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## Evaluating Stucco

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### **Introduction**

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 3 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 3 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 3 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 which is formed by layering flakes of wood in different orientations. Over the sheathing a water resistive barrier is applied. 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 3 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 They may also be applied over insulation boards. Exterior Insulation and Finish Systems are composed of a synthetic coating over fiberglass mesh applied directly on Extruded Polystyrene Insulation. EIFS systems 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 to 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 which have withstood the test of time.

Due to innovations in construction technology different materials which do not have the same time tested performance characteristics are now being utilized. Changes in the building codes have been slow and in the case of stucco is a response to apparent failures. These new designs require a 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 board has very poor moisture resistance qualities and tends to easily delaminate when wet. While plywood will also degrade when exposed to moisture, the OSB board 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 usage 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 Lsitburek 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 pg. 13 he states "There appear to be significant performance issues with WRB's (water resistive barriers) relating to manufacture, testing and approval. All plastic housewraps and some building papers tend to bond to stucco renderings thereby negating drainage. Additionally, many plastic housewraps loose 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 in the 2006 version has updated their 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 board panel sheathing. This condition could potentially cause rot and mold. DuPont the manufacturer of Tyvek makes the following statement in their 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 upon 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 \_006 International Building Code (Section \_510.6) and the \_006 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 second layer of DuPont Tyvek water-resistive barrier, a layer of Grade D 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 standard as outlined in the Ohio Residential Code is no longer recommended by DuPont.

The problem in Ohio and other states which have not adopted newer requirements is that 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.



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. Below is a 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.



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 which receives the stucco at the base of the wall. It is a perforated metal channel which 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 4 inches from the earth and 2 inches above sidewalks and patios.



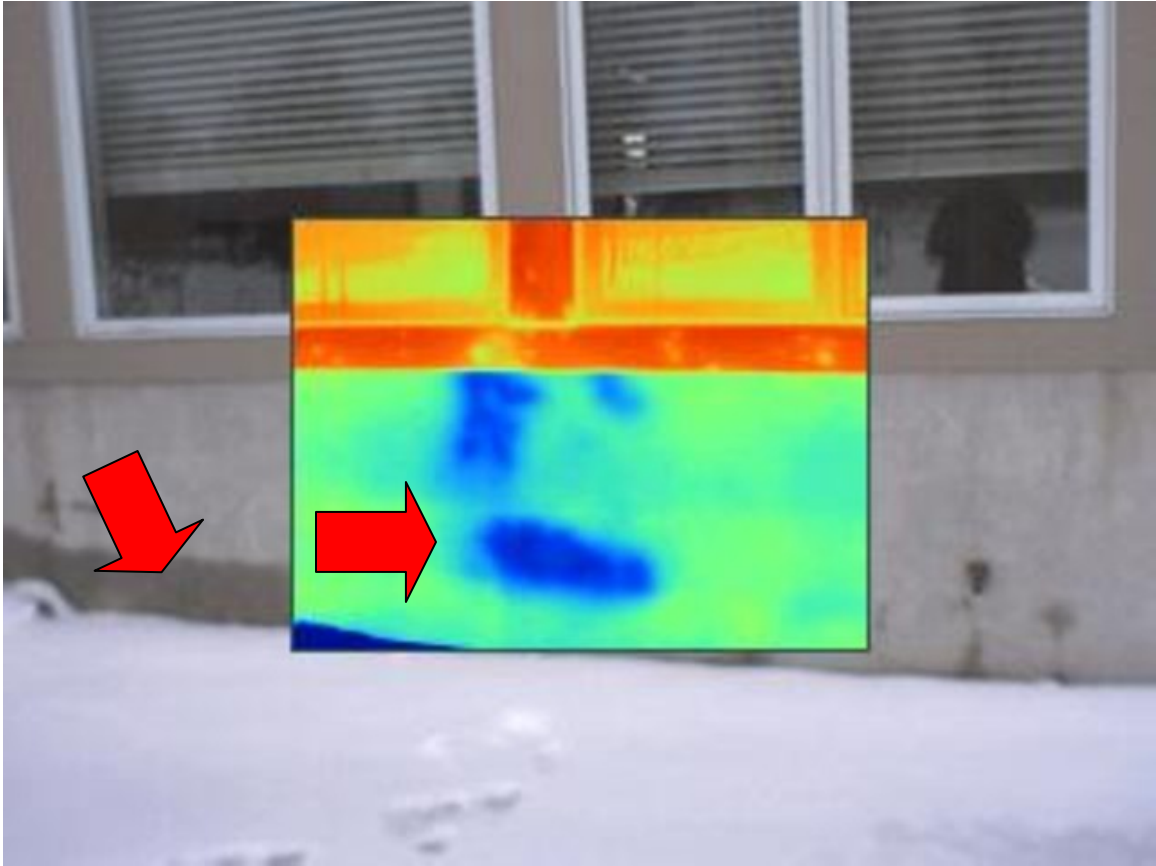
In this example the home owner had been complaining about mold growing along the rim joist behind the insulation where the floor structure meets the foundation wall. The builder was called back out and concluded that the problem was due to the colder temperature of the rim joist. They elected to spray foam insulation in order to keep warmer house air from coming in contact with the colder wood.



When a pin type moisture meter was inserted into the wood, moisture contents well above 20% were observed. The insulation was merely concealing the true problem, 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 this case the windows were leaking. One can also see how the stucco has absorbed moisture front 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 use. Generally the best circumstances are about 48 hours after a heavy saturating rain. Conditions can be simulated on a limited basis with a spray rack.



Ultimately the areas which 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%. Sustained levels of moisture above 20% 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 home owners 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, they are often reluctant to acknowledge problems of a serious nature. They 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.

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