NYC Buildings

CONSTRUCTION ADVISORY:

COMMON EXTERIOR INSULATION & FINISH SYSTEMS ISSUES

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EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS): CLADDING SYSTEMS THAT COMBINE IN ONE PRODUCT RIGID INSULATION BOARD WITH A WEATHER-RESISTANT EXTERIOR FINISH; THE TERM APPLIES TO A VARIETY OF PROPRIETARY SYSTEMS

BACKGROUND

Developed in post-war West Germany to quickly rebuild war-devastated areas, EIFS was introduced in the United States in 1969 by Dryvit. Thanks to its insulating properties, versatility, and low cost, EIFS surged in popularity for both new construction and retrofits during the energy crisis of the 1970s and remains one of the most popular cladding materials today. In retrofits, EIFS is often installed over the existing exterior envelope to improve the energy performance of the building.

EIFS TYPES & ATTACHMENT SYSTEMS

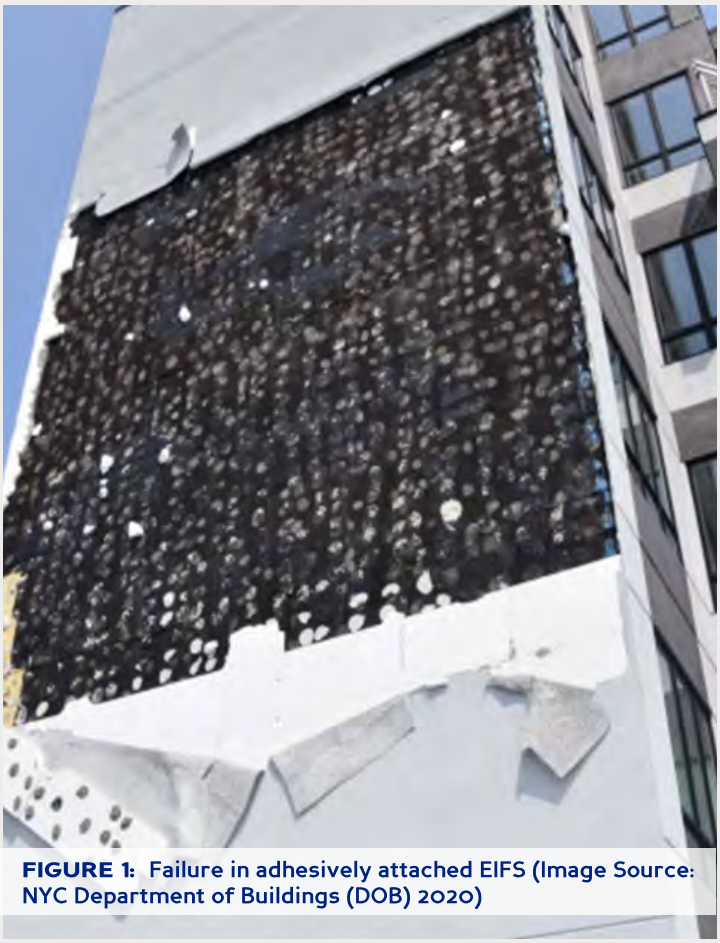

FIGURE 1: Failure in adhesively attached EIFS (Image Source: NYC Department of Buildings (DOB) 2020)

The first system to be introduced, **barrier** or **traditional EIFS** relies on a theoretically impermeable, face-sealed exterior to prevent water and moisture from entering the wall. Unfortunately, there is no such thing as a perfect barrier wall. Water inevitably enters the system through defective or deteriorated sealant joints, cracks, and other defects in the protective finish coat, around fasteners, around windows and doors, etc. Once water enters the wall assembly, it is unable to exit through draining or evaporation, instead becoming trapped within and causing the growth of mold and mildew inside the wall, leaks, deterioration of the EIFS panel components and the substrate, corrosion of mechanical fasteners or degradation of adhesives, and, if left uncorrected, structural defects leading to panel failure **(Figure 1)**. For these reasons, many building industry experts believe barrier EIFS is an inherently problematic system. In fact, most EIFS-related incidents and complaints reported to the DOB involve barrier wall systems.

EIFS with drainage was introduced in the mid-1990s as an attempt to resolve the problems caused by water intrusion seen in traditional EIFS. In this system, a secondary water-resistive barrier is incorporated between the substrate and the EIFS panels to create a drainage plane. When this system is designed and installed correctly, moisture entering the wall assembly will travel down the drainage plane and exit through weeps and flashing. Unfortunately, we sometimes see would-be drained EIFS installed without flashing.

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EIFS panels may be **mechanically** or **adhesively** attached to a substrate. The selection of attachment method should take into consideration the surface material the EIFS is being attached to. Bare substrates such as raw concrete, concrete block, or masonry are better suited, depending on their condition, for adhesive bonding. Certain surfaces that are not compatible with adhesives--such those covered with paint, waterproofing, liquid applied membrane, etc—are better suited for mechanical attachment to EIFS.

Unless properly designed for wind load, mechanically attached EIFS may fail in shear around the fastener heads, should point loads exceed the capacity of each fastener. Many catastrophic EIFS failures were caused by the incorrect type or spacing of fasteners **(Case Study 1)**. The penetrations at the metal fasteners provide a pathway for water to enter the wall assembly. To make matters worse, the metal fasteners themselves are subject to corrosion.

In adhesively attached EIFS, the compatibility of the substrate's surface with the adhesive is critical. The adhesive must be specifically formulated for that substrate and installation must follow manufacturer's instructions, including those for the preparation of the substrate, the correct temperature at the time of application, sufficient curing time, etc. **(Figure 2)** When adhesively bonded EIFS fails, the adhesive is often found to remain attached to the EIFS, suggesting issues with substrate type or preparation are at least partially to blame. **(Figure 3)**

FIGURE 2: Barrier EIFS ready to be installed directly over a CMU substrate (Source: QEWI photo 2021. DOB archives)

FIGURE 3: Traditional/barrier EIFS was adhesively attached to CMU substrate (Source: QEWI photo 2021. DOB archives)

CASE STUDY 1

FIGURE 7: EIFS failure in mechanically attached EIFS (Source: DOB, 2020)

During a high wind event on August 2020, an 1,800 sf section of EIFS collapsed from a side façade of a 13-story apartment building. **(Figure 7)**

Inspectors from DOB's Façades Unit and Emergency Response Team responded on site by closing the street, issuing a vacate order for a parking lot directly below the façade **(Figure 8)**, a violation to provide public protection, an emergency work order to make the façade safe, including a violation requiring

CASE STUDY 1

FIGURE 8: Debris in parking lot, sidewalk, and street (Source: QEWI photo dated 2020. DOB archives)

FIGURE 9: Emergency stabilization with post-installed anchors (Source: QEWI photo dated 2020. DOB archives)

FIGURE 10: Close-up view of failed fasteners (Source: QEWI photo dated 2020. DOB archives)

the building owner to hire a registered design professional to complete a 100% hands-on inspection of the EIFS with an engineering report to be submitted to DOB's Façades Unit for review.

A sidewalk shed was installed immediately, and the emergency stabilization was completed within 4 days of the incident, allowing DOB to lift the vacate order on the parking lot and for the street to re-open. Emergency stabilization consisted of removing all loose materials and debris and securing the remaining EIFS with post-installed anchors **(Figure 9)**.

It was concluded that an insufficient number of fasteners had been provided. Additionally, water seepage through the elastomeric coating had caused significant deterioration in the gypsum boards and corrosion to the metal components **(Figures 10 & 11)**. Together these defects caused the EIFS panels to loosen when subjected to wind forces well below Code-prescribed design loads. The absence of vertical and horizontal control breaks allowed the initially localized failure at the building corner to propagate over a very large surface area. Research into the repair and maintenance history of the building revealed the EIFS panels had been installed on the original masonry wall 20

CASE STUDY 1

FIGURE 11: Corrosion of metal substructure (Source: QEWI photo dated 2020. DOB archives)

years prior, possibly to remedy water penetration through the masonry.

The completed repair, as documented in the amended report, consisted of the removal of all EIFS cladding from the east façade, and restoration of the original brick masonry, window lintel/sill replacement, and recaulking of the window perimeters.

CASE STUDY 2

A notification of unsafe conditions (FISP3) had been filed with the DOB in February of 2019 for cracked and loose EIFS and loose appurtenances on all four elevations of an 8-story residential building. This was followed by an incident in May 2020 when a panel fell off the South facade, and yet a second incident in August 2020 during tropical storm Isaias, when two additional panels came off also from the building's South façade **(Figures 12 and 13)**. In addition to an OATH violation for failure to maintain the facades and protect the public from hazardous conditions, the DOB issued a violation requiring a 100% hands-on inspection and accompanying engineering report to investigate the cause of the incident and identify any similarly hazardous panels.

FIGURE 12: Failure of adhesively attached EIFS (Source: QEWI photo dated 2020. DOB archives)

FIGURE 13: Adhesive haphazardly applied (Source: QEWI photo dated 2020. DOB archives)

CASE STUDY 2

FIGURE 14: Reinforcement of the existing EIFS panels using brushed aluminum channels (Source: QEWI photo dated 2020. DOB archives)

It was revealed the EIFS installation did not follow any known manufacturer instructions: irregularly distributed dollops of adhesive had been applied to the back of the EIFS panels which were directly adhered onto liquid-applied vapor barrier - an incompatible surface for the adhesive. Lack of flashing at the window heads allowed water to penetrate the wall construction, causing deterioration of the EIFS components and adhesive, possibly contributing to the failure of the panels. Pull tests were performed to identify panels unable to withstand Code mandated wind loads.

Corrective repairs consisted of reinforcing the existing EIFS panels through a grid of aluminum channels installed around the perimeter of the building, these were fastened to the concrete masonry substrate with stainless steel bolts **(Figures 14)**.

CASE STUDY 3

FIGURE 15: QEWI photo 2020. DOB archives)

During a high wind event in August 2020, a 25'x25' area of EIFS cladding blew off the South façade of a recently constructed mixed-use building in Queens, falling on the roof of an adjacent building and on the sidewalk. In accordance with standard protocol for such incidents, the DOB ordered an engineering report of the 100% hands-on inspection of all the EIFS on the building.

A sidewalk shed was provided on the street to protect the public from any additional loose EIFS. All the remaining EIFS removed from the South façade. The primary cause of failure had been either incompatibility between the adhesive used and the coating on the CMU, or the adhesive had been applied to wet surfaces. He recommended that the EIFS on the entirety of the south elevation be replaced with a mechanically fastened system and that mechanical anchors be added to the EIFS cladding on the North façade.

Unfortunately, preventive action was not taken quickly enough: in March 2021 a 16'x16' section of EIFS cladding fell off the North façade onto the roof of the adjoining building **(Figure 15)**. Vacate orders were needed for the entire rear yard as well as the roof of the neighboring building. Ultimately, both the South and North facades were entirely stripped of their original adhesively attached EIFS panels and re-clad in new mechanically attached EIFS.

SUMMARY AND LESSONS LEARNED

Since water damage is correlated with many defects seen in EIFS buildings, the façade inspector should thoroughly check the water tightness of EIFS façades. Defects causing water intrusion should be corrected as soon as possible.

The safety and durability of all types of EIFS depend highly on proper design, installation, and maintenance. A complete EIFS inspection should include verifying the EIFS was installed in compliance with applicable Codes and in accordance with the manufacturer's recommendations, as well as a review of the maintenance and repair history of the façade. Verifying the EIFS installation is capable of resisting Code-prescribed lateral loads is an essential part of the qualified exterior wall inspector's due diligence.

Because EIFS defects are often systemic, an incident where an EIFS panel becomes dislodged may require full hands-on inspection and investigation of the entire EIFS cladding to determine the root cause of the failure and to identify and correct any remaining potential hazards.

REMINDER. . .

The descriptions provided are of common EIFS issues and not all issues associated with EIFS. Each registered design professional must do their own due diligence.

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