

# Residential Stucco

Every step counts when applying residential stucco for durability and performance

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# Topics

- Installing the drainage plane, bond break, and lath
- Selecting and storing raw materials
- Mixing and applying cementitious stucco
- Applying the scratch coat or base coat
  - Differences between one coat and three coat
- Executing wetting and testing for hydration
- Applying the finish coat

# Residential Stucco: Builder View

Stucco is a cementitious mix  
Delivered to the surface for application  
Finished to uniform surface  
Enhanced with texture and details  
Finished with color

# Residential Stucco: Quality View

Stucco is a cementitious mix

Of carefully proportioned clean materials

Delivered to the surface for application

Which includes pumping or hand application

Finished to accurate thicknesses

Over a stable, level base layer with tooling to achieve a  
specified uniform thickness and texture

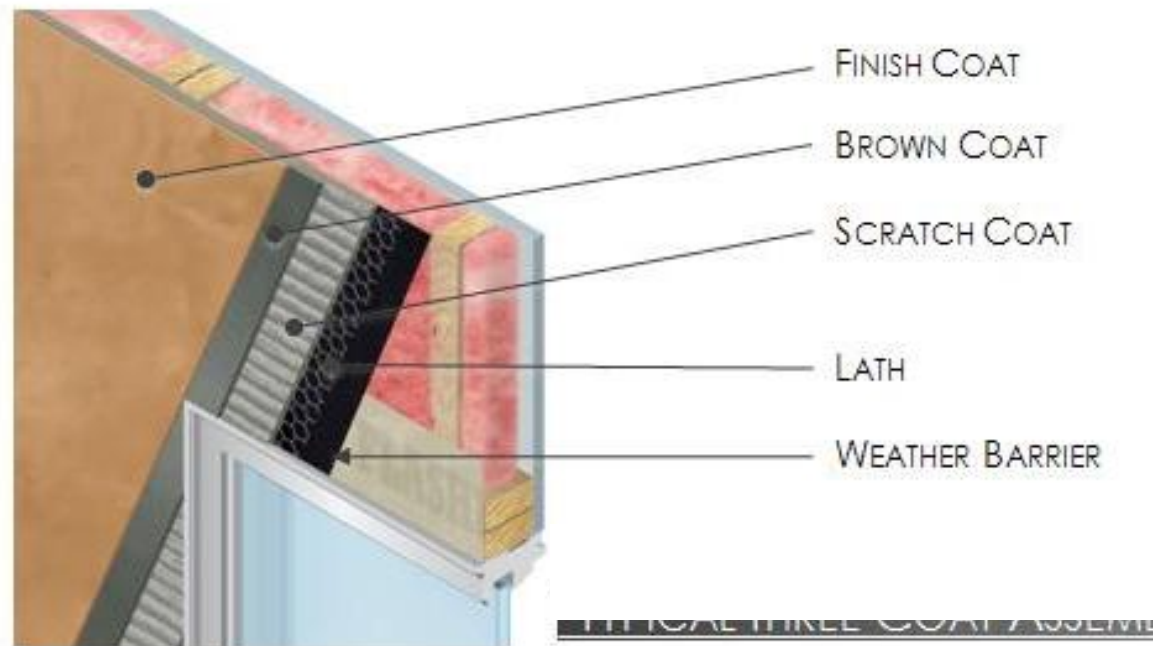
Enhanced with texture and details

Finished with color

# Basic Stucco Practice

Stucco is a cementitious mix of carefully proportioned materials

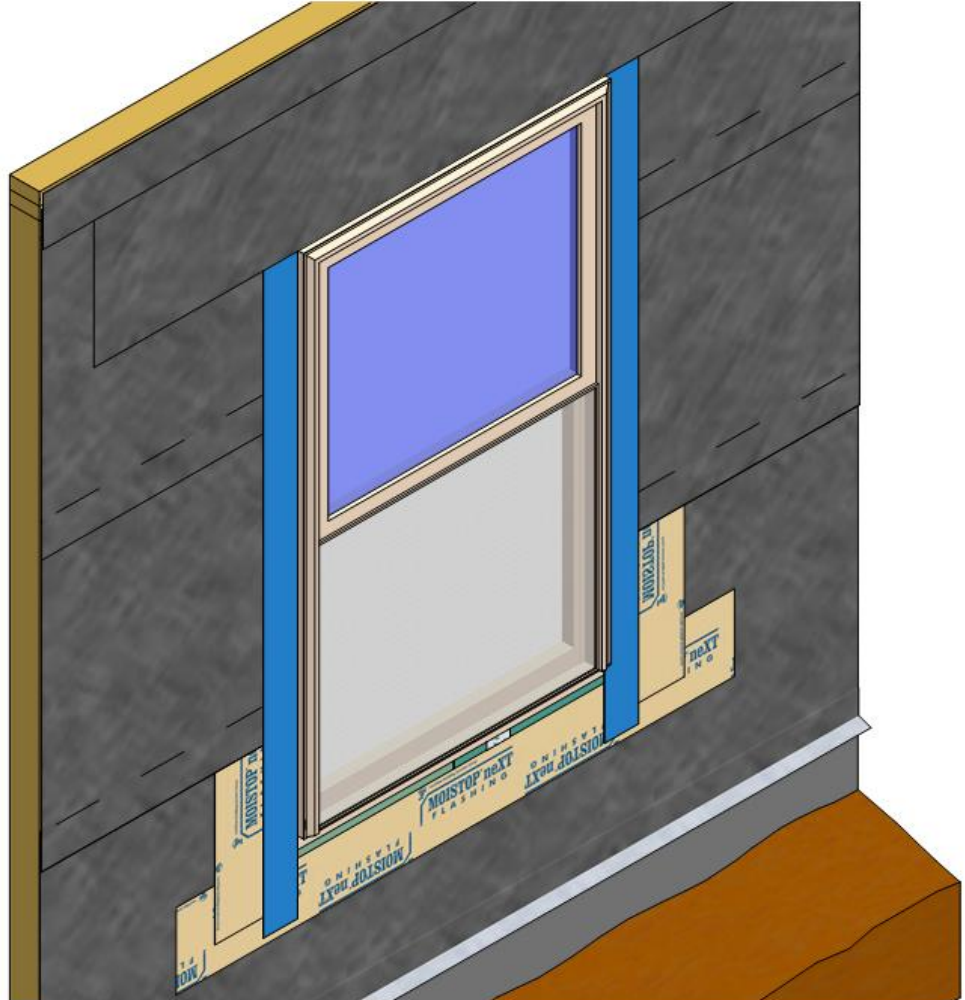
- Cement, preferably low alkali
- Additives including workability modifiers and lime
- Sand, clean and graded
- Water, potable



**Typical Three-Coat Stucco System**

# Drainage Plane and Bond Break

- Apply drainage plane integrated with penetration and opening flashings
- For one coat systems the paper is the drainage plane behind the foam
- For two coat systems the first layer of paper is the drainage plane, the second layer is a bond break





# Drainage Plane and Bond Break

All stucco systems need two layers of paper, except direct application to masonry backer.

Double layer on one roll looks like a productivity tool, but can create major cracking in the finish.



# Drainage Plane and Bond Break

Back layer of paper is the drainage plane.

Front layer is the bond break.

Drainage plane water is reintroduced to the stucco and causes a water concentration, which changes the hydration and shrinkage rates .



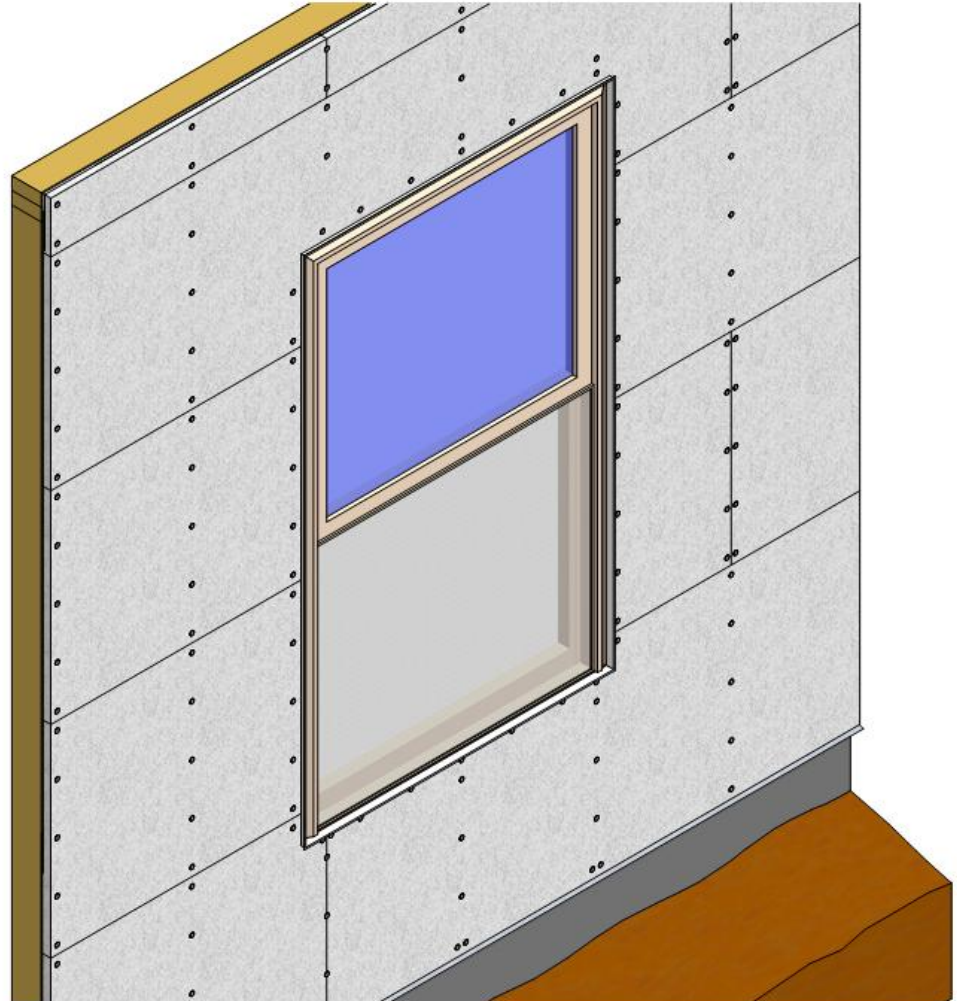


# Wall Preparation

One inch expanded foam board is applied over the base layer of paper.

Fasteners must be into framing members and not over-driven

Board should fit tightly and gaps should be filled with slivers of foam

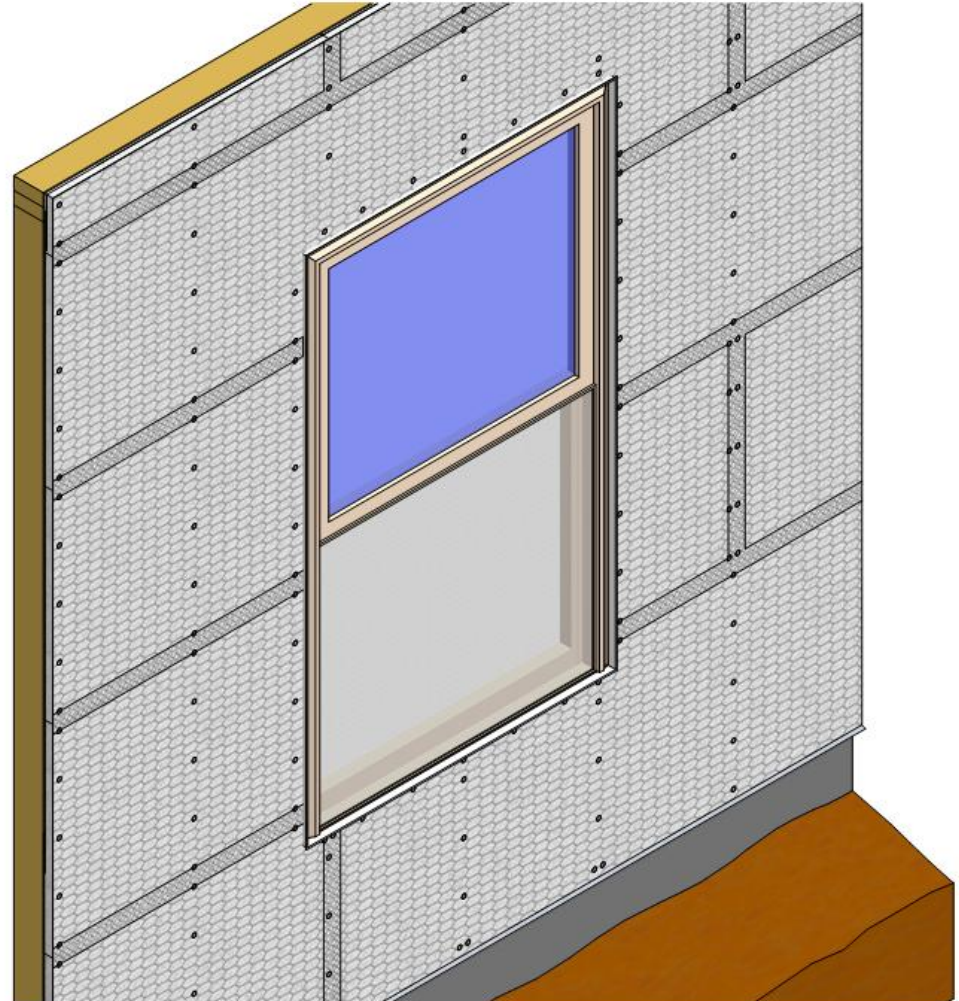


# Lath Application

Metal lath is applied to engage the base layer of stucco.

Over expanded foam, the lath may be pulled tightly and not furred out, since the foam deforms under the application of the base.

All other conditions require self furred lath or furring nails

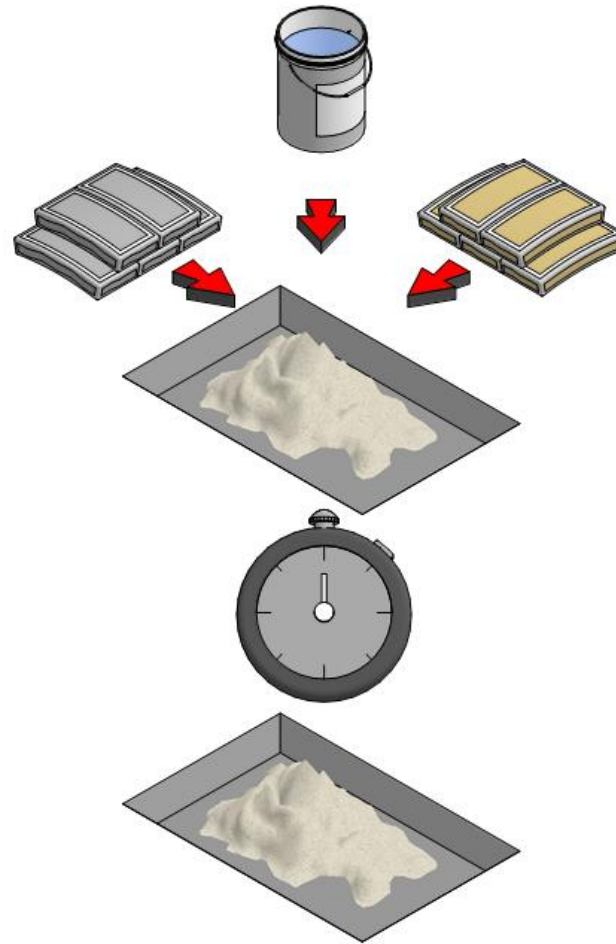


# Stucco Mix

Each stucco layer is mixed specifically for the function of that layer.

The base layer is always stronger than the next layer.

All must be mixed for application consistency within certain proportions to control strength and shrinkage.



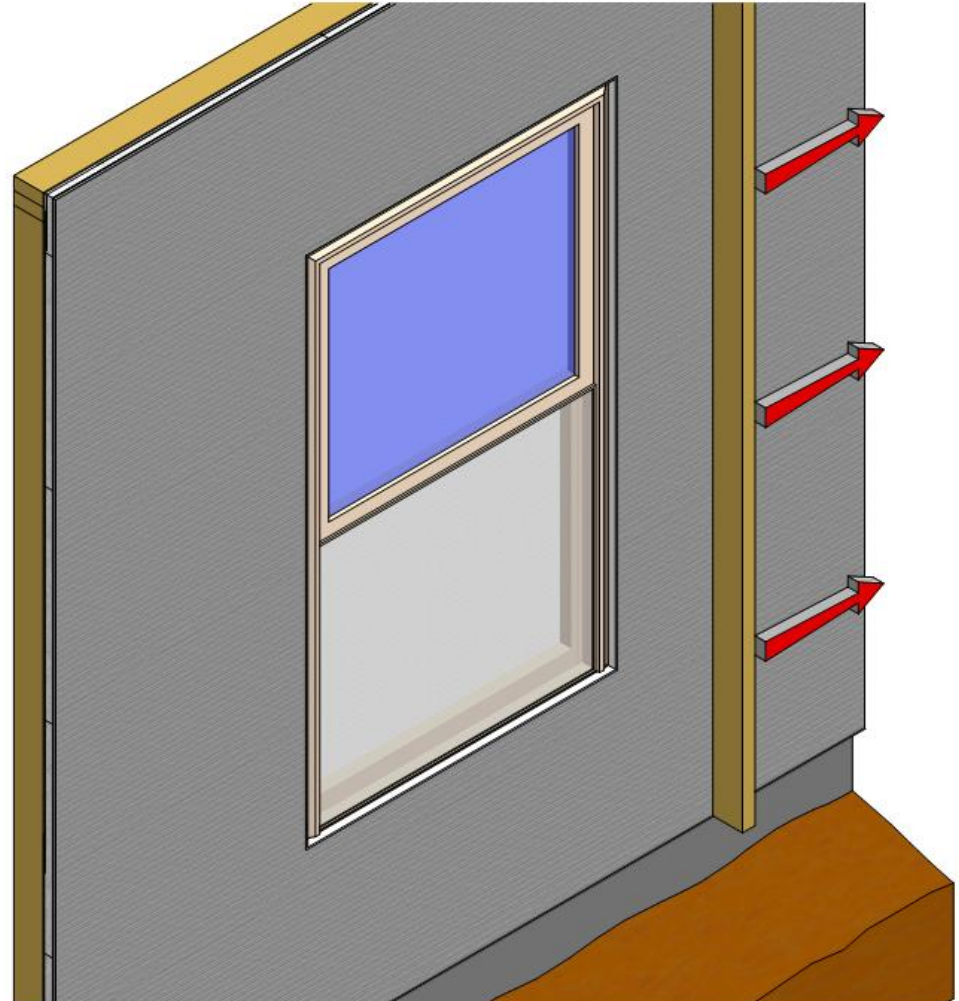


# Base Coat or Scratch Coat

The first coat engages the lath and forms a stable base for the next one or two layers.

Thickness control is critical and often overlooked .

Uniform thickness allows small uniform shrinkage crack to form and uniform thickness allows consistent hydration

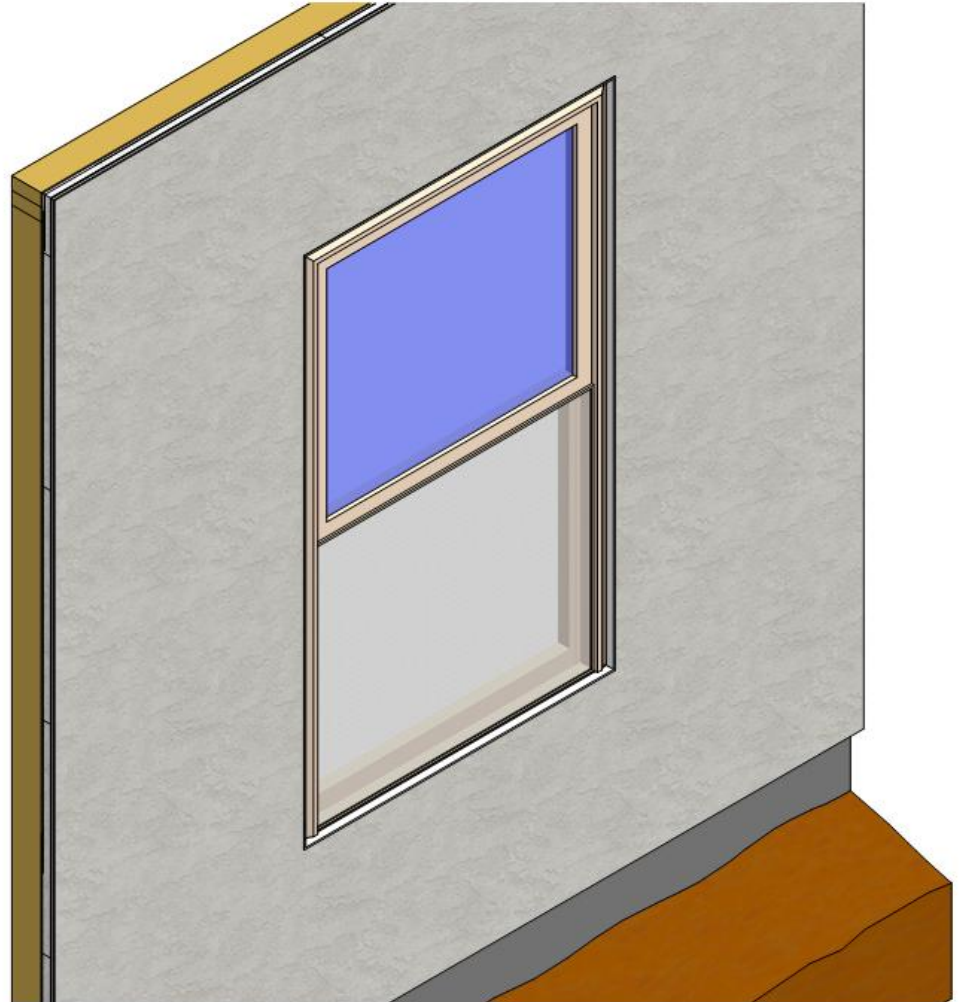




## Brown Coat, Texture Coat, or Color Coat

The next layers are slightly weaker but again uniform in thickness.

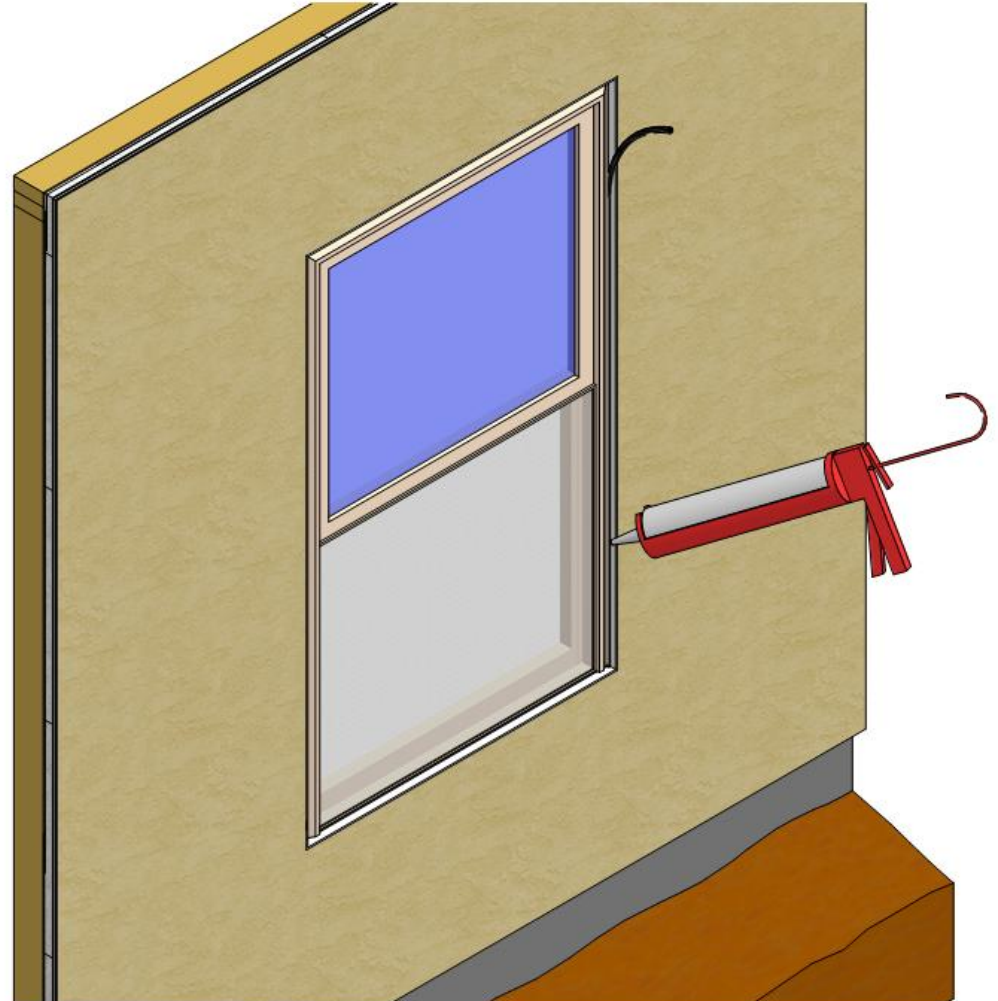
The prior coat must be wet prior to application of the next coat for both suction and for maintenance of moisture for hydration.



# Finishing

The top coat provides texture and can either be integrally colored or can be painted to provide a variety of colors.

All systems should be completed with appropriate sealants to provide weather resistance.



# Many Substrates

## Continuous OSB

- sheathing and block are two difficult substrates

## OSB

- Proper gapping is critical. 1/8" or more may be required and must be in both directions

## Block

- Must respect control joints and changes in mass





# Stucco Over OSB

- Gap was not adequate
- Nailing was at half of shear schedule
- Lath was not furred or on furred nails
- Scratch coat not engaged with lath

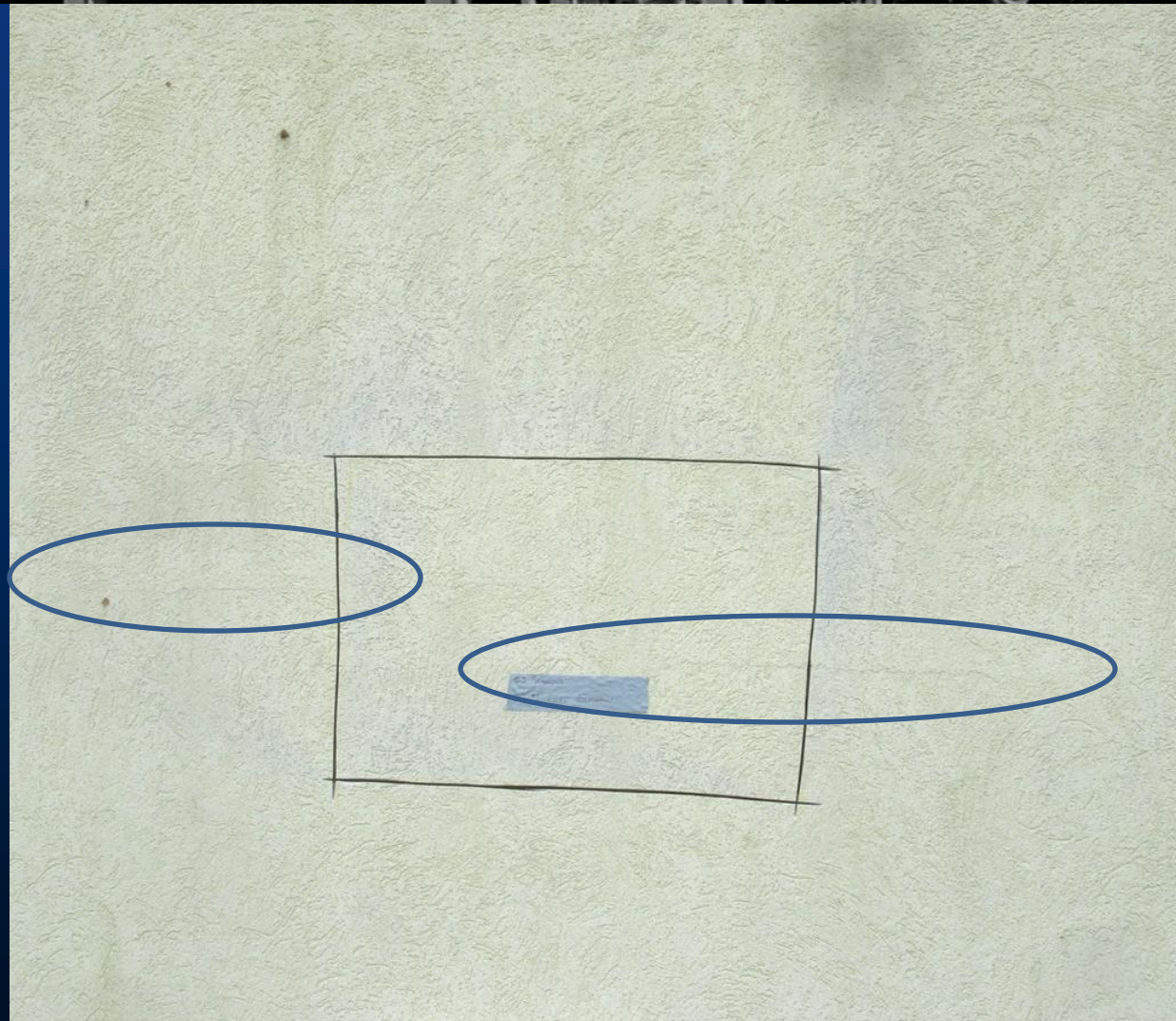




# Cracks due to OSB

## Horizontal cracks

- Expansion of OSB caused a belly in the stucco and the under-nailed OSB
- Second crack was caused by the poorly bedded lath causing a change in thickness of the stucco





# Lapped Lath

## Three impacts of lapped lath

1. Reduction in the cross section of the cement
2. Poor consolidation or fill of intermediate space
3. Top layer of lath extends to surface creating defect location

Diamond lath at window corners can cause as many issues as it solves





# One Coat Stucco Preparation

- Electric panel is on plywood backer
- Drainage plane is not in the same plane and will collect water
- Expanded foam is not tightly applied and should be filled





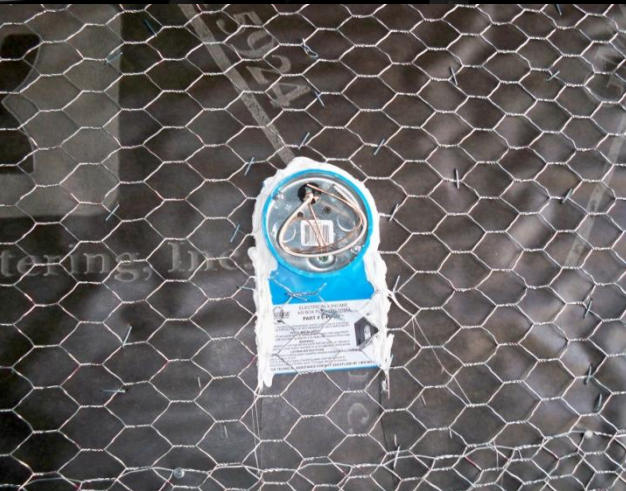
# Three Coat Preparation

- Self furred lath is applied uniformly
- Small defects are sealed with sealant to minimize water penetration
- Good use of flashing at penetrations
- Good position of weep screed





# Flashing at Penetrations



## Field built or pre-manufactured?

- Integrated in shingle style
- Rubber membrane stretched over penetrations, particularly pipes, works well
- Make sure pipes slope down with positive slope

# Three Coat Detailing

- Furred with spacer nails. Each nail has a fiber disc to support the lath off the paper
- Window sill flashing should integrate between two layers of paper





# One Coat Detailing

## Good detail at wood interface

- Ground at interface controls thickness
- Ground separates the stucco from the wood
- Ground allows space for sealant application



# One Coat Detailing

## Comments

- Insulation should be square at corner, not held back
- Corner bead would help in definition of corner and help control stucco thickness
- Water runs of surface of sloped weep, not really through holes





# Detailing of Inset Window

## Substrate must be sloped to start

- A continuous membrane is needed to carry window sill flashing to outer wall
- Do not build slope with base layer of stucco
- Corner bed will define stucco thickness
- Repair foam before lathing



# One Coat Stucco

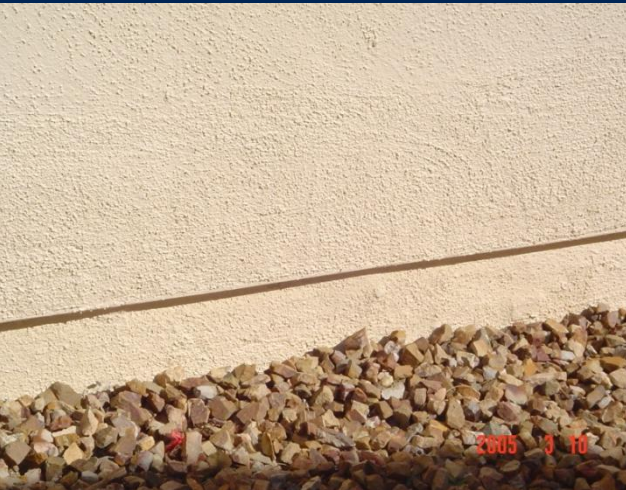
## Excellent preparation

- Minimum and controlled lapping of lath
- Open end of lath tight to wall
- Staples in framing members
- Staples not over driven
- Adequate reveal at window
- Adequate space to grade





# Stucco to Grade



- Stucco is a porous material with strong capacity for capillary draw of moisture
- Depending on the coating quality of the paint, water can rise as much as two feet
- Lime plaster parging was a sacrificial layer to control
- Use weep and texture coat below to create sacrificial layer



# Drainage Layer Integration

Membrane should continue behind roof framing

Typically done with second piece of drainage plane

Should have stucco ground at stucco return to fascia

All wood to stucco should be primed



# Drainage Layer Integration

## Flashing integration issues

- Kick out is not tall enough, this is a tile roof
- Massive sealant mess results in thin base coat and a point of water intrusion
- Poorly aligned foam at upper roof results in thin base or projection beyond roof overhang





# Drainage Layer Integration

## Flashing integration solutions

- Taller kick-out flashing
- Counter flashing integrated with drainage plane
- Still have issue with wood in stucco





# Control Joints

- Dissimilar masses
- Dissimilar materials
- Areas over 150 square feet
- Lengths over sixteen feet
- Control joints accommodate movement in the structure and provide preferred locations for the shrinkage to be released



# Design appropriate solutions

## Learn from past experience.

- Cracks appear at window corners
- Two pieces now is less than a field repair latter
- Lath is continuous
- Make sure to fully work in base coat or edge of control joint could be the crack location





# Design appropriate solutions

- Stucco above and lumpy stucco below
- Horizontal control joint separates three coat stucco system from direct application of manufactured stone
- Too many fasteners
- Drainage plane not continuous at bottom
- Window sill flashing draining on bond break





# Stucco Mixing

- Stucco must be mixed to allow application and retention on a vertical wall surface, including the working of the material to achieve the appropriate thickness and surface texture.
- The base coat relies on adhesion and embedment in the lath, while the additional coats can benefit from suction and bond to the base coat.
- There is no standard for slump, but workability is judged by the applicator. Most production stucco companies use a proprietary mix such as Omega brand products, which include proprietary additives to help with workability and to control shrinkage.

# Specific strength and thickness

- Scratch coat is to be stringer than the brown coat.
- Nominal sand
- Thickness no less than brown coat
- The same or greater sand proportion shall be used in the second coat than is used in the first coat

## Base Coats<sup>1</sup>

Plaster mix symbols	Parts by volume <sup>2</sup>							
	Cementitious materials					Volume of aggregate per sum of separate volumes of cementitious materials		
	Portland cement or blended cement	Plastic cement	Masonry cement <sup>4</sup>		Lime			
			N	M or S		Scratch coat	Brown coat 2nd <sup>3</sup> coat	Finish coat <sup>5</sup>
C	1	—	—	—	0 – 3/4	2-1/2-4	3-5	—
CL	1	—	—	—	3/4-1-1/2	2-1/2-4	3-5	—
M	—	—	1	—	—	2-1/2-4	3-5	—
CM	1	—	1	—	—	2-1/2-4	3-5	—
MS	—	—	—	1	—	2-1/2-4	3-5	—
P	—	1	—	—	—	2-1/2-4	3-5	—
CP	1	1	—	—	—	2-1/2-4	3-5	—

## Finish Coat<sup>1</sup>

F	1	—	—	—	3/4-1-1/2	—	—	1-1/2-3
FL	1	—	—	—	1-1/2-2	—	—	1-1/2-3
FM	—	—	1	—	—	—	—	1-1/2-3
FCM	1	—	1	—	—	—	—	1-1/2-3
FMS	—	—	—	1	—	—	—	1-1/2-3
FP	—	1	—	—	—	—	—	1-1/2-3

<sup>1</sup>The mix proportions for plaster coats to receive ceramic tile shall be in accordance with the applicable requirements of ANSI A108.1 series applicable to specified method of setting time.

<sup>2</sup>Variations in lime, sand, and perlite contents are allowed due to variation in local sands and insulation and weight requirements. A higher lime content will generally support a higher aggregate content without loss of workability. The workability of the plaster mix will govern the amounts of lime, sand, or perlite.

<sup>3</sup>The same or greater sand proportion shall be used in the second coat than is used in the first coat.

<sup>4</sup>Additional portland cement is not required when Type S or M masonry cement is used.

<sup>5</sup>In areas not subject to impact, perlite aggregate shall be permitted to be used over base-coat plaster containing perlite aggregate.



# Stucco Sand

**The gaps between sand grains is filled by cement paste and water**

- Sand that is too course will require too much cement and water to make a workable mix
- Sand that has too many fines will require too much water because of high surface area of the sand
- Clean general purpose sand is a good choice
- Mason sand is too course

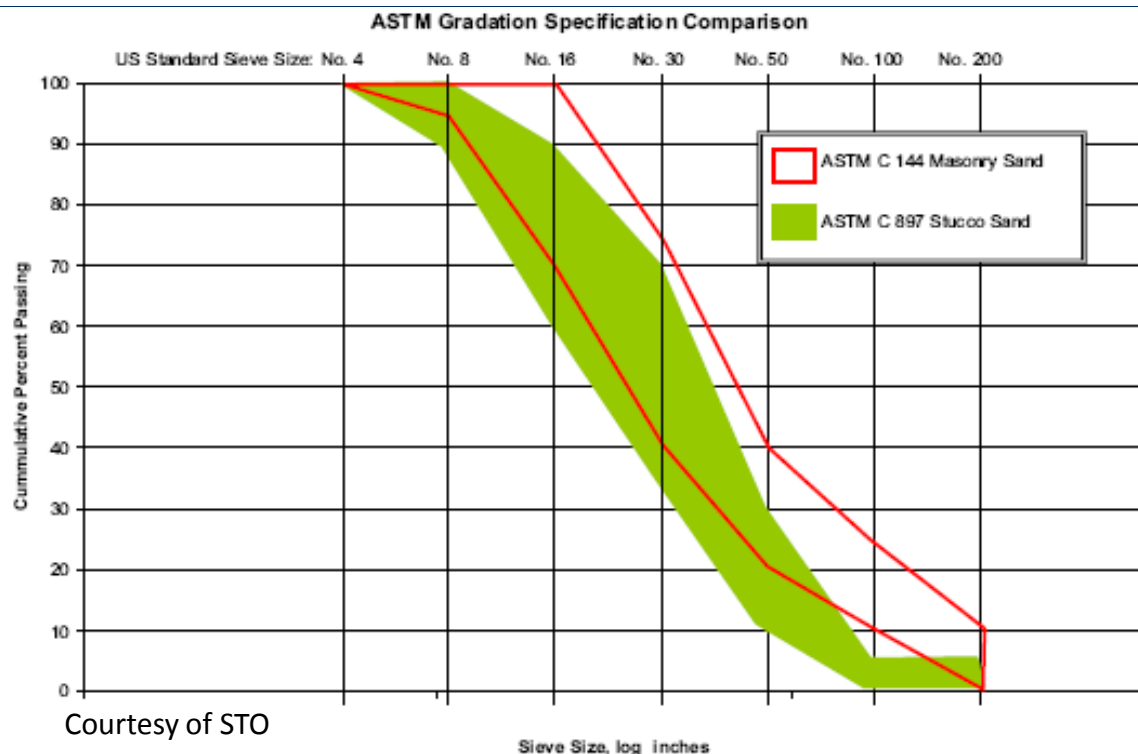


# Stucco Sand

- ASTM C- 897  
Stucco
- ASTM C 144  
Masonry
- Masonry Sand is much more common but contains more fines and therefore has a higher water demand
- Translate higher water demand as higher shrinkage

## Sand - Percent Passing

Sieve Size Inches	3/8"	#4	#8	#16	#30	#50	#100
Sieve Size Millimeters	9.51 mm	4.76 mm	2.38 mm	1.19 mm	595 μ	297 μ	149 μ
Masonry Sand	100	95-100	70-100	40-75		10-35	0-10
Stucco Sand	100	95-100	70-100	40-75			
Concrete Sand	100	95-100	80-100		30-60	5-40	0-5
Grit Sand	100	90-100	50-70	30-50	10-25	0-10	0-5





# Stucco Sand

- Sand is the aggregate of stucco
- Sand must be clean and free of deleterious materials
- Sand determines workability of the stucco mix
- Sand also determines the amount of water needed to reach a good workability



# Sand Storage



## These are not equal sands

- Sand on the ground will have native soils mixed in
- Can require 200% more water to reach workable consistency
- The loss of water creates shrinkage
- It also reduces the paste's ability to form a consistent gel stage

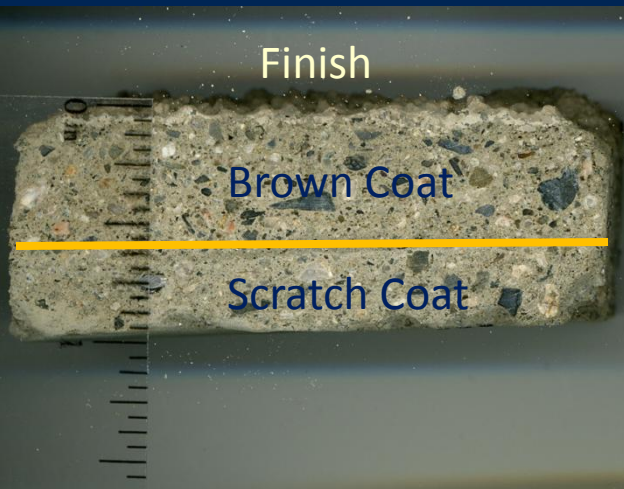


# Looking at Thickness



**Cracking is controlled by assuring that the scratch coat is stronger than the brown coat**

- Scratch coat should be thicker, marginally
- Scratch coat should be more cement rich
- Scratch coat must be hydrated to advance the cure and the shrinkage



# Thickness Control



- One coat stucco is designed to be optimally applied between 3/8" and 1/2" in thickness
- Thicker brown coats will develop cracks farther apart
- Controlled cracking in a properly hydrated base coat will minimize cracking in the texture coat





# Three Coat Stucco

## What's wrong

1. Non uniform thickness
2. Poorly Hydrated
3. Too much water for this gun application
4. Bond break layer is visible and not patched as part of the Scratch Coat step
5. Oh yeah, it also isn't scratched horizontally



# Three Coat Stucco

## Diamond lath

- Staple applied with no self furring
- Two layers must both be fully bedded in scratch coat
- Rust can bleed through the stucco and stain the finish
- Oh Yeah, it also isn't scratched horizontally





# Three Coat Stucco

## Brown coat

- Builds out the detail of the finish
- If the scratch is properly level, the brown is uniform and approximately 3/8" in thickness
- Notice roof is fully loaded with tile





# Three Coat Stucco

- Details are built over foam with Lath and full thickness stucco

Or

- Foam plant-ons can be applied and finished with just a thin finish layer





# Hydration

**All cement based construction must be maintained in a wet condition in order for the cement to build strength**

- Depending on conditions, a stucco layer must be wet at least once a day
- Note dark edges vs. light field, indicating poor thickness control and poor wetting



# Ready for Paint?

## Hydrated cement will become more neutral in pH

- Latex based paint is attacked by Alkali environments
- Acrylic paints are more resistant, but will not stop poorly hydrated stucco from showing efflorescence
- The only way to know is to test





# Testing for pH

## pH strips are most accurate but least convenient

- The goal is to be less than pH 9
- Early on pH will test at up to 12
- Testing must be done on fully wetted area
- The surface of the stucco will carbonate and show a false neutral



# Paint Burning and Efflorescence

Areas of water concentration will activate uncured stucco.

This is not water from the ground, but infiltrating water from poor roof detailing  
In some cases, poor paint allows water to enter through holidays





# Detailing



- Projections of stucco can pick up concentrated flow off roofs
- Even well executed stucco can not survive concentrated wettings

## Foam plant on

- Adhered with adhesive mortar over a full base coat of 3/8" stucco
- Note: wall texture is a skip trowel, plant on finish is brush applied thin coat finish

## Clearance to weeps

- Note 1" drop to trim and no stucco in weeps





## Many windows are not dimensioned for stucco

- Brown coat should be held back to allow finish to be flush
- This detail will allow water in through dissimilar materials
- Better detail is to use a groud and sealant



# Detailing



- Stucco ground is used to provide:
- Thickness control for brown coat
  - Keying for edge of stucco
  - Space for backer rod
  - Clean edge for sealant
- 
- Ideal dimension is 3/8" wide and 3/16" deep

