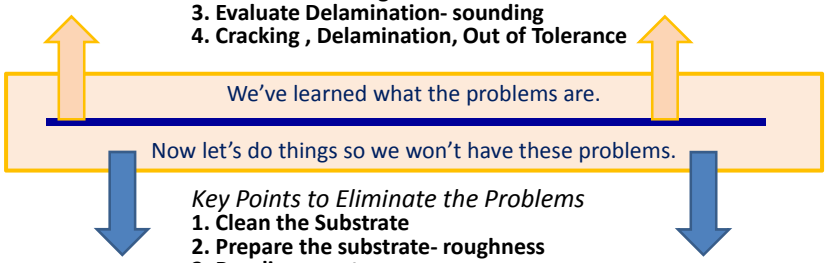
NOTE: in section D we will discuss means to eliminate or minimize these problems.

KEY THOUGHT: Ensure PERFORMANCE

16

Defining Solid Substrate
Understanding the Problem
Key Review Points to Evaluate the Problem:

1. Examine the Substrate -
2. Evaluate Cracking
3. Evaluate Delamination- sounding
4. Cracking , Delamination, Out of Tolerance



Key Points to Eliminate the Problems

1. Clean the Substrate
2. Prepare the substrate- roughness
3. Bonding agent
4. Integral Admixture
5. Proper Mixing Sequence
6. Proper Application – damp & pressure
7. Plan the work that can be accomplished each day. –
8. Curing
9. Maintenance Bulletin

17

Now let's do things so we won't have these problems.

Key Points to Eliminate the Problem

1. Clean the Substrate
2. Prepare the substrate- roughness
3. Dash Bond Coat or Surface-applied Bonding Agent; or
4. Integral Admixture
5. Proper Mixing Sequence
6. Proper Application – damp & pressure
7. Plan the work that can be accomplished each day.
8. Curing
9. Maintenance Bulletin

18

Key Points to Eliminate the Problems

1. Clean the Substrate
2. Prepare the substrate- roughness

First Two of Nine Points

Let's see what the ASTM tells us:
ASTM C 926 @ 5.0 5.
Requirements for Bases to Receive Portland Cement-Based Plaster

5.2 Surfaces of solid bases to receive plaster, such as masonry, stone, cast-in-place or precast concrete shall be straight and true within 1⁄4 in. in 10 ft (2.1 mm/m) and shall be free of form oil or other elements, which would interfere with bonding.

Conditions where the surfaces are out of tolerance shall be corrected prior to the application of the plaster. Form ties or other obstructions shall be removed or trimmed back even with the surface of the solid base.

5.2.1 Solid surfaces shall have the suction (ability to absorb water) or surface roughness, or both, to provide the bond required for the plaster.

KEY THOUGHT: Ensure PERFORMANCE

19

Key Points to Eliminate the Problems

1. Clean the Substrate

2. Prepare the substrate- roughness

First Two of Nine Points

5.2.2 Smooth or nonabsorbent solid surfaces, such as cast-in- place or precast concrete, shall be prepared to receive portland cement plaster by one of the following methods:

5.2.2.1 Sandblasting, wire brushing, acid etching, or chipping or a combination thereof.

A RELATIVELY CLEAN AND QUIET METHOD

This scoring pattern was accomplished with a 4" Makita grinder with a 4" diamond blade. Two men working with two of these grinders can accomplish an amazingly large scored area in a relatively short time. This presents an excellent base for achieving good bond.

KEY THOUGHT: Ensure PERFORMANCE

Key Points to Eliminate the Problems

3. Bonding Agent

4. Integral Admix

#3 & #4 of Nine Points

5.2.2 Smooth or nonabsorbent solid surfaces, such as cast-in- place or precast concrete, shall be prepared to receive portland cement plaster by one of the following methods:

5.2.2.2 Application of a dash-bond coat applied forcefully against the surface, left untroweled, undisturbed, and moist cured for at least 24 h, or

5.2.2.3 Application of a bonding compound suitable for exterior or interior exposure solid surfaces in accordance with the manufacturer's written directions.

Bonding Agent Requirement

The Bonding Agent shall meet the requirements of ASTM C 932 and shall not re-emulsify.

Some of these products can be used both as a surface applied roll on bonding agent and as an integral admixture to the stucco mix.

They can also be used with the "dash-bond" coat mentioned above at 5.2.2.2. In the Dash Bond coat, the addition of it as an admix will hold moisture in the small splatters of dash coat and assist in curing them and making them strong; otherwise the splatter may dry out too quick and turn to powder.

5.2.3 Where bond cannot be obtained by one or more of the methods in 5.2.2, a furred or self-furring metal plaster base shall be installed in accordance with Specification C1063.

KEY THOUGHT: Ensure PERFORMANCE

Key Points to Eliminate the Problems

3. Bonding Agent
4. Integral Admix

#3 & #4 of Nine Points

Benefits of Bonding Agent – as an integral admix.

- **Improved Water Resistance**
- **Improved Density**
- **Reduce Cracking**
- **Reduced H_2O permeability**
- **Increased Strength**
- **Improved Curing**
- **Increased Durability**

5.2.3 Where bond cannot be obtained by one or more of the methods in 5.2.2, a furred or self-furring metal plaster base shall be installed in accordance with Specification C1063.

KEY THOUGHT: Ensure PERFORMANCE 22

Key Points to Eliminate the Problems

5. Proper Mixing Sequence

#5 of Nine Points

Maintain mixer in clean condition before, during, and after plaster preparation. Remove partially set and hardened plaster from mixer drum before next batch. If mixer has been previously used in preparing gypsum plaster, thoroughly clean prior to use to prepare cement plaster.

The following sequence for mixing is to be use:

1. **Add the mixing Liquid**
2. **Add the first ½ of the Sand**
3. **Add the cement**
4. **Add the second ½ of the sand**
5. **Add water (if needed) to get to the correct workability.**
6. **Mix for 5 minutes after all the ingredients are in the mixer.**

Note: Over mixing causes too much air entrainment . Do not over-mix. Maintain mixer in continuous operation while charging mixer.

KEY THOUGHT: Ensure PERFORMANCE 23

Key Points to Eliminate the Problems

5. Proper Mixing Sequence + mixing the liquid portion with admixture

#5 of Nine Points

How to always have the right amount of admixture in the liquid.

Always use a 55 gallon barrel:

Water: Potable, cool and free from impurities.

Base coat(s):

a. ASTM C 926 Plaster Mix Base Coat :

c. ***Add ASTM C 932 compliant Admixture to the liquid portion of the base-coat cement plaster at a rate of 1 gallon Admixture to 2 gallons water.***

1. The procedure for mixing the correct amount of 932 Admixture follows:

a. Obtain a clean 55 gallon barrel for the mixing liquid.

b. Add one 5 gallon pail of 932 Admixture

c. Add two 5 gallon pails of water

Repeat the steps b and c for a total of <u>three</u> times.

At that point, the barrel will contain: 15 gallons of 932 Admix and 30 gallons of water for a total of 45 gallons. (Thus 1/3 (15 gal) is Admix and 2/3 (30 gal) is water)

All of the liquid going into the stucco should come out of the barrel and the process will assure that 1/3 of the liquid will always be Admix.

As the barrel gets somewhat low, it should be replenished using the same procedure above , i.e. always placing one five gallon 932 Admix into the barrel and then adding two each 5 gallon pails of water. Never pour water into the barrel from the hose.

KEY THOUGHT: Ensure PERFORMANCE 24

Key Points to Eliminate the Problems

6. Proper Application – Damp & Pressure

#6 of Nine Points

ASTM C 926 @ 7.0 Application:

7.1.1 – Apply to thickness in Table 4, i.e. ½" or 5/8" on SOLID substrates (CMU) .

Dampen the Substrate:

7.3.1 – High suction bases shall be evenly <u>dampened</u> with clean water prior to the application of plaster. Always dampen the substrate to be SSD "Saturated Surface Dry".

Apply with Pressure: (no slicker) – use the trowel

7.3.2.1 - The first (scratch) coat shall be applied with sufficient material and <u>pressure</u> to ensure tight contact and complete coverage of the solid base, to the nominal thickness shown in Table 4.

As soon as the first (scratch) coat becomes firm, the entire surface shall be scored in one direction only. The vertical surfaces shall be scored horizontally.

7.3.2.2 The second (brown) coat shall be applied with sufficient material and <u>pressure</u> to ensure tight contact with the first coat.

KEY THOUGHT: Ensure PERFORMANCE 25

Key Points to Eliminate the Problems

7. Plan the work that can be accomplished each day

#7 of Nine Points

Remember, the only control joints that are required on SOLID BASES are those that are in the stucco where there is a Control Joint or Expansion Joint in the BASE MATERIAL, i.e. in the SOLID substrate.

Control Joints as spelled out in ASTM C 1063 (for lathed work) they do not apply on SOLID BASES. Therefore, the plasterer should plan his work for the day and make plans such as plastering from one corner to another corner.

He should choose the best locations to start and stop the plastering process. He may use grounds to assist in depth control or for a location to stop the plaster. However,

The plasterer should avoid as many extra accessories as they actually act as a point of potential water intrusion.

There is no need for additional control joints on SOLID substrates and they should be avoided.

EXTRA JOINTS ARE AN INVITATION TO WATER INTRUSION – AVOID THEM !

KEY THOUGHT: Ensure PERFORMANCE

Key Points to Eliminate the Problems

7. Plan the work that can be accomplished each day

#7 of Nine Points

Plan to use the double-back or double-up method.

ACI 524R @ 10.3.2 Delays between application of coats

coats—The traditional method of plastering requires that there be a delay between the applications of the scratch and brown coats (Table 10.1). The intent of delay is to allow the scratch coat to harden and dry, and to allow for the initial volume change from hydration and mixing-water loss. The brown coat is then applied and troweled with force to fill any shrinkage cracks and to key into the scratch coat.

The double-back is the preferred alternative method of application where successive applications of plaster coats are applied with little or no delay between each coat. Typically, each coat is applied as soon as the prior fresh-plaster undercoat hardens enough to support another coat without sliding, sagging, or falling away.

This method eliminates delay between coats and curing requirements for the scratch coat. In addition, the double-back method promotes intimate bonding between coats and facilitates uniform hydration of the coats. When using the double-back method, scratch and brown coats should be applied to full and final thickness as rapidly as possible. This method is especially appropriate for plastering on solid bases. It may be used on lathing applied over sheathed-frame construction.

KEY THOUGHT: Ensure PERFORMANCE

Key Points to Eliminate the Problems

8. Curing

#8 of Nine Points

ACI 524R @ Chapter 12 - CURING

Portland cement-based plaster requires moisture to hydrate the portland cement. Plaster, like concrete, can lose moisture from the upper surface.

A significant difference is that plaster has a minimal thickness that renders it incapable of storing moisture needed to continue hydration. As a result, rapid moisture loss from plaster can occur in certain environments.

Concrete, because of its thickness, has a greater ability to store moisture and replenish vital moisture to the surface lost to evaporation or absorption. Plaster has little reserve of moisture to replenish lost surface moisture. Therefore, a method of curing should be used that ensures continued hydration.

Curing can be accomplished by supplementing moisture to the plaster through sprinkling, spraying, soaking, immersing, or otherwise maintaining moisture within the plaster.

The duration of the curing required may be dependent on the rate of strength gain. The curing period is terminated when the plaster has attained the amount of strength necessary to adequately perform its intended function.

KEY THOUGHT: Ensure PERFORMANCE 28

Key Points to Eliminate the Problems

8. Curing

#8 of Nine Points

Let's look back at item #4 – Integral Admixture
The integral admixture greatly assists in curing.

Slide #21:
Benefits of Bonding Agent – as an integral admix.

- **Improved Water Resistance**
- **Improved Density**
- **Reduce Cracking**
- **Reduced H_2O permeability**
- **Increased Strength**
- **IMPROVED CURING**
- **Increased Durability**

An Engineer (*John Buchholtz*) on the West Coast (California) wrote that adding an integral Admixture will almost negate the requirement for curing.

KEY THOUGHT: Ensure PERFORMANCE 29

Key Points to Eliminate the Problems

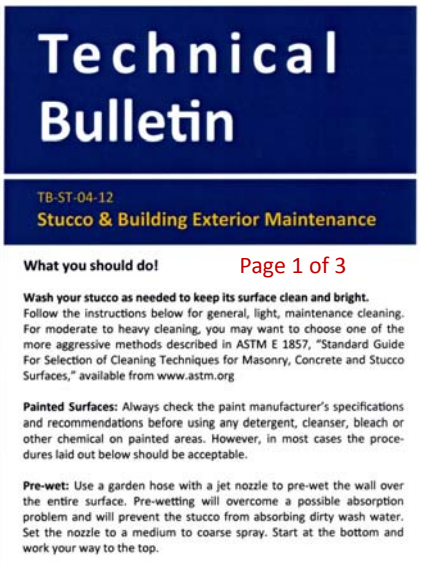
9. MAINTENANCE

#9 of Nine Points

FLORIDA LATH & PLASTER BUREAU

All buildings require maintenance. Stucco requires maintenance. Maintenance should commence when the stucco work is completed.

Florida Lath and Plaster Bureau has developed this maintenance guide.



Technical Bulletin

TB-ST-04-12

Stucco & Building Exterior Maintenance

What you should do! Page 1 of 3

Wash your stucco as needed to keep its surface clean and bright. Follow the instructions below for general, light, maintenance cleaning. For moderate to heavy cleaning, you may want to choose one of the more aggressive methods described in ASTM E 1857, "Standard Guide For Selection of Cleaning Techniques for Masonry, Concrete and Stucco Surfaces," available from www.astm.org

Painted Surfaces: Always check the paint manufacturer's specifications and recommendations before using any detergent, cleanser, bleach or other chemical on painted areas. However, in most cases the procedures laid out below should be acceptable.

Pre-wet: Use a garden hose with a jet nozzle to pre-wet the wall over the entire surface. Pre-wetting will overcome a possible absorption problem and will prevent the stucco from absorbing dirty wash water. Set the nozzle to a medium to coarse spray. Start at the bottom and work your way to the top.

KEY THOUGHT: Ensure PERFORMANCE 32 **30**

This is a 1 hour Webinar

Purpose of this Webinar

To review the BASIC RULES for stucco applied on a SOLID BASE MATERIAL to assure that the stucco will meet the Code Standards and will perform well.

KEY THOUGHT: Ensure PERFORMANCE 33 **31**