

EIFS Come and EIFS Go; A Case Study on EIFS Cladding Rehabilitation

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Project Title: Exterior Facade Rehabilitation, Fisher Corporate Center

Location: 1707 North Randall Road, Elgin, Illinois



Figure 1 – Overall view of Fisher Corporate Center.

Exterior insulation and finish systems (EIFS) were cladding systems that became very popular in the United States in the 1980s. They were initially designed to be barrier wall systems. However, significant failures of barrier EIFS began occurring in the 1990s. These failures were primarily due to water penetration through the EIFS to moisture-sensitive substrate materials. As a result, code officials around the country began banning barrier EIFS wall assemblies, or at least stiffening code requirements for EIFS construction.

Most current EIFS wall assemblies

include a water-resistive barrier and drainage plane between the insulation and the exterior wall sheathing. The water-resistive barrier prevents water that penetrates through the EIFS from reaching moisture-sensitive substrates such as gypsum sheathing and metal wall components that can corrode. The drainage plane allows penetrating water to drain out of the EIFS wall assembly.

Fisher Corporate Center is a four-story office building located in the Chicago suburb of Elgin, Illinois. The building was primarily clad in 6400 linear feet of prefabricated EIFS panels and aluminum-framed strip windows (Figure 1). The joints between EIFS panels

and around window perimeters were sealed with an elastomeric sealant. Unfortunately for the owners, the building was constructed in 1992, before code requirements for EIFS wall assemblies became more stringent. Water leakage throughout the façade began shortly after construction.

In 2009, a sealant replacement program was initiated to address widespread water leakage. While the program was somewhat effective in reducing the leaks, the sealant repairs did not address the underlying deficiencies that caused the leaks. Leaks continued where some repairs had been performed, and new leaks developed where no repairs had been performed.



Figure 2 – Failed sealant between EIFS panels.

During a façade evaluation in 2012, several deficiencies in the EIFS cladding were identified as potential contributors to the ongoing leakage. Such deficiencies primarily included the following:

1. Failed primary and/or secondary sealant at joints between EIFS panels (Figure 2)
2. Failed bond between EIFS finish coat and base coat
3. Extension of EIFS base and finish coats onto supporting steel stud and completely through the thickness of the wall panels, providing a direct path for water to reach the interior of the building (Figure 3)
4. Lack of back-wrapping of the base coat behind the EIFS panels



Figure 3 – EIFS base and finish coats extended onto studs.

Follow-up water testing performed in 2013 confirmed that deficiencies in the strip windows were also contributing to the leaks. Such deficiencies primarily included the following:

1. Lack of cover plates over splice joints between frame sections at window heads and sills (Figure 4)
2. Failure of retrofitted sealant at splices due to thermal expansion and contraction of the window frame sections (Figure 5)
3. Failure of sealant at window perimeters
4. Failure of sealant within glazing pocket



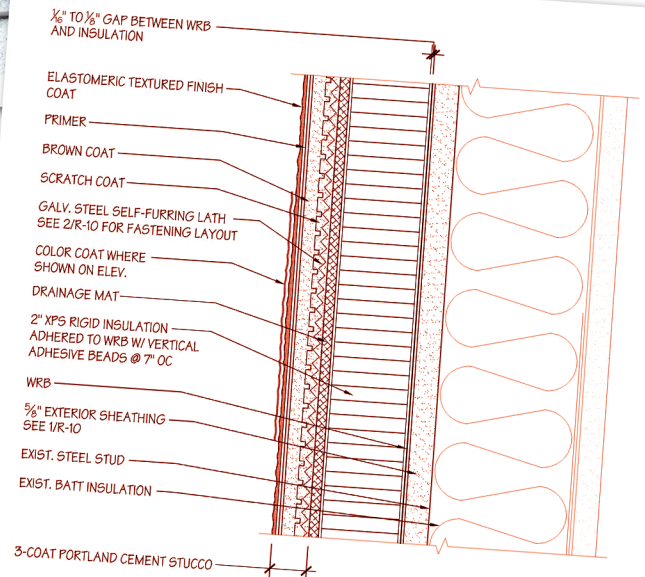
Figure 4 – Splice joint with no cover plate.



Figure 5 – Failure of retrofitted sealant at splices.

The primary conclusion from the façade evaluation was that the EIFS panels had surpassed their useful service life and that repairs were necessary. A façade rehabilitation project was recommended that included replacement of all EIFS panels and localized repairs of the strip windows to address the deficiencies indicated above. Several repair alternatives with order-of-magnitude cost estimates were developed. Replacement options for the existing EIFS panels included drainable EIFS, drainable stucco, or metal panels. The owner wanted a leak-free, durable building that would maintain the company’s strong image in the community and attract tenants to occupy the desirable office space. Considering aesthetics, durability, anticipated future maintenance, life cycle costs, and other factors, the owners selected a three-coat stucco system as their most viable option.

Figure 6 – Stucco system detail.



1 TYPICAL EXTERIOR ASSEMBLY
6" = 1'-0"



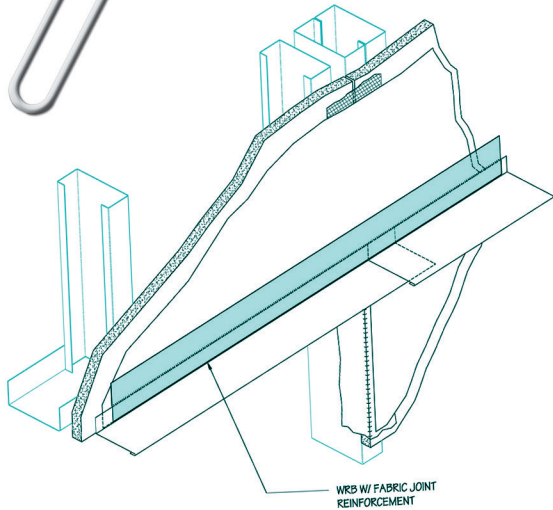
Figure 7 – Original EIFS cladding.



Figure 8 – Stucco system designed to replicate original appearance.

Figure 9 – Window head flashing detail.

Figure 10 – Window head flashing.



The three-coat stucco system was designed to appear nearly identical to the existing EIFS system, but to incorporate redundant resistance to water penetration (Figure 6). The scope of work included complete removal of the existing EIFS cladding system and installation of new sheathing, fully integrated water-resistive barrier, secondary drainage cavity, insulation, drainage composite, and three coats of Portland

cement stucco reinforced with metal lath.

As is the case with any cement-based material, controlling cracking is the biggest challenge in stucco construction. Strict limitations on panel sizes and aspect ratios help minimize the possibility of cracking.

The existing EIFS panels had horizontal reveals between colors that could not be duplicated without compromising the aspect ratio of the stucco panels. The stucco system design included an elastomeric textured finish coat, which

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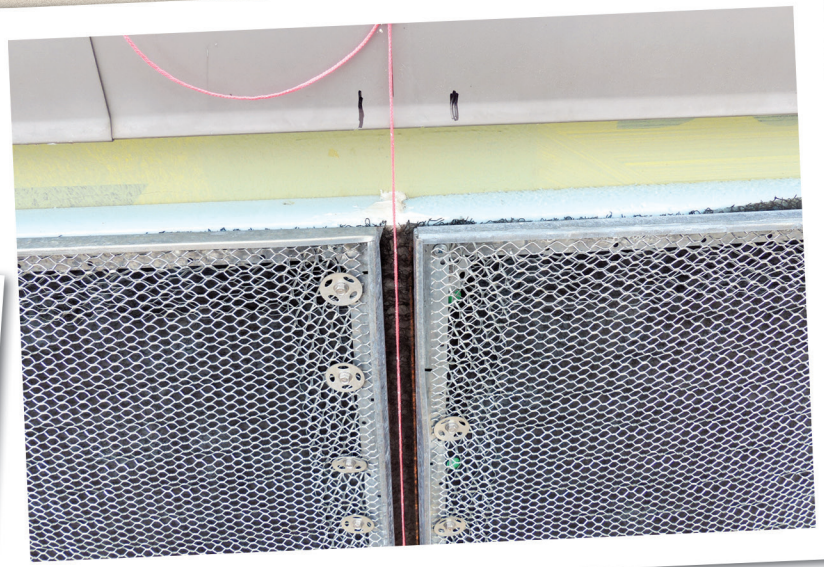
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Figure 12 – Metal lath fasteners spanning across insulation and sheathing.

Figure 11 – Joint detail for metal lath fasteners spanning across insulation and sheathing.



was tinted to replicate the light and dark gray colors of the original EIFS panels. An acrylic-based finish coating was then used to replicate the red stripe accent bands (Figures 7 and 8).

Intricate flashing details were developed to redirect water that penetrates the stucco system back to the exterior (Figures 9 and 10). The integration of the new cladding system components made material selection a critical design consideration. The stucco system manufacturer was selected because of its capability to provide appropriate water-resistive barrier (WRB) and fluid-applied flashing materials, allowing the entire cladding system to be captured under a single warranty. Using a single manufacturer also helped minimize potential for compatibility issues among various materials.

Prescriptive requirements for fastening metal lath to light-gauge framing were based on the most common stud spacing used in the industry (i.e., 12, 16, or 19.2 inches). However, the light-gauge steel studs at the building were spaced at 24 inches. As such, detailed calculations and fastener patterns were necessary to ensure adequate resistance to wind loads, given the atypical stud spacing. Additionally, the metal lath fasteners had to span across 2 inches of insulation and the exterior sheathing to anchor into the existing studs (Figures 11

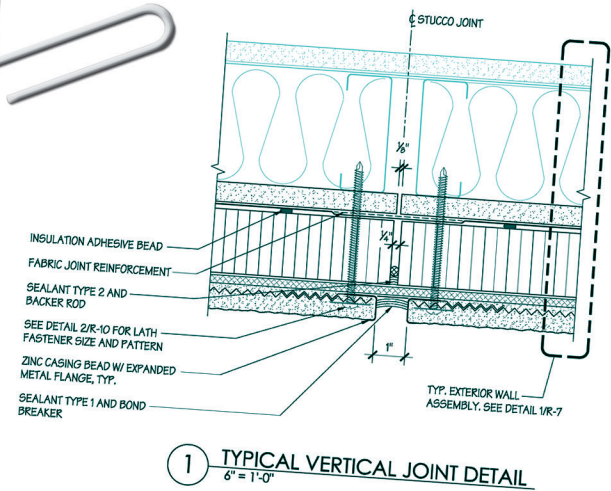


Figure 13 – WRB application around signage support anchors.

Figure 14 – Reinstallation of signage over finished stucco cladding.



Figure 15 – Strip window repair detail.

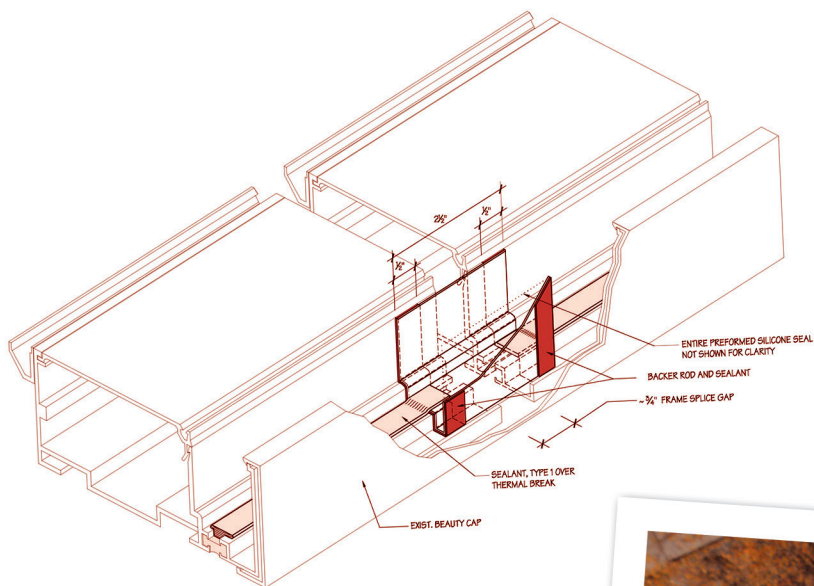


Figure 16 – Strip window repairs.



and 12). As such, the anchors had to be designed to withstand bending stresses in addition to shear and pullout strength considerations.

The new stucco system was designed to be thicker than the existing EIFS panels in order to achieve redundant water resistance. Sheet metal flashings were designed to minimize visual differences. The increased thickness of the stucco cladding system affected the interaction with adjacent materials, as well. A proprietary coping cap system was specified for installation over the new wall assembly. Flashing details were developed for wall penetrations such as overflow scuppers, light fixtures, and security cameras that needed to be reconfigured to accommodate the added thickness. Signage support anchors and electrical connection conduits needed to be replaced with

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Figure 17 – East elevation during construction.

Figure 18 – Completed east elevation.



longer anchors and conduits to span across the thicker stucco system. Location of the anchors needed to be closely coordinated by the various trades prior to installation of the stucco system components so they could be properly flashed with the fluid-applied WRB (Figures 13 and 14).

Strip window repairs included repairing internal seals and thermal breaks and adding splice cover plates at head receptor joints (Figures 15 and 16). Repairs to the internal seals and thermal breaks required temporary removal and reinstallation of glass panels at frame splice locations where leaks had been reported. The strip window repairs were uniquely designed to be performed independently. This gave the contractor flexibility to complete the strip window repairs before, during, or after installation of the stucco system. Frame splices were only repaired at known leak loca-

tions during this project. As such, the unique design will allow for future strip window repairs at other locations, if necessary, without affecting the stucco cladding system.

The first phase, which included the east elevation only (approximately 10% of the total façade area), was treated as a mock-up phase where the contractor worked through a learning curve in order to establish the most efficient sequencing (Figures 17 and 18). The first phase was completed in three months. The remainder of the building was completed over a five-month period the following year. Mast climbers were used for the

majority of the work. Although cumbersome to set up, the general contractor ultimately determined that the mast climbers provided the most effective way to balance the various trades and sequencing of work. Pipe scaffolding was necessary at some locations where mechanical equipment prevented mast climber installation. Swing stages were used to access two small areas at the top of a glass atrium. Man lifts were used for some of the strip window repairs and to finish stucco panels where mast climbers were attached to the structure of the building. Strip window repairs were performed during off hours to minimize the impact on building occupants.

The building remained open during construction. As an office building with significant pedestrian traffic throughout the day, overhead canopies were necessary to protect building entrances and walkways. Due to the size of the building, the staging area was shifted several times over the course of the project to improve efficiency. In each case, the staging areas were fenced off to prevent pedestrian or vehicular access.



Figure 19 – Metal lath installation several days after sheathing and insulation.

During construction, EIFS panels were removed and new sheathing was fastened directly to the existing steel studs the same day. Metal lath, which also needed to be fastened directly to the steel studs, was typically installed several days after the sheathing fasteners had been covered by the subsequent layers of the stucco wall system (Figure 19). As such, the detailed fastener patterns previously discussed were critical to ensure adequate resistance to wind loads and to ensure proper staggering for the “blind” installation of the metal lath fasteners.

The fourth floor of the building was not occupied and was unfinished during the construction phase of the façade rehabilitation project. As such, fastener penetration into the studs could be verified from the interior on the fourth floor as a measure of quality control. Metal lath fasteners were also randomly tested for pullout resistance using a calibrated pull tester throughout the project to verify their attachment to the steel studs (Figure 20). Fasteners had engaged the steel studs at 100% of the tested locations.

As removal of the existing EIFS panels progressed, some of the light-gauge steel-framing members were found to be severely corroded and needed to be reinforced (Figure 21). A detail was devel-

oped that allowed for a quick installation of reinforcement at corroded framing members to ensure openings could be closed the same day and still provide a sufficient substrate to which to fasten the stucco system components.

The underlying conditions along a building expansion joint were different than anticipated. Alternate sheet metal closure plate details were developed to properly

terminate the stucco wall system adjacent to the expansion joints without restraining movement.

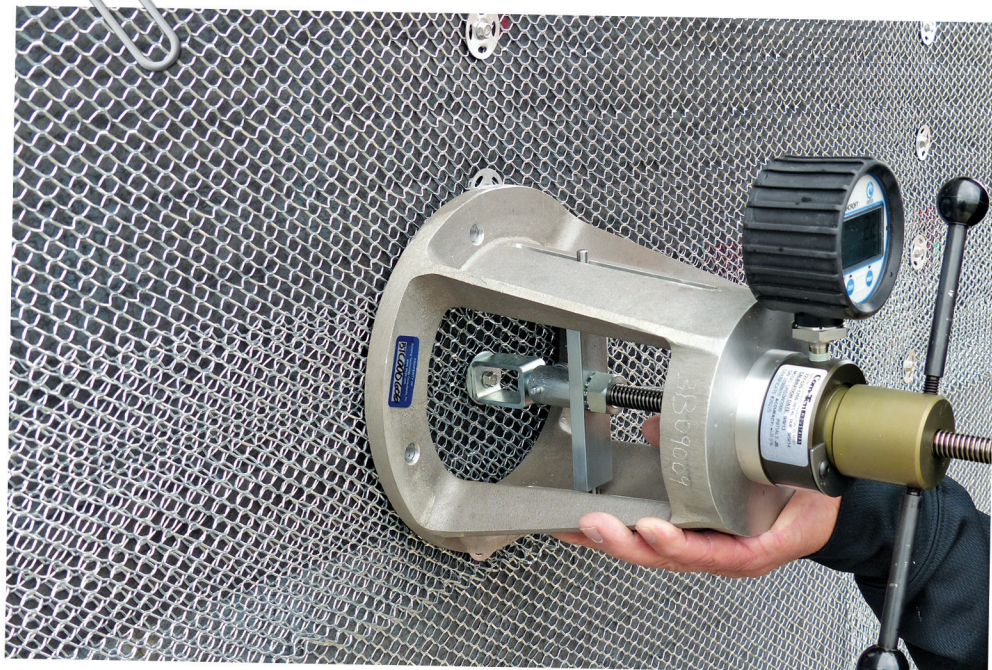


Figure 20 – Fasteners tested for pullout resistance.



Figure 21 – Corroded light-gauge steel-framing members.



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SUMMARY

Challenges in designing a cladding system that would replicate the original appearance include continuous insulation, and incorporate redundant resistance to water penetration made this a unique rehabilitation project. Once construction began, the general contractor was tasked with balancing numerous trades to install integrated parts of the stucco system, while maintaining an aggressive construction schedule. The project was a success in that all the objectives were met. The project finished on time and under budget, the owner was pleased with the appearance, and, most importantly, no leaks have been reported since the work has been completed. 

FOOTNOTES

1. A barrier wall system is defined as any exterior wall system or assembly that relies principally upon the watertight integrity of the outermost exterior wall surfaces and construction joints to resist bulk rainwater penetration and/or moisture ingress.
2. The EIFS finish coat extended into joints between panels, which meant sealant at those joints was only

adhered to the finish coat. The bond between the finish coat and base coat is not strong enough to accommodate tensile stresses from thermal contraction of the EIFS panels. As such, joint sealants were effectively pulling the finish coat off the base

3. This included calibrated spray nozzle testing in general accordance with AAMA 501.2 and calibrated spray rack testing in general accordance with ASTM E1105.



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Josh Summers

Josh Summers is a principal structural engineer at Building Technology Consultants, Inc., a forensic engineering firm in Arlington Heights, Illinois. He is a Registered Exterior Wall Consultant, a licensed structural engineer, and a licensed professional engineer. During his 23-year career, he has managed over 450 structural repair and façade rehabilitation projects. His experience includes investigation of building façades and water leakage issues, structural analysis and design, condition assessments, nondestructive testing, and failure investigation.

OSHA RULE WOULD CURB POST-ACCIDENT DRUG TESTING

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A new Occupational Safety Health Administration (OSHA) rule that went into effect on December 1 does not allow employers to “deter proper reporting” or retaliate against employees for reporting workplace injuries or illnesses. This means that if a company has a policy in place that automatically mandates drug testing after every accident or injury, it will now be in violation of the law.

In Texas, several employers have filed suit against the agency to reverse the regulation, claiming that the new rules are unlawful because they would prohibit or limit the use of incident-based employer safety incentive programs and mandatory post-accident drug testing programs currently in place. The plaintiffs say these programs exist to help employers promote workplace safety. The action initially delayed the effective date of the provision’s implementation.

OSHA’s final rule states that employers’ procedures for reporting work-related injuries and illnesses must be “reasonable.” Drug testing itself is not banned. “You may still use your discretion and drug test an employee after an incident. But if you do, you must have a very good reason to believe that ‘employee drug use is likely to have contributed to the incident, and for which the drug test can accurately identify impairment caused by drug use,’” according to an article by Optimum Safety Management.

— OSHA.gov and oshasafetymanagement.com