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Restoring Mies van der Rohe's 860-880 Lake Shore Drive: When Less is Not Enough

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Rico Cedro, is Associate Principle and Director of Sustainable Design at Krueck & Sexton Architects, a Chicago-based design firm. The focus of Rico's expertise is the design and integration of sustainable architecture, interiors and urban planning with innovative corporate, academic and civic projects. In addition to the restoration of modern classics such as S.R. Crown Hall, University of Chicago's School of Social Services Administration and 860-880 Lake Shore Drive, Rico is leading the sustainable design initiatives for a new town for 20,000 people in Chennai, India. Taking a decisively ecological approach to infrastructure, urban design and architecture, the project merges deeply rooted traditions with contemporary lifestyle aspirations.

"To reconstruct is to collaborate with time gone by, penetrating or modifying its spirit, and carry it towards a longer future."

Memoirs of Hadrian, Marguerite Yourcenar

Mies van der Rohe's 860-880 Lake Shore Drive (1948-51) is one the supreme monuments of modern architecture. With this pair of apartment buildings, Mies first realized his vision of the steel and glass high-rise. However, after fifty years of weathering, this City of Chicago Landmark is exhibiting problems requiring investigation and significant repair, including; failure of its coating system and corrosion of exterior steel cladding; deterioration of its travertine plaza and supporting structure; and glass failure in the ground floor curtain wall. Leading an inter-disciplinary team, Krueck & Sexton Architects is undertaking a rigorous and systematic restoration, reconstruction and repair of this historic structure. In addressing these critical needs, an opportunity developed to return this masterpiece more closely to its original design, and correct historically inaccurate repairs. By demonstrating how the architectural legacy of the recent past can successfully be restored, a case is made for extending the life of other buildings of this era.

Mies van der Rohe's 860-880 Lake Shore Drive (1948-51) is one the supreme monuments of modern architecture. With this pair of apartment buildings, Mies first realized his vision of the steel and glass high-rise conceptualized in his unbuilt skyscraper projects of the 1920s. In Chicago, the birthplace of the tall building—and certainly no stranger to high-rise living—Mies helped create an architectural paradigm that would change the face of cities across Post-war America, and beyond (see Figure 1).

Figure 1. Aerial view of 860-880 Lake Shore Drive, ca. 1953. ©Hedrich Blessing Collection, Chicago History Museum

The vision of an architecture composed only of a skin of glass wrapping a skeleton of steel inspired pioneering modern architects, such as Mies van der Rohe, during the early decades of the twentieth century. Among the most compelling skyscraper images of this era was created by Mies in 1921 for a Berlin office building competition. He imagined this un-built structure as a soaring translucent and crystalline form, replacing the traditional

Figure 2. Friedrichstrasse Skyscraper Project, Berlin-Mitte, Germany, Ludwig Mies van der Rohe, 1921. © 2009 Artists Rights Society (ARS), New York / VG Bild-Kunst, Bonn

Figure 3. Prefabricated façade panels lifted and welded into place ca. 1951. © Hedrich Blessing Collection, Chicago History Museum

Figure 4. Mannesmann-Hochhaus, Düsseldorf, Paul Schneider-Esleben, 1954-57. © Raimond Spekking

masonry forms of previous construction (see Figure 2). However, it would take two decades before this or any other glass skyscraper would become a reality—and in the New World not the Old.

By the end of the Second World War, American and European émigré architects like Mies were finally presented with willing clients and the building technologies needed to construct their crystal towers. Pietro Belluschi's Equitable Life Assurance Building (1944-47) in Portland, Oregon was the first to be built, followed quickly by the United Nations Secretariat (1947-50) by Wallace Harrison, with Le Corbusier among other architects. Mies van der Rohe's 860-880 Lake Shore Drive (1948-51) completes this troika of Post-War modern skyscrapers. Using a compositional strategy often repeated, even by Mies himself, the building consisting of two 26-story steel framed structures situated on a travertine plaza, occupying a prominent and exposed site facing Lake Michigan, just north of Chicago's Loop. Cladding the towers in a grid of painted steel plates and I-sections, infilled with aluminum windows, Mies developed an aesthetic that stripped the elements of architecture to beinahe nichts, or 'almost nothing'. Pre-fabrication and rapid assembly was utilized wherever possible to speed its construction, enhancing the modern credentials and aura of the building (see Figure 3).

A Modern Classic

Hailed immediately upon its completion for its refinement of detailing, proportion and minimal, yet sophisticated use of modern materials, 860-880 Lake Shore Drive became one of the most influential buildings of the 1950's and 60's. Emulated widely, particularly by large corporate architecture firms, numerous progeny of this building can be found throughout the United States. And in a curious reversal of influence, the off-spring of 860-880 Lake Shore Drive are also found in the re-built city centers of Europe, and indeed throughout the developed world (see Figure 4). With the proliferation of this aesthetic, the glass-clad, steel framed high-rise became the face of a triumphant modern architecture.

The subsequent work of Mies drew heavily from the design innovations of 860-880 Lake Shore Drive. This culminated in his finest expression of the modern skyscraper, the elegant, bronze-clad Seagram Building (1954-58) in New York City. The importance of 860-880 Lake Shore Drive is recognized not only by numerous citations in architectural texts and frequent visitors, but also its listing on the National Registry of Historic Places in 1980, and designation as a City of Chicago Landmark in 1996. The United States Postal Service included 860-880 Lake Shore Drive in a 2005 special commemorative issue of Masterworks of Modern American Architecture stamps.

While relatively well-cared for over the years by the residential cooperative that owns and occupies the buildings, over 50 years of age and weathering took its toll (see Figure 5). About 2004, several areas of the building began to exhibit problems requiring investigation and significant repair, including failure of its coating system and corrosion of exterior steel cladding, deterioration of the travertine plaza and its supporting structure, and glass failure in the ground floor curtain wall.

Figure 5. Steel corrosion and paint deterioration. © Wiss, Janney, Elstner, Associates

In addressing these critical needs, the cooperative recognized the opportunity to return this masterpiece more closely to its original design, and correct historically inaccurate and technically deficient previous repairs.

Realizing the potential solutions involved more than routine repair, the building's cooperative association retained Krueck & Sexton Architects in 2007 to lead the building's preservation, restoration and repair. Joining Krueck & Sexton were a consulting team including: Harboe Architects, preservation architect; Wiss, Janney, Elstner, Associates, forensics, structural engineering and technical consulting; and Schuler Shook, lighting design.

A property tax freeze granted by the Illinois Historic Preservation Agency assisted the owners in funding the project, with a stipulation of substantial completion by the end of 2008. Throughout the project process, The Secretary of the Interior's Standards for the Treatment of Historic Properties, with review by city and state authorities, guided all preservation, repair and reconstruction decisions

Research and Forensics

The team began with an extensive archival review and forensic investigation—the first in the building's history. These two steps worked closely together, one to document the building at its completion in 1951, and the other to understand its current conditions. Investigation and analysis focused on exterior paint systems; steel cladding; window sealants; the lobby curtain wall; plaza stone; waterproofing, drainage, structural concrete and steel; and interior paint analysis.

Using documents including the original linen working drawings, repair records, photographs, interviews, publications and field observations, the team reconstructed 860-880 Lake Shore Drive as it was designed and built by Mies, as well as subsequent changes to the fabric of the building. One interesting discovery emerged. Despite the building's state of the art mid-20th century building technology, this embodiment of the steel and glass skyscraper rests on a foundation system of driven wooden friction piles—the same technology Venice is built on.

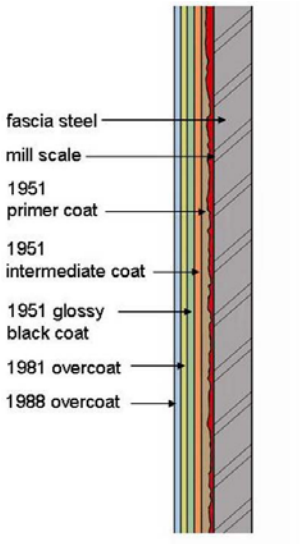

Figure 6. Analysis of existing coatings on tower facades. © Wiss, Janney, Elstner, Associates, Krueck & Sexton

Forensic investigation of the building's painted steel exterior revealed corrosion over at least 10% of its surface. The most recent paint coating was also at the end of its life. While mill scale is present on the original steel surfaces, and is the weakest link in the façade's paint system, adhesion tests indicated that one more overcoat of the existing paint layers was possible (see Figure 6). The original 1951 black paint and primer manufactured by Detroit Graphite were found to contain lead and other heavy metals.

...seismic design

"Some thought we were breaking the rules because we weren't following the language of the code. Others feared, and still do, that those unqualified will attempt this."

Ron Klemencic, Magnusson Klemencic Associates explaining why the seismic design community resisted Performance-Based Design (PSD), which he calls 'real' engineering in U.S. codes. From 'Seismic Engineer Pries Open Floodgates for Performance-Based Design of High-Rises', ENR , January 12th, 2009.

Figure 7. Façade painting mock-up. © Harboe Architects

Figure 8. Weld split at steel faced column due to corrosion. © Krueck & Sexton

Detroit Graphite has a mythical status in Chicago architectural circles. Architects old enough to recall a newly constructed Mies building have an opinion—usually strong—of the exact tone, shade and intensity of the black used by the master. Given the subjective nature of color, especially when remembered after the passage of years, its exact qualities can be very illusive. Sample chips or other historical records that would answer conclusively "how black was this black", could not be located. Specifications from other Mies buildings of the period indicated he used standard colors from the Detroit Graphite company. The 860-880 Lake Shore Drive design team benefited from the recent re-coating of Mies's Federal Center, and its own work on the restoration of S. R. Crown Hall at Illinois Institute of Technology also by Mies, to understanding available paint systems and their design impact.

Facade Restoration

Two options for re-coating the steel cladding were developed: strip to bare metal using a chemical peel, sandblast and repaint with a high-performance three-coat paint system with a semi-gloss urethane finish coat; or overcoat with the existing paint layers with a lower performance, although more forgiving, and flatter acrylic system. The chemical peel proposed for the first option assists with abatement of hazardous materials, without costly enclosures and ventilation equipment.

With each option presenting different cost, schedule, aesthetic, historical and performance implications, the team utilized a full-scale mock-up to evaluate the alternatives (Fig 7). Throughout the project process, mock-ups such as this one proved a crucial—and usually the decisive factor when selecting among alternatives. Mock-ups also demonstrated the team's quality expectations to sub-contractors, and provided an opportunity for experimentation with means and methods.

Balancing longevity and cost with financial and historical stewardship, the flatter sheen acrylic overcoat was selected for the building's steel above the second floor. Corrosion where present was removed using hand and power tool methods, followed by spot priming. Remarkably, less than ten of the numerous welds on the façade's steel plates were split from corrosion and rust jacking (Fig 8). Metal artisans effected repairs to match the building's original high-quality welds, which were ground smooth in typical Miesian fashion. The free-standing columns at the base of the building, like a roof re-shingled one too many times, required a complete strip to the bare metal, although the final coat, rather than the urethane, is acrylic to match the floors above. Manufactured by the Tnemec Company, the paint systems and their black urethane top coat met the project's technical and preservation criteria.

Due to oxidation of the building's aluminum windows—anodized was not typically used in the late 1940's for architectural aluminum—the building's windows were painted light gray soon after completion. Five years of service life remain on their coatings, corresponding fortuitously to the anticipated years of service in the window's sealants. Removing paint and restoring the natural aluminum finish, as well as stripping and re-painting of the windows was investigated and mocked-up. Since these finish options require re-sealing all the building's windows, which are currently functioning well, the team with the client decided to only gently clean these painted surfaces.

More from Less

Classical tendencies are a strong theme throughout Mies's career, especially after his move to the United States in 1937. Travertine, that quintessential Roman material, covers the building's plaza and lobby floors, concealing two levels of underground parking. Chicago, however, is a harsh climate for this elegant stone. Further complicating this situation, the plaza as constructed is essentially flat, with hardly any means of shedding or draining water. The formal desire of Mies for a continuous flat plinth connecting inside and outside took precedence over practical needs. Consequently, over the years water penetrated the stone and attacked the supporting steel and concrete, causing extensive structural damage. Although surely not intended, after 50 years, the plaza took on the weathered qualities of a Roman era structure rather than a modern one (see Figure 9).

Figure 9. Travertine plaza deterioration. © Wiss, Janney, Elstner, Associates

All of the plaza's existing travertine, including poorly matched stone from previous repairs, and its waterproofing membrane was removed. A small amount of original stone was identified and salvaged for re-use—the majority at 860-880 Lake Shore Drive, and the rest for Farnsworth House (1946-51), another masterpiece by Mies undergoing restoration. Critical steel beams suffering section loss were strengthened, and full and partial depth repairs were required over approximately 15% of the reinforced concrete slab. After evaluating alternative drainage strategies, including an open joint pedestal system, the team chose to reconstruct the original mortar set paver system using modern materials and technical improvements.

To gain additional depth to properly slope the travertine for surface drainage, the top of the slab was scarified by 20 mm. With a Mies project—albeit a restoration—fractions of an inch matter, especially when the original system was too thin to begin with. A new sloped polymer concrete bonded overlay, waterproofing membrane, drainage mat and additional concealed drains augment the plaza's single original surface drain. Carbon-fiber reinforcing adhered to the back of the open joint pavers allows these stones to span greater distance within the limited thickness of the plaza.

A discreet system of ridges and valleys are introduced to shed water to the landscape and drains. Special shaped pavers channel water without creating a diagonal line—a form verboten in this most rectilinear of buildings. The result is a minimally intrusive drainage system which functions without compromising the plaza's historic qualities.

Because 860-880 Lake Shore Drive is a residential cooperative building, all the restoration work is occurring while the building is fully occupied. The project's general contractor Bulley & Andrews put into place an intricate site logistics plan to allow residents to access their units 24/7 during all phases of construction. Maintaining access to the garage which lies underneath the building's deteriorated travertine plaza presented unusual difficulties, given the large amount of overhead concrete repair work required. Cars were relocated temporarily to a neighboring parking garage to prevent their damage and to allow greater freedom of movement for construction crews. Work on the garage's concrete entry ramp required phasing facilitated by alternating traffic flow controlled by a temporary traffic signal.

Extensive use of barricades channeled pedestrian pathways into the buildings, providing safe and clear entries.

Communication by the general contractor with residents through Cotter Consulting, the owner's representative, the cooperative board and the building's on-site management team was vital for maintaining orderly and predictable workflow. The project and construction team presented the project during a special resident meeting to allay fears of disruption, manage expectations and explain the rigorous basis of the restoration.

The historical importance of the travertine required a patient search to locate a correct match for the original stone. Because it is a natural material from the earth, no two strata of travertine are exactly alike, especially when the original stratum was depleted over 40 years ago. The team located a source in Tivoli Terme, near Rome, quarried by Mariotti Carlo & Figli. Their material matches closely the characteristic color, texture, pattern and structure of the original travertine. From two promising travertine varieties, Este Lailia was selected (see Figure 10). Because this stone is from a new section of the quarry, third party testing for compressive and flexural strength, density, and absorption was required before fabrication and installation.

Reconsidering a Legacy System

During the early 1980's, the building's original aluminum clad lobby storefront was replaced by a new stainless steel system, ostensibly because the aluminum experienced the same oxidization problems as the upper story windows. The glass was also changed, increasing from the original 6 mm to 10 mm thickness to meet more stringent wind loading code requirements. The original translucent sandblasted panes were replaced by a laminated assembly with a translucent interlayer. These changes imparted to the glass a pronounced and decisively non-historic aquamarine tint.

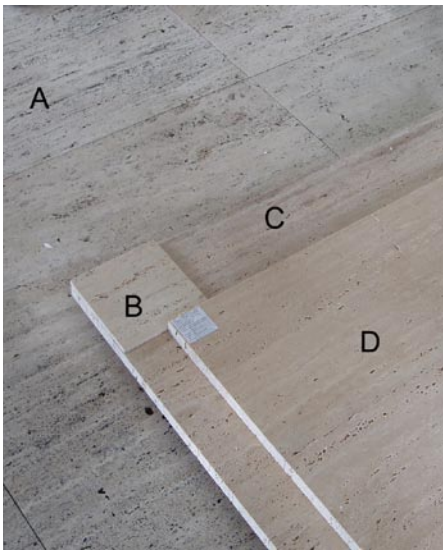

Figure10. Comparing travertine alternatives with existing stone in building lobbies. © Krueck & Sexton

Figure 11. Night view of 880 Lake Shore Drive Lobby ca. 1953. © Hedrich Blessing Collection, Chicago History Museum

Corrosion uplift from the steel beams in the plaza deck began to distort the storefront, causing several glass lites to shatter. While the team initially planned to completely demolish the 1980's stainless steel window replacement system and reconstruct the aluminum-clad lobby storefront, cost considerations precluded this solution. Instead the stainless steel system was accepted as a "legacy" of the building's history and retained for refurbishment and repair. The glass however was replaced by 10 mm thick low-iron lites, eliminating any potential green discoloration. New sandblasted lites with a protective sealer returned the translucent glass to the soft velvety quality of the original.

Early photographs of 860-880 Lake Shore Drive capture the importance of night lighting in creating the building's modern image (Fig 11). Richard Kelly (1910-1977), the lighting designer of 860-880 Lake Shore Drive, pioneered architectural lighting as a distinct profession in the Post-War period. In addition to Mies, he worked with other well-known architects of the times, such as Eero Saarinen and Philip Johnson. Kelly designed the lighting at 860-880 Lake Shore Drive to emphasize the weightlessness of the buildings, and the transparency and luminosity of their glazed lobbies, using means as minimal and precise as the architecture itself. Unfortunately, because of poor lamping choices and aging fixtures, his powerful vision was lost. By replacing the old fixtures with ceramic metal halide, the drama and punch of Kelly's design is restored. These energy-efficient, long-life lamps—again selected after full-scale mock-ups—render the richness of the travertine, and reflect light off the stone to illuminate the exterior plaster ceilings, reconstructing the building's distinctive modern radiance and glow.

Fate of the Recent Past

Buildings of the recent past represent an enormous architectural, cultural and environmental inheritance. The Post-War years of 1945 to 1975 represent over 40 percent of the building stock in the United States. As exemplified by 860-880 Lake Shore Drive, the buildings of this era are aging, and their restoration and repair can appear complex and challenging. This building is in a fortunate position with its status as a world-class landmark, available financial incentives, and informed enthusiastic owners. The continued investment and stewardship of this important example of modern architecture by its residents vividly demonstrates how buildings of this era, regardless of their historical situation, can be restored to many more years of useful life. Other tall and not so tall buildings of the period are not so fortunate and are threatened with demolition or insensitive alterations. With the recognition that reuse of an existing building is one of most effective sustainability strategies available, increasing attention needs to be given to this intrinsic green strategy—a strategy that preserves both historical and environmental capital. ■

...cutting in half

"You cannot believe that in a project that has been touted as so master-planned and so composed, that taking one of the tallest elements that sits on the Strip and cutting it in half is not a significant change."

David Schwarz, the Smith Center designer, disagrees with Peter Cavaluzzi, leading master planner of the overall design vision for City Center, who downplays the effect of cutting Norman Fosters building design in half.

From 'Adaptation or disaster?', Las Vegas Sun, February 20th, 2009.