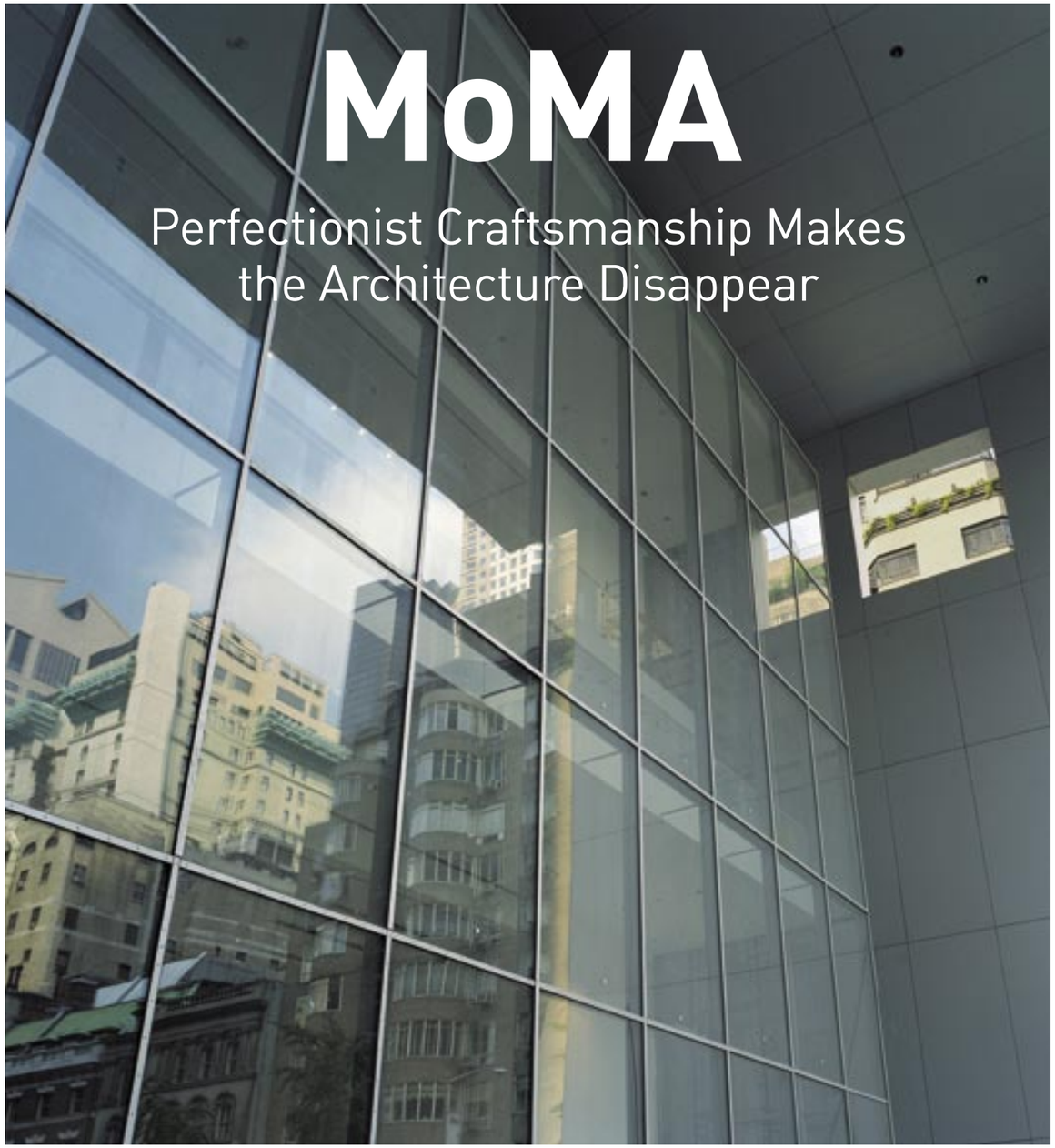
MoMA

Perfectionist Craftsmanship Makes the Architecture Disappear



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Yoshio Taniguchi, design architect of the recent addition and renovation of the Museum of Modern Art (MoMA) in New York City, famously said that if he got a lot of money he would deliver great architecture, but if he got more he would make the architecture "disappear." If that statement seemed mysterious at the time, MoMA's response to it wasn't. The museum spared little expense in executing Taniguchi's exacting specifications for the project, $425 million for the construction, which was paid out of a $858 million capital campaign. And when walking through the 630,000-square-foot museum today, it is clear what Taniguchi meant by "disappear"—the surfaces throughout the interior, but especially within the grand lobby and atrium space, achieve a flatness and transparency that subdues an experience of the building as such and defers almost completely to the works of art and the visitors.

The irony is that attaining this seemingly anti-architectural effect required pushing the limits of what was physically possible in terms of construction tolerances and a level of craftsmanship that could not fall short of perfection. In the end, the success of MoMA rested on the abilities of the contractors who executed the work, most notably the ornamental metal workers, and, of course, on the unique properties of steel.

Perhaps the most technically innovative and visually striking element of the new construction is the glass-and-metal curtain wall that separates the lobby from the Abby Aldrich Rockefeller Sculpture Garden, designed by Philip Johnson in 1953. The goal here was to achieve as high a degree of transparency as possible. In part this was achieved by using low-iron insulated glass, supplied by Zadra Vetri of Belluno, Italy, that avoids the usual greenish tint. (In addition, the glass contains UV filtration to protect the museum's artwork.) But it was also achieved by combining the largest span of glass attainable with the least amount of structural support. "The thing about Taniguchi's work," noted Tom Holzmann, an architect-in-charge from Kohn Pedersen Fox Associates (KPF), executive architects of the project, "is that the sections are as thin and elegant as possible and this is coupled with his interest in having the largest possible module."

"All of the limits were really pushed in terms of what's technically practicable to fabricate," continued Holzmann. "Not only fabricate, but fabricate and replace." The structural steel mullions were reduced to the absolute minimum 2 1/2 inches wide by 7 1/2 inches deep, while horizontals are spaced at 13 feet. In addition, the vertical span of the curtain wall rises 65 feet before encountering its one intermediate lateral connection for bracing against wind loads. This occurs at a staircase where the wall folds back to form a skylight before rising vertically again to its full 82-foot height. "The tolerances here are pretty amazing," commented Katherine Miller of R. A. Heintges and Associates, curtain wall consultants

OPPOSITE The minimal stick work of the lobby curtain wall is painted structural steel.

LEFT MoMA comprises 20 different curtain wall types.

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OPPOSITE, ABOVE Day and night the lobby curtain wall provides near total transparency.

OPPOSITE TOP The Abby Aldrich Rockefeller Sculpture Garden

OPPOSITE BOTTOM Taniguchi's face lift of the Philip Johnson wing

for the project. "Taniguchi wanted the mullions to appear as thin as aluminum, but in order to support the large spans we needed the strength of steel." Gartner, who fabricated the wall components in Germany, was able to provide mullions of the desired thinness in steel.

A highly engineered expansion joint was implemented where the curtain wall abuts the museum's existing residential tower. The resulting system is able to move plus or minus two inches in all directions to accommodate differential movements between structures.

Permasteelisa handled the erection of the curtain wall through its Windsor, CT-based erector, Tower Installation LLC. The facade design is based on a moment frame construction. Wall sections were welded together on site. The individual components were fabricated so that spliced connections could be made mid-span between straight segments, allowing the corners of the intersections between vertical and horizontal members to be cut with precision. Permasteelisa actually placed quality-control agents at the fabricator's facility, in part to cut down on construction time, but also to ensure that the wall achieved its highest formal expression.

The same attention to detail was continued throughout the interior, where once again all surfaces were pushed to their maximum spans with the absolute minimal seams and supports. The 3/16-inch anodized aluminum panels cladding the escalators and the fascia panels in the well openings all seem to flow together in one extended surface. "In order to make this happen, all of the joints had to be square corners," explained Herb Koenig of Allied Bronze, which fabricated and erected much of MoMA's ornamental metal work. "When you're shearing metal you generally get a rounded edge. So to get a square edge you have to saw cut everything. The sheet had to be totally flat or it would read terribly. It's very time consuming."

Perhaps trumping the bill on transparency within the interior space is the ubiquitous glass railing system that rings all of the atrium's balconies, walkways, and stairs. The 1/2-inch-thick tempered, low-iron, clear glass panels that form the railing, some as much as four feet in height, rise directly out of the floor and are capped by bead-blasted steel channels 1/2-inch-wide with 3/4-inch legs. "The rails had to be

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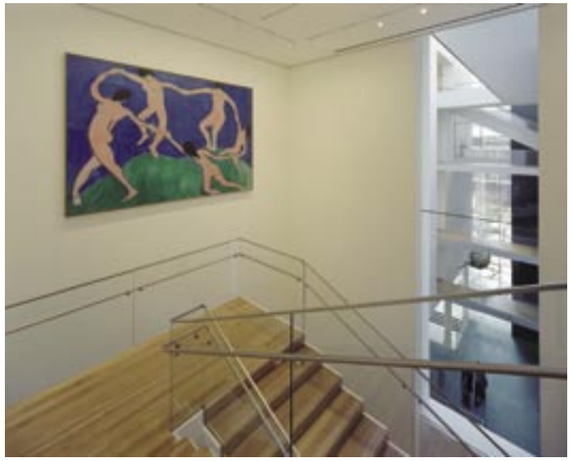
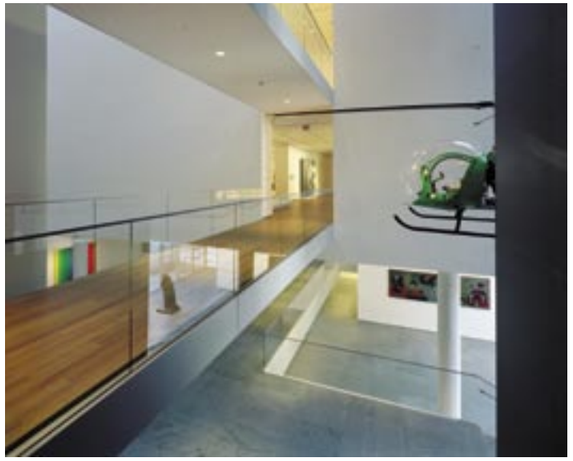
installed before the floors were finished," said Koenig. First, glass was installed in stainless steel channels inside a steel expansion frame that had been welded to embedments in the concrete floor plate. Liquid rock was then poured in to set the glass in place. The bead-blasted steel channel capping the glass was affixed with silicon and all of the corners were fully welded rather than mitered, further enhancing the rail system's sense of seamlessness.

Another technical marvel of the new MoMA in which steel played a starring role is a stair that connects the fourth and fifth levels. "This is probably the most challenging stair in the whole building," said Holzmann, "as it's a welded steel stair that had to meet the highest expectations in terms of quality." The stair is cantilevered at two locations from columns embedded in the adjacent wall. Staying true to his promise to make the architecture disappear, Taniguchi specified that it be an open riser stair. "The stair is viewed from below as from above and in elevation," continued Holzmann, "such that the underside of the stair became as important as what you see from above."

Among the most admired ornamental metal work in the building are the steel and glass railings on the cantilever and lobby stair. Looped directly into the glass, the railing seems to float in mid-air.

As pleasing as an elegant design may be, it only exists in the mind and on paper before the nuts and bolts of construction give the design its final shape. It's clear that MoMA understood the importance of this ultimate stage of architecture and dedicated the time and money to see that the museum would stand up to the most stringent scrutiny. "It was a monumental job," said Koenig. "A challenge to everyone's talents. It created three times the drawings as a normal project of this size and took three times as long." But to those who visit the museum the remarkable craftsmanship seems effortless. ■





OPPOSITE The lobby's curtain wall and monumental stair

ALL ABOVE Low-iron glass and narrow stainless steel channels make the railings throughout the atrium space "disappear."

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MoMA

Owner **Museum of Modern Art** *New York, NY*
Architect **Taniguchi and Associates** *Tokyo, Japan*
Executive Architect **Kohn Pedersen Fox Associates** *New York, NY*
Structural Engineers
Severud Associates *New York, NY*
Guy Nordenson and Associates Associates *New York, NY*
General Contractor **AMEC** *New York, NY*
Curtain Wall Consultant **R. A. Heintges Associates** *New York, NY*
Curtain Wall Fabricators
Josef Gartner Germany *Gundelfingen, Germany*
Permasteelisa *Windsor, CT*
Curtain Wall Erector **Tower Installation LLC** *Windsor, CT*
Miscellaneous Ornamental Metal Fabricator and Erector
Allied Bronze LLC *Long Island City, NY*
Miscellaneous Iron Fabricators and Erectors
Empire City Iron Works *Long Island City, NY*
Ment Bros. I.W. Co. Inc. *New York, NY*