Technical Features − Water Resistance
Taking The Doubts Out Of EIFS Wall Performance

LIKE ANY CONSTRUCTION CONCEPT, EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) HAVE GONE THROUGH AN EVOLUTION. THIS EVOLUTION IS CREATING A SERIES OF LOW−COST, TROUBLE−FREE SYSTEMS THAT ARE AS RELIABLE AS THEY ARE ATTRACTIVE.

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(Editor's Note: This article originally appeared in the 1997, Issue 2 of Form Function. Some pictures, graphics or charts may not appear in this version. To receive a printed copy of this article, or information about the products mentioned in it, contact: Editor, FORM FUNCTION, 125 South Franklin Street, Chicago, IL 60606−4678.)

In April 1996 USG discontinued the sale and promotion of its "barrier" or face−sealed EIF System in the market. It had become obvious through extensive testing, both in USG's own research facility and at the National Research Council of Canada (NRCC), that these systems could not adequately accommodate water penetration. In existing structures clad with barrier EIFS, elevated moisture levels have led to deterioration of water−sensitive materials in the walls. USG determined that it would only market systems with long−term reliability that protect the building owner's investment.

Construction industry professionals have had reservations about the EIFS "barrier" concept over many years, but few problems surfaced and few changes were made to the system. Ultimately, design flaws in the concept came to light in coastal areas and other regions with high humidity and rainfall.

EIFS History
Originally, EIFS was an exterior wall concept designed to have high insulation values and a reliable stucco finish that could be economically created in a wide array of textures and colors. It immediately became successful because it provided so much performance for so little cost. The most unusual aspect of the system was that expanded polystyrene (EPS) insulation was installed on the exterior side of the wall forming a base for an exterior coating as well as adding more insulation to the building. The surface has a 1/8−inch−thick synthetic−stucco finish system which performs two functions. It is designed to provide a face−seal or barrier to seal out moisture and provide a decorative finish at the same time. This 1/8−inch−thick finish system consists of reinforcing mesh, latex fortified basecoat, and an aggregated, polymeric, textured finish.

The principal weakness in the concept is that it has only one line of defense against water intrusion. Although the surface usually forms an effective water barrier, intersections of the surface with other elements often leave gaps or openings that driving rain can penetrate. Once in the sealed wall, the water remains trapped long enough to damage or rot any water−sensitive elements, such as wood studs, oriented−strand board, plywood, or gypsum sheathing. Highly publicized failures in

hundreds of homes in North Carolina made water intrusion a major issue. The North Carolina failures are of concern throughout the United States because the climate extremes of this region created accelerated water−damage problems that are becoming present in other areas.

As a result of these problems, a large insurance company no longer insures contractors installing "barrier" EIFS. Most recently, a major window manufacturer has announced that it will exclude barrier EIFS from its covered warranty. In fact, most major manufacturers of EIFS products, while still promoting barrier EIFS, now offer water managed systems in their product lines.

Thus the EIFS concept is evolving into a slightly more expensive system that provides a water−resistant redundancy. That is, designs are now available that resist water intrusion at more than one level and expel water that enters the wall. United States Gypsum calls this concept "water management."

To meet the demand for water−managed stucco−look systems, USG has developed an extensive offering of exterior wall systems that provide the designer and building owner with the popular esthetics of synthetic stucco and long−term reliability of water management. USG also has begun an extensive research program to better understand how these systems work and to determine how they should be tested.

Elements Of A Water Managed System

The concept of water management is not a new one. In fact, many common exterior claddings can be considered water managed. Brick veneer, for instance, is typically detailed with a cavity between the face brick and a protected wall framing. This cavity creates a drainage plane, and with weeps at the foundation, it allows water that has penetrated the brick to be removed to the outside. USG has applied similar design concepts to its full line of water managed exterior systems (see Fig. 1). Should water flank the synthetic stucco cladding or enter openings for penetrations, it will be stopped at the weather−resistive barrier, drained to flashing elements, and removed to the outside, thereby protecting the stud cavity and any water−sensitive materials in the wall from damage.

EIFS Research Study

A paper entitled "Barrier EIFS Clad Walls: Results from a Moisture Engineering Study" was recently published in the Journal of Thermal Insulation and Building Envelopes, Volume 20 (January 1997). This paper outlines the third−party tests performed by the National Research Council of Canada to determine the design deficiencies in barrier EIFS walls. From these tests USG has gained a thorough understanding of water penetration and moisture transport in these systems. Test results show that sealant joints and windows account for the highest levels of water infiltration. Even when sealant and backer rod is installed in textbook fashion, water can migrate through the interface with the cladding under simulated storm conditions. In the barrier EIF Systems, this water infiltration led to highly elevated moisture levels in the water−sensitive materials within the wall. "It was concluded that barrier EIFS−clad walls do not provide effective management of rain penetration. As such, in−service performance is unpredictable and unreliable." However, in the water managed system tested, the intruding water was stopped at the weather−resistive barrier and removed at flashing located at the base of the wall assembly. Therefore, walls using a weather resistive barrier in conjunction with a

drainage space were shown to provide good control of rain penetration.

Testing Issues

It is clear that the synthetic stucco industry needs a standard test protocol to evaluate the ability of any proposed wall system to drain water that breaches the finish or cladding system. The local and model building code organizations asked the manufacturers to provide such a test. USG has developed a test protocol and is working with the American Society of Testing Materials (ASTM) to refine this test method for evaluating and quantifying the drainage potential of stucco systems.

USG Systems

USG water managed systems are classified into two families, DuroScreen Direct−Applied Exterior Finish Systems and InsulScreen Insulated Exterior and Finish Systems. All the USG systems incorporate weather−resistive barriers and flashing that evacuate any water that penetrates the exterior finish material.

DuroScreen 1000 System

The DuroScreen 1000 Direct−Applied Exterior Finish System is a time−proven assembly utilizing Durock Cement Board as a substrate for basecoat and finish materials. The Durock Board has the advantage of being water−durable. The system can be installed over wood− or steel−stud framing; a structural sheathing may be used, depending on the design criteria. Flashing components are installed, along with a weather−resistive barrier, such as 15−pound felt. Wrapping this barrier into openings protects window and door penetrations. Following the application of Durock Cement Board, a layer of basecoat is applied to the entire surface and allowed to dry. To complete the wall, pre−colored USG Exterior Textured Finish is trowel applied and floated to the desired look.

DuroScreen 1500 System

The DuroScreen 1500 System is popular in markets where conventional stucco is utilized. Conventional stucco is usually applied in several coats over a paper−backed metal lath material that has been attached to substrate and framing members. Once the portland cement stucco is cured, USG finish materials are applied to achieve the rich color and texture.

InsulScreen 2100 System

The InsulScreen 2100 System is similar to the DuroScreen 1000 System with the addition of expanded polystyrene (EPS) insulation. The insulation adds to the overall R−value of the system and enhances the design freedom afforded to the architect. This system is the premier system for EIFS applications because the insulation is adhesively bonded to Durock Cement Board, a substrate that is not damaged by water.

Case History

A good example of the difference water managed systems can make occurred at the Central DuPage Health System Medical Offices complex in Wheaton, Illinois. The existing building was clad in a barrier−EIF System with a glass−fiber−faced gypsum sheathing that had failed because of water penetration. The architect, Anderson Mikos Architects, Oakbrook, Illinois, was retained to replace this existing system with a more reliable one and to duplicate the finish on a 25,000−square−foot addition to the building.

"The existing EIF System had allowed water to enter, but had no way to let the water back out," explained Ralph Wiser of Anderson Mikos Architects. "As a result, steel studs were rusting, insulation was mildewed and losing its insulation value, the sheathing had deteriorated, and even the interior drywall was rotting.

"We selected the InsulScreen 2100 Exterior Insulation and Finish System from United States Gypsum because we had confidence that it would perform properly. USG recognizes that water will get into the exterior wall system and thus has planned a way for the water to get back out. Additionally, the substrate behind the USG system is Durock Cement Board, a material that is not damaged by the presence of water. USG’s water management concept was the system of choice."

Conclusion

The market for a synthetic stucco look continues to grow with customer demand for this attractive exterior. However, if water managed systems are not used, the long−term reliability and eventual decline in market acceptance will greatly affect their viability as the wall system of choice in new construction. Critical to long term performance is the need for protecting any water−sensitive materials, such as wood framing, gypsum sheathing, oriented−strand board, and plywood, with a weather−resistive barrier. Also critical to the performance of the wall is the way in which penetrating elements are detailed and installed. These elements must interface with the exterior wall system so that they work with the water management design concept by directing any intruding water to the front of the drainage plane.