

Evaluating Stucco

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The problems with stucco have been well-documented for years. Lawsuits involving Exterior Insulation and Finish Systems (EIFS) have been common knowledge among the home inspection community for years. Here in the Columbus, Ohio, area many homes are traditional three-coat plaster stucco or one-coat stucco.

Most home inspectors are ignorant of the problems that are occurring in high-priced subdivisions here in our market. I used to believe that we simply didn't have problems with traditional three-coat exterior plaster stucco until I saw a video by Ram Builders in Utah titled "What's Happening Behind Your Stucco." Now, I believe that the amount of homes with extensive rot and mold concealed within the walls is substantial. When problems occur, they are generally undiscovered until they become so extensive it is no simple matter to repair them.

Traditional three-coat stucco is a mixture of Portland cement, lime and sand. It is generally applied over some type of sheathing material such as plywood in older applications. More recently, foam sheathings are used as well as OSB (oriented strand board) or waferboard. OSB

is an engineered wood product formed by layering flakes of wood in different orientations. A water resistive barrier is applied over the sheathing. Traditionally, this has been 15-lb asphalt-saturated building paper, but now products such as Tyvek® are being used. Corrosion-resistant wire lath is attached to the structure. This is then coated with three coats of stucco called the scratch coat, brown coat and finish coat. The total thickness should be 7/8 inches in a traditional stucco application. One-coat stuccos are thinner (3/8 inch to 5/8 inch) and have polymers in the mixture to add strength. Either also may be applied over insulation boards. EIFS are composed of a synthetic coating over fiberglass mesh applied directly on Extruded Polystyrene Insulation. EIFS are beyond the scope of this article.

Stucco is actually a porous material and is designed to allow the absorption of water. The building paper or Tyvek (water-resistive barrier) acts as a drainage plane, and as the stucco dries, water flows down the building paper and weeps out the bottom of the stucco. As long as the wood sheathing stays dry and water does not get trapped in the

wall cavity, problems will be rare.

Generally, few problems are observed in older applications. The use of plywood for the sheathing and the heavier building felt help eliminate problems. Generous overhangs, which keep water off the windows, also serve to prevent leakage behind the water-resistive barrier. There is certainly merit to using tried-and-true building methods and materials that have withstood the test of time. Due to innovations in construction technology, different materials that do not have the same time-tested performance characteristics are now being used. Changes in the building codes have been slow and, in the case of stucco, are a response to apparent failures. These new designs require strict attention to detail and are far less forgiving when water enters the system.

The use of oriented strand board

One noteworthy change is the use of OSB (oriented strand board) for the sheathing rather than traditional plywood. OSB has very poor moisture resistance qualities and tends to easily delaminate when wet. While plywood will also degrade when exposed to moisture, OSB ►►►

swells and rots at a much faster rate. Many homes are being constructed in the greater Columbus area with this type of sheathing.

The problem with house wraps

Another change is the use of Tyvek® HomeWrap®, rather than the older 15-lb. asphalt building paper. Tyvek is a synthetic product known as spun-bonded polyolefin.

The product is primarily an air barrier with water-resistive qualities. It will stop air and water in the form of liquid from moving through an assembly, but will allow vapor to pass through due to its permeability.

Joseph Lstiburek, Ph.D., P.Eng., of the Building Science Corporation in his research report titled "Rainwater Management Performance of Newly Constructed Residential Building Enclosures During August and September 2004" shows how Tyvek HomeWrap actually will chemically bond with the stucco.

On page 13, he states, *"There appear to be significant performance issues with WRBs (water-resistive barriers) relating to manufacture, testing and approval. All plastic house wraps and some building papers tend to bond to stucco renderings, thereby negating drainage. Additionally, many plastic house wraps lose their water repellency when in contact with sheathing and stucco renderings."*

The 2006 Ohio Residential Code, which is based on the 2003 International Residential Code, allows Tyvek HomeWrap to be used as a water-resistant barrier. The International Residential Code's 2006 version has updated its requirements for exterior plaster. One layer of Tyvek HomeWrap is no longer sufficient in municipalities that have adopted this standard. The current requirement would be to use either Tyvek® StuccoWrap® or Tyvek HomeWrap with one layer of class D building paper as a bond break between the Tyvek and the plaster itself. This change was made due to the fact that the Tyvek HomeWrap can bond to the stucco, causing water to migrate through

the Tyvek and thus wetting the OSB panel sheathing. This condition could potentially cause rot and mold. DuPont, the manufacturer of Tyvek, makes the following statement in its Architect's Frequently Asked Questions:

"19. Can I use DuPont™ Tyvek® HomeWrap® under stucco?"

"DuPont™ Tyvek® StuccoWrap® is recommended under stucco because it has been specially designed to work with both traditional and synthetic stucco applications. The engineered surface with special grooves is designed to assist in drainage of incidental moisture that may penetrate the primary cladding in synthetic stucco systems. DuPont™ Tyvek® HomeWrap® will also provide the weather barrier characteristics in an EIFS wall system, but its drainage properties will differ. Therefore, in synthetic EIFS stucco systems, DuPont™ Tyvek® HomeWrap® can be used as the secondary weather barrier but in conjunction with an additional drainage medium (either matte or grooved foam) to achieve the desired drainage characteristics.

"In traditional stucco systems, DuPont™ Tyvek® StuccoWrap® has been shown to aid in curing, helping reduce scratch coat cracking and promoting flexural strength for improved stucco integrity."

The following is also stated in the DuPont Tyvek Water-Resistive Barrier Installation Guidelines:

"Façade Considerations

"Water-resistive barrier performance is dependent on the ability of the façade to drain. You must consider the following for specific façades.

"Stucco

"When stucco is installed over wood-based sheathing, the 2006 International Building Code (Section 2510.6) and the 2006 International Residential Code (Section R703.6.3) require "a water-resistive, vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper" or a layer of water-resistive barrier which is separated from the stucco by an 'intervening layer.' When DuPont™ Tyvek® water-resistive barriers are used behind stucco they should be separated from the stucco by a second layer of DuPont™ Tyvek® water-resistive barrier, a layer of Grade D

Bits & Pieces About Stucco

The ASHI Technical Committee provided the following interesting facts about stucco applications and suggested sources for additional information:

- At one time, stucco applications were installed over shiplap sheathing.
- Waferboard was the precursor to oriented strand board (OSB). The change occurred in 1978.
- In Western states, older stucco was applied over line-wire lath – there was no sheathing.
- On the West Coast, poor-quality OSB is mostly a thing of the past. The modern OSB products now in use — Structurewood Gold, for example — perform as well as plywood with regard to decay resistance and delamination. OSB products from the '80s and early '90s were clearly inferior products.
- Some small cracks and stains are a problem; some are not. It's up to the inspector to determine the difference.

For additional information about stucco, visit the following Web sites:

www.cement.org/stucco/MIP_splash.asp

www.nocsa.org/

www.parex.com/Stucco/One_Coat_Overview.html

www.stuccomfgassoc.com/industry/tech.shtml

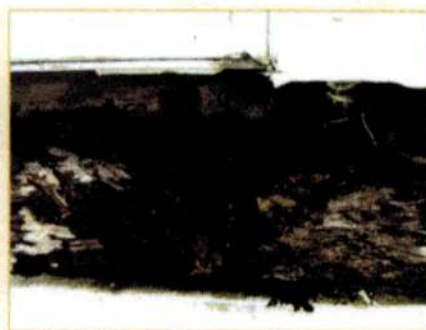
www.4specs.com/s/09/09-2400.htm

building paper, felt, rigid foam board or the paper backing of paper-backed lath. The first layer (directly over sheathing or studs) serves as the wall system's water-resistive barrier and is integrated with window and door flashings, the weep screed at the bottom of the wall and any through-wall flashings or expansion joints. Lath shall be installed over the intervening layer in accordance with ASTM C1063-03 Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster and applicable codes. Rigid foam board, when installed over DuPont™ Tyvek® water-resistive barrier as an intervening layer, will provide enhanced structural support to the DuPont™ Tyvek® layer and if installed within 4 hours of the DuPont™ Tyvek® layer, may reduce the required number of fasteners used for the attachment of the DuPont™ Tyvek® water-resistive barrier."

It is evident from DuPont's statements that Tyvek StuccoWrap is the preferred product to be used as it specifically is designed to act as a drainage plane and is less likely to allow liquid water to migrate through the material. The older



Galvanized chicken wire lath over Tyvek HomeWrap.



An example of the result of improper window flashing.

standard, as outlined in the Ohio Residential Code, is no longer recommended by DuPont.

The problem in Ohio and other states that have not adopted newer requirements is homes are still being built to the older standard, which is no longer supported by the manufacturer of the product. It is difficult to argue that a builder is using an improper practice when it meets code. Some builders are realizing that these practices are leaving them susceptible to problems and are spending the extra money to add a layer

of building paper over the Tyvek to provide a bond break between the stucco and the house wrap.

Improper window flashings

The next major area of problems is the improper flashing of windows and other penetrations. When sufficient quantities of water are allowed to get behind the water-resistive barrier, it is very difficult for evaporative drying to take place. The stucco cladding is most vulnerable to excessive quantities of water entering the wall assembly at window flashings and roof wall connections. ▶▶▶

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Typically, windows are installed by nailing the integral flange and nailing fin to the framing on the exterior of the sheathing. If the windows are not properly flashed with flashing tape and integrated into the housewrap and water-resistive barrier, water will drain down the window frames in sufficient quantities to saturate the sheathing.

The photos top left and right provide examples of the proper installation of Tyvek and flashing tape around a newly installed window. Building paper and wire lath is then installed over the properly flashed window.

This installation insures that water running along the frame will drain down the drainage plane as intended rather than becoming trapped between the water-resistive barrier and the sheathing.

Unfortunately, it is nearly impossible to determine if the window is flashed properly after the stucco has been installed. Sometimes the only clues visible are stains at the stucco trim junctions (see photo, middle left).

Builders and stucco contractors who are not informed regarding stucco failures will often consider this to be normal. They do not understand that water running down the window frames is becoming trapped behind the trim. The trim, which is often not back-primed, allows water to rot not only the trim, but to degrade the water-resistive barrier behind it.

Weep screeds

A weep screed is a termination accessory that receives the stucco at the base of the wall. It is a perforated metal channel that allows water, which saturates the stucco, to drain by gravity out of the system. Oftentimes, the weep screed is omitted entirely, and the stucco or cultured stone is allowed to terminate directly into the ground. This creates a condition whereby water will wick up the stucco by capillary action and eventually enter the wood sheathing at the base of the building. There should be a minimum clearance of four inches



An example of proper installation of Tyvek and flashing tape around a newly installed window.



An example of proper installation of Tyvek and flashing tape around a newly installed window.



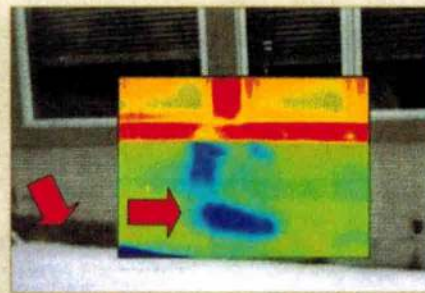
Stains at the stucco trim junctions indicate improper flashing.



Mold growing along the rim joist due to a lack of weep screed.



A pin-type moisture meter detected a moisture content over 20 percent, indicating a lack of weep screed.



An infrared view of leaking windows.

from the earth and two inches above sidewalks and patios.

In one example (see photo, middle right), the homeowner had been complaining about mold growing along the rim joist behind the insulation where the floor structure meets the foundation wall. The builder was called back and concluded that the problem was due to the colder temperature of the rim joist. He elected to spray foam insulation to keep warmer house air from coming in contact with the colder wood.

When a pin-type moisture meter was inserted into the wood (see photo, bottom left), it registered moisture content well above 20 percent. The insulation was

merely concealing the true problem, which was the lack of a weep screed and the dirt-to-stucco contact.

Infrared thermography

An infrared camera can be used effectively to observe where water may be saturating the stucco and ultimately the sheathing.

In the case illustrated in the bottom-right photo, the windows were leaking. One also can see how the stucco has absorbed moisture from the ground due to the lack of a weep screed and required clearance from the concrete patio. While infrared can be a useful tool, conditions must be right for its use.



A moisture reading of 74.2 percent indicates a serious problem.

Generally, the best circumstances occur about 48 hours after a heavy saturating rain. Conditions can be simulated on a limited basis with a spray rack.

Ultimately, the areas that have been identified in the infrared scan must be investigated further, either with a moisture meter or by removing stucco. In this case, moisture contents in the

OSB sheathing were measured at 74.2 percent. Sustained levels of moisture above 20 percent will result in rot and deterioration.

Summary

Problems with both traditional three-coat plaster stucco and one-coat applications are far more widespread than most homeowners realize. Often, what appears to be a small crack or a stain in the area of a window can be indicative of a far deeper problem. Too many times when the problems are apparent, the damage is so severe that rot and mold will be present within the wall assembly. Many times, well-meaning contractors are not aware of the issues surrounding improper flashing of windows and consider small cracks and stains to be normal.

If the home is newer and the builder is called back under the structural warranty, he is often reluctant to acknowl-

edge problems of a serious nature. The builder may be in damage-control mode and recommend low-cost "Band-Aid™" solutions such as caulking and elastomeric sealers. These measures rarely solve the problems and many times make the situation worse by sealing water into the wall assembly.

One must remember that building codes are merely minimum standards and don't always represent best practices within the industry. ■

Reprinted with permission of David Tamny, Professional Property Inspection, Columbus, Ohio. Tamny is a registered architect and has been an ASHI member since 1995. He is serving his third term as ASHI's treasurer. Contact him at 614-459-5941, or visit his Web site, www.worryfreeinspections.com.

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