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The Performance of Exterior Insulation Finish Systems and Property Value

Exterior insulation finish systems, or synthetic stucco, is a siding material used on a quarter of a million residences and several thousand commercial buildings in the United States, Canada, and Europe. EIFS use has been linked with moisture problems and structural rot in many buildings, necessitating value impact estimates by appraisers. The value estimates, which may require outside expertise in accordance with Advisory Opinion 9 of the *Uniform Standards of Professional Appraisal Practice,* include cost to cure and stigma. For residential appraisals, stigma may be estimated with matched pairs. For a commercial appraisal, stigma takes the form of an increased capitalization rate.

Synthetic stucco, commonly known as exterior insulation finishing systems (EIFS), has been used as a siding material since World War II on residential and commercial buildings. While the product is sold and installed throughout Europe and North America, usage seems to be geographically concentrated in certain areas, particularly in the Southeast and the Pacific Northwest.

EIFS continues to be sold and installed, but as a system for exterior siding, it is meeting increasing opposition. EIFS-clad homes appear to suffer elevated inter-wall moisture levels and a proclivity to structural rot, stemming from leakage around windows, doors, corners, roof seams, and other joints. Owners of such properties face significant potential value losses stemming from three distinct areas of impairment: present value of future repair and replacement costs, present value of future increased maintenance costs, and stigma.

EIFS generally refers to an exterior siding system with four primary components:[1]

1. Expanded polystyrene foam insulation panels, which are attached (usually with adhesive) to the intermediate sheathing or other substrate
2. A base coat that is applied to the insulation panels with a trowel

1. Insurance Institute for Property Loss Reduction, "Exterior Insulation and Finish Systems," *Natural Hazard Mitigation Highlights* (Boston, Massachusetts: Insurance Institute for Property Loss Reduction, February 1997), 1–12.

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3. A fiberglass reinforcing mesh laid over the panels and imbedded in the base coat
4. A finish coat applied with a trowel over the fiber mesh

Components 2, 3, and 4 together are usually about 0.125–0.25 inches thick. Beneath the insulation panels is an intermediate sheathing, usually gypsum board, plywood, or oriented strand board. Recently the EIFS industry began using alternative substrates and application methods to address moisture problems.

EIFS is designed to shed all water, although the EIFS Industry Members Association indicates that the systems are intended to be "water-vapor" permeable.[2] The material is often confused with traditional stucco, which is similar in appearance. However, traditional stucco application anticipates water permeation and uses building paper or other flashing behind the wall surface to carry water down and out of the bottom of the wall. Also, stucco is a Portland Cement-based plaster, troweled directly onto a metal mesh or an underlying masonry wall. In short, despite their physical resemblance, the two siding systems are significantly different, and the common term "synthetic stucco," often used to describe EIFS, simply adds to the confusion.

EIFS was first developed in Europe in the late 1940s to aid in economically rebuilding war-torn areas. As a result, European countries apply EIFS differently from how North America applies it. In Europe, EIFS is typically applied over an underlying masonry base, because the use of EIFS over a stud wall is virtually unknown in Europe. Also, European EIFS installers usually use two base coats, a base primer coat, and thicker insulation boards.

As of 1997, EIFS accounted for 13%–14% of all new commercial construction in the United States. Residential market penetration nationwide is lower, standing at about 4% of new homes in 1997 although this market penetration varies regionally from zero in some areas to over 15% in other areas. In 1995, EIFS was used on about 25,000-30,000 new homes nationwide.

PERFORMANCE ISSUES WITH EIFS SIDING

Using EIFS siding assumes that moisture will not penetrate to the substrate. In practice, however, water does penetrate, principally at the edges of wall openings (e.g., doors, windows, decks, roof intersections), through jambs and sills of window frames, and through cracks or chips in the siding itself. It appears that even high-quality window frames allow moisture to penetrate the siding, which is then contained between the surface of the EIFS system and the underlying wood, gypsum, or OSB intermediate sheathing and the stud wall. Even a small crack in the EIFS surface, resulting from hail damage or wind-blown debris, provides a moisture entry pathway, and there is unfortunately no consensus test method in the United States for EIFS impact resistance.[3] The EIFS industry itself admits that if "the likelihood of impact damage is very high, it is probably a good idea not to use EIFS at these locations."[4]

The earliest published reports of EIFS problems in the United States apparently originated from a study funded by the Massachusetts Executive Office of Communities and Development in 1985.[5] The study analyzed 17 public buildings with EIFS systems used as a siding material. Every one of the buildings had cracks in the surface sufficient to allow water penetration and internal substrate damage. Problems were uniform across all four EIFS system manufacturers in the study.

The U.S. Department of Housing and Urban Development (HUD) then commissioned a study of 50 commercial, institutional, and multifamily buildings with EIFS system siding in Missouri, Massachusetts, and Illinois. The EIFS systems had been supplied by eight different manufacturers. The HUD study found that 73% of all buildings, and 10 of 11 buildings more than eight years

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2. Ibid.

3. Ibid., 4; A generic impact-resistance test can be used, but EIFS impact resistance standards are not commonly published. See American Society for Testing and Materials, *ASTM E 695* (West Conshohocken, Pennsylvania: American Society for Testing and Materials, 1997).

4. Robert F. Thomas, Jr., *The Exterior Insulation and Finish Systems Design Handbook* (Seattle, Washington: Robert F. Thomas, Jr., 1998), 70.

5. R. Kenny and R. Piper, "Proposed Material and Application Standards for More Durable Exterior Insulation and Finish Systems," *Development, Use, and Performance of Exterior Insulation and Finish Systems* (West Conshohocken, Pennsylvania: American Society for Testing and Materials, 1995), 56–57.

old had cracks sufficient to allow water penetration. Further, 52% of the buildings had sealant failures, and seven of the 11 buildings more than eight years old had elevated moisture levels in the substrate. The HUD report recommended not using some types of gypsum as a substrate in adhesive-fastened systems, increasing the thickness of the base coat, applying the base coat in two layers, and independent, third-party inspections of buildings using EIFS systems. The HUD report also concluded that EIFS manufacturers do not have the staff or procedures needed to ensure proper installation of their products. Subsequently, HUD issued a bulletin prohibiting the use of gypsum substrate in EIFS systems.[6]

The first reports of residential damage came from New Hanover County in North Carolina, where homeowners began complaining to building officials about structural damage. Inspections in 1994 and 1995 found that 30 of 32 houses had moisture problems. The houses were spread out over four different subdivisions and involved different contractors and several different manufacturers. Subsequent inspections of 209 EIFS system houses in the area found structural damage caused by water penetration in most of them. Apparently, any spot where the plane of the EIFS panel met an opening or another part of the structure was a leak zone. The North Carolina Chapter of the American Institute of Architects cited that 68% of these houses had improper or no caulking at key joints.[7]

Unfortunately, underlying moisture damage may not be evident from the surface. In homes inspected in New Hanover County, the surface often appeared intact, but the underlying wood commonly showed moisture readings of 50% or more.[8] According to the National Association of Home Builders (NAHB), serious decay occurs when the moisture content of wood exceeds the fiber saturation point of 30%.[9]

One major EIFS system manufacturer, United States Gypsum Company, recently conducted an investigation of 30 homes in New Hanover County clad with EIFS systems manufactured by that company. They found elevated moisture levels in all homes, and ceased supplying EIFS systems without a moisture drainage system. Their new product has a drainage plane, flashing, and weephole details designed to vent the wall cavity. The EIFS Industry Members Association disagrees with U.S. Gypsum, and states that quality construction is the key issue.[10]

A further problem stemming from EIFS systems was revealed when Hurricane Opal hit the Florida Panhandle in October 1995. EIFS had been a common siding in that part of the country on condominiums, offices, and other buildings with metal studs. The Insurance Institute for Property Loss Reduction (IIPLR) noted that the failure rate of EIFS siding to withstand wind pressure was more extensive than those of other types of wall sidings:

> The predominant reason for EIFS failures appeared to be water damage to the gypsum sheathing. In many instances of damage, both the EIFS and gypsum sheathing had been blown off, leaving only the metal studs. Many studs were rusted, indicating prolonged water infiltration had saturated – thereby weakening – the gypsum sheathing. The water-damaged sheathing provided little support against wind-induced forces, and weakened portions of EIFS often fell from the metal studs during passage of Opal.[11]

In a study of Hurricane Erin, which struck in August 1995, the Southern Building Code Congress International, Inc. (SBCCI) also noted the relatively large number of EIFS-related failures in hurricanes. The SBCCI found that vinyl siding and EIFS were "by far the most damaged systems" and questioned whether EIFS had been installed and tested in accordance with wind-load requirements. The authors of the study again surveyed the area after Hurricane Opal, and validated their previous findings.[12]

The problems with EIFS are not limited to the Southeast or even to the United States.

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6. Ibid., 57–60; *U.S. Department of Housing and Urban Development, Use of Materials Bulletin,* no. 101 (July 26, 1993).
7. "Special Inspections Vital in Proper EIFS Installation," *The Building Official and Code Administrator* (May / June 1996): 20.
8. C. Kidder, "EIFS Under Scrutiny," *Journal of Light Construction* (April 1996): 12.
9. J. Crandell and T. Kenney, *Investigation of Moisture Damage in Single-Family Detached Houses Sided with Exterior Insulation Finish Systems,* 2d ed. (Washington, D.C.: National Association of Home Builders, January 1996), 6.
10. *Natural Hazard Mitigation Insights,* 7.
11. Insurance Institute for Property Loss Reduction, *A Summary of the Effects of Hurricane Opal on the Florida Panhandle* (Boston, Massachusetts: Insurance Institute for Property Loss Reduction, March 1996), 6.
12. G. Nichols, S. Gerace, and J. Slaght, "A Survey of Hurricane Erin," *Southern Building* (March / April 1996): 14.

The city of Vancouver, British Columbia, has reviewed EIFS use for several years and began officially questioning EIFS use in 1992.[13] Since 1996 Vancouver has required rainscreen or drainage pathways to evacuate moisture from EIFS systems. Vancouver also requires an independent inspection of the installation of site-troweled EIFS installation, although it does not require such inspection of prefabricated panels surfaced with EIFS coating.[14] Since March 1996, the North Carolina Building Code Council has required similar drains on wood-frame houses sided with EIFS systems in that state.

Maryland Commercial Insurance Company, one of the nation's largest construction liability carriers, has announced that it will no longer cover home builders who install EIFS systems.[15] Lawsuits are pending against EIFS manufacturers in several states, including a class action suit in North Carolina. One of the North Carolina EIFS defendants, Senergy, Inc., has separately offered to settle by contributing $20 million to a repair fund for the state's residences, leaving eight other defendants as of this writing.[16]

APPRAISAL IMPLICATIONS FOR EIFS-CLAD STRUCTURES

In an article by Scott B. Arens, a basic valuation model for the analysis of defective properties is demonstrated:[17]

Before condition = After condition + Diminution in value

For EIFS-clad properties, the diminution in value includes three categories of impairment: cost-to-cure, cost of maintenance, and stigma. Estimating costs in the first category may often be beyond the scope of the appraisal process. According to the Appraisal Standards Board's commentary on Advisory Opinion 9:

> An appraiser is a trained and experienced observer of real estate, but recognizing, detecting, or measuring contamination is often beyond the scope of the appraiser's expertise… Remediation and compliance cost estimation involves knowledge and experience beyond that of most appraisers.[18]

In other words, an appraiser may often be in the position of relying on external expert opinion, such as contractor estimates or engineering studies, to determine the cost to cure.

Remediation of an EIFS problem can fall into the categories of repair or replacement. The simple repair of limited damage to an EIFS-clad structure to "like new" condition brings with it two additional categories of costs: enhanced ongoing maintenance and stigma. Both of these categories of costs are also present in new EIFS-clad construction.

Different types of siding require different levels of maintenance. For example, various masonry products (e.g., true stucco, brick, block, stone) require little or no ongoing maintenance, and the siding often outlives the economic life of the rest of the structure. Other types of siding, such as wood lap, require perpetual maintenance in the form of painting, caulking, and replacement of rotten wood. Deferral of these maintenance items is reflected at various junctures in all three of the approaches to value.

Likewise, a brand new EIFS-clad structure will require intense ongoing maintenance. Most common ongoing maintenance concerns include periodic moisture testing, intense caulking (at least once or twice per year), and continuous monitoring of sealant problems on window jambs and door thresholds. Most homeowners are unable or unwilling to do these chores themselves and will need to contract this out to an appropriate professional.

Stigma, as commonly considered in appraisal literature, concerns the impact on capitalization rates of a public perception of contamination.[19] In short, a parcel with no actual cost to cure, but with a public perception of contamination, will suffer a value impairment best measured by an increase in the capitalization rate. Thus, while appraisal practice is replete with examples of capital-

13. City of Vancouver, *Bulletin 92-7* (August 20, 1992).
14. City of Vancouver, *Bulletin 95-9* (December 1995).
15. Sherrie Winston, "Cladding System Troubles Mount," *Engineering News Reporter* (October 28, 1996): 12.
16. "Stucco Maker Agrees to Terms," *Engineering News Reporter* (June 1, 1998): 19.
17. Scott B. Arens, "The Valuation of Defective Properties: A Common Sense Approach," *The Appraisal Journal* (April 1997): 143–148.
18. Appraisal Institute, *The Standards of Professional Appraisal Practice* (Chicago, Illinois: Appraisal Institute, January 1, 1998), 113.
19. See, for example, Bill Mundy, "Stigma and Value," *The Appraisal Journal* (January 1992): 7–13; James A. Chalmers and Scott A. Roehr, "Issues in the Valuation of Contaminated Property," *The Appraisal Journal* (January 1993): 28–41.

izing future costs into present value, such as the cost to maintain a historic façade easement, the future costs are usually discounted at market capitalization rates. An impaired property with a negative public perception should be capitalized at a different rate. The impact of the different rate is stigma.

To illustrate the appraisal implications, assume a residence with $4,000 in EIFS-related repair costs.[20] Once restored to "as new" condition, the structure will require $1,000 per year of extraordinary ongoing maintenance costs. Assuming an appropriate market capitalization rate of 10%, the actual reduction in value for a contaminated property *(V_C)* would be:

$$V_C = \$2{,}000 + \frac{\$1{,}000}{0.10} = \$12{,}000$$

Note that the present value of the ongoing maintenance is significantly greater than the current repair costs. Also, this model does not take into account the impact of stigma on property value. Stigma is a real factor, and in a nonquantitative sense, the market perceives the value loss of stigmatized properties, and transaction prices are reduced accordingly. A study by the North Carolina Home Builders Association noted that one homeowner of a six-month-old EIFS-clad home with minor moisture problems stated, "I couldn't give this house away now if I wanted to." Regardless of whether this case was extreme or the homeowner was exaggerating, there is substantial anecdotal evidence for severe market reaction to EIFS-clad residences.[21] In the absence of any real cost to cure a problem, stigma imposes market behavior costs such as:[22]

- Diminished rents
- Increased vacancy losses
- Higher ongoing expenses
- Increased capitalization rate

The general model for valuing a contaminated income-producing property *(V_C)* over a valuation horizon of *t* years can be shown as:

$$V_C = \sum_{t=1}^{n} \frac{NOI_t - Costs_t}{(1 + i_c)^t}$$

While the value of a similar, uncontaminated property would be:

$$V_U = \sum_{t=1}^{n} \frac{NOI_t}{(1 + i_u)^t}$$

Note the different capitalization rates. The uncontaminated cash flow is capitalized at i_U while the contaminated property is valued at the somewhat higher rate of i_C. To illustrate, assume two otherwise similar properties, property C being EIFS-clad and property U sided with some other material. Both properties are fully rented at market rates (and identical *NOI* = $100,000) and will be for the foreseeable future. However, the EIFS-clad structure will require $10,000 in repairs in the first year and an ongoing enhanced maintenance of $2,000 per year. An analysis of the market indicates that unimpaired properties are capitalized at 10%, while impaired properties carry a 12% capitalization rate. The problem is to isolate the EIFS-related value impact on property C.

Therefore, it is necessary to take the difference between the two preceding equations. Assume a cost-to-cure in the first year, a perpetual *NOI*, and a perpetual increased maintenance cost:

$$\begin{aligned} V_{difference} &= \frac{NOI}{i_C} - \frac{NOI}{i_C} + \frac{Costs}{1 + i_c} + \frac{maintenance}{i_c} \\ &= \frac{100{,}000}{0.10} - \frac{100{,}000}{0.12} + \frac{10{,}000}{1 + .12} + \frac{2{,}000}{0.12} \\ &= \$192{,}000 \end{aligned}$$

The first two terms in this equation are the loss in value resulting from stigma alone. Even in a fully cured, no-maintenance world, the stigma loss would be $166,667, which is a quantified measure of the market's reaction to potential future problems associated with this property. Note also that the uncontaminated property value *(V_U)* is $1 million. Thus, this relatively "minor" EIFS impairment, given the constraints of this model, result in a

20. The North Carolina Home Builders Association reports that 95% of randomly tested homes have damage averaging $3,000–$5,000. The EIFS Industry Members Association inspected 68 homes in North Carolina. Sixty-one had some damage, and nearly 10% had damage in excess of $10,000. Several North Carolina home builders report repair costs as high as $100,000. Allen Golden, assistant director of inspections for Hanover County, North Carolina, reports one insurance settlement of $417,000. See Rick Schwolsky, "Troubleshooters Target EIFS," *Builder* (March 1996): 168–171.

21. Ibid., 169.

22. Mundy, 28–41.

value loss of nearly 20%. This model helps explain the economically significant market reactions to EIFS-clad properties.

CONCLUSION

EIFS-clad properties, both residential and commercial, make for challenging assignments in many areas throughout the United States. The EIFS industry suggests that a quarter of a million homes and many thousands of commercial buildings have been built with EIFS siding. For example, in Florida alone, EIFS is estimated to be used on 25% of the 100,000 homes built annually.[23]

Both residential and commercial appraisals must not only take into account the cost to cure for EIFS-related damage, but also account for increased future maintenance costs and the impact of stigma. For cost-to-cure and maintenance estimates, the appraisal will probably need to rely on outside expertise, in accordance with USPAP's Advisory Opinion 9.

Stigma, which is manifested in market impacts of transaction prices, can be more easily estimated for commercial properties via the increased capitalization rate in the income approach. For residential properties, measuring stigma will probably require a matched-pair analysis, and will most likely vary from one geographic market to another, particularly because EIFS siding has its critics in some areas.

23. Jacqueline Bueno, "Florida Journal: Big Insurer Won't Cover Stucco Process," *The Wall Street Journal* (October 16, 1996), F-1.