Feature

Reviving a Historic Landmark: Restoration and Monitoring of "Detroit's Largest Art Object," the Iconic Fisher Building

By Ziad Salameh, PhD, PE

This paper was presented at the 2023 IIBEC Building Enclosure Symposium.

THE FISHER BUILDING, an iconic example of Art Deco architecture, stands as a National Historic Landmark and a symbol of Detroit's rich architectural heritage from the golden age of the automobile. Although it is often called Detroit's "largest art object," neglect and deferred repairs have taken a toll on its magnificent facade in recent years. In response, a new owner group has stepped forward, dedicated to the restoration of this architectural landmark. This article presents a summary of the findings and recommendations derived from a comprehensive facade assessment program performed by my firm, ZS, highlighting the utilization of LiDAR (light detection and ranging) technology in conjunction with high-resolution photography to monitor facade movement.

Figure 1. *The Fisher Building in Detroit, Michigan.*

OVERVIEW OF THE FISHER BUILDING COMPLEX

The Fisher Building complex encompasses a 30-story tower, two 11-story wing structures, the Fisher Theatre, and an attached parking structure (**Fig. 1**). The complex, as a whole, encompasses an entire city block along Grand Avenue in the city's New Center district.

Each component within the complex possesses distinct structural framing and exterior wall construction. The tower and wings feature steel-framed and transition masonry walls. Steel-framed/transition masonry walls consist of structural steel-framed columns and spandrel beams that are fully encased with masonry construction or poured concrete. The inner wythes (backup) of the walls typically consist of brick masonry or extruded clay tile blocks that infill the plane of the main building structural system. The inner wythes are header bonded to each other (via bonded masonry construction). The exterior wythe of the walls is supported by rolled steel shapes attached with lateral tie anchors into the inner wythes' construction.

The parking garage and theater are composed of transition mass masonry walls. The parking garage exterior wall cladding varies along the elevations and consist mainly of either granite, ashlar-stone decorative cut units, or clay brick. The granite cladding is present at partial height of the first floor on the north elevation of the garage. The remaining garage elevations are clad with limestone, which turns the corner for a partial bay width on the west elevation. The remaining portion of the garage west elevation is primarily a solid brick wall. The Fisher Theatre's walls consist of granite-face brick for a partial height of the first floor of the west wall. The remainder of the west facade as well as the south and east facades are stone ashlar units with glazed brick features. The north facade is brick with the limestone from the west facade turning the corner for a small width.

EXTERIOR WALL COMPOSITION AND CLADDING MATERIALS

At the tower and wings, the walls' cladding (the exterior wythe) type varies along the elevations and consists mainly of either marble, granite, or decorative cut units made of ashlar stone. The granite cladding is mainly present on the first three floors. The remaining floors above are either clad with marble or limestone. All the walls are articulated with numerous changes in plane with the main feature being alternating mullions and piers of various depth, width, and articulation. Other main features include bronze statues, dentils, carved ornaments, various types of granite and marble insets, stone soffits, carved brackets, carved figures, and metal spandrels.

The size and thickness of the ashlar decorative cladding units varies significantly and include units that are as large as 5 ft x 5 ft x 24 in. (1.5 m x 1.5 m x 0.6m) thick to units as small as 16 in. x 16 in. x 3 in. (406 mm x 406 mm x 76 mm) thick. The exterior walls' backup construction consists of bonded clay brick/clay tile block construction or concrete-encased framing (**Fig. 2**). The marble, granite, and stone cladding is gravity supported using embedded steel plates and shelf angels that are connected mechanically to the backup wall construction. In addition, the cladding is laterally tied to the backup wall construction using brass Z-shaped dowels at the marble and granite elevations and mild steel anchors/dowels at the stone elevations. Adorned with intricate marble cut details such as mullions, piers, statues, dentils, and carved ornaments, the facade exemplifies the meticulous craftsmanship of its era.

ASSESSMENT PROCESS

To evaluate the condition of the exterior walls, a combination of three-dimensional (3-D) laser scanning, high-resolution photography, and hands-on examinations were employed. A 3-D laser scanning approach was utilized with a high-speed, infrared laser (coupled with high-resolution photography) to quickly obtain millions of 3-D measurements (**Fig. 3**). The scans were then registered, so that each individual scan is aligned within a group of scans to form a "point cloud." For this project, we generated a composite point cloud model that accurately depicted the as-built/as-existing conditions of all elevations. We then utilized the point cloud model to generate as-built elevation plans that depicted and quantified all observed exterior walls' distress conditions. These same elevation plans will then be used in the future to prepare the repair construction documents. Additionally, through the use of the state-of-the-art scanner and supporting software, subsequent laser scan point clouds can be generated and utilized to perform facade monitoring via future plane deviation analysis for each exterior wall elevation. This analysis technique can detect out-of-plane movement as small as 1 in. (25 mm) and will enable remote monitoring and movement/displacement detection at areas of localized distress. The results of this analysis will then enable the owner to strategically prioritize and phase locations that require repairs.

We also performed a hands-on/close-up examination and condition documentation of a 60 ft (18 m) wide by full building height area that is clad with marble and granite at the lower

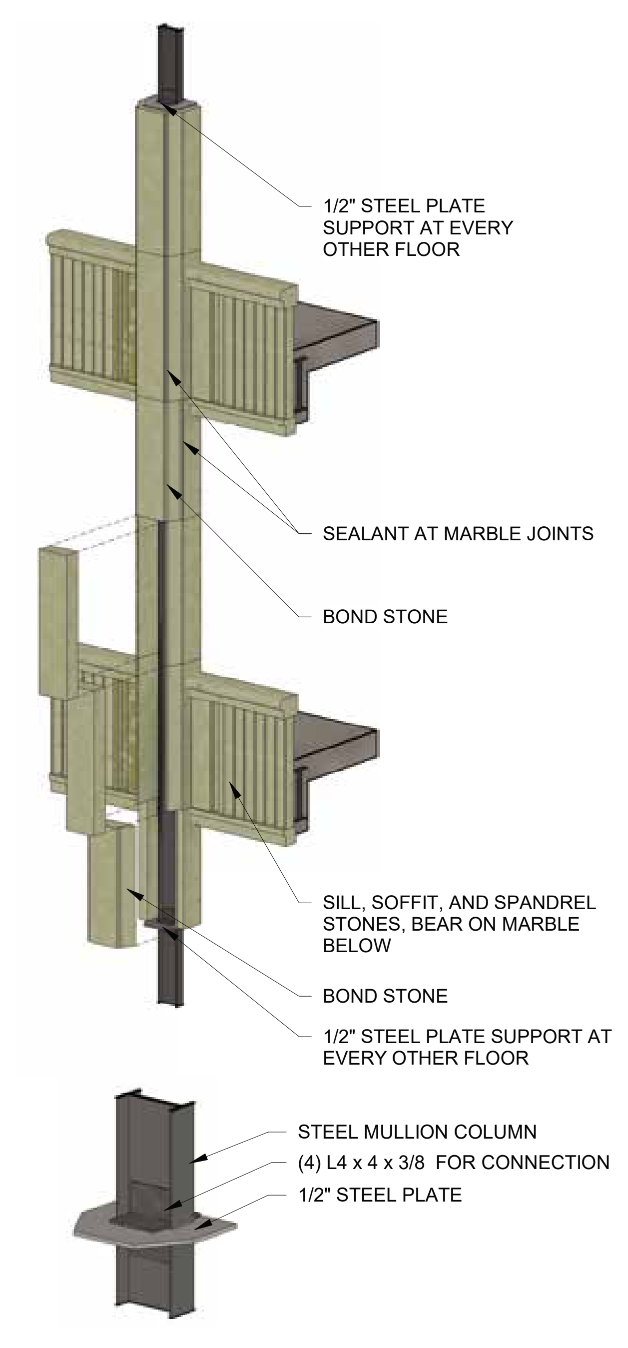


Figure 2. *Composition of exterior walls at the Fisher Building.*

Figure 3. *Laser Scanning utilized during assessment.*

floors and located at the north end of the east wing. A swing stage was utilized for access at this location. The hands-on examination included sounding (using a hammer) testing to determine loose/delaminated material, sample measurements of level/plumb, and inspection of joints and connections at each level at different areas of the building elevation. A rappelling subcontractor was utilized for performing a hands-on/close-up examination and condition documentation of two 15 ft (4.6 m) wide by full building height areas that are clad with marble and located at the southeast corner of the tower. Originally, the rappelling access was planned at six additional tower locations; however, the activities of a pair of peregrine falcons that have a nest with fledglings—located behind a bronze sculpture at the fifth level above the south elevation main entrance door—endangered the rappelling personnel and resulted in ending the hands-on examination of the tower structure. It is important to note that the presence of the falcons and their endangered status must be considered in planning and scheduling all exterior wall restoration efforts. We also performed three invasive wall examination openings to examine and document the condition of the exterior wall backup construction.

ASSESSMENT FINDINGS

The comprehensive assessment uncovered various types of distress and classifications for each cladding material. These distresses included damaged/spalled units, failed repaired units, unsafe/ready-to-fall units, displaced units, cracked units, deteriorated coping units, failed mortar joints, failed sealant joints, unsafe cladding and supports at bronze sculptures, and deteriorated brick-clad areas (**Fig. 4**). The extent and severity of these issues were meticulously documented on as-built facade elevations, created from laser scans and converted into digital twins using Scan-to-BIM (building information modeling) technology.

The distresses observed and documented included, but were not limited to, the following:

- Previously replaced marble ashlar units with matching marble units.
- Temporary stabilized/anchored marble and limestone units. Five temporary repair details were observed as follows:
  - A strapping technique using steel wires, wood blocking, turn buckles, and round-eye anchor rods.
  - Steel anchor rods that are drilled into the face of a displaced unit and grouted in place.
  - Bent steel plates or shelf angles placed at the sides of a displaced unit and anchored with bolts to adjacent units.
  - Plywood sheets anchored into the wall backup construction at the north elevation at a location where two stone units have been removed.
  - Netting anchored into adjacent units.

The previous repair records did not reveal when these measures were installed; however, most of the measures appear to be more than 10 years old. Additionally, there are no engineering design or detailing records available to review the load capacity or predict the useful life of the installed temporary repairs.

- Damaged/spalled marble/limestone/granite units.
- Previously repaired damaged/spalled marble/limestone/granite units.
- Unsafe/ready-to-fall damaged/spalled marble/limestone/granite/brick units. The observed unsafe damaged/spalled units and areas are occurring at locations that are in direct contact with (or near) embedded steel elements which indicate that the damage was primarily caused by corrosion of embedded steel. To protect the public, building users, and pedestrian traffic from the falling hazard of these units and

Figure 4. *Examples of cladding distress observed.*

areas, the owner has erected a pedestrian protection canopy along the building's street- facing elevations.

- Displaced/out-of-plane movement at marble/limestone/granite/brick units. The majority of the displaced units are located near embedded steel units and exhibited signs of active movement (that is, split open vertical sealant joints, visible out-of-plane movement, and plane deviation).
- Low-severity cracked marble and limestone units.
- Unsafe/ready-to-fall cracked marble and limestone units.
- Deteriorated/damaged/displaced marble/limestone coping units.
- Deteriorated/failed mortar joints repaired with multiple layers of sealant/caulk products.
- Unsafe/damaged cladding and supports at bronze sculptures.
- Unsafe deteriorated brick-cladded areas.

CAUSES OF DAMAGE AND INSTABILITY

The observed damage and instability of the facade cladding primarily resulted from the corrosion of embedded steel elements, such as shelf angles and tie anchors. Furthermore, previous improper repair campaigns, including inadequate patching, incorrect removal of spalls, anchoring unstable damaged cladding with mild steel supports, and the improper application of sealant to repair cracks or mortar joints, contributed significantly to the ongoing deterioration.

RECOMMENDATIONS FOR RESTORATION

The assessment report proposed a comprehensive make-safe campaign, involving a yearly 100% hands-on inspection to remove or stabilize damaged cladding areas. This included hammer sounding and removal of all ready-to-fall masonry pieces and spalls, installation of engineered netting systems at displaced and cracked units, and installation of engineered shoring systems at projecting elements. In addition to the locations identified by examination of the laser scan point cloud, engineers marked the locations of all new make-safe measures on building elevation sheets in real time during hands-on inspections. These elevation sheets created from the point cloud served as a record of work for construction crews with easily verifiable locations and extents. Final certification inspection was performed using these sheets for comparison.

Additionally, we recommended semiannual laser scanning of the cladding to detect out-of-plane movement using point cloud–to–point cloud analysis (**Fig. 5**). The initial laser scans have been archived as a baseline model to serve as a point of comparison. Through the use of state-of-the-art scanner and supporting software, subsequent laser scan point clouds can be generated and utilized to perform cloud-to-cloud deviation analysis for each

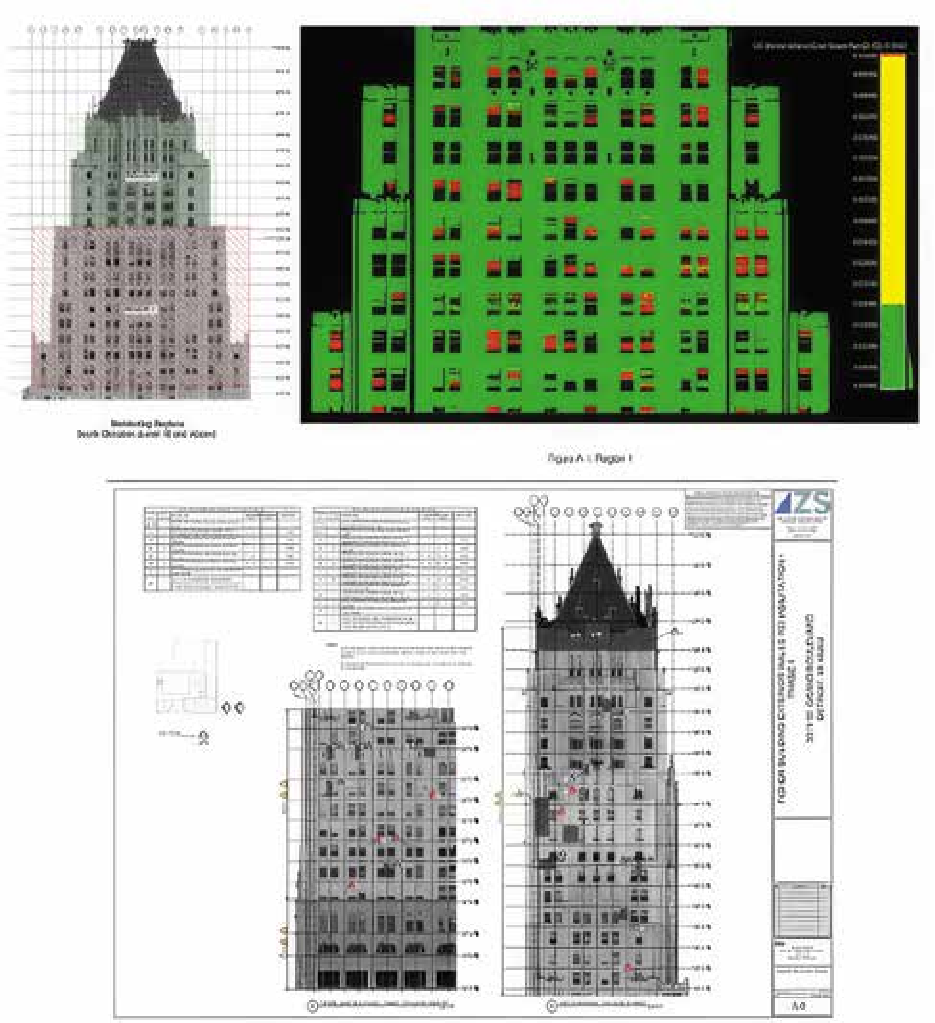


Figure 5. *Laser scanning monitoring plots.*

exterior wall elevation. This analysis technique uses software that automatically colors the new point cloud data using the least squares method based on the distance from the prior cloud data. Subsequent scans will reveal significant local movement in the building street facades. Any new critical repairs can thus be identified and performed in a timely manner. The recommended repair schedule and exterior wall classification can also be continually evaluated and adjusted during the planning phase for long- term repairs.

A phased restoration effort was suggested to address the distresses and ensure the long-term preservation of the Fisher Building's exterior walls. The integration of advanced scanning technology with hands-on examinations provided invaluable data for the formulation of long-term restoration plans. The primary repair construction elements recommended for permanent repairs include the following:

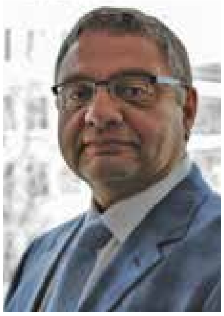
1. At select damaged/spalled/cracked/displaced cladding locations along all elevations of the building, and as directed by engineer, perform the following:
    a. Carefully remove and salvage the cladding units/areas as necessary to expose the embedded supporting steel elements (plates and shelf angles).
    b. Replace unsalvageable embedded support elements with corrosion-resistant steel elements and install waterproofing/through-wall flashing where required and as directed by engineer.
    c. Clean, repair, prepare, and paint all salvageable steel elements and install waterproofing/through-wall flashing where required and as directed by engineer.
    d. Reinstall salvaged cladding units with corrosion-resistant lateral ties/anchors.
    e. Replace unsalvageable cladding units with matching units.
2. Remove sealant installed at all marble and granite mortar joints. Grind and tuckpoint the joints with new mortar.
3. Grind and tuckpoint deteriorated mortar joints at select areas at all elevations as directed by engineer.
4. Remove, salvage, and reinstall select coping units at all elevations. Reinstall the coping units with new engineered stainless steel anchors and copper flashings.
5. Rebuild localized areas of brick wall construction with new brick units (matching in color and size) and stainless steel lateral ties and as directed by engineer. Where exposed, replace embedded support steel shelf angles with corrosion-resistant steel elements and install waterproofing/through-wall flashing where required and as directed by engineer.

Completing this phase of repairs should give the building's exterior walls up to 50 years of additional life, excluding the windows, and assuming proper maintenance.

CONCLUSION

By adhering to the recommendations put forth by the comprehensive facade assessment program, the new owner group can embark on a journey to restore the Fisher Building to its former grandeur. With a meticulous approach to addressing the identified issues and implementing appropriate rehabilitation measures, this architectural masterpiece can continue to serve as a cherished symbol of Detroit's splendor and a tangible vision of the Motor City's storied history.

ABOUT THE AUTHOR



ZIAD SALAMEH, PHD, PE

Ziad Salameh, *PhD, PE, is owner and principal-in-charge of ZS LLC Architectural Engineers.*

Please address reader comments to chamaker@iibec.org, including "Letter to Editor" in the subject line, or IIBEC, *IIBEC Interface*,
434 Fayetteville St., Suite 2400,
Raleigh, NC 27601.