

RESTORING FRANK LLOYD WRIGHT'S SOLOMON R. GUGGENHEIM'S MUSEUM

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The Solomon R. Guggenheim Museum in New York City, dating to 1959, is considered a masterpiece of the American architect Frank Lloyd Wright (Fig. 1). However, when it was first completed, it was not the recognized icon of Modernism that it is today. Instead, because of its prominent location across from Central Park on Fifth Avenue between East 88th and 89th Streets, it was considered an aberration by the Upper East Side's wealthy class. It did not fit in with their taste for classicism, or into Manhattan's relentless street grid.¹ However, over the years, the building was accepted not only as an attraction to the neighborhood, but also as the largest artifact in the museum's collection. It has become the second most visited site in New York City after the Statue of Liberty. It is now celebrated as a National Historic Landmark, and in 1979, it became the youngest building to be designated as an individual landmark by the New York City Landmarks Preservation Commission.

Solomon R. Guggenheim, who began collecting Modern art in 1929, formed the Solomon R. Guggenheim Foundation in 1937. At first, his collection was displayed in rented space, but by 1943, he had hired Frank Lloyd Wright to design the building that would eventually house his collection. The site, composed of several lots, was bought piecemeal over a four-year period.² After numerous redesigns, including early concepts where the building was to be clad with orange, red or white marble,³ the unorthodox design finally received approval from the New York City Department of Buildings and construction began in 1957. At this point, Frank Lloyd Wright was 89 years old.

The original building was composed of a large Rotunda and a smaller appendage known as the Monitor (now referred to as the Thannhauser Gallery). The Rotunda is supported on twelve web walls – concrete walls perpendicular to its circumference spaced every 30 degrees (Fig. 2). These support the partially cantilevered spiraling ramp that leads to the top of the Rotunda. The web walls connect at the roof level forming hairpin beams that support the massive central skylight. Along the perimeter, continuous skylights concealed by lay-lights permit diffuse natural light to illuminate the artwork. The curved walls are constructed of shotcrete (gunite) which was sprayed from the interior onto plywood forms secured every 10 degrees to vertical steel Tees embedded in the walls. The reinforcing of the shotcrete consists of vertical and horizontal steel bars sandwiched between two layers of welded wire mesh.

From his sketches, it appears that Frank Lloyd Wright always envisioned a rectangular addition behind the building along East 89th Street.⁴ By 1968, the first addition was erected. Designed by Wesley Peters, an engineer and architectural apprentice who was also Frank Lloyd Wright's son-in-law, the addition was relatively short and squat and not as tall as Wright's sketch version. In 1975, Donald Freed designed the glazed endosure that became the ground floor museum shop, eliminating the driveway that once connected East 89th Street to Fifth Avenue. Richard Meier converted the original Architectural Archives into the Aye Simon Reading Room in 1978. Finally, in 1992, the current Gwathmey Siegel and Associates-designed limestone-clad addition was completed on the foundations of the former Peters' structure, with proportions more closely resembling Wright's vision. Arguably, the most significant of the alterations to the building in terms of visual impact, it was described by noted architectural critic Paul Goldberger as "a calm

¹ A cartoon from the *New Yorker* during that period depicts a couple driving by the Guggenheim with one asking the other, "Are they allowed to do that on Fifth Avenue?" Anthony Calnek, *The New Yorker Visits the Guggenheim*, (New York: Solomon R. Guggenheim Museum, 2005), 9.

² William Allin Storrer, "The Wonder of It All. The Guggenheim at 50," *Modernism* (Spring 2009): 36-43.

³ Frank G. Matero and Robert Fitzgerald, "The Fallacies of Intent: 'Finishing' Frank Lloyd Wright's Guggenheim Museum," *APT Bulletin* 38, No. 1 (2007): 6.

⁴ Storrer, 38.

background, a kind of curtain, before which Wright's dynamic forms can hold forth."⁵ When completed, Goldberger summed up the addition as follows:

This, then, is the great achievement: the building is now a better museum and a better work of architecture. If the Guggenheim's roles as a museum and as a piece of architecture have always been somewhat at odds, this renovation at least partly resolves them. In the end, Mr. Gwathmey and Mr. Siegel have come to praise Wright, not to bury him, and the honor they bring to this building ennobles us all.⁶

CONSERVATION OF THE MUSEUM⁷

From December 2004 through September 2008, the Solomon R. Guggenheim Museum underwent its first major exterior restoration. Up until that time, only minor repairs had been made to the exterior and the building had been repainted several times, as evidenced by up to eleven layers of paint. A comprehensive documentation and monitoring program consumed the first year and a half of the restoration. Extensive archival research, involving both the museum's archives as well as copies of the Frank Lloyd Wright Foundation's materials available at the Getty Research Institute in Los Angeles, revealed historic construction photographs and volumes of correspondence, as well as original construction drawings, specifications and shop drawings. Existing conditions (crack mapping)⁷ were painstakingly recorded of the exterior surfaces before and after paint removal (Fig. 3).⁸

Over 100 paint samples were removed and analyzed. Simultaneously, samples of shotcrete were analyzed and replicas were used in the laboratory as mock-ups for various manufacturers' systems of flexible patches and coatings that underwent rigorous accelerated weathering in order to assess characteristics and service life of proposed repair materials⁹ Structural monitoring of cracks and environmental monitoring of temperature and relative humidity, both within the shotcrete walls and at the interior of the museum, permitted a better understanding of the building's behavior. Laser scanning of interior and exterior surfaces produced a 3-D model that enabled structural engineers to comprehend the effects of thermal loading on the 5"-thick shotcrete walls.¹⁰ Non-destructive evaluation located embedded steel. Exploratory probes at select locations revealed the existing condition of concealed steel. Exhaustive documentation was concluded prior to finalizing bid documents.

The comprehensive building enhancement program that followed, involved not only the restoration of the exterior, but also mechanical infrastructure upgrades.¹¹ In addition, the sixth floor ramp walls were structurally reinforced with a basket-weave pattern of carbon-fiber-reinforced polymer (CFRP) applied to the interior surface. The performance of the building envelope was enhanced through the installation of an air barrier at the sixth floor ramp walls, insulation at gaps around the perimeter, and the replacement of the single-glazed windows and skylights with thermally broken replicas.

A QUESTION OF COLOR

The original color of the Guggenheim was identified as matching Benjamin Moore HC-35, a buff light yellow or light brown.¹² It was accomplished with an early version of an elastomeric paint

⁵ Paul Goldberger, "In Adding to the Guggenheim, a Little Less Goes a Long Way," *New York Times*, February 15, 1987.

⁶ Paul Goldberger, "The Liberation of the Guggenheim," *New York Times*, June 21, 1992.

⁷ Haeyoun Park, "Face-Lift for an Aging Museum," *New York Times*, April 17, 2007, E1.

⁸ WASA/Studio A (Wank Adams Slavin Associates LLP) was the preservation architect for the restoration.

⁹ The materials conservation work was carried out by Integrated Conservation Resources (ICR).

¹⁰ Robert Silman Associates, PC was the structural engineer for the project.

¹¹ Atkinson Koven Feinberg Engineers, LLP (AKF) was the mechanical engineer for the project.

¹² Integrated Conservation Resources, "Historic Paint Analysis for Exterior Colors. The Solomon R. Guggenheim Museum Exterior Restoration and Building Enhancement," unpublished report, June 11, 2007, 4.

known as the “cocoon”. Frank Lloyd Wright was notorious for not inserting expansion joints in his monolithic concrete structures, and the Guggenheim was no exception. By selecting the cocoon, a high-build coating originally designed for use in mothballing World War II naval vessels recommended by the painting subcontractor, Wright hoped to bridge cracks that had formed during construction as a result of his decision.

Charles Gwathmey believed the whitish color he chose to repaint the exterior of the Guggenheim in 1992 was close to the original, and perhaps his selection of a limestone finish for his addition was based on this mistaken concept.¹³ Recognizing that this would be an area of controversy, the New York City Landmarks Preservation Commission (LPC) separated the paint color from the general application for repairs that was submitted by the museum. Indeed, the final choice of paint color divided the preservation community. On the one side, the purists viewed the museum’s restoration as the ideal opportunity to reapply Frank Lloyd Wright’s original color. On the other hand, the museum, supported by the preservation architects saw the building as a living institution that had evolved over time, taking on the characteristic whitish color that the building has become known for. Both of these approaches to authenticity could be considered valid.

This sparked a major debate that was widely publicized in the local press.¹⁴ Should the building be painted the original color, or should the alterations and additions be acknowledged as having fundamentally changed the object that was being preserved? Both sides advanced convincing arguments. It took two LPC hearings to resolve this issue.

The museum’s position, as well as that of WASA/Studio A, was based on the Venice Charter (1964) and the Nara Document on Authenticity (1994). Since we were not removing the alterations or additions, the best we could accomplish was a 1992-period restoration. We favored a progressive authenticity approach, retaining changes that have occurred over time so that a building reads as a timeline of its history.¹⁵

In the very first sentence of the Venice Charter, it states, “Imbued with a message from the past, the historic monuments of generations of people remain to the present day as living witnesses of their age-old tradition... It is our duty to hand them on in the full richness of their authenticity.” Further on, under Article 3, the charter notes, “The intention in conserving and restoring monuments is to safeguard them no less as works of art than as historical evidence.” In Article 7, it reads, “A monument is inseparable from the history to which it bears witness and from the setting in which it occurs...” Finally in Article 11, the charter states, “The valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration. When a building includes the superimposed work of different periods, the revealing of the underlying state can only be justified in exceptional circumstances and when what is removed is of little interest and the material which is brought to light is of great historical, archaeological and aesthetic value, and its state of preservation good enough to justify the action...”¹⁶

¹³ Pamela Jerome, “An Introduction to Authenticity in Preservation,” *APT Bulletin* 39, No. 2-3 (2008): 6.

¹⁴ Karla Schuster, “A Decorating Dilemma at Guggenheim,” *Newsday*, October 14, 2007; Karla Schuster, “So What’s the ‘Wright’ Color? Friction over Guggenheim Paint Job,” *AM New York*, October 15, 2007, 3; “Guggenheim Exterior to Go Gray,” *New York Sun*, Vol. 123, No. 155, November 21, 2007, 3; Sewell Chan, “Pale Gray or Light Yellow? A Ruling on the Guggenheim,” *New York Times*, November 21, 2007, E3; Hasani Gittens, “Guggenheim Gray Stays,” *New York Post*, November 21, 2007, 3.

¹⁵ Brend von Droste and Ulf Bertilsson, “Authenticity and World Heritage,” in *Nara Conference on Authenticity, Japan 1994, Proceedings*, ed. Knut Larsen, (Paris: UNESCO World Heritage Centre; Tokyo: Agency for Cultural Affairs; Rome: ICCROM; Paris: ICOMOS, 1994), 4. ‘“Due recognition should be given to “progressive authenticity”, that is to say, to buildings and constructions, in which, although having been modified throughout time, some of the original intention was retained”.’

¹⁶ International Charter for the Conservation and Restoration of Monuments and Sites (Venice Charter) (1964), accessed on the website www.icomos.org.

Purists viewed our acknowledgement of the significant role of the additions and alterations, particularly the Gwathmey Siegel addition, as allowing “the tail to wag the dog”. For us, however, the alternative was equivalent to an approach favored by the mid-nineteenth century preservation theorist, Eugene Emmanuel Viollet-le-Duc, who stated, “to restore a building is not to conserve it, to repair or reconstruct it – but to reestablish it to a complete state such as may have never even existed at any given moment.”¹⁷ Instead, we were inclined to agree with Paul Philippot, who wrote, “It is an illusion to believe that an object can be brought back to its original state by stripping it of all later additions... The original state is an abstract idea and not a historical reality.”¹⁸ Further, the great Italian theoretician of modern conservation, Cesare Brandi, stated in 1951, “It is manifest that a work of art has a life in time. For this reason, which is the same one that forbids falsification, the work of art cannot be taken back to its starting point as if time were reversible.”¹⁹ In the end, the LPC voted for a color that was not Wright’s original.

CONDITION OF THE EXTERIOR SURFACE

A recent publication has raised the question of the significance of Wright’s intent versus what actually got built relative to the exterior finish of the museum.²⁰ While it is true he died before the building was opened to the public, there is an archival photograph of Wright on the balcony of the Monitor with workers painting the Rotunda in the background (the building was actually painted in 1958, six months before Frank Lloyd Wright passed away).²¹ So we know that he saw the building with its final finish.

The museum, once stripped of its multiple layers of paint, was revealed as remarkably hand-crafted. Formwork marks are visible in raking light even through the paint (Fig. 4), but the uncoated shotcrete surfaces exhibited great detail including the imprints of the wood graining from the plywood forms. From archival correspondence, it appears that Wright was expecting a smoother finish. However, the photograph referenced above is evidence that he accepted the final product, however imperfect. Therefore, were the surface marks to be considered defects or evidence of authenticity of craftsmanship?²² We opted for the latter approach.

As preservationists, we are responsible for the choices made about the object in our care. In preservation theory, one of the recognized tenets is to perform the minimal intervention necessary to safeguard the object. Additionally, our profession accepts that our interventions should be as reversible as possible, and that we should save original fabric to the greatest extent practical. The Venice Charter states under Article 9, “The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp...” At the Guggenheim, this latter concept was accomplished through the selection of repair materials, which although compatible, is recognizably different under microscopic examination. The Venice Charter continues under Article 15 to say, “...The material used for integration should always be recognizable and should be the least that will ensure the conservation of a monument and the reinstatement of its form.”²³

¹⁷ Augusto Molina-Montes, “Archaeological Buildings: Restoration and Misrepresentation,” in *Fabrications and Misreconstructions of Pre-Columbian Art*, ed. Elizabeth H. Boone, (Dumbarton Oaks, 1982), 22

¹⁸ Paul Philippot, “Historic Preservation: Philosophy, Criteria, Guidelines,” in *Preservation and Conservation: Principles and Practices. Proceedings of the North American International Regional Conference, Williamsburg, VA, 1972*, (Washington, DC: Preservation Press, 1976), 372, 374.

¹⁹ Molina-Montes, 128.

²⁰ Matero and Fitzgerald, 3-4.

²¹ Storrer, 39.

²² The World Heritage Convention Operational Guidelines have always included workmanship as one of the tests of authenticity that properties must meet in order to be designated on the World Heritage List. Jerome, 3.

²³ Venice Charter.

We perceived the Guggenheim in its present condition as the vessel to be restored. We did not take the position that we could presume to know Wright's intent. For this reason, when the question came up as to how to accomplish the post-reinforcement of the sixth floor ramp wall, the solution to wrap its exterior surface with CFRP, thus permanently altering the texture of those surfaces by grinding them smooth, was rejected in favor of a less invasive, although structurally adequate, approach: the installation of the carbon-fiber reinforcement on the interior surface of the wall.

In addition, the contractor, who applied the patches and crackfillers using the specified compatible compound, carefully recreated the texture of the surface as well as the formwork marks (Fig. 5).²⁴ Yet our choice to leave the evidence of the original workmanship may continue to be perceived by critics as marring the surface.

EXCESSIVE CONDENSATION

As stated earlier, as preservationists we strive to maintain original building fabric. However, there comes a point where a building's use may take precedent. That point arrived when it came to the Guggenheim's original single-glazed steel window walls and aluminum skylights. Although the fabric of both types of units was in remarkably good condition, fluctuations in New York City's temperatures permitted condensation to form on the interior of the glazed surfaces during the coldest days of winter months (Fig. 6).

At Frank Lloyd Wright's Fallingwater, a former private weekend residence that now functions as a house museum, as preservation architects we elected to save similar single-glazed steel casement windows, although in some cases, elements of the sash were severely corroded.²⁵ In good weather, the windows are often left open, and the house is displayed to visitors as it was lived in. In the case of the Guggenheim, however, we needed to acknowledge the building's continued use as a functioning world-class art museum, and the integrity of the priceless artwork displayed inside took priority.²⁶ The performance of the shotcrete walls and apron slabs had been upgraded at the time of the 1992 addition, and was further improved during the 2004-08 building enhancement, but the single-glazed thermally unbroken window walls and skylights were clearly still an issue.

Numerous design attempts were made to retrofit the existing sash of both windows and skylights, thereby saving the original fabric. In the case of the windows we found that we could not accomplish this without seriously compromising the interior aesthetics (Some of the museum's interior spaces are also a New York City-designated landmark.) In addition, for both glass walls and skylights, the retrofit designs would not provide a true thermal break. After much deliberation, a decision was made to recreate the windows and skylights.

For the windows, this resulted in the unprecedented step of fabricating thermally broken steel replicas with double-glazing (Fig. 7).²⁷ With the skylights, it was much easier to find a manufacturer to recreate the aluminum profiles with thermally broken double-glazed units. Discrete improvements were made to the original design of the skylights, which are not actually visible at the interior because of the lay-lights and are recessed in shadow on the exterior, as the upward advance of the building's spiral shape overhangs each floor below.

²⁴ The concrete repair contractor was Nicholson and Galloway, Inc. of Glenhead, NY.

²⁵ Pamela Jerome, Norman Weiss and Hazel Ephron, "Fallingwater Part 2: Materials-Conservation Efforts," *APT Bulletin* 37, No. 2-3 (2006): 8.

²⁶ Pamela Jerome, Angel Ayón and Paul Shwartzbaum, "Restoration and Facilities Enhancement of Frank Lloyd Wright's Solomon R. Guggenheim Museum in New York," *News in Conservation*, No. 6, June 2008, 4-5.

²⁷ The manufacturer of these units was Torrance Steel Windows of Torrance, CA.

CONCLUSION

When dealing with the restoration of Modernist icons, there are many approaches to conservation that could be considered valid. Because of the relatively young age of these buildings there are far fewer case studies and there have not been as many opportunities in our profession to validate our actions. In the case of the Solomon R. Guggenheim, the design team went through two-day peer reviews twice by an invited panel of distinguished colleagues. Still, some of our decisions provoked major public debate. Fortunately, with the exception of the windows and skylights, our interventions are reversible, leaving options open for future restorers who may make other legitimate choices.



Fig. 1: The Solomon R. Guggenheim Museum after restoration. (All photos by Angel Ayón of WASA/Studio A, courtesy of the Solomon R. Guggenheim Foundation.)

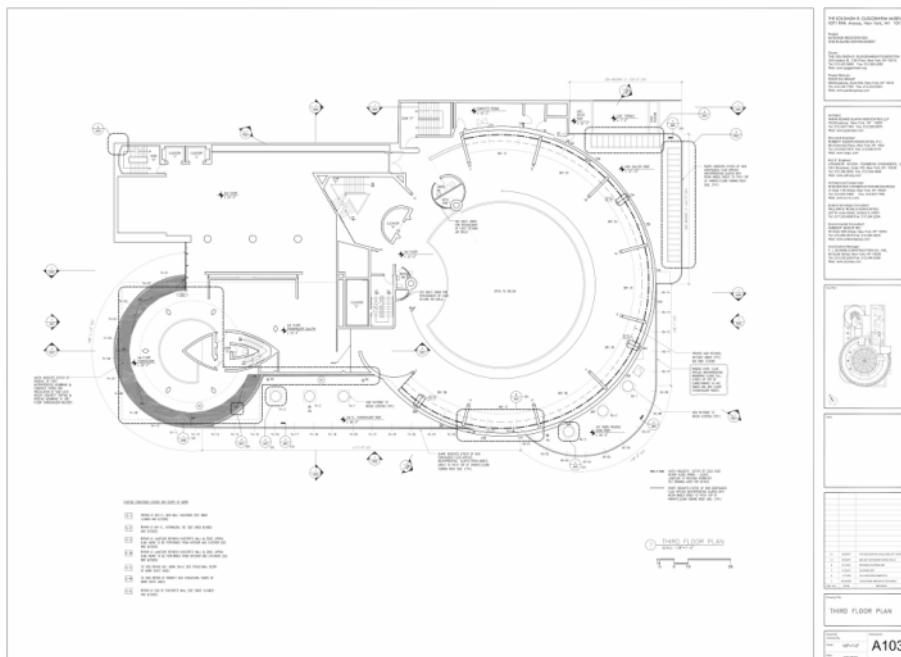


Fig. 2: Third floor plan of the museum showing the web walls in the Rotunda, and the Monitor on the lower left-hand corner. The addition is the rectangular layout in the upper left-hand corner. (All drawings by WASA/Studio A courtesy of the Solomon R. Guggenheim Foundation.)

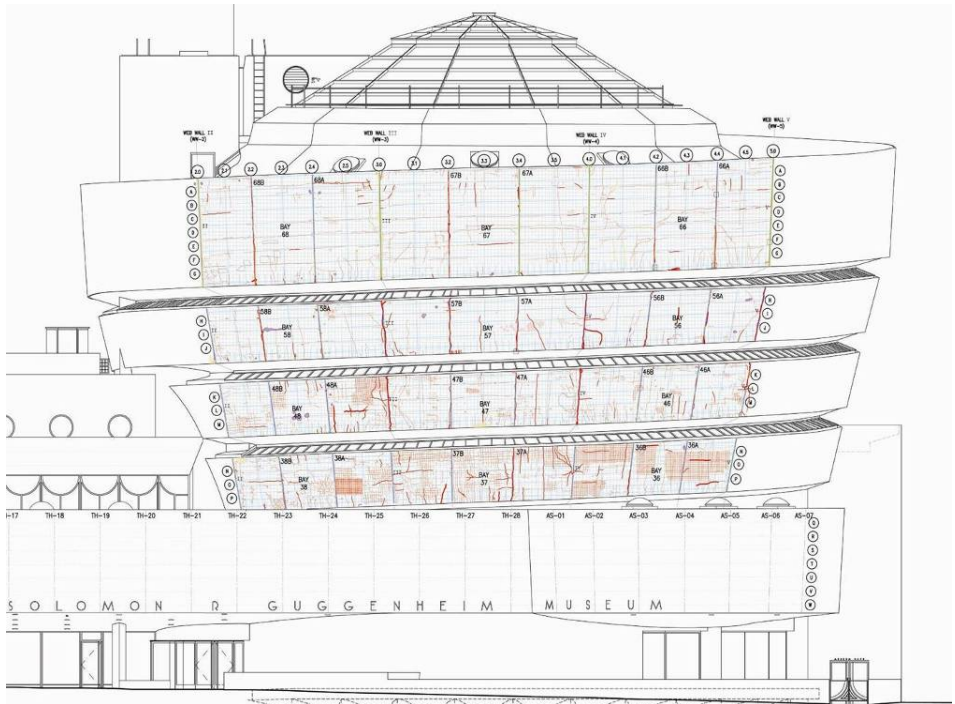


Fig. 3: Crack mapping of the west elevation.

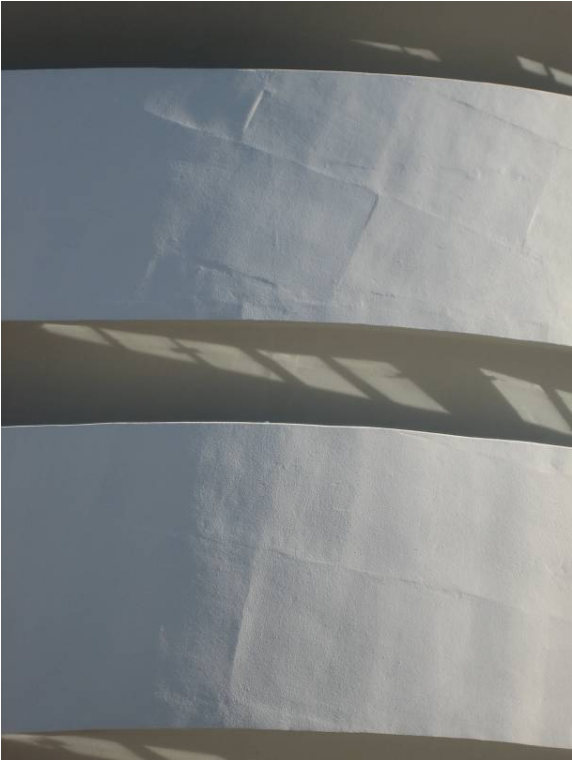


Fig. 4: Formwork marks were deliberately retained on the restored façade and were treated as evidence of authenticity of craftsmanship.



Fig. 5: Patches carefully recreated the texture and board-form marks. This patch is at the sixth floor ramp wall, where vertical control joints remedially installed during the 1992 work were retained.



Fig. 6: Excessive condensation was an issue and the reason for not retaining the original single-glazed windows and skylights.



Fig. 7: The new windows replicated the existing in thermally broken steel.