ARCHITECTURAL RECORD

The Perils of Restoring "Less Is More"

Krueck & Sexton architects faced tremendous challenges in the restoration of Mies Van der Rohe's 1956 masterpiece, S.R. Crown Hall, at the Illinois Institute of Technology

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By Sara Hart

Formal ceremonies celebrating architecture are usually reserved for ground breakings, openings, or reopenings, rarely for closings. But on May 17, 2005, S.R. Crown Hall at the Illinois Institute of Technology (IIT), designed by Ludwig Mies van der Rohe and completed in 1956, was closed for restoration and renovation amid much fanfare. A hundred or so admirers of the school and the architect convened to witness a symbolic demolition—the inverse of a ribbon cutting—to launch the restoration. Mies's grandson, Chicago architect Dirk Lohan, won the opportunity to smash one of the 10-foot-tall windows at an online auction on eBay, sponsored by the **Mies van der Rohe Society**.

In the audience at the ceremony was Mark Sexton, AIA, principal of **Krueck & Sexton Architects**, the local firm charged with this phase of an ongoing restoration of Crown Hall and other Mies structures. Sexton admits that after the sledge hammer shattered the glass and the university president announced that the reopening would take place in 15 weeks, reality set in, and his heart began to race. Although an opportunity of a lifetime for any firm, performing reconstructive surgery on what Time magazine called "one of the world's most inspiring and astonishing structures" is an undertaking fraught with danger, suggesting that a tight schedule might have been the least of Sexton's worries. Crown Hall is the home of IIT's College of Architecture, where Mies was director from 1938 until 1958. Thirty-six years after his death, the faculty still consists of Mies disciples, who, with a student body of 600, consider themselves conservators of masterpiece, which received Chicago landmark status in 1997 and became a National Landmark in 2001.

Ludwig Mies van der Rohe circa 1956 standing in S.R. Crown Hall, the architecture school he designed at the Illinois Institute of Technology. Images: Courtesy Krueck & Sexton, except as noted; Hedrich-Blessing

The weight of "almost nothing"

Unlike earlier Crown Hall renovations in which the travertine and steel of the South Porch were replaced and women's bathrooms were added in the basement, this phase was more complex and intricate. Crown Hall contains the architectural DNA of Mies's entire aesthetic. The beauty exists paradoxically in the metaphorical nothingness of it. The building is a big box, a "one-room school house," as Dean Donna Robertson, AIA, has called it. The 120-foot-by-220-foot floor plate seems to hover 6 feet above grade. Meanwhile, the roof hangs 18 feet above the floor from an

exoskeleton made of four, 6-foot-deep steel girders. From the inside, the resulting clear-span, “universal space” experience is that of being in a structure with no visible means of support. Furthermore, the curtain wall had enormous expanses of glass held in place by the slimmest of stops.

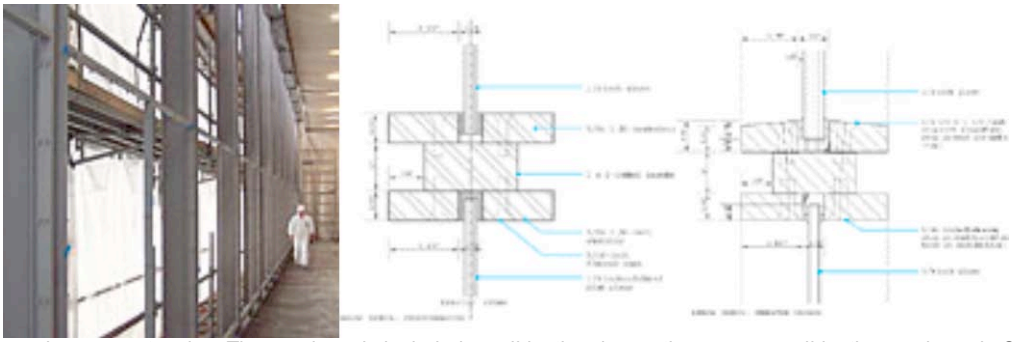
Ronald Krueck, FAIA, and Sexton, both alumni of IIT, were well aware that the starkness of Mies’s work does not equate to simplicity, nor was his bias in favor of off-the-shelf components suggest a generic architectural vocabulary. They were ready to preserve and protect every detail, adjacency, span, and material. Still, it takes a lot of research and study to restore “almost nothing.” The architects were fortunate to have the services of preservation consultant Gunny Harboe, AIA, of Austin AECOM (formerly McClier).

The scope of work was extensive: The sandblast removal of all lead-based paint from interior and exterior steel and repairs to the members that had rusted. The steel hadn’t been repainted in 25 years, so the dense “Miesian black” from photographs had faded to a dull gray. The glass panels did not conform to any code, so they had to be replaced, and the steel stops redesigned. The process also involved refurbishment and reactivation of the blinds, disassembling and retrofitting them with electromagnetic release hardware, and refurbishing the original Ellison stainless-steel doors on the north and south facades. Finally, the $3.6 million renovation included upgrading the bathrooms to meet current ADA accessibility standards.

Steel corrosion was extensive. The repair cycle included sandblasting, inspection, more sandblasting, and repair. Steel conducted moisture along the base causing condensation in the winter. When the paint is damaged by moisture and exposes the steel to the elements, the steel rusts and forms a red dust (1 & 2). Corrosion pits form, which produce just enough pressure in the stop to crack the glass (2 & 3).

Obviously, the restoration didn’t actually take place in 15 weeks, as the closing ceremony pronouncements suggested. Assessment of the existing conditions, study of Mies’s details, and the final design solution evolved over a two-year period. The actual demolition and construction lasted 15 weeks, but when the symbolic shattering took place, every beam, frame, and pane of glass was already fabricated and waiting for assembly nearby. The planning process was methodical, and the execution surgically precise. Much of the credit for this goes to Clune Construction Company, whose scheduling and coordination of the demolition, repair, and reconstruction sequences included a contingency plan for dealing with and solving unforeseen problems while staying on schedule.

The first task was to quickly shroud the entire building in order to contain dust from the lead-based paint that was to be sandblasted off all the steel members. “We divided the building into quadrants,” explained Michael A. Tenuta, senior vice president of Clune Construction. “Sandblasting the steel was followed by an inspection, then more sandblasting, then repairs, then another inspection, then the first of three coats of paint. There was no float time, and there was a constantly roving punch list.”



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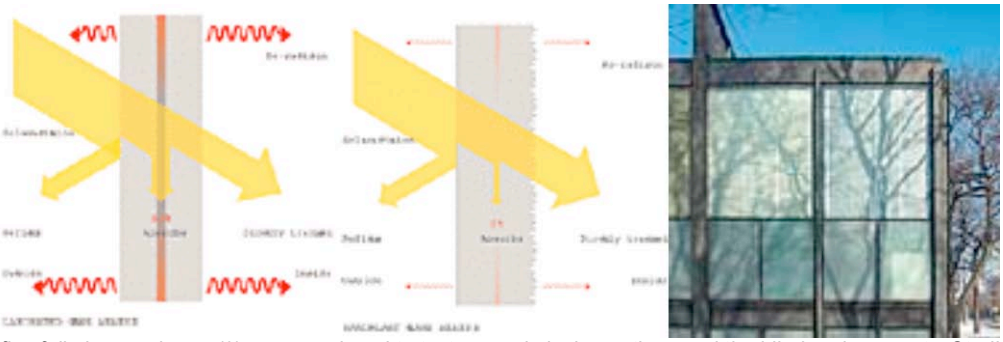
The sound of glass shattering

"Mies's design was experimental," explains Sexton. "At the time, glass technology was in its infancy, and there were few regulations. Mies relied on his intuition regarding size." The facade consists of two types of windows. The original upper panels were enormous and not tempered—9 feet 8 inches by 12 feet 9 inches—and only 1 1⁄4 4 inch thick. With no codes to dictate size and thickness at the time, Mies was free to push the known limits of engineering. His experiment had mixed results. Great expanses of crystal-clear glass poured daylight into the studio and created the "barely there" effect he sought. However, "great expanses of glass have a tendency to break and fall out in strong winds," Sexton adds. (Anecdotal evidence suggests that no one was ever injured, or at least not seriously.)

The contractor shrouded the entire building (1) to keep the dust from the lead-based paint from escaping into the environment. Students work at Mies-designed drafting tables in 1956 (2). Mies's grandson, architect Dirk Lohan (3), ceremoniously launches the restoration by smashing one of the glass panels.

In contrast to the perfectly transparent upper panels, the lower units were sandblasted, which provided some privacy for the students, but mostly it served to hide interior activity from view, and thus retained a pristine Modernist face to the public. However, the glass was sandblasted on the interior face. Sandblasted glass is porous and absorbs oil from fingerprints and the adhesives students used to mount drawings on the windows. Due to decades of unintentional damage, the lower units became stained and scratched. In addition, the building was subjected to ad hoc alterations and mandatory repairs between 1970 and 1977. In 1975, Skidmore, Owings & Merrill (SOM) replaced all the glass, including the thin upper panels, which were replaced with 3 1⁄4 8-inch lites. Then, employing new technology for the lower panels, SOM installed a laminated glass with a mylar interlayer to imitate the translucent qualities of the original sandblasted glass. Although the solution eliminated the staining problem, the result was more reflective than Mies's matte finish, and repairing the repair, as it were, presented a perplexing challenge for Krueck & Sexton.



At least five full-size mock-ups (3) were produced to test several glazing options and the blind replacements. Studies of solar radiation transmission show the difference between laminated glass units (1) and single sandblasted panes (2).

Every solution seemed to create more problems. The first challenge, and the one that generated the most controversy, centered on the upper panels. First of all, the glazed area was too large by code (or common sense) to have the original 11⁄44-inch-thick polished plate glass replaced. To comply with the code, the architects could have simply specified 31⁄48-inch tempered glass. Keeping in mind that Mies's details are deceptively simple, Sexton recognized that tempered glass could be less than perfect. "When glass passes through an oven during the tempering phase, it can develop the slightest surface wave from contact with the rollers," he explains. The waviness can sometimes be noticeable when viewing reflected images from a distance. This would be unacceptable to even the most forgiving critic.

Now, 11⁄42-inch glass doesn't have to be tempered, so Sexton was confident that he could deliver a perfect surface. But, of course, every solution yields a new problem. In this case, the problem was color. Iron in glass gives it a green tint, so the thicker the panes, the greener the tint. Crown Hall was intended to have glass so clear as to seem barely there, which was possible with 11/44-inch panes. The architects eventually found a manufacturer that could make low-iron glass in such large sheets, in order to achieve maximum transparency, high-fidelity light transmission, and the kind of brilliance usually reserved for jewelry cases and museum displays.

The 68 original lites of the upper panels were replaced with PPG Starphire (low iron) glass, and the cycle of problems and solutions continued. Thicker glass is heavier, of course. The new panels weighed 700 pounds, making them way too heavy for the original stops. In other words, the stops had to be enlarged from 51⁄48 inch to 31⁄44 inch in depth. As the wall sections show, this redesign is subtle enough to be called invisible. However, it has a slope. The architects felt, and the mock-ups confirmed, that a deeper reveal would look heavy. Sexton argued that by sloping the stop from 31⁄44 inch at the glass to 51/48 inch at face, it would read the same as the original. The purists rebutted that it would be blasphemous to introduce any amount of slope in a rigidly rectilinear structure. They also argued that Mies used off-the-shelf extrusions, and a sloped stop would have to be custom fabricated, a clear violation of his principles. Sexton, with the support of Dean Robertson and Gunny Harboe, prevailed, because they convinced all the interested parties that, first of all, the slope cannot be seen. And secondly, compromising on the custom-design issue was better than specifying a heavy, and thus inappropriate, stock stop.

Clune enlisted specialty-glazing contractor Harmon to handle the field work and endure the closest scrutiny. According to Harmon, the facade consists of more than 800 steel stops held in place by more than 6,250 screws, and each screw was countersunk to protect the ever-so-slightly beveled profile. Tenuta marvels at the scrutiny. They had to be submitted for approval, were rejected, remade, and resubmitted. Even the depth of the countersink was debated, until a tolerance of a mere 11⁄464 inch was agreed upon.

The 120 lower lites were replaced with a clear tempered glass from Viracon, and the inner face was sandblasted to recreate the exact same effect as the original. The Miesian scholars were in agreement with this solution. However, Sexton knew that unless the sandblasted side was treated, the school would face the same staining and scratching problems it did before. Fortunately, technology eliminated many concerns. Computer-controlled manufacturing allows glass to be both tempered and sandblasted, and as proved here, to be protected by the

application of three layers of ultra-clear epoxy, which has no reflectivity, will not change character, and will never yellow.

S.R. Crown Hall is returned to its original glory. Krueck & Sexton Architects and Clune Construction searched until they found a manufacturer to recreate the "Miesian black" that delineates the structure's exoskeleton in stark contrast to the rest of the campus.

Finally, there was the issue of the paint. The sharp "Mies black" had faded to a dull gray. The original paint could not be used again, because it was lead-based. Product research led the architects to Tnemec, an industrial paint and coatings manufacturer known for products of extreme durability. The three coats that were applied should last about 25 years.

Studying Krueck & Sexton's restoration and renovation of Crown Hall reveals more about Mies's design methodology than a slide-show lecture in architecture school ever could. Its work also makes a convincing argument for balancing preservation of original intent with current needs. The great Modernist buildings of the 20th century were meant to have long, working lives. Modifications to Crown Hall will be necessary again in another 50 years. As evidenced by SOM's restoration of Lever House in New York in 2002 and Polshek and Partners' careful restoration of Louis Kahn's Yale Art Gallery in New Haven, currently under way, intimate intervention of Modernist icons might be the only authentic way to know them.

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