THE STUCCO INSTITUTE NEWS LETTER

Stucco Information by and for Stucco Applicators
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Effects of Moisture Behind Florida Framed Wall Stucco Systems

Technical Bulletin TB 103.1

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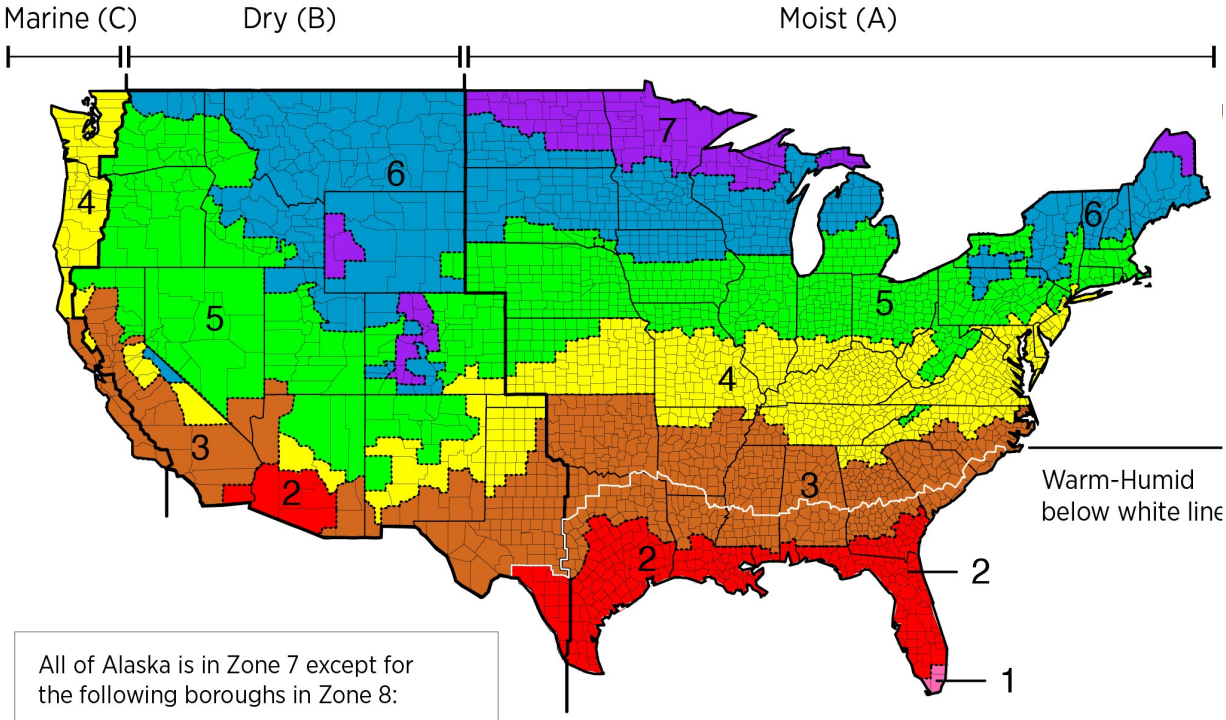
Code Climate Zones 1 and 2

Applicable for all Gulf Coast States



All of Alaska is in Zone 7 except for the following boroughs in Zone 8:

Bethel, Northwest Arctic, Dellingham, Southeast Fairbanks, Fairbanks N. Star, Wade Hampton, Nome, Yukon-Koyukuk, North Slope

Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands

What is Really Happening with our Stucco Applications

Generally, traditional cement stucco systems are applied either by way of:

1. Direct application to a wall that is constructed using a similar material (cement block or poured concrete) referred to as a "solid base" -or-

2. Applied to sheets or rolls of metal, wire, or non-metal "lath" that has been mechanically fastened to wood / steel studs or structural panels (such as plywood). This is generically referred to as "framed wall construction." The cement stucco is attached to the "lath" by the wet stucco "keying" itself into and around slits, separations, or pockets provided by the lath - during the initial application of the stucco, referred to as the "scratch" coat.

It is this "framed wall construction" application process we will be discussing.

Traditional framed wall construction stucco systems have performed flawlessly since the inception of stucco applications, yet now it is said, they have begun to intermittently fail across Florida - largely since the early 2000's. But, are these failing systems really "Traditional" stucco systems or some newer developed, altered or hybrid application process or related component?

Attorneys, armed with so-called "experts", incorrectly blame contractors for stucco code violations and incompetent building inspectors for the problems – mostly for the sole motivation of profitable lawsuits. (See "The Truth About Florida Stucco" publication at www.stuccoinstitute.com for a more complete discussion on that topic).

This report will focus on the moisture problems causing the degradation of wall substrates, metal lath, attachments, stucco and accessories. We will look at causes, cures and prevention. We will first look at some examples and end with a discussion.

Result from multiple sources. Deteriorated metal lath caused by bulk water entry at incorrectly installed control joint and insufficient coating and sealants.

All leading to high R/H behind stucco system

Figure 1 - Damage result from multiple sources

Methods of Moisture Intrusion Behind the Stucco Assembly

In Florida, moisture is a major problem, if it gets behind the stucco thereby affecting the metal lath.

The moisture has two modes of entry;

1. Bulk water intrusion (an actual crack, separation or opening that allows water to enter and/or
2. Water vapor (elevated relative humidity R/H holding behind the stucco system) condensing during radiant heat loss to open sky at night.

Figure 2 Denotes a common entry point for both modes of entry; bulk and vapor. The condition is exacerbated when corner beads are used. If flanges are not fully filled with wet cement, water entry is imminent. See The Sealed Cladding Manual for details regarding proper corner applications including "rodding".

Figure 2 - Corner bead infiltration

How Moisture Gets Behind the Stucco Assembly Continued...

Control joint admitting bulk water entry.

Insufficient coating thickness. (3 mils)

Sealants needed.

All leading to high R/H behind stucco system

Figure 3 - Control Joints admitting water causing expansion cracking

How Moisture Gets Behind the Stucco Assembly Continued...

Close-up of screed. Cracking and allowing bulk water infiltration.

Coating so thin it is practically immeasurable.

Sealants needed.

All leading to high R/H behind stucco system

No plasterer should leave a joint like this.

It should have been cleaned, edges brushed, and a small "V" groove on each side for the painter to seal.

Figure 4 - Horizontal screed interface

Coating is supposed to be 12 mills. - How thick does this appear to be? Paper thin, too thin to obtain useable measurement.

Proper millage would bridge this gap and prevent water entry.

The old way was to cut a "V" groove on each side of the control joint interface and seal.

The sequence should be; prime wall, install sealant, apply finish coats.

How Moisture Gets Behind the Stucco Assembly Continued...

Figure 5 - Corner Beads . Eliminate and Rod (see Sealed Cladding Manual)

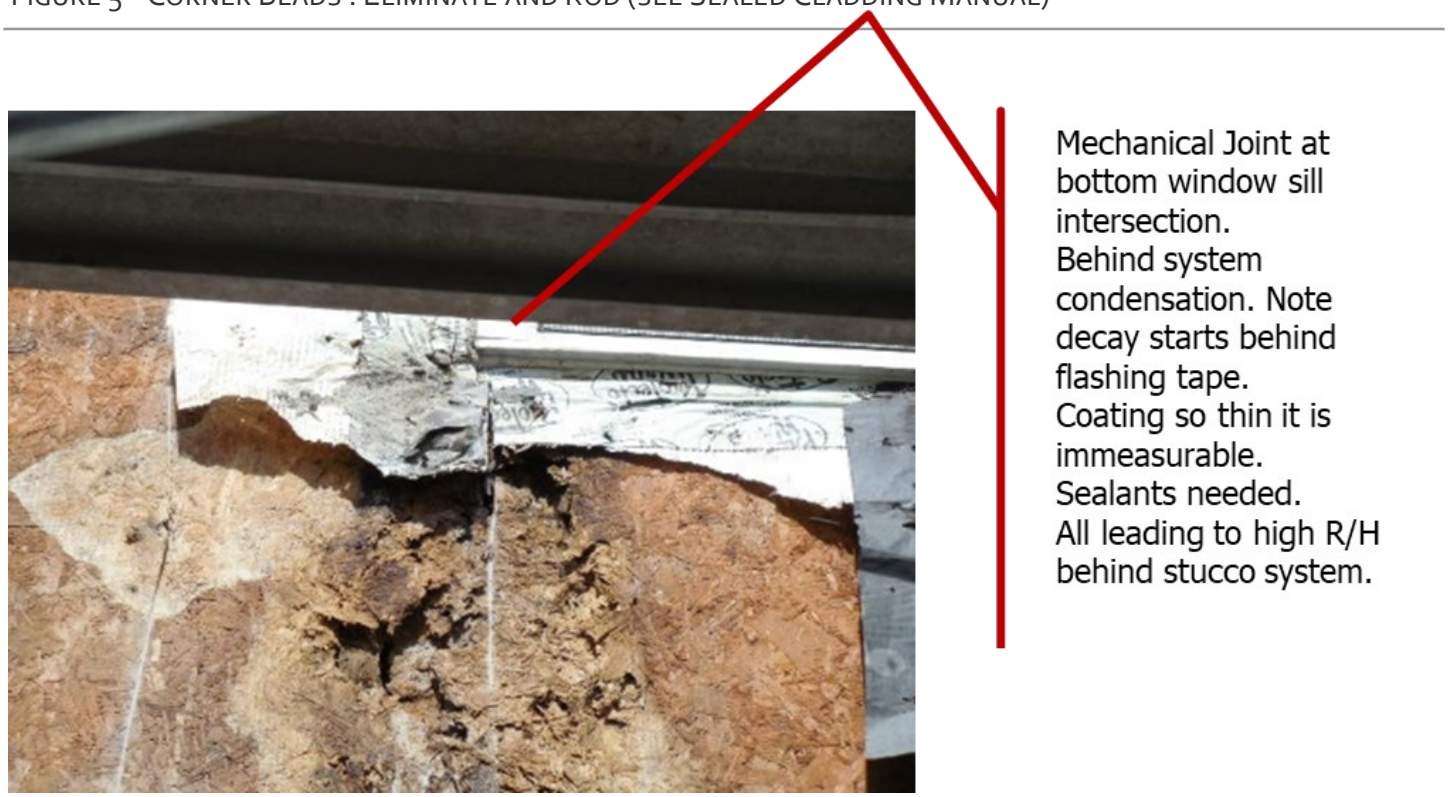


Figure 6 -Mechanical Joint. Need resealing when building is re-coated

How Moisture Gets Behind the Stucco Assembly Continued...

Roof flashing incorrectly interfaced and improperly sealed.

Plumb-Cut fascia

Soffit Slope and termination

Edge metal incorrectly formed and sealed.

All leading to bulk water and high R/H behind stucco system.

Figure 7 - Roof Interfaces, Edge metal, Soffit slope and Plumb cut fascia. All sources of potential problems.

Horizontal Control Joint allowing bulk water infiltration.

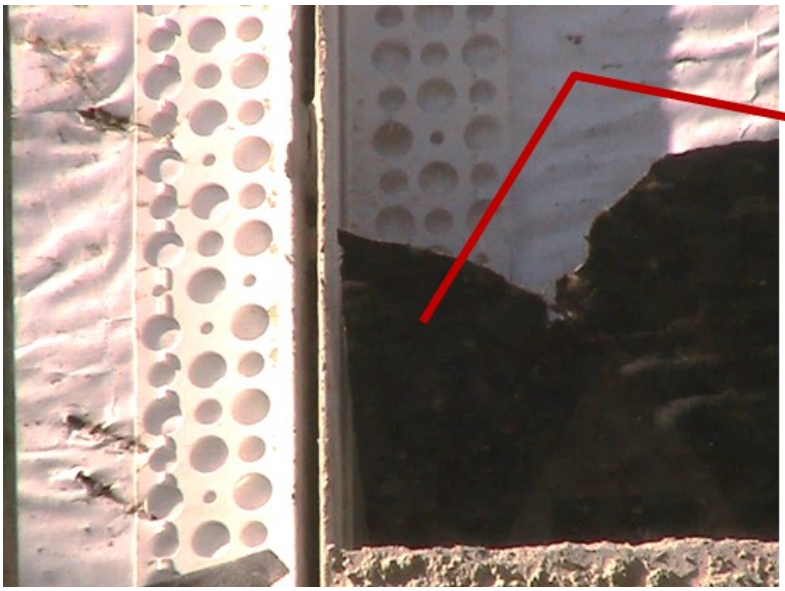
Coating too thin (2-3 mils).

"V" Groove and Sealants needed.

All leading to Bulk Water and high R/H behind stucco system.

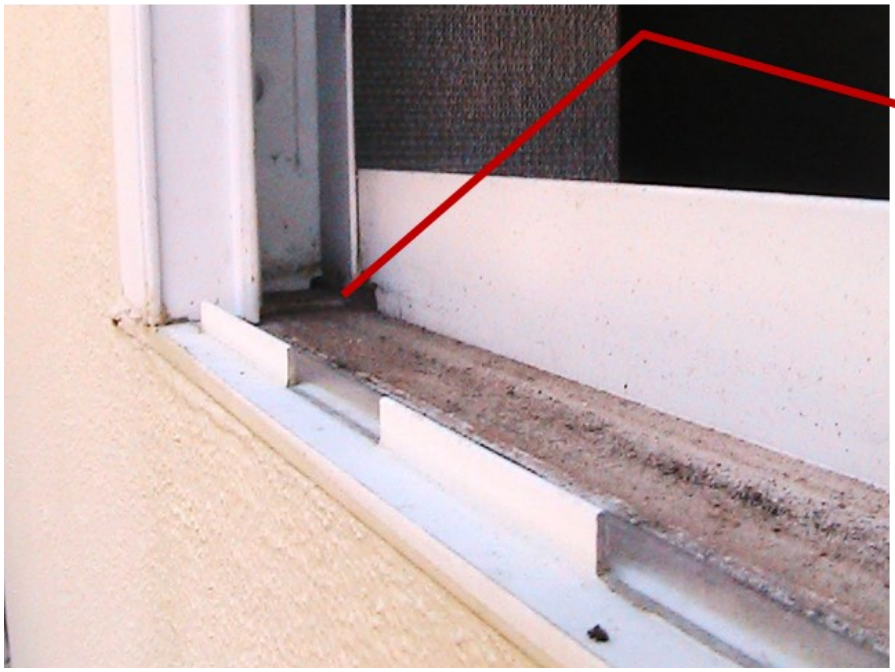
Figure 8 - Horizontal Control Joint improper installation.

How Moisture Gets Behind the Stucco Assembly Continued...



Vertical Control Joint installed with paper over flange preventing flange embedment – source of bulk water entry.
"V: Groove and Sealants needed.
All leading to bulk water and high R/H behind stucco system.

Figure 9 - Improper lap on paper - no "V" Grooves



Mechanical joint only watertight to approx. 10% of design pressure.
Stressed by wall movement and high wind conditions,
Mechanical corners must be re-sealed when building is repainted.
Sealants needed.
All leading to bulk water and high R/H behind stucco system.

Figure 10 - Mechanical Joints need re-sealing

How Moisture Gets Behind the Stucco Assembly Continued...

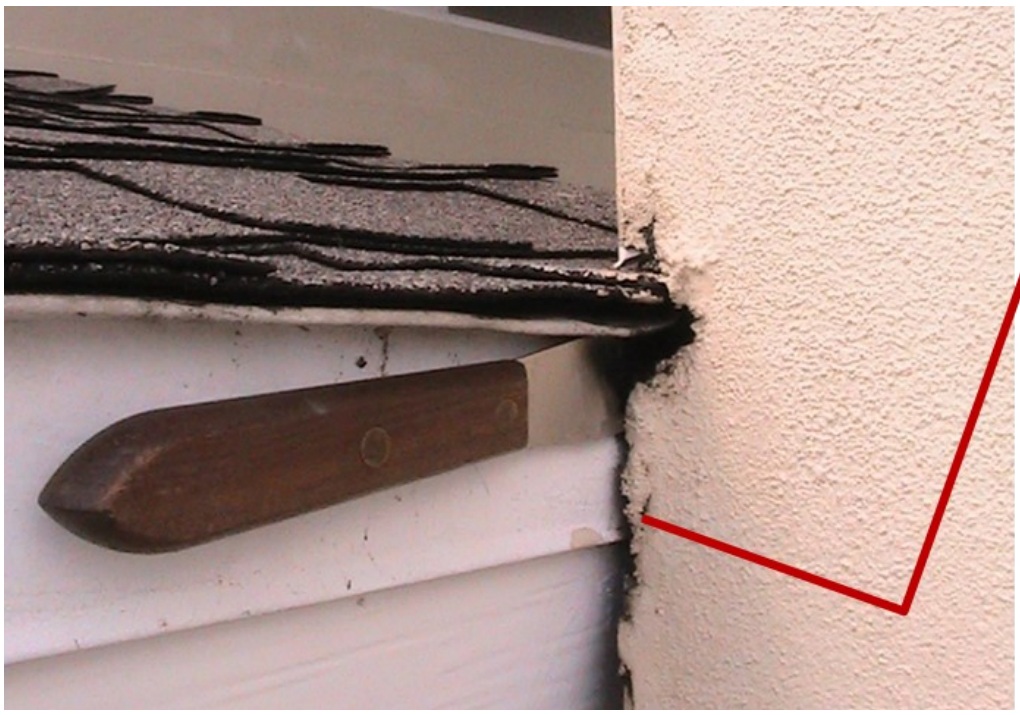
Flush mount dryer exhaust mounted to wall instead of on top of the finished stucco. Localized intrusion. Can lead to high R/H behind stucco system.

Figure 11 - Improper Dryer vents and flashing

Window mechanical corner joint failure. Moisture source behind flashing. Aluminum window jambs/sills are first condensing surface at dew point. Sealants needed. All leading to high R/H behind stucco system.

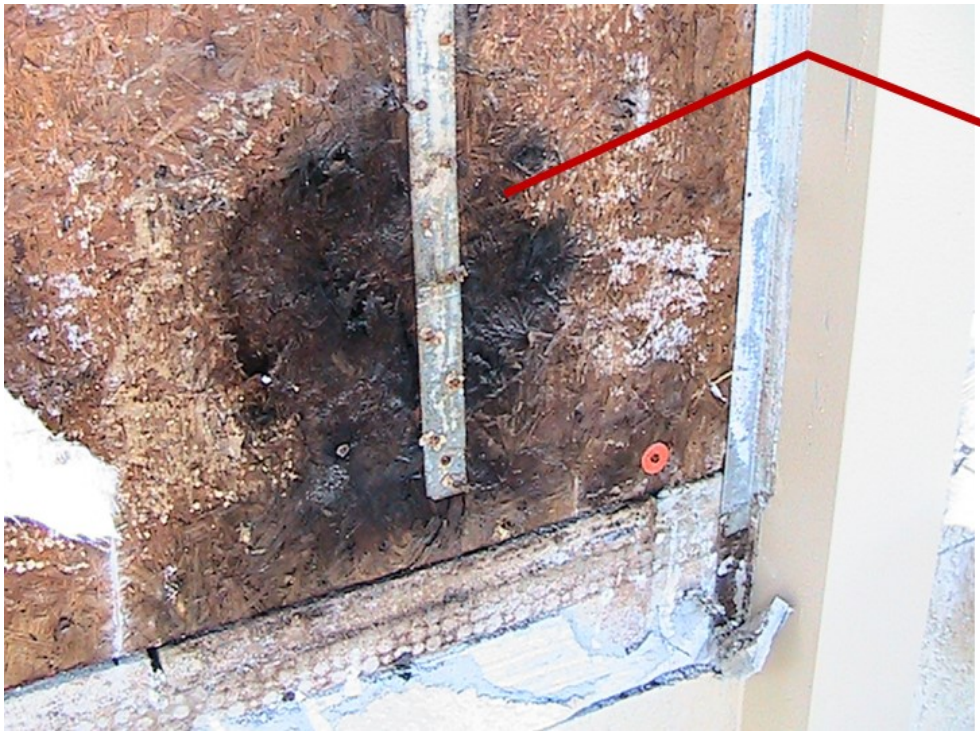
Figure 12 - Mechanical Joint failure. Reseal at re-coating interval.

How Moisture Gets Behind the Stucco Assembly Continued...



Metal eave drip behind stucco.
Incorrect sequencing of work.
No sealant.
System not separated with "V" groove and sealed.
Bulk water entry.
R/H behind stucco system.
This was entirely preventable.

Figure 13 - Improper Interfacing



Condensation on fasteners and strap.
Fungal growth on OSB.
As the wall cools from radiant heat loss, the humidity falls below its dew-point temperature.
Strap is first condensing temperature source.
Like a glass of Iced Tea.

Figure 14 - Condensation behind cladding and housewrap.

How Moisture Gets Behind the Stucco Assembly Cont.

Slickers noted by arrows

Hey, what is this, stucco being simply "laid-up" with a slicker? Hey, that won't work. But, most all have all been done that way. The industry is now moving to stop this practice. Look at the picture – 3 men "mudding" up the walls – no trowels. This makes for a "fluffy" application that vapor can pass through a lot easier than a densely packed application. Proper face barrier however will prevent that passage. (See Sealed Cladding Manual for further information on slickers)

Face Barrier System Needed in Florida

Manually applying a specialty penetrating coating or high build acrylic applied to a minimum thickness of 14 mils dry film thickness in conjunction with high-grade sealants, will assure the moisture (bulk and vapor) is rejected at the outside skin of the building. Just where you want it to remain!

Examine Figure 15. How much vapor (and moisture) do you think is passing through this wall? Paint so thin, measurable samples cannot be practically taken. Microscopic examination shows 0.75 – 1.0 mil.

Figure 15 - Paper thin paint. Note white streaks (efflorescence) and darken crack pattern (moisture saturation)

In a recent study, the author found the average mil thickness of 70 painted houses (<5 years old) to be ≈3 mils (12 mils minimum needed). Ironic that we are getting about 5 years of life out of these systems with coatings that are being applied at 1/3 their required thickness.

Assume you had thickness of 3 mills and you only needed 9 mills; 2/3 of your product would be missing, gone, not there!. Now, think of a standard roofing shingle, if you could remove 2/3 of its thickness with a laser and placed the remaining 1/3 on the roof – how long would it last? Maybe 5 years?

Now think of all that passing vapor "trapped" behind the wall. When evening comes, temperature drops, dew point is attained, the vapor will condense on what? Maybe the back of the metal lath?, aluminum window frames?, metal straps, OSB ?…. You get the point.

How Moisture Gets Behind the Stucco Assembly Continued...

Figure 16 - Close up of a newly painted home.

This is a close-up of a cut-in stucco reveal above a window on the 2nd story of a newly built, newly painted, occupied home. The paint specifications SHOULD call for 12 mil thickness – but, as usual, it was not stated.

In case you're missing it, the gray is bare stucco. Since a spray rig was used to paint (instead of brush and roller) the upward spray caught the upper side (the one you see from the ground) of the reveal, but left the bottom (that will catch water) completely bare. Thickness on face of wall was less than 4 mils. Gee, I don't know why where're having these stucco problems!

How Moisture Gets Behind the Stucco Assembly Continued…

Wall coating too thin, moisture condensing behind panels.
Building needs re-coating and new sealants
All leading to high R/H behind stucco system.
Action is needed now – not later, all is salvageable now with no further damage.

Figure 17 - Coating too thin

How Moisture Gets Behind the Stucco Assembly Continued...

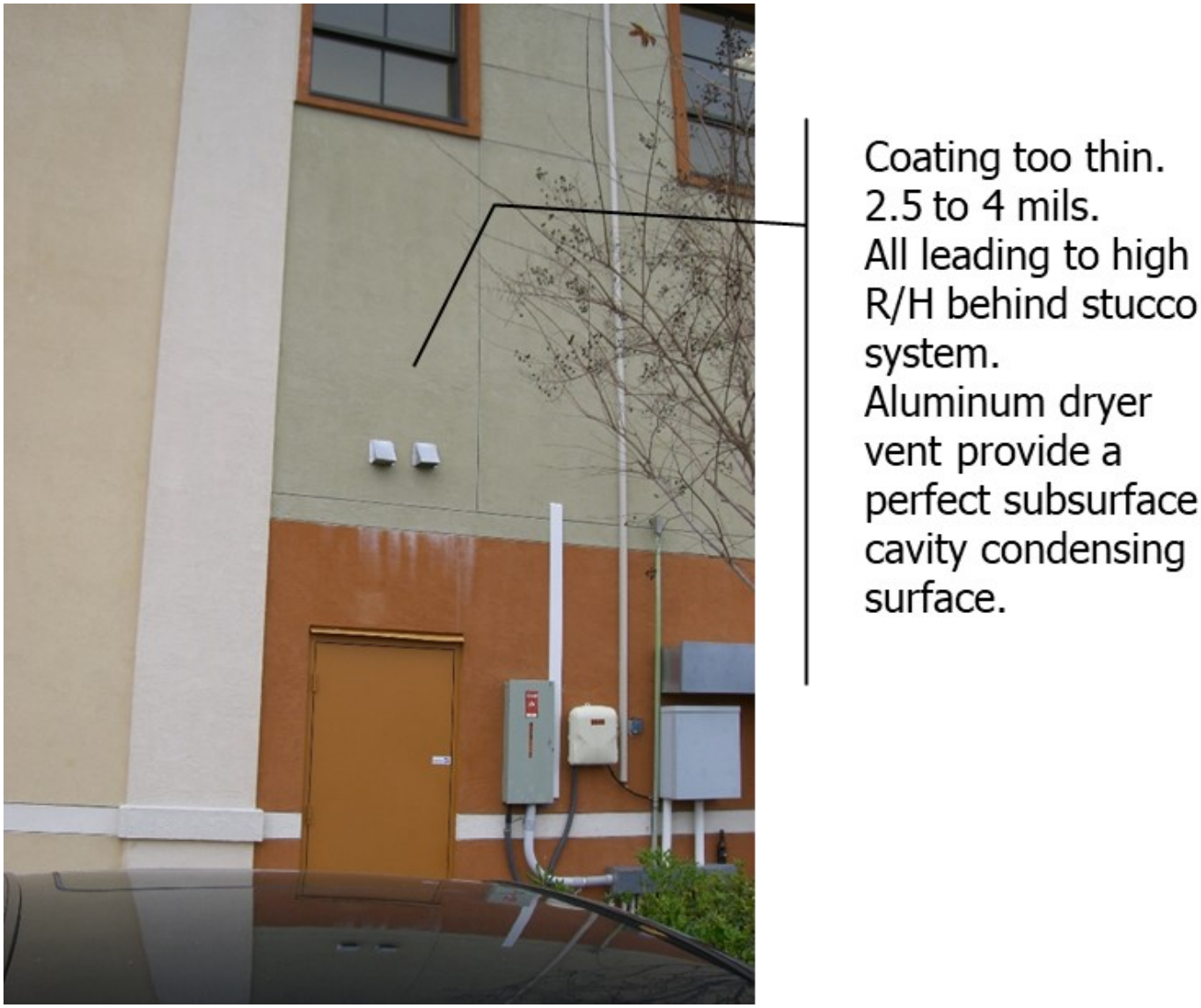


Figure 18 - Coating thickness deficient

How Moisture Gets Behind the Stucco Assembly Continued...

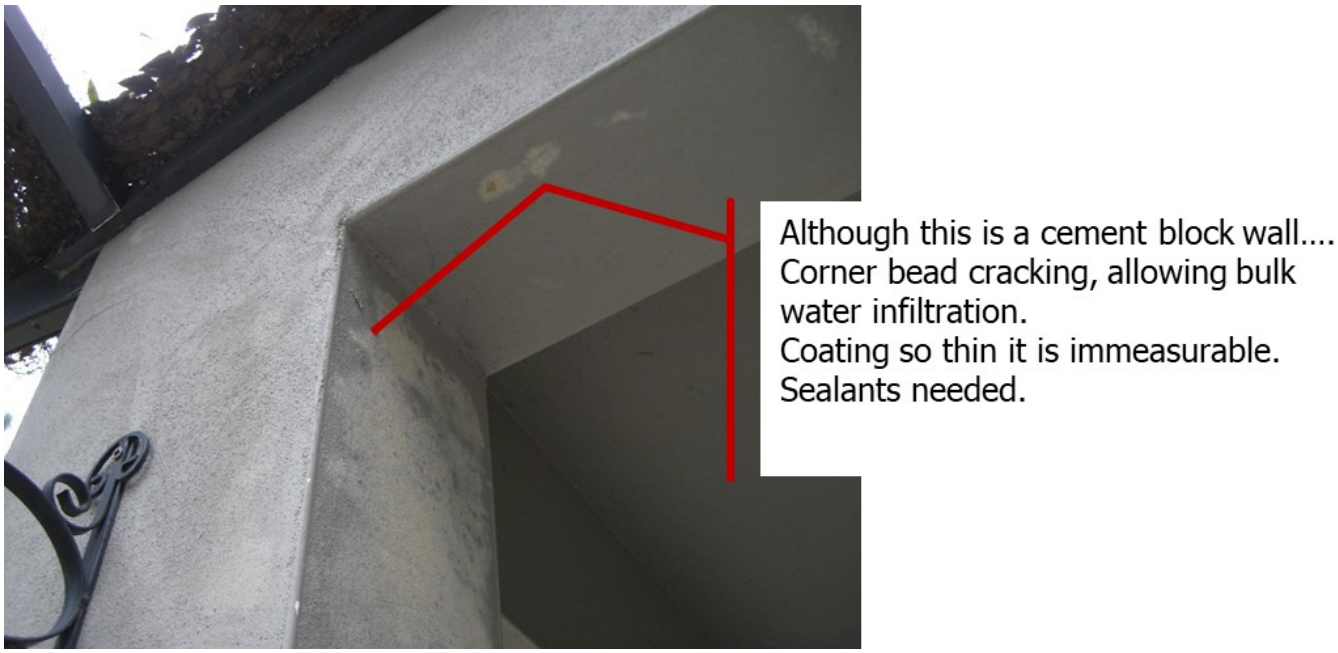


Figure 19 - Block walls need protection also

How Moisture Gets Behind the Stucco Assembly Continued...

Figure 20 - Prolonged water and vapor exposure to Florida's coastal environment - Photograph of 2.5 flat Black expanded metal lath after prolonged moisture exposure at the sub-cladding interface (back of lath).

Effects of prolonged water intrusion and condensation on flat black metal lath at the back plane of the stucco assembly.

I was taught how to prevent this from happening by plasterers over 40 years ago. They knew this would happen if you did **not** install a stucco system needed for Florida's environment. USE A FACE BARRIER SYSTEM AND ATTACH THE LATH 6" O.C. EACH WAY! (See the Stucco Cladding Manual for complete non-proprietary, no cost details)

De-Skins Show the Fallacy of Recommending Total Stucco Replacement

Walls That Need Removal Can Be Easily Identified

Walls That Need Removal Can Be Easily Identified Cont.

UNNECESSARY STUCCO REMOVAL

These buildings are being de-skinned by the advice of a "con-sultant" masquerading as a stucco expert. Their reason for de-skinning; there were no drain planes or weep screeds so the system was deemed "non-code compliant". Otherwise, the jobs were perfect and around 8 years old. Note, there is no damage, no water migrating to be let out of a "weep" screed. The houses had face barrier systems that were working perfectly. These new code compliant replacement systems are now showing signs of failure as soon as 5 years.

The ASTM standard referenced by the code has an important provision within its text that reads: "unless otherwise specified". The consultant should have determined if the contractor had in fact, "specified otherwise" before claiming code violations and ordering un-necessary de-skinning.

UNNECESSARY STUCCO REMOVAL CONTINUED…

No weep screed, no drain plane, perfect performance – yet, the order to deskin was given by the "professional". Anyone see any damage?, any water dammed at the bottom? Face barrier system performing perfectly. Un-knowledgeable, un-professional consultants….. This is what is ruining our profession. We can fix the job problems – we cannot seem to fix the professional incompetence.

(see article: 35 Year old Stucco application performing perfectly - no weep screeds, no control joints, no cornerbeads….)

UNNECESSARY STUCCO REMOVAL CONTINUED…

Again, a complete waste of money, time and effort – and the new so called "code compliant" systems being re-installed (although the new installations really are not compliant) are now are on their way to failure. Boy is this going to be a mess 10 years from now..

General Issues Discussion

Although the subject of stucco problems within Florida is rife with complexities and variables, the majority of the problems are being misdiagnosed as "non-code compliant" installations. This is a misdiagnosis by and of itself, by those who remain untrained in the proper design and application of Florida specific code compliant stucco installation methodologies.

Applying ALL of the code provisions, modifications, exclusions and conditional provisions to a Florida stucco assembly is an extremely complex task that requires understanding Florida's plastering history.

Traditional ("old time") plasterers installed their stucco assemblies directly over a layer of felt paper. "V" grooves were cut and "brush sealed" at all intersections of dissimilar materials to allow for proper sealant seating, tooling and bonding.

These jobs were all done with flat un-galvanized lath, nailed tight to the wall (no furring) and continue to perform flawlessly for well over 40 years.

When the ASTM C-926 and 1063 eventually made their way into the code, regional (Florida) plasterers recognized it as a western developed standard that could not be entirely applied in Florida's high humidity, high salt, and high wind environment.

The ASTM stucco and lath standards then, as today, were developed for lath over open framing, and finished with colored stucco, i.e., no paint. Accordingly, water that enters the system through cracks, migrates down the back of the lath and exhausts out a "weep" screed at the bottom of the wall. All is fine in those low R/H or "dry" climate locations.

Florida plasterers knew that this methodology would never work in their environment. Any water migrating from the surface, through to the back of the stucco assembly, would carry migrating salts. Additionally, allowing humid air to circulate behind the assembly, could create frequent dewpoint conditions occurring behind the plaster assembly. The resultant condensation would initiate rusting of the lath, and the then metal accessories.

Since the ASTM stucco and lath standards are "International", they need to be (and are) subject to regional modifications.

Accordingly, regional plasterers and designers relied on the "unless otherwise specified" statement in those standards providing a method for regional modifications when needed. This allowed the old time Florida's plasterers to continue with their time tested and proven installation methodologies…

To continue historical installation methodologies in the building envelope science, the painting contractor then "brushed and rolled" two coats of the specified coating to its required mil thickness.

Sealants (as opposed to "beauty beads") were applied and tooled in place. The sealants, applied into the "'"V" grooves provided by the plasterer, along with the required coating, melded into a outer "skin" that was not only water proof, but bridged further cracking and stabilized the wall covering system.

This coating inefficiency (or more correctly, "deficiency") is the prime source of the current stucco situation.

General Issues Discussion Cont.

Aggravating the situation is the fact that we now use OSB as a substrate whereas plywood or angular wood sheathing planks were the Florida substrate material of our predecessors.

Although OSB and Plywood both fall into the "Vapor Semi-Permeable" classification (materials with a permeance of 10 perms or less and greater than 1.0 perm), OSB has some characteristics that are not conducive to high moisture conditions if trapped behind a stucco assembly.

OSB resists the passage of vapor far greater than plywood.

Let's consider a stucco assembly in Florida's environment:

Average Annual Temperature:

- 88.5o Avg. High
- 70.7o Avg. Low

Average Annual Relative Humidity:

- 88% Sundown
- 59% Sunrise

Next, consider a stucco system in this environment that has a drain plane allowing for introduction and movement of this air behind the stucco assemblage.

Then add an improper or unsealed face barrier, allowing for mass migration of vapor through the face of the stucco exterior to the back side of the stucco system.

Now, encourage the installation of the stucco to provide thousands of contiguous reservoirs of wrinkles, pockets and voids terminating at a mechanism made with intended voids to let moisture out (and thereby air in); a/k/a; weep screeds.

All of these ASTM stucco and lath methodologies are designed and sequenced to promulgate such unfettered drainage (and therefore unfettered air circulation) behind the "drained" stucco assembly.

Given such a system, the vapor conditions (R/H) on the inward side (behind) the stucco will mirror, or very closely mirror, those on the outward (front) of the assembly.

This collective high humidity will remain after sundown, wanting to migrate towards the cooler, dryer condition space or component.

If that migration is effectively restricted, the vapor will remain and begin to cool. Soon the outward assembly will become the cooler surface.

Whenever surrounding materials cool too the vapor's dewpoint, the vapor will seek a condensing surface such as metal lath or metal window members which act as a thermal bridge.

Using the average Florida temperature and humidity conditions, Dew point would occur when surrounding materials cool to approximately 84o. Fahrenheit

The back side of the metal lath and metal accessories will be the first (and best) condensing surface.

This chronic condition will lead to rusting of the lath, expansion of the metal and bulging (tented) stucco ruptures in the wall region.

General Issues Discussion Cont.

Plywood has somewhat more forgiving properties for passage of the moisture.

In the report, posted at www.stuccoinstitute.com in its entirety)

"Moisture performance properties of exterior sheathing products made of spruce plywood or OSB", (Tuomo Ojanen & Jarkko Ahonen, 2005), some important properties of OSB were noted from the report:

Water vapour permeability

The vapour permeability of both OSB and plywood were in a relatively low level under dry conditions, but the level increased a lot after certain relative humidity level. There was a significant difference between the products in this respect.

The vapour permeability level of plywood was under 80% / 58 % RH condition measurements from 5 to 11 times higher than those measured under dry cup conditions for the same product. With OSB these values were only about 1.23 times higher than under dry cup conditions. When the relative humidity test conditions were 97 %/ 72 % RH, the vapour permeability of OSB had increased to be about 4 to 9 times higher than in the dry cup tests, while the plywood vapour permeability level was 12 to 20 times higher, depending on the product.

This data shows that plywood is much more permeable (able to pass vapor) than OSB which is more restrictive.

Plywood has a greater ability to increase its permeability (and therefore pass) higher levels of relative humidity to the interior under higher humidity levels. OSB simply remains a better vapor barrier under elevated humidity.

Essentially the OSB (acting in concert with the housewrap and paperbacked lath (or 2nd grade 'D" paper layer) is a barrier to passage of vapor and allows the drain plane crevices, voids and spaces to act as vapor collection reservoirs in the space between the back of the lath and drain plane.

Once either side of the wall cools to dewpoint, the back side of the metal lath and metal accessories will become the first (and best) condensing surfaces.

This chronic condensing condition will lead to rusting of the lath, expansion of the OSB, expansion of the stucco, expansion of rusting metal accessories, etc….. all resulting in bulging (tented) stucco ruptures in the wall region.

Additionally, from the same study:

"Moisture performance properties of exterior sheathing products made of spruce plywood or OSB", (Tuomo Ojanen & Jarkko Ahonen, 2005), examined the capillary capabilities of OSB. From the study:

Capillary water absorption

The final moisture content level of these four OSB products was about 2.5 times higher than that of plywood products.

General Issues Discussion Cont.

Lastly (and of most importance) the effect of moisture an dimensional stability was examined in that study:

Dimensional Stability

The dimensional stability of the product has an effect on the air and moisture tightness, thermal performance and even on the strength of the structure. High swelling of the material could be detected mainly in the board thickness. The relative dimensional change on the longitudinal direction was significantly lower than that of the thickness.

The relative change of OSB board thickness under capillary contact was in the range of 19 - 28 % and with plywood it was from 3 to 6 %. Most of the swelling of plywood boards took place in the hygroscopic area, but about half of the swelling of the OSB boards took place between 87 % RH and the capillary saturation conditions.

Change in the thickness of OSB board to an attached brittle stucco system will induce cracking, will induce water, which will rust lath, which will induce more cracking, etc... The dog chases its proverbial tail.

Now I told you that to tell you this…..

In Florida, If you do NOT keep the water and vapor blocked at the face of the stucco system – you will allow water to migrate through and behind the stucco with devastating results. We have known this since we began stuccoing!!

To successfully install a stucco cladding system in Florida, you will need to modify the ASTM C-926 and C1063 provisions using the "unless otherwise specified" provision.

Essentially, we need to modify it to represent the provisions of the old South Florida Building Code used by Miami/Dade for years. But that code has been replaced.

Since it takes years of experience or a lot of special training to understand Florida's unique building envelope conditions in order to know if, and when, and to what extent details interrelate to correct code applications, how are plans examiners and code officials to know whether the modifications are right or wrong?

Code officials simply cannot, are not, and should not - be tasked with this responsibility.

Now you have arrived at the reason, purpose and need for the Sealed Stucco System. We needed to recommitment to those proven details, provisions, methodologies and traditions, adding newer improvements.

The next step was to get the whole system tested and approved for code approval so contractors and code officials would not have to deal with the "con-sultants" feeding lawsuits over so-called "code violations" from necessary modifications of the ASTM referenced documents.

Go to: www.sealedstuccosystem.com

For further information on that topic.

Some More Examples with Discussion

Recently, some of us were discussing the following condition. The following is my explanation of the causes of these types of problems.

Some More Examples with Discussion Cont.

Group, in this case, classic control joint defects is the probable initiator. We have traced them on many jobs. Paper over control joint flange. Water enters, travels down until a paper lap, or void, turns and migrates it horizontally. Aw is elevated behind the assembly, OSB swells (in its thickness stressing the brittle stucco coat), cracking (minute at first) is then further initiated, leading to the introduction of ambient R/H (vapor). Vapor cools at night, condenses on the first available condensing surface (back side of the lath) causing rusting, which expands….etc.…

Notwithstanding the paint is most likely so thin it probably will need microscopic measurement. It must be determined and factored.

The initiator my be improper quantity and placement of fasteners. If insufficient or incorrect, the negative forces in Florida's high wind events will fracture the cladding assembly allowing massive water intrusion. This will need to be quantified and factored.

Exacerbating factors; drain plane allows vapor to accumulate and circulate behind the stucco assembly, slickers used to lay on first coat, insufficient mil thickness allow the whole wall to become permeable.

Small amounts of vapor should be able to pass through (when we used wood or plywood) the sheathing, but OSB is virtually a vapor barrier unto itself. So the vapor is blocked or severely impeded at this plane. Again, small amounts still would not be a problem by and of itself. However the amount grows exponentially and after a few years it can become catastrophic when coupled together with other exacerbators such as; base coat by slicker, air circulating drain plane allowing the free entrance of moisture laden air, insufficient mil thickness allowing the passage of vapor and allowing the stucco to become wet after each rain, stucco control joints installed incorrectly allowing bulk water and vapor admission behind the wall that that is seriously restricting the vapor migration (discharge) through to the conditioned side of the wall. Dew point behind the stucco assembly occurs almost every night causing condensation on the first available condensing surface; the exposed metal lath, and, if we could make it worse, the depositing of migrating salts on the same metal surface, now factor the stress of thermal swings to the front and back of the assembly coupled with wet/dry areas…

This is what is going on. There are other items connected to specific installation anomalies, roof leaks behind the assembly, incorrectly sloped soffit, window leaks at mechanical joints, incorrectly installed banding, etc… But the root of problem is most likely summarized above.

Some More Examples with Discussion Cont.

The generations of plasterers before me, who taught me how to apply stucco in Florida, applied plain UNGALVANIZED (black coated), flat (no dimples or ridges masquerading as "self-furring") lath, nailed TIGHT, and I mean tight – against the wall. They wanted no air pockets or air circulation, no weep screeds and no so called "control" joints. Lath was randomly nailed to the wall to ensure it laid flat in order for withdrawal resistance to be distributed for wind loading.

The substrate was plywood or diagonally applied wood sheathing (rough sawn 1x10) covered with 15 lb felt . We 3 coated, (cement & lime & sand – densifying the brown coat) and cut "V" grooves at all penetrations and stops (for sealant application), rodded all corners (no external beads or exterior control joints allowed in the wall plane) with either sand floated or textured finishes. This was followed with an actual PAINER applying a coating (by roller) the 3 coats required; prime, and then 2 coats of exterior paint, to the proper mil thickness. All "V" grooves were sealed by the painter (no "beauty beads").

I can drive anyone all day long (or months long), to house after house, with these systems intact, no (other than normal) cracking, no spalling, no defects, performing perfectly, some now 80 YEARS old!

Homes NEVER had stucco problems in Florida AT ALL until we started the drain plane concept, weep screed concept, putting in control joints (incorrectly), began painting (not coating) with airless sprayers from ladders to achieve a visual acceptance of the paint (thereby diminishing the mil thickness required to "coat" the wall), stopped the "V" grooving, and quit sealing and started "beauty beading".

And we wonder what is going on in Florida…. Really?

Code Discussion Form

Sealed Stucco System

For more information on the standards and installation practices, refer to the Sealed Stucco System at: www.sealedstuccosystem.com

The sealed stucco system is simply the traditional stucco application process used in Florida's type climate for over 40 years with some modern modifications and products.

The system has been laboratory tested and approved.

My Florida Code is a Public Code Discussion Forum for Florida Code, Construction and Licensing Issues, Downloads and Links.

www.myfloridacode.com

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Robert Koning has been involved with the plastering, stucco, masonry, roofing and waterproofing industry for over 40 years.

Beyond that, the Koning family's involvement in the Florida industry dates back to the 1920's. These combined provide both an indispensable knowledge of ever-advancing products, methods, and standards, and a discernment against persistent myths and outdated requirements.

His numerous licenses and certifications include: Bachelor of Science in Construction Engineering – Certified Arbitrator & Mediator – Director of Construction Education at Contractors Institute – Certified General, Building, Roofing, Plumbing, Underground Utilities, Air Conditioning, Master Electrician, Solar, Mold Assessor, Mold Remediator, Home Inspector, and BPI Building Analyst.

Robert Koning is a Code Certified: Level 1 – Building, Roofing, Plumbing, Mechanical, and Electrical Inspector; Level 2 -Building, Plumbing, Mechanical, and Electrical Plans Examiner; Level 3 – Chief Building, Plumbing, Mechanical and Electrical Code Analyst; Level 4 -Code Enforcement and Administration Professional; State Certified Standard Building Code Administrator

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