The 895-foot-tall 10 Hudson Yards, the first of 16 major buildings reshaping Manhattan's West Side, features an 82-foot-tall cable wall lobby façade and a trapezoidal 207-foot cable wall.

10 Hudson Yards

The first of 16 new developments on Manhattan's west side, a striking high-rise features an expertly crafted curtain wall system held together by high-tensile cables.

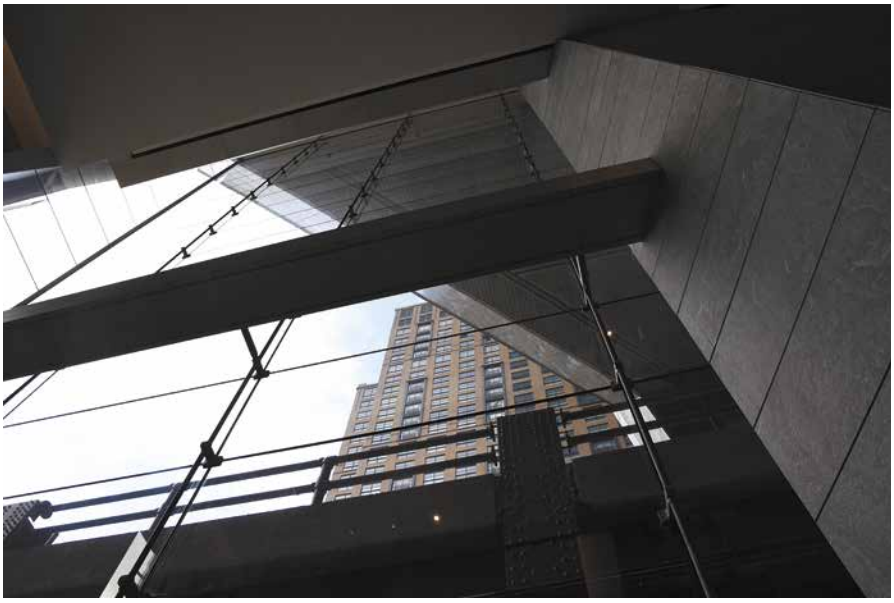
THE HUDSON YARDS PROJECT HAS been described as constructing an entire neighborhood from scratch. As the first of the development's 16 planned skyscrapers (and the only one not supported by two giant platforms over the East and West Rail Yards), 10 Hudson Yards showcases the beauty, engineering precision, and craftsmanship possible with today's cutting-edge curtainwall technologies. Designed by Kohn Pedersen Fox Associates (KPF), the 52-story building—anchored by the luxury fashion company Coach, Inc., features a multi-faceted shape and several intersecting curtain wall sytems.

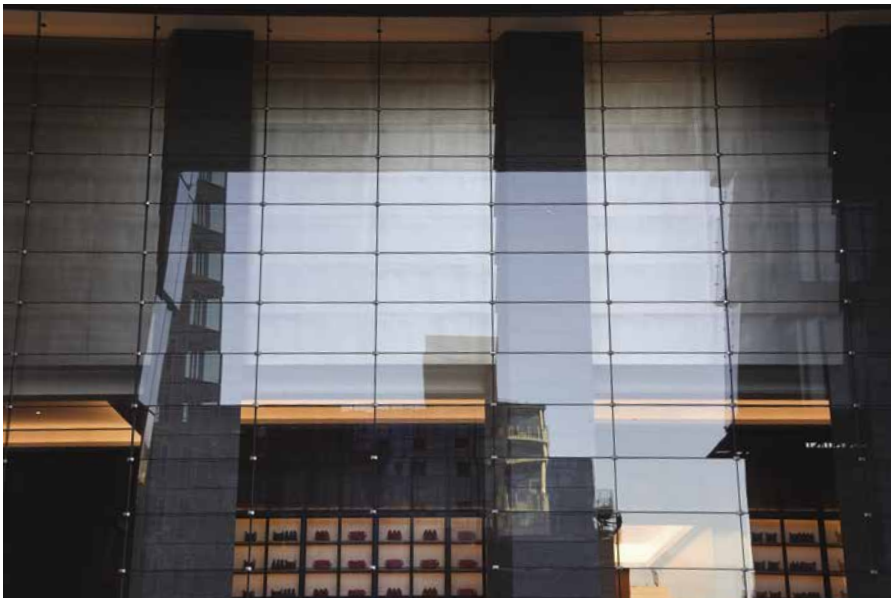
The southern façade of 10 Hudson Yards cantilevers over the 30th Street spur of the High Line, and the building's main lobby entrances to the west are directly accessible from the elevated park.

This unique siting made the creation of the lobby's 82-foot-tall cable wall façade and a trapezoidal 207-foot-tall Coach Atrium cable wall, which spans from the 6th floor to the 21st floor, a challenge for its designers and its installers.

Structural engineer Thornton Tomasetti, who provided structural and façade consulting services for the project, conducted a study of the atrium aimed at understanding the structural implications and façade issues involved in building a multistory atrium. The study led to the design of a one-way vertical cable system with intermediate beams supporting laminated glass panels through glass fittings. The tension façade system optimizes the façade's transparency, and provides the airy, open experience the design team desired for their tenants.

"In retail venues, the tension façade maximizes the available floor space for products





Top A stainless steel cast patch fittings on which cable wall glass is set. The fitting connects to a Galfan link locked tension cable—with such a large glass load, stainless steel cable was not an option due to limitations in stainless cable diameter and strength.
Center Glass was not drilled to create a connection to the fittings; instead, it is clamped in place at the corners to allow a specific amount of flexibility and rotation in the patch, allowing glass lites to safely deflect with the cable over the spans between structural members.
Bottom Tensioned cables support the Coach lobby façade, which runs along a section of the High Line.

and services on display, while looking terrific, and in other public spaces, the lack of deep vertical mullions means easier and better circulation behind the façade," explains Michael Awad, an engineer for atrium and lobby curtain wall installer W&W Glass.

Analagous to stringing a tennis racket, the tensioning process involved imposing tens to hundreds of thousands of pounds on the surrounding structure, with large steel truss beams at the head of the opening and large reinforced embed plates at the sill. In spite of the additional steel and concrete required for this design, early planning for and coordination of the design among the entire project team helped control costs.

For the Coach wall, this design helped to cut down on the overall loading that otherwise would have been required at the head and sill of the 200-foot-tall wall by bracing the wall at every other floor laterally. A larger span would have required larger end reactions and cable diameters.

At the same time, designing, fabricating, and installing the tension façade system involved intensive structural analysis, performed by Thornton Tomasetti, taking into account details that are generally not critical in standard curtain wall design.

For this project, "there were many space limitations that affected the distance between the inside face of glass and

This page and opening spread: W&W Glass

Left A view of one of the building's entrances beneath the High Line from the upper lobby.
Right Exterior of the lobby cable wall that wraps underneath the tower at the southwest corner, connecting with the High Line and the shingled exterior façade above.

the cable center," explains Awad. "This distance was important to both the macro structural engineering analysis and the detailed analysis of the hardware that joins the glass to the cable. Thus, it was critical to balance the size and spacing of the hardware that joins the cables to the building superstructure with the size and spacing of the fitting hardware that controls the glass to cable relationship."

Due to the tension façade's heavy loads, stainless steel cable was not an option as it is not available in the diameter and strength levels required. So, as an alternative, the team selected a Galfan link-locked galvanized cable, which has an extremely high load-carrying capacity, for the Coach wall and the lobby walls.

The "link-locked" cable is a stranded wire material made from wire that is drawn in a "Z" shape rather than a cylindrical section, according to Awad. "These 'Z'-shaped wires are wound together in the stranding process in such a way that the exterior of the stranded wire is extremely smooth, in contrast to typical wire rope and strand made from round wires."

The architects opted to clamp the glass in place at the corners to provide a level of flexibility and rotation in the patch fittings so that the glass lites would safely deflect with the cable over the spans between structural members.

As for the Coach Atrium wall, kickers tie back every vertical cable to horizontal steel beams every two floors, or approximately every 27 feet. The kicker tieback module was driven by both KPF's desired aesthetic and an interest in keeping cable diameters and cable end reactions to economical levels on the structure, per Thornton Tomasetti.

In order to support the façade's gravity loads from the 52-story tower, anchors embedded in the slab at the top of each unitized system unit carry the load back to the primary structure.

"Wind loads on glass panels are transferred through the split mullions to the top and bottom of the unitized panel," says Zach Wiegand, an associate with Thornton Tomasetti. "The top wind load is transferred directly to the slabs through the anchors, and the bottom wind load is transferred to the unit below via a splice plate, and then into the slab anchor. The anchors themselves are essentially aluminum angles or hooks bolted to the top of the slab in

Left: Steve Freihon; right: W&W Glass

Left The dramatic 21-story Coach Atrium offers a clear view of the High Line and downtown Manhattan. Its units are approximately 13½ feet high by 5 feet wide.
Facing The Coach Atrium is a 207-foot-tall trapezoid-shaped Pilkington Planar Optiwhite low-iron laminated glass tension cable façade spanning from floors 6 to 21. The wall is highly visible from the High Line from the south.

recessed pockets, located specifically for each anchor."

At the atrium cable wall, all dead load is transferred to the top through the pre-tensioned cables, he explains. Wind load is transferred equally to the top and bottom of the wall through axial tension in the supporting cables.

Reflecting back on this colossal curtainwall project, Wiegand suggests that detailing the unitized shingled façade was perhaps the most challenging aspect as there was no "natural" location to position the stack joint and mullion splices since adjacent units are not coplanar. To address this, special adapters were bolted to the top of the units to transfer the loads.

In addition, implementing the cable wall design was challenging because cable tensions result in large deflections of the supporting primary structure. "At the lobby, the cable wall actually wraps a corner, so shear straps were integrated in the horizontal glass joints to manage deflections at the corner," he says.

Moving on to the next project, 30 Hudson Yards is rapidly rising from the ground on its way to a 90-story summit. The 2.6-million-square-foot office tower, also designed by KPF and already committed with tenants, will feature a large curtain wall system, spanning the majority of the structure. In addition, the building will showcase a dramatically cantilevered observation deck, accessible to the public.

While 10 Hudson Yards slopes toward the river, 30 Hudson Yards will gesture toward the city, thereby creating a changing profile from different skyline vantage points. The two buildings will join together via a bridge occupied by shops, restaurants, and a new wave of visitors to a neighborhood like none Manhattan has seen before.

"The lack of deep vertical mullions means easier and better circulation behind the façade."

Michael Awad, W&W Glass

Steve Freihon

Courtesy Thornton Tomasetti

10 HUDSON YARDS

Location: **10 Hudson Yards, New York, NY**
Owner/Developer: **Related Properties**, *New York, NY*
Architect: **Kohn Pedersen Fox Associates**, *New York, NY*
Structural Engineer: **Thornton Tomasetti**, *New York, NY*
Mechanical Engineer: **Jaros Baum & Bolles Consulting Engineers**, *New York, NY*
Construction Manager: **Tutor Perini Corporation**, *New York, NY*
Curtain Wall Consultant: **Thornton Tomasetti**, *New York, NY*
Curtain Wall Fabricators: (atrium and lobby) **Pilkington Planar**, *Hauppauge NY*; **Tripyramid Structures**, *Westford, MA*; (podium) **Coordinated Metals**, *Carlstadt, NJ*; (tower façade) **Enclos**, *New York, NY*
Curtain Wall Erectors: (atrium and lobby) **W&W Glass**, *Nanuet, NY*; (podium) **Coordinated Metals**, *Carlstadt, NJ*; (tower façade) **Enclos**, *New York, NY*

10 Hudson Yards