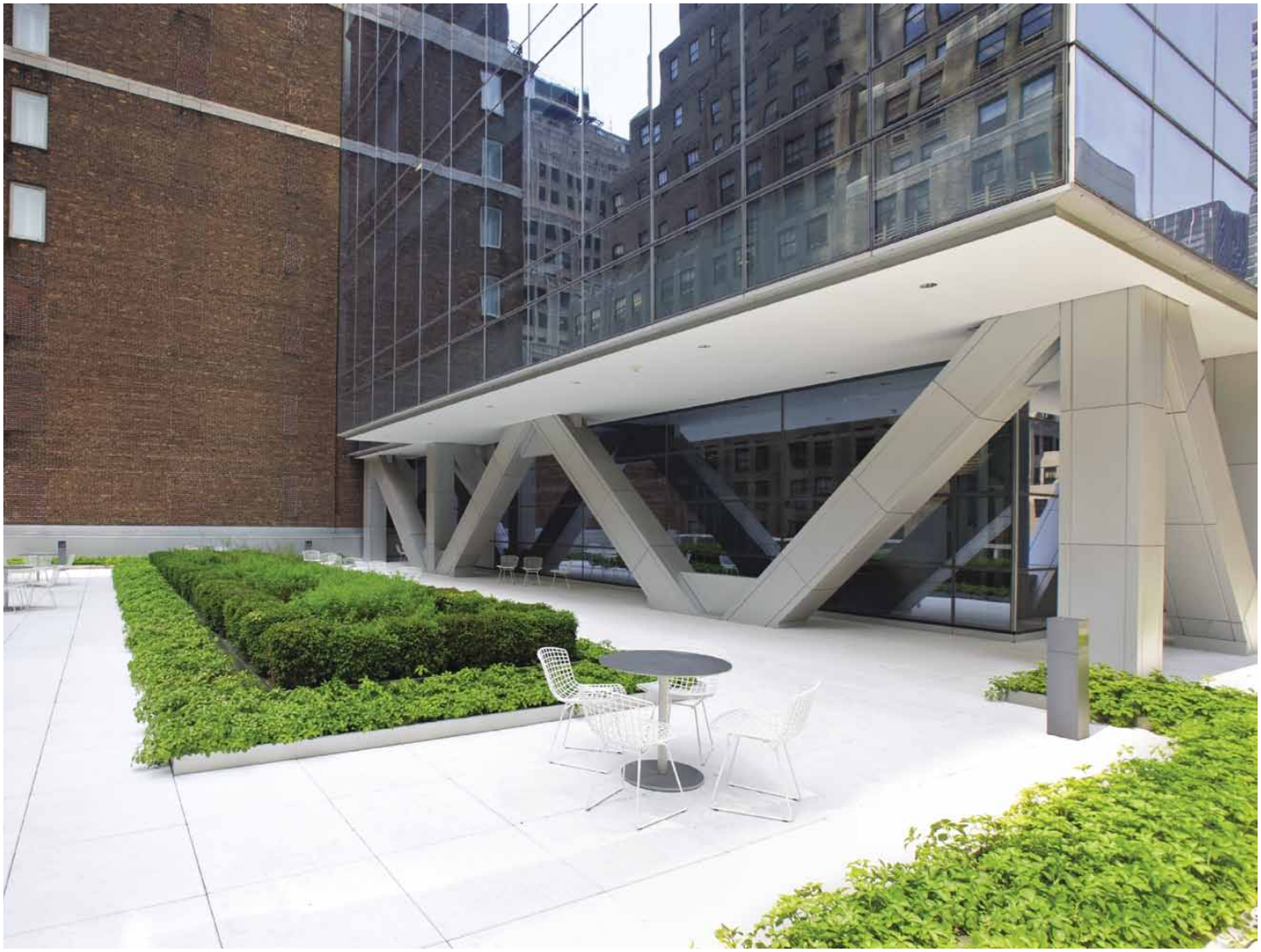


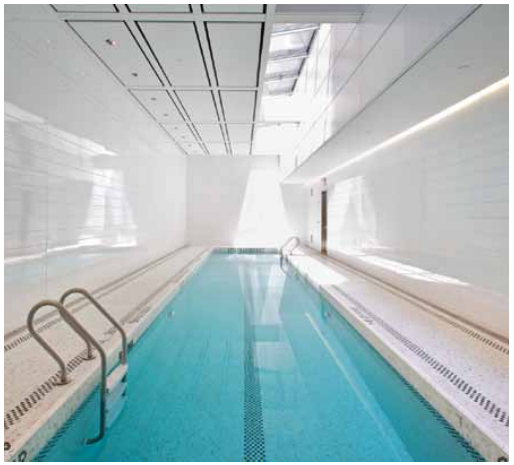
510 Madison

Some bold moves resulted in a minimal column-free interior for a new, high-end high rise on Madison Avenue.

BASE-AND-PODIUM BUILDINGS ARE the lingua franca of post-1960s New York office towers. They appear on the street, if not the skyline, as inevitabilities of the city's restrictive zoning requirements governing setbacks and floor area ratio. Completed in 2011 at the corner of Madison and East 53rd Street, 510 Madison certainly falls under the constraints upholding this tradition, but that is where the comparisons stop.

Like other towers of this era, its envelope profile is designed to maximize the amount of interior floor area possible within zoning constraints. But the designers of 510 Madison went one step further. Through a carefully conceived structural design, they were able to minimize the space lost to interior columns and the stair core. Because the building is only 30 stories (429 feet) in height, the engineers at Gilsanz Murray Steficek (GMS) were able to use just two bands of large wide-flange-section outrigger trusses, one each at the bottom and top of the tower, to control drift. Most designs include at least three. This allowed the engineers to shrink the footprint of the braced frame within the tower section to the point of imperceptibility, and added a full story of column-free office space. A 55-foot interior span ties the relatively small (only three elevators) south-side core, to perimeter columns that are set back 1-foot, 10-inches from the aluminum glazed curtain wall. "There's 2-feet, 6 inches from the glass to the column line, so you really get this feeling of disconnection between the facade and columns," says Karl Rubenacker, the partner in charge of the project for GMS.

Things could have gone quite differently for 510 Madison. Originally planned as a residential tower,



This page The building's structural steel design created long column-free spaces for the building lobby and a 50-foot-long pool.
Previous page A landscaped terrace on the sixth-floor podium, where an outrigger truss transfers loads to the tower above.

the recession shifted the priorities of owner and developer Macklowe Properties toward a 350,000-square-foot office building for the so-called Plaza District in Midtown. Dan Shannon, the design architect in charge of the project for Moed de Armas & Shannon Architects, says the focus of the building was column-free tenancies of between 11,000 and 45,000 square feet. Zoning restrictions meant an 85-foot base street wall on the site perimeter before they would need to step the building back for the tower above. "This created a structural challenge of driving the tower superstructure through the base without impinging on the quality of the base floor plate," says Shannon.

The outrigger truss on the level-six transfer floor effectively transitions between the columns along the perimeter of the five-story base and the 25-story tower above, transferring the truss loads in the level five ceiling with 6 foot by 9-inch-thick built-up plate girders. "The necessity of this truss gave the building a distinct architectural look of having the tower floating on the base," he says. "We couldn't just solve these problems with more steel, it had to be efficient and cost-effective." The engineers addressed the loads through adding more perimeter columns, while keeping the scale of individual components smaller. The owner's purchase of the air rights on the adjacent lot allowed the building to go higher, but instead the team designed the tower to protrude into the adjacent air space by approximately eight feet to allow for larger floor plates.

The building's envelope intensifies the lightness of the structure with floor-to-ceiling glazing that floods the interior with views and daylight, both of which are enhanced by 10-foot ceiling heights. The engineers used W18s for the interior spans, which allowed them to compress the ceiling plenum down to deliver those high ceilings within an overall 13-foot, 6-inch floor-to-floor height. Shannon also says the design

Previous spread and this spread: Moed de Armas & Shannon

Right Trusses and transfer girders connect the tower to the base, allowing the tower floors to cantilever over the adjacent building to the west.

team focused on coordinating the mechanical system with the structure, designing penetrations in the beams to anticipate future ductwork. "Doing that after the fact is not that effective, but if you plan for this, it could happen efficiently," he says. "Tenants understand how that affects ceiling height, so they are happy to coordinate around the openings." In the structural bays at the corners, engineers removed the columns to provide an unencumbered corner office view—an executive perk prized by the building's expected high-end tenants.

Achim Hermes, a structural engineer and the building's facade consultant from GMS, says the goal for the exterior was a monolithic, uniform building. The unitized glass-and-aluminum curtain wall, manufactured by Permasteelisa Group, consists of nominal 5-foot-wide, 1-story-high panels that are clipped onto anchors at the end of the floor plates. Tower floor slabs are 2½-inch concrete over 3-inch, 18-gauge metal deck. The building slightly chamfers with a 2 percent slope through the top three floors, though the curtain wall was easily sloped without special requirements. The curtain wall panels have Guardian AG43 glass in the vision zone, which couples a low-emissivity coating with a relatively high 43 percent visible light transmittance. The glazed shadow box spandrel, which is hidden from the interior, barely reads from the exterior. "None of the facade units contain reinforcing steel, they were all within the limits to handle the wind loads," says Hermes. The only departure from the curtain wall is the storefront system used along ground-floor retail.

Both the project's construction manager, Tishman Construction Corporation, and the steel fabricator were brought on board during the design process, which helped to smooth over coordination and constructability issues in connections and steel quantities. Structural analysis was performed using a variety of software packages, including RAM

Left The curtain wall's vision panels have a low-e coating and 43 percent visible light transmittance.
Above Steel erectors construct outrigger trusses at the sixth floor.

Gilsanz Murray Steficek; facing: Moed de Armas & Shannon

Right The building has been awarded a Gold certification using the LEED for Core and Shell rating tool, which includes points for the building's recycled steel structure.

Steel, ETABS, and SAP2000, while GMS's engineers used internal analysis spreadsheets to design all of the connections. A wind tunnel analysis had been performed for the original residential building, which was planned to be 700-feet tall, so the wind consultants performed a simpler desktop analysis based on that outcome. "The torsional velocity of the highest rented floor's corner office was used to set the controlling wind criteria for drift and stiffness," says Rubenacker. GMS also carried out a progressive collapse study, which resulted in no changes to the design. The steel structure ties directly into concrete footings below grade on Manhattan's rock, with the cellar enclosed by a concrete foundation wall with an at-grade concrete slab.

The building, now owned by Boston Properties, was recently certified Gold using the LEED for Core and Shell rating tool, which in part relied on recycled steel used in the structure. An exposed structural steel stair also leads down to a basement health club complete with a swimming pool, another perk geared toward the expectations of high-end tenants. Added in with the high ceilings, column-free tenancies, and elegant outrigger truss transfer, 510 Madison has proven successful in attracting tenants, even in a challenging market.

510 MADISON

Location: **510 Madison Ave. New York, NY**
Owner: **Boston Properties**, *New York, NY*
Developer: **Macklowe Properties**, *New York, NY*
Architect: **Moed de Armas & Shannon**, *New York, NY*
Architect of Record: **SLCE Architects**, *New York, NY*
Structural Engineer: **Gilsanz Murray Steficek**, *New York, NY*
Mechanical Engineer: **I.M. Robbins**, *New York, NY*
Construction Manager: **Tishman Construction Corp.**, *New York, NY*
Curtain Wall Consultant: **Gilsanz Murray Steficek**, *New York, NY*
Structural Steel Erector: **Falcon Steel, Co., Inc.**, *Wilmington, DE*
Curtain Wall Fabricator: **Permasteelisa North America**, *Windsor, CT*
Curtain Wall Erector: **Tower Installation LLC**, *Windsor, CT*
Metal Deck Erector: **Falcon Steel Co., Inc.**, *Wilmington, DE*