METALS IN CONSTRUCTION

PUBLISHED BY THE STEEL INSTITUTE OF NEW YORK AND THE ORNAMENTAL METAL INSTITUTE OF NEW YORK

SUMMER 19

3 WORLD TRADE CENTER / JOAN WEILL CENTER FOR DANCE / MILSTEIN CENTER AT BARNARD / NYU LANGONE KIMMEL PAVILION / KOSCIUSZKO BRIDGE: PHASE I / EMMA AND GEORGINA BLOOMBERG CENTER AT CORNELL TECH / ELECTRICAL INDUSTRY TRAINING CENTER / NASSAU VETERANS MEMORIAL COLISEUM

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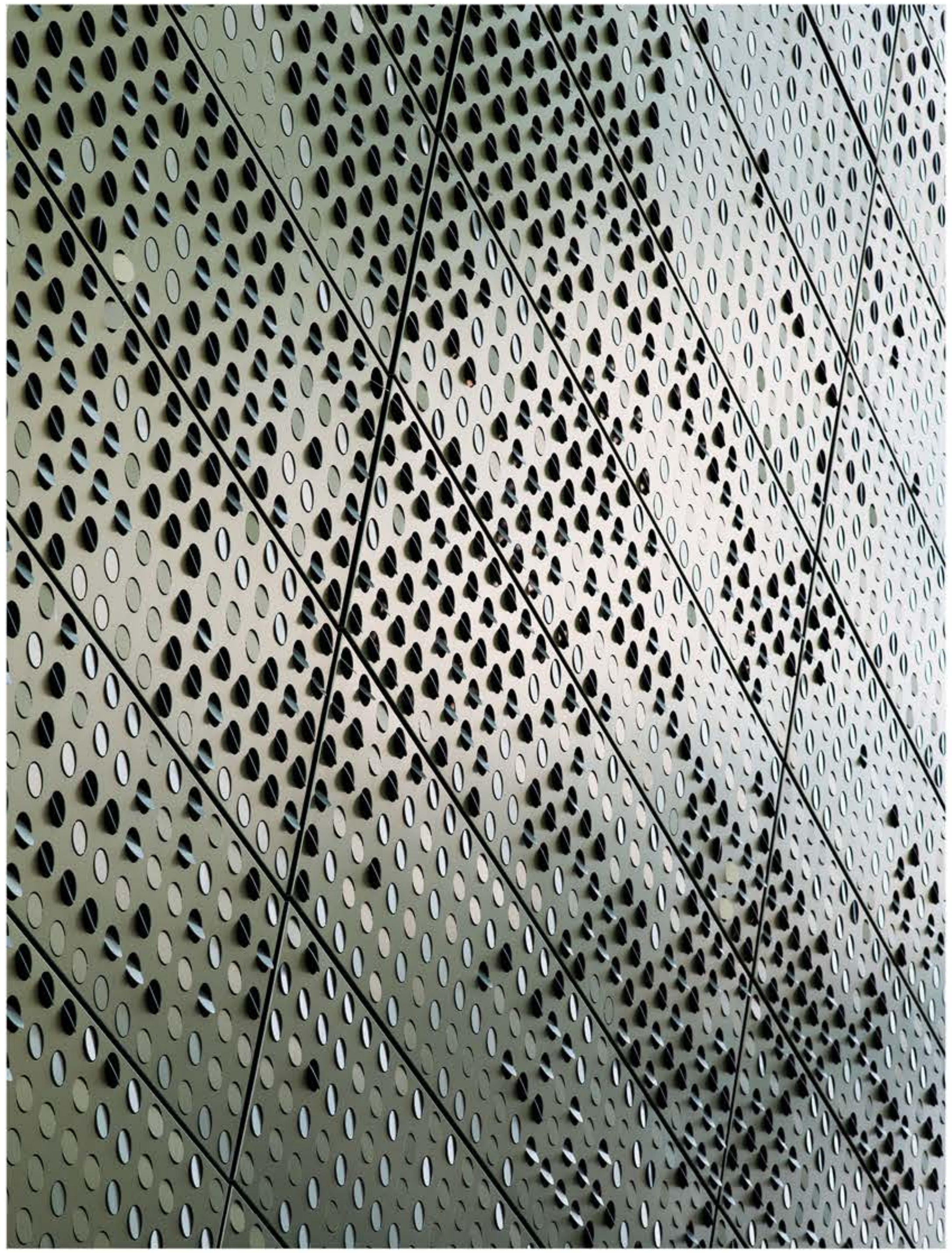

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Above A detail of perforated aluminum facade panels at Cornell Tech's Bloomberg Center, designed by Morphosis.
Cover The facade of the Nassau Veterans Memorial Coliseum designed by SHoP.

This page: Matthew Carbone; Cover: SHoP

EDITOR'S NOTE

Learning from those who build

Last October, facade industry professionals gathered at the Princeton Club of New York to hear panels of experts discuss managing the risks inherent in delivering high-performance facade systems. The event—Facade Tectonics Institute's New York City Forum hosted by the Ornamental Metal Institute of New York—highlighted many projects completed by the Institute's contributing contractors, most of which were featured in past issues of the magazine. In exploring how risks were managed on these projects, one of the panelists emphasized that success was not just choosing the right delivery strategy, managing the supply chain efficiently, or coordinating the critical path of envelope closure for the following trades. It resulted from an ability to obtain highly skilled installers when they were needed, eliminating the risk of having too few at critical stages in the project or too many when the level of work did not demand it. This flexibility and scalability, he pointed out, was afforded by employing union ironworkers to install the complex facade systems. Thanks to a union hall having a pool of highly trained installers who contractors could engage as needs arise, a skilled workforce could be tailored to meet owner deadlines in the most cost-effective manner. This was just the type of conversation that the Institutes hope to foster when hosting or sponsoring events in the city. Whether through the lecture series we underwrite at the city's architecture and engineering schools, the luncheon seminars we conduct at design firms around the city, or the competitions we hold for students and practitioners, our goal is to draw out the experience of experts in order to advance the knowledge of others. Nothing is more important than this to improving the way buildings are designed and delivered. As I consider the articles featured in this issue, I am reminded that it is not enough to just showcase projects, it is important to communicate what contributes to their success by learning from those who built them.

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A view of stainless steel-clad K-bracing that climbs the building's north and south corners.

Luca D'Amico/RSHP

3 World Trade Center

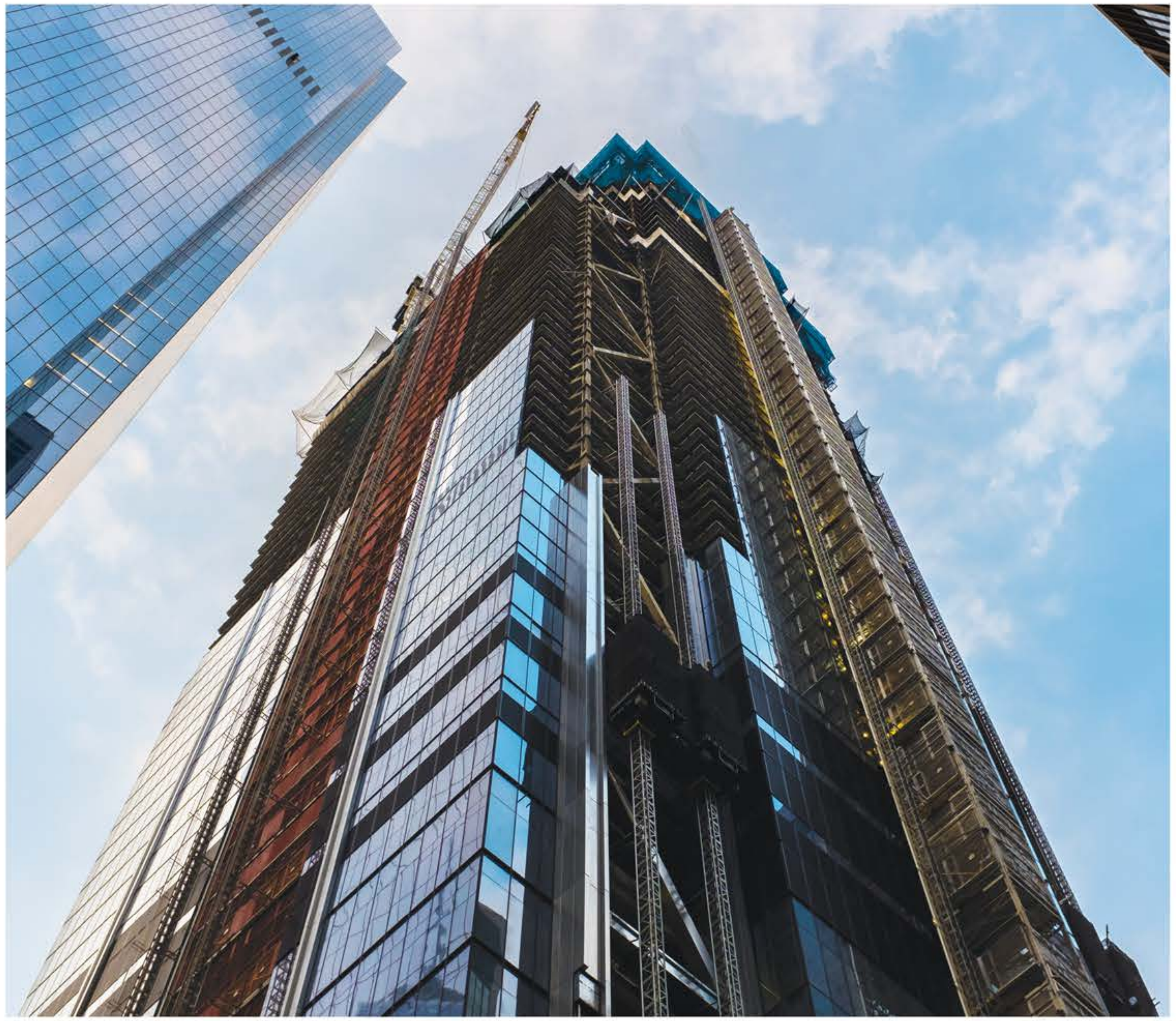
For one of Lower Manhattan's newest office towers, exterior steel K-bracing not only provides structural stability, it also grants tenants column-free views from every corner of the building.

ALONG WITH THE RECONSTRUCTION of the World Trade Center complex has come renewed attention to restoring the street grid that was blotted out by the original World Trade Center superblock. In the time since 2001, Greenwich Street has been reconnected to the east of the site and Fulton Street extended west. With the completion of 3 World Trade Center, Lower Manhattan has added another piece of pedestrian connectivity with two new non-vehicular areas. Cortland Way, to the south of 3 WTC, adds a block of Cortland Street that was "de-mapped" in the original WTC scheme; on the north side, a new plaza allows pedestrians to travel between 3 WTC and the Calatrava-designed transportation hub. But the building's relationship with its neighborhood doesn't end with improving pedestrian permeability. From the onset, architects Rogers Stirk Harbour + Partners envisioned a structural steel design design that would complement and acknowledge the WTC Memorial and present a series of human-scaled elements to those who see and use the building on a daily basis.

The design brief for the tower by Silverstein Properties included development of 2.8 million square feet of commercial space, with 2.5 million square feet above grade. Commercial office space comprises approximately 2.1 million square feet of this, accommodated in large trading floors within the podium section as well as in typical office floors in the tower. The tower's stepped design is meant to offer a variety of floor-plate sizes to tenants, ranging from 30,000 to 70,000 square feet.

"The main core of the building is pushed further to the back, so the relationship of the tower passes straight away down to the ground and reinforces the Church Street frontage, and the Dey and Court Street frontage," says RSHP project partner Richard Paul. The tower's slightly offset positioning accounts for its neighbor to the south, Tower 4 designed by Fumihiko Maki, whose face stands only 41 feet from Tower 3. "The Maki tower is further forward and Tower 3 is pushed to the back, and that's purely to gain aspect—something that came out of the overall master plan," says Paul.

Tower 3's most noticeable feature is a stainless steel-clad exterior frame and unique load-sharing system of K-shaped steel bracing that climbs the corners of the structure on the north and south facades and allows the building's corners to cantilever. "It was one of the main objectives to keep the corners of the building completely column-free so every corner of the building allows you panoramic views out both sides," says Paul. "In doing that we have also expressed the relationship of the structure with this perimeter load-bearing structure, where

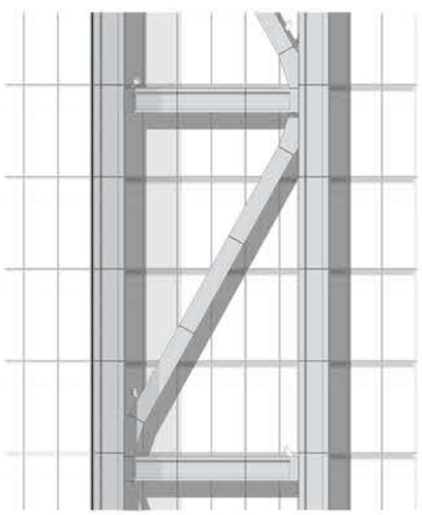


effectively the facade edges have been pushed in to keep the main expression external to the skin."

The K-bracing acts as part of the building's redundancy system. "In the event we lost a column in a catastrophic event, the load is transferred to the diagonal bracing system, which we've used as an expressive element." Owen Steel Company fabricated the tower's 27,000 tons of steel, which was erected by NYC Constructors, a company of Banker Steel.

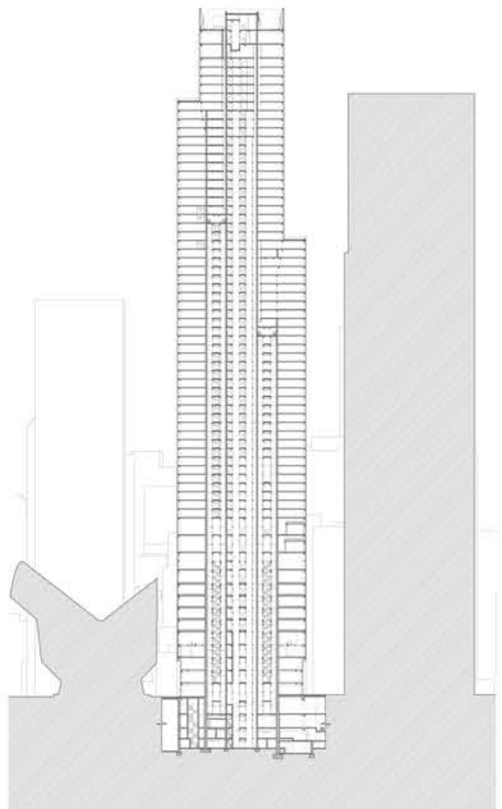
On a four-story module, the K braces—constructed of a pair of columns with a diagonal element bolted between them—accentuate the central volume of the tower and its east-west configuration while also providing, the architect points out, the human scale of grain and texture to the external facade. Clad in a linen-finish stainless steel, the expressive elements do change the building's appearance depending on how light hits them. "When you see the sun hitting off it, it turns the color of the building into an almost orange glow," says Paul, lamenting on the day of a cloudy site visit, "It's a shame you can't experience it today in the rain!"

Changing weather changes the view for those inside as well.



Billie Grace Ward via Flickr; Diagram: Rogers Stirk Harbour + Partners

Facing top Erection of the tower's curtain wall in August 2016.
Facing bottom A detail diagram of the building's cross-bracing
This page, from top The Greenwich Street entrance looking north. The building's three-tiered lobby, looking north. The west elevation, seen in context with Calatrava's Transportation Hub and Maki's 4 WTC.



Photos: Joe Woolhead; Diagram: Rogers Stirk Harbour + Partners

Positioned opposite the WTC Memorial, the building's triple-height office entrance lobby presents an expansive cable net facade to Greenwich Street and the Memorial beyond; 3 WTC purports to be the first building in the world with a three-sided cable net facade. Designed to withstand high loads like the impact of a blast, the walls are composed of laminated glass units 5 feet wide by 10 feet high that will not shatter into shards if broken. A truss element goes around the perimeter floor above the lobby and cantilevers to take the load of the facade.

"We have a gradually descending scale inside the lobby to try to bring in as much natural light as possible," says Paul. The lobby steps from 62 feet at its highest to 42 and then 22 feet. Three sides of the space have three levels of retail; there are nine entrances, including two each from the retail area and the Transportation Hub and five from the street. With completely pedestrianized space on Cortland and Dey, the building is a new gateway between the east side of Lower Manhattan and the Memorial area.

Above, the tower also offers outdoor respite for tenants, who include GroupM, IEX, and McKinsey, with three outdoor

terraces on levels 17, 60, and 76. Located 935 feet above street level, the 76th floor terrace is the tallest outdoor office terrace in Manhattan (the 60th- and 17th-floor terraces are positioned 718 feet and 205 feet above street level, respectively).

More than a symbol of continued growth at the WTC site, Tower 3 represents the leaps and bounds being made by the city's building developers in responding to Governor Cuomo's Minority and Women Owned Business Enterprises campaign. Silverstein Properties MWBE commitment for 3 WTC was estimated at $402 million, or 40 percent of all contracts awarded, with minority and female workers making up 36 percent of skilled labor during the tower's construction.

"I couldn't be more proud of the 2,300 union construction workers who have already put in over 5 million hours to build this tower from bedrock to 1,079 feet," said Gary LaBarbera President, Building and Construction Trades Council of Greater New York, at the building's topping out in 2016. Nearly three years later, the tower stands as another testament to the city's ability to move forward.

Three World Trade's east elevation as seen from the 9/11 Memorial.
Facing At 1,079 feet tall, RSHP's tower is the third building to be completed on the World Trade Center masterplan site developed by Silverstein Properties.

Joe Woolhead

3 WORLD TRADE CENTER

Location: **175 Greenwich Street, New York, NY**
Owner/Developer: **World Trade Center Properties, LLC, An affiliate of Silverstein Properties, Inc.**, *New York, NY*
Architect: **Rogers Stirk Harbour + Partners**, *New York, NY*
Architect of Record: **Adamson Associates**, *New York, NY*
Structural Engineer: **WSP USA**, *New York, NY*
Mechanical Engineer: **Jaros Baum & Bolles**, *New York, NY*
Construction Manager: **Tishman Construction Corporation**, *New York, NY*
Curtain Wall Consultant: **Vidaris**, *New York, NY*
Structural Steel Erector: **NYC Constructors, a company of Banker Steel**, *New York, NY*
Curtain Wall Fabricator: **Permasteelisa**, *New York, NY*
Curtain Wall Erector: **Tower Installation**, *Windsor, CT*

Paul Rivera

Exposing the full-length curtain wall and truss allowed dance studio classes and performances to be showcased to passersby on West 55th Street.

Joan Weill Center for Dance

Large expanses of high-performance glass fill out the newly erected curtain wall designed for the existing Alvin Ailey American Dance Theater and its new three-story expansion in midtown Manhattan.

KNOWN AROUND THE WORLD FOR its vibrant fusion of dance styles, the Alvin Ailey American Dance Theater's performances, training programs and educational activities can look forward to an even brighter future at the Joan Weill Center for Dance. Now, the huge expanses of glass that form the center's newly erected facade showcase the vibrancy and movement inside its studios. Choosing the right product and installer for the glass, and a close-knit project process, were key to seamlessly integrating the old with the new at the Midtown Manhattan facility.

The attention-grabbing project involved removing 2,400 square feet of the original 2004 curtain wall and installing 7,400 square-feet of new curtain wall on the existing facade and on a new three-story addition. The addition accommodates four new dance studios, two classrooms and administrative offices inside approximately 10,227 square feet of added space at the corner West 55th Street and Ninth Avenue.

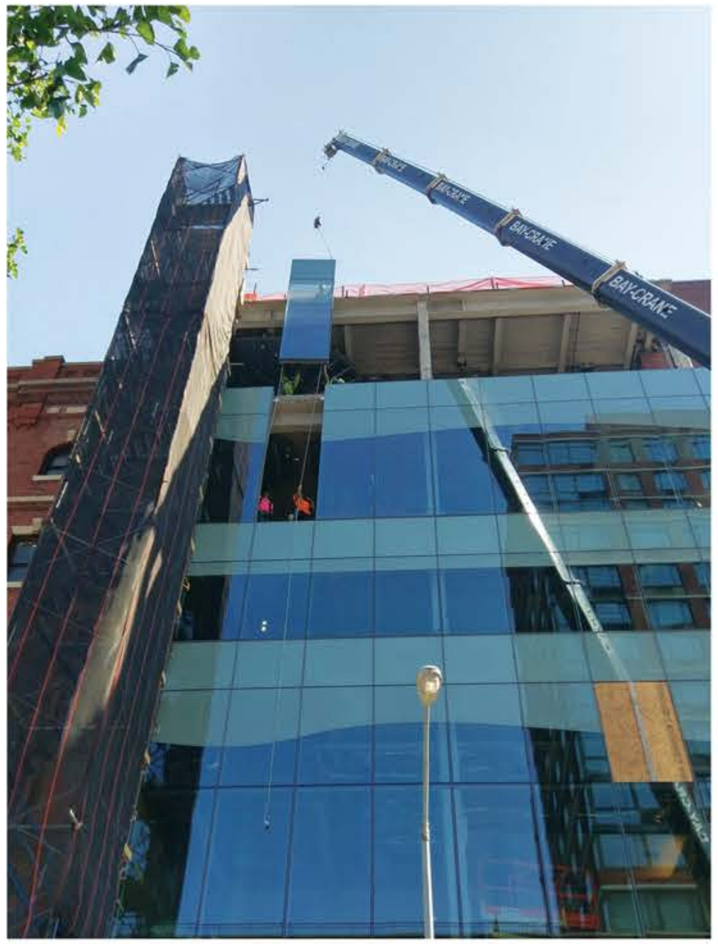
"The addition's new, less articulated, more transparent curtain wall exposes the dancers to the streetscape, further fulfilling Mr. Ailey's vision of bringing dance to the people," explains Natan Bibliowicz, partner at Iu + Bibliowicz Architects, New York, which designed the renovation as well as the original 2004 building.

The building's core spaces are enclosed by red brick masonry to help blend into the tenement brick buildings in Manhattan's Clinton District. The curtain wall is accented by a silk-screened "wave pattern" of frit. "The undulating frit on the transparent, less articulated curtain wall of the newly expanded West building reinforces the concept of the Teflon forms of the entry marquee and the roof veils referencing the 'Wade in the Water' segment from Ailey's signature dance, 'Revelations,' which uses billowing blue fabric that stretches across the stage as dancers glide through it," says Carolyn Iu, partner at Iu + Bibliowicz.

In its quest to design a high-performance facade, the design team chose Erie Architectural Products' Enviro Facade unitized curtain wall fitted with Interpane Ipasol low-e coated insulating glass units. With panel sizes running as large as 100 inches by 288 inches, the Enviro Facade was unique in its ability to meet the design requirements of this size and scope.

The project's tight timeline also placed constraints on the materials used. "The Interpane Ipasol low-e coated IGUs were procured for this project due to the sourcing at the time not allowing for any domestic glass fabricators to be able to produce the largest coated insulating glass lite required on the project, which was 98-inches wide by 174-inches tall," says Bruce Hernsdorf, senior project manager at W&W Glass.

Beyond the unique size requirements, the Enviro Facade curtain wall offered a high level of thermal, air, water, and structural performance. Moreover, the project team benefited from the expertise of Erie's highly sophisticated engineering team when it came to addressing the many challenging detail, interface, and anchorage issues presented by the facade's complex design.



> “The addition’s new, less articulated, more transparent curtain wall exposes the dancers to the streetscape, further fulfilling Mr. Ailey’s vision.”
>
> **Natan Bibliowicz, Iu + Bibliowicz Architects**

This page Large low-e coated insulating glass units are hoisted by a crane on West 55th street. Due to space constraints on the courtyard side of the project, a custom monorail had to be built on top of the building’s expansion in order to hoist the panels loaded onto the roof by the 55th Street-side crane.

W&W Glass

Iu + Bibliowicz; following spread: Fred Charles Photography

Oversized lites of high-performance glazing welcome natural light and New York City views into the Alvin Ailey American Dance Theater.

“The unitized facade allowed for faster installation on site at a very tight project site with little to no layout space,” adds Hernsdorf.

While the work on the 55th Street side was able to be crane set, the theater’s interior courtyard presented more of a challenge. Here a custom monorail had to be built on top of the expansion to hoist panels that were loaded onto the roof by the 55th Street side crane. “The monorail was the only way to lower the panels down to the courtyard area for distribution and setting as there was no other accessibility into that space, otherwise,” Hernsdorf explains.

The anchoring conditions on the three-story existing portion of the building posed another installation challenge for the team. Once the old curtain wall was stripped off and the anchors were exposed, a full X-ray scan and analysis of the existing reinforcement in the concrete slabs revealed that they were insufficient to support the new curtain wall system.

To resolve this issue, W&W and Erie worked together to design, engineer, and fabricate new anchors on the fly since the structure had already been exposed to the elements.

The X-ray analysis also revealed that some of the existing columns required reinforcement and therefore some additional lateral bracing was needed. At the same time, the existing footings, columns, and lateral system in the existing building had reserve capacity, so did not require structural changes.

Offering some more details on the curtain wall’s structural system, Phil Murray, partner at Gilsanz Murray Steficek, explains, “The curtain wall is supported by connectors that are embedded into the concrete topping slab and the slab provides gravity and lateral support for the mullions and glazing. The anchors have reinforcing bars around them to provide a ductile connection.”

While the facade components themselves are not fire protected, because this is not required by the building code, all of the structural steel beams, columns, and girders are fireproofed with a two-hour fire rating. The majority of the steel was treated with a spray-on cementitious material and where the structural steel is exposed, intumescent paint was applied. Otherwise, the thickness of the concrete topping was sufficient to achieve the desired fire

Along with a three-story addition, the entire facade of the Alvin Ailey American Dance Theater in Midtown Manhattan was refaced with a high-performance curtain wall system.

rating for the concrete and metal deck floor slabs, according to Bibliowicz.

Unique to this particular project was the fact that the space had to actively function as a dance studio during construction. This meant that vibration and acoustic considerations had to be built into the long span design.

"The steel beams were proportioned so that their natural frequency of vibration exceeded 10 Hertz, i.e., cycles per second," relates Murray. "This frequency helps to ensure that the structure is not excited by the rhythm of the dancers."

In addition, the architects specified the thickness of concrete on metal deck for the dance floors at 6 inches to provide additional mass. "Then the dance floor itself was supported on vibration isolation pads that help with acoustical separation and provide a cushioned surface that does not impact that dancer's knees and joints as would be the case if the floor was supported directly on the concrete slab," says Bibliowicz.

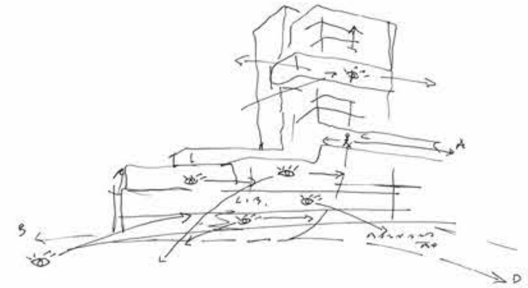
Another acoustic design step involved filling the mullions, which interconnect from floor to floor, with sand in order to dampen sound or vibration that would otherwise telegraph up or down the mullions.

Now, with a new high-performance skin as their backdrop, rehearsals and performances at Alvin Ailey have new brightness. This would not have been possible without the properties of the materials used and the close-knit team that worked in tandem to deliver the building's new high-performance skin. "Our project management team was involved every step of the way to ensure a successful installation to achieve the architectural intent and system performance criteria," says Hernsdorf. And, just as in a dance performance, this coordination made all the difference.

JOAN WEILL CENTER FOR DANCE

Location: **405 West 55th St., New York**
Owner: **Alvin Ailey Dance Foundation**, *New York, NY*
Architect: **Iu + Bibliowicz Architects**, *New York, NY*
Structural Engineer: **Gilsanz Murray Steficek Engineers and Architects**, *New York, NY*
Construction Manager: **Structure Tone**, *New York, NY*
Curtain Wall Consultant: **Gilsanz Murray Steficek**, *New York, NY*
Structural Steel Fabricator and Erector: **United Structural Works**, *Congers, NY*
Curtain Wall Fabricator and Erector: **W&W Glass**, *Nanuet, NY*

The Milstein Center at Barnard College, designed by SOM, is a new academic hub on campus, featuring a library, conference facilities, workspaces for four academic departments, and more.



Milstein Center at Barnard

A terraced design avoids casting shadows on the campus lawn while opening the building to the surrounding community and creating a variety of interdisciplinary spaces within.

A NEW HUB FOR ACADEMIC and intellectual life on the Barnard College campus opened last fall and owes its soaring library and structural feats to its steel frame. Designed by Skidmore, Owings & Merrill (SOM) and built on the former site of Barnard's former library, Lehman Hall, the distinctive 128,000-square-foot building has a terraced, five story base anchored by an 11-story tower on the west side. Its rain screen system of shingled, patinated zinc panels breaks down the building's scale and blends in with its historic surroundings.

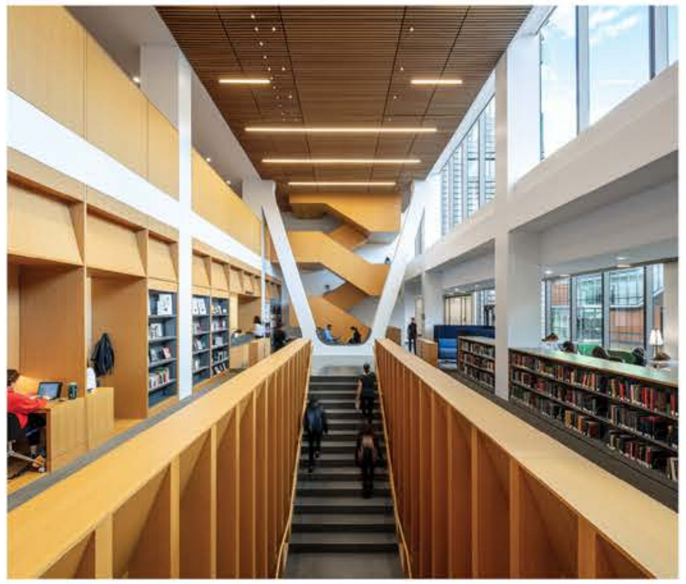
SOM and structural engineer Robert Silman Associates explored both concrete and steel structures early in the design process for Milstein, but ultimately found that the regular column layout played to the strengths of structural steel.

In addition to the double-height library, the Milstein Center includes over 370 inviting student spaces for individual study or collaborative group work; large, light-filled classrooms; a conference center on the lower level; offices for departments and programs that were previously dispersed throughout the campus, such as computer science, economics, and political science; and a home for programs such as the Vagelos Computational Science Center and the Athena Center for Leadership Studies.

"One of the reasons why we really wanted to pursue this project was its location—how many opportunities do you get to create an intervention at the center of a campus?," says Meredith Bostwick-Lorenzo Eiroa, SOM Project Manager.

Indeed, Milstein is located at the heart of Barnard's campus, facing Broadway and Columbia University, and in front of an open green space often occupied by students and events. Because Milstein is twice as big as Lehman was, "a big part of our responsibility was to make sure the building didn't become a detriment to the pavilion of the lawn," says Bostwick-Lorenzo Eiroa. SOM determined the building's massing

Clockwise from top Milstein's double-height library is framed with U-braces and anchored by a cantilevered, switch-back feature stair. The stiffness achieved by using braced frames, expressed on the ground floor of the library, allowed for an overall more efficient structural frame and supported Milstein's height. The steel structure of the U-braces and stair visible during construction.



based on sun studies and added glass rails to the terraces, which feature sedum and pavers, to allow unobstructed views to the lawn below. They also appear to extend the lawn vertically.

Milstein's central location on campus also influenced SOM's facade choice. The pre-weathered zinc panels match the terra cotta and brick on campus, as well as Weiss/Manfredi's adjacent Diana Center, with its clear and color-integral glass panels. Fabricated by Zahner and erected as part of a unitized curtain wall by Island Exterior Fabricators, each of Milstein's metal shingles is unique, shifting in tone with the changing light and modulating the building to its context. The pre-weathered finish also means the facade requires minimal cleaning and maintenance.

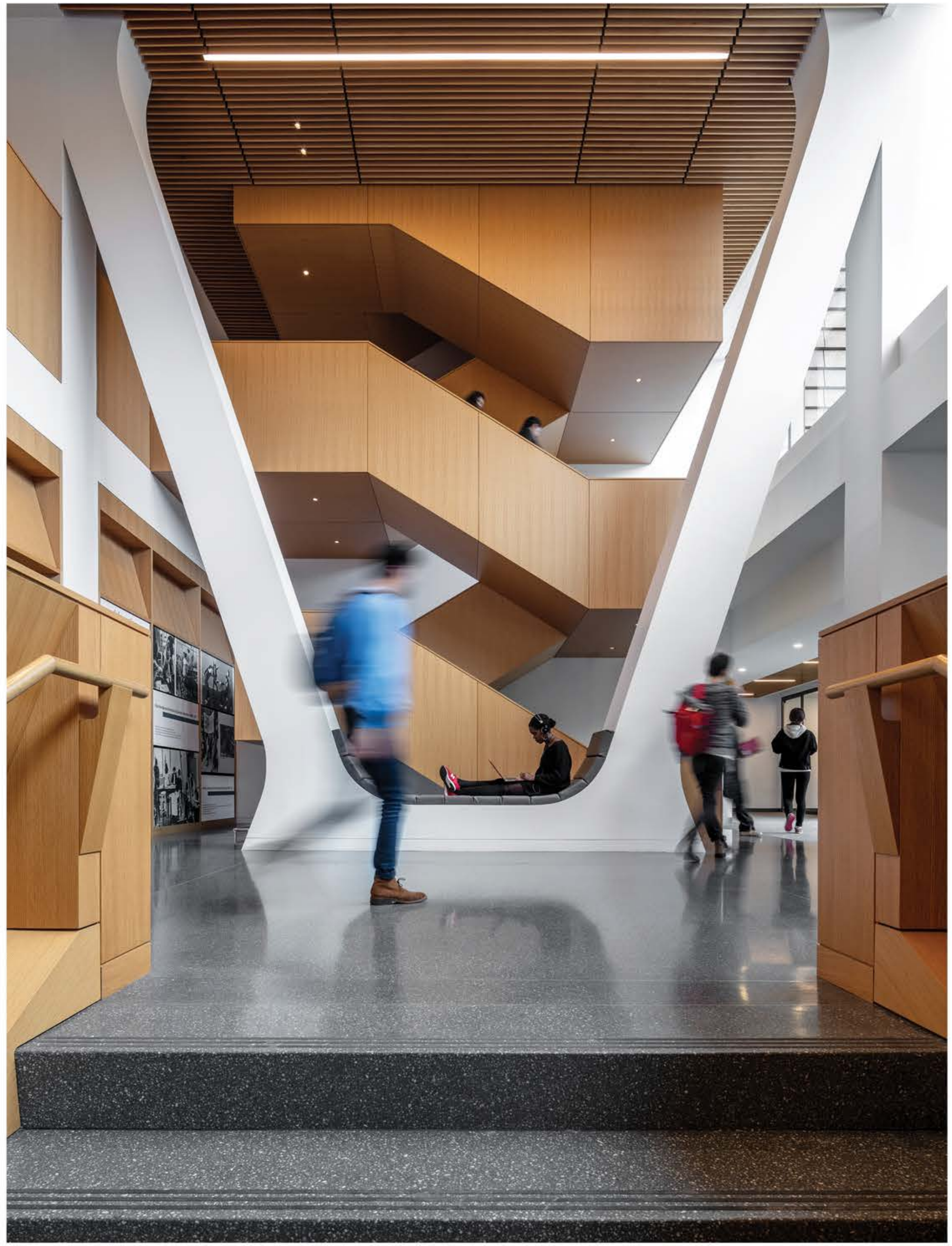
Bostwick-Lorenzo Eiroa notes that the exterior wall was completed through a design assist process with Zahner, Island, and construction manager Turner Construction. This fast-tracked process relied on collaborative sessions with the team, and meant that design drawings could be speedily turned into shop drawings with troubleshooting along the way. The wall system was procured early, while Lehman was still being demolished, and ultimately allowed the project to come in on budget and on schedule. "It afforded us a better quality wall than we would have been able to get otherwise, if it was a traditional process," says Bostwick-Lorenzo Eiroa. "Design assist is becoming the status quo in the industry, especially in New York, and we encourage a lot of our clients to pursue it."

Stepping inside, Milstein welcomes the Barnard community with a grand library clad in warm wood. The structure's lateral bracing is expressed in two mirrored, W12x72 wide-flange U-braces that define the library's central bay, as well as the book stacks on the second floor. At about 31 feet long, they weigh around 2,200 pounds each, or 4,400 pounds per "U." The stiffness achieved by using braced frames for a building of Milstein's height allowed for a more efficient structural frame. (While moment frames would have kept all of the bays of the library open, they are significantly more expensive and heavier.)

The elegant trusses are upholstered at their curved bases on the ground floor, creating coveted seats. "We went through many iterations of hiding or expressing the bracing and ultimately thought it was a great way to integrate it into the design," says Julia Grabazs, SOM designer.

Adding to the drama, a monolithic, switch-back four-story

Opening spread: photo courtesy SOM/© Magda Biernat; sketch courtesy SOM/Roger Duffy; this spread: professional photos courtesy SOM/© Magda Biernat; construction photo courtesy SOM



stair clad in wood connects the library floors. It cantilevers from the second story, anchored to the north by two 16-inch-deep columns hidden in the wall. Two W12 beams, which are aligned with each landing, cantilever out to provide a platform, and the stair stringers then span between the cantilevers. The moment connections of the landing cantilever beams were field-welded to the 16-inch columns. “Simple details, like reveals in handrails, really make the space and add humanity to the design,” says Grabazs. She adds that active design was an important part of Milstein’s architecture, and the stair means that students can forgo the elevator for at least four floors.

The open and flowing library experience prioritizes fire safety in several ways. The main entrance connects to Level 1 below via a grand straight-run communicating stair flanked by continuous fire-rated glass walls and a large pair of fire-rated wood swing doors, which have hold-open devices that connect to the building’s fire-alarm system. As the library flows into Level 4 from the switch-back feature stair, there is a large fire-shutter concealed in the ceiling.

On the fifth floor, the design team chose to connect Milstein’s tower with its neighboring tower, the 1969 Altschul Hall. This sky-bridge connects the Vagelos Computational Science Center at Milstein with the science-focused spaces inside Altschul Hall. Because the floor plates of the two buildings don’t match up, SOM created a gradually sloping ramp that allows students to easily travel from the classrooms in Altschul to the collaborative spaces in Milstein. “The computational sciences—all of that brain power—is in the ivory tower next door. How do we invite the sciences to participate here?,” asks Bostwick-Lorenzo Eiroa. The bridge was the obvious answer. It was built with one W36x136 cantilever and one W30x90 cantilever on the 5th floor. The roof of the bridge is framed with one W36x135 cantilever and one W36x170 cantilever.

Further up Milstein’s tower, a window-walled faculty room cantilevers 16 feet over the base building with sweeping views of the Hudson River, Columbia’s campus, and Midtown Manhattan. It was achieved with W24 cantilevers on both the 9th and 10th floor. The upper 10 floors of the tower itself also cantilever to the north, over the Altschul Hall garage. Four parallel full-story trusses cantilever 19 feet to support those upper floors.

Another structurally challenging space was the large-span lecture hall on the lower level. Transferring a column over the room required a non-traditional approach: Due to the beam depth restrictions aimed at preserving sightlines, two side-by-side W40x397 beams were needed to span the 50 feet.

While not as visible as its muscular steel structure, Bostwick-Lorenzo Eiroa adds that the project was also noteworthy for its team of female architects and engineers, including Principals Victoria Ponce de Leon and Sarah Steele from Robert Silman Associates. “This being a women’s college, it was important to Barnard that there were women who really contributed and thought innovatively about how we brace this building.”

The building is clad in shingled, patinated zinc panels that reflect the warmth and variation of the campus’s material context. On the west side of the base building, an 11-story tower connects via skybridge to its neighbor, Altschul Hall. **Facing** A view of Milstein’s five-story base, which rises in a series of stepped-back, occupiable terraces and overlooks the campus lawn.

This spread: photos courtesy SOM/© Magda Biernat

MILSTEIN CENTER AT BARNARD

Location: **3009 Broadway, New York, NY**
Owner: **Barnard College**, *New York, NY*
Architect: **Skidmore, Owings & Merrill LLP**, *New York, NY*
Structural Engineer: **Robert Silman Associates**, *New York, NY*
Mechanical Engineer: **WSP Group**, *New York, NY*
Construction Manager: **Turner Construction**, *New York, NY*
Curtain Wall Consultants: **Gordon H. Smith Corporation**, *New York, NY*; **A. Zahner**, *Kansas City, MO*; **Erwin & Bielinski**, *New York, NY*
Structural Steel Fabricator: **Cives Steel Company**, *Gouverneur, NY*
Structural Steel Erector: **JC Steel Company**, *Bohemia, NY*
Miscellaneous Iron Fabricators and Erectors: **Post Road Iron Works Inc.**, *Greenwich, CT*; **United Structural Works**, *Congers, NY*
Architectural Metal and Ornamental Metal Fabricator and Erector: **JEM Architecturals Inc.**, *New Rochelle, NY*
Curtain Wall Fabricators: **Island International Exterior Fabricators**, *Calverton, NY*; **Jordan Panel Systems**, *East Northport, NY*
Curtain Wall Erector: **Island International Exterior Fabricators**, *Calverton, NY*

The Kimmel Pavilion's 65-foot-tall light-filled atrium is supported by vertical steel bars hung more than 60 feet from the perimeter beam of the 6th floor to the roof of the entrance canopy.

NYU Langone Kimmel Pavilion

An expansive curtain wall and unique long-span bridge support New York City's first single-occupancy hospital tower.

PART OF THE LARGEST, MOST extensive revitalization ever undertaken by NYU Langone Health, the new 830,000-square-foot, 21-story Helen L. and Martin S. Kimmel Pavilion is New York City's first acute clinical care facility outfitted with all single-occupancy rooms; it also houses Hassenfeld Children's Hospital, the first children's hospital built in the city in nearly 15 years.

Tracking for LEED Platinum certification and enhancing NYU Langone's full offering of medical services meant the Ennead and NBBJ-designed facility had to overcome some real architectural and engineering challenges. But perhaps even more pressing was contending with NYU Langone's history of battling natural disasters—most notably Hurricane Sandy, which caused extreme flooding and backup generator failure and led to the temporary closure of the institution.

Furthermore, as the only remaining above-grade site on NYU Langone's campus, the building team found itself contending with four underground Amtrak commuter train tunnels and a major combined sewer outfall line, neither of which could withstand new foundation loads.

The answer was to bridge the new structure over the tunnels using structural steel because of its long-span capabilities. With spans of more than 100 feet required in order to achieve this, 34-foot-high trusses were erected at the 6th floor level, from which the lower floors are suspended while transferring the structural support for the floors above.

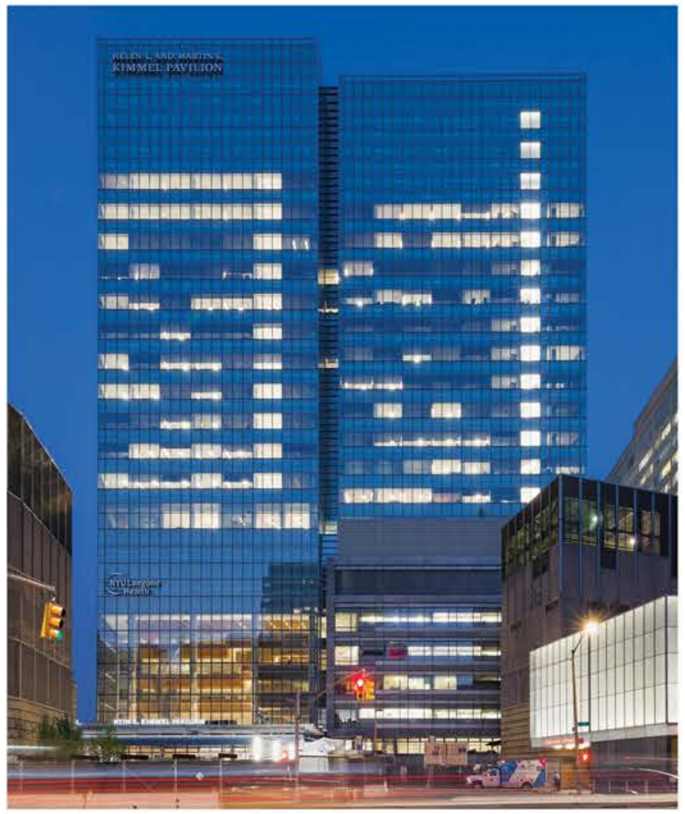
In addition to the complex structural design, the striking new structure features an expansive curtain wall facade with low-iron vision glass, contrasting white ceramic frit, and an innovative canted shadow box design.

The Kimmel Pavilion maintains the same planes and terracotta cladding as the adjacent Energy Building, creating a unified campus appearance. "A continuous lightwall feature provided at the top of the Energy Building and the Kimmel Pavilion podium also unifies the two buildings," adds Vicki Match Suna, senior vice president and vice dean for real estate development for NYU Langone Health.

The new tower, overlooking the East River on 34th Street, features a thermally broken aluminum unitized curtain wall with triple-glazed insulated glass at the north, south, and east facades, while the west facade incorporates a double-glazed insulated glass unit.

"With expansive views of the city and access to an abundance of natural daylight, the upper half of the building is cladded with vision glass and spandrel panels, and the lower half, on the other hand, is designed with vision glass and ultra-high performance concrete panels that serve as a rainscreen," explains Kevin Krudwig, senior associate at Ennead.

With a six-lane highway and heliport bordering the east facade, controlling interior noise levels factored in significantly to the facade design. Early design iterations included a combination of window wall, precast concrete



NYU Langone Health now includes the new 830,000-square-foot, 21-story Helen L. and Martin S. Kimmel Pavilion, the city's first acute clinical care facility outfitted with all single-occupancy rooms. It also houses Hassenfeld Children's Hospital, the first children's hospital built in the city in nearly 15 years.

spandrels, and unitized curtain wall at the podium with a unitized curtain wall at the tower. However, the need for good acoustics, in addition to thermal performance, led the design team to choose curtain wall for the entire facade.

Acoustic sashes were considered, but, "thermal analysis determined that adding the sash inboard of the IGU led to the risk of condensation forming in the cavity, which is unacceptable in a healthcare environment," explains John Pachuta, senior principal at Heintges & Associates.

Ultimately, extensive acoustical analysis and testing determined that laminated, triple-glazed IGUs could provide the level of sound attenuation required for the majority of site exposures. Consequently, the IGUs were integrated with an acoustical PVB interlayer and the aluminum mullions were filled with mass-loaded vinyl.

A facade design highlight, the curtain wall towers 65 feet above the atrium floor. "Vertical steel bars are hung more than 60 feet from the perimeter beam of the 6th floor to the roof of the entrance canopy. The curtain wall units are hung from those steel bars, thus the entire weight of the wall is carried by the perimeter beam above," explains Pachuta.

In addition, stainless-steel struts carry the lateral loads acting on the wall to the interior horizontal steel ring beams. In order to accommodate thermal expansion, contraction, and deflection coming from the 6th floor, the struts run in slots that allow them to freely move up and down with the building.

During curtain wall installation units were delivered to each floor using construction hoists and installed using mobile cranes and monorails positioned on floors above. "The procedure involved a pair of support cables that were hung from outriggers at the top of the building and lowered to pick the units at the floor needing to be enclosed," says Krudwig.

At the podium level, the UHPC cladding panels were installed onto the appropriate curtain wall panels on-site before the entire units were hoisted and installed.

In order to ensure a tight enclosure, the architect specified a pressure-equalized system with multiple lines of defense against water and air infiltration. "This system utilizes a rainscreen gasket to resist bulk water, a weather seal to limit ingress of water further into the system, and an air seal that frames the pressure equalized cavity and prevents indoor air from entering the system where it could condense," explains Pachuta. This approach ensures redundant protection against water infiltration and reliably limits how much air can circulate through the system's joints.

Prior to fabricating the curtain wall units, the performance of the system was extensively tested using full-scale mockups to ensure that the specified air, water and thermal targets were being met. Further field tests were conducted to ensure that the system was being properly installed.

As carefully considered as its highly visible facade, the building's hidden structure is supported by a uniquely designed, long-span bridge comprised of steel trusses between 104 feet to 140-feet long and 34-feet deep, which are integrated into the mechanical floor placed at the top of the podium.

The choice of steel framing minimized the weight that needed to be transferred and allowed for maximum strength and stiffness for the bridge. "Without these bridging trusses, a third of the site would be unusable, rendering the building impossible to construct," explains Doug Gonzalez, associate partner and project director at LERA Consulting Structural Engineers.

The trusses primarily span to columns and frames located on each side of the rail tunnels with their deep caisson foundations, positioned clear of all tunnels, extending down to bedrock. The building's services core, which contains the majority of the lateral load resisting system, had to be located off-center of the tower and podium in order to avoid the southern tunnel zone.

In addition to avoiding the Amtrak tunnels, the engineers were challenged to deliver the required tolerance and deflection. "Trusses supporting the podium only consist typically of heavy W14 shapes in the 400 and 500 weight series, but trusses bearing the weight of the tower also needed to have built-up box sections weighing over 1,000 pounds per linear foot consisting of plate 4 inches to 6 inches thick," explains Gonzalez.

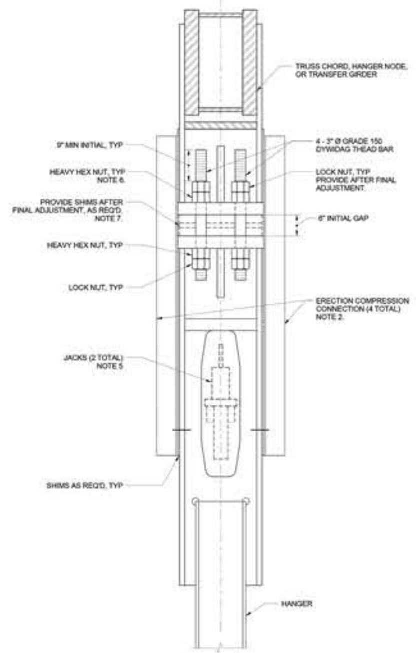
"While the trusses are fairly stiff, with small deflections and vibrations relative to the significant transfer loads, satisfying tolerances in order to successfully cast the flat floor slabs for clinical spaces was incredibly challenging," he adds.

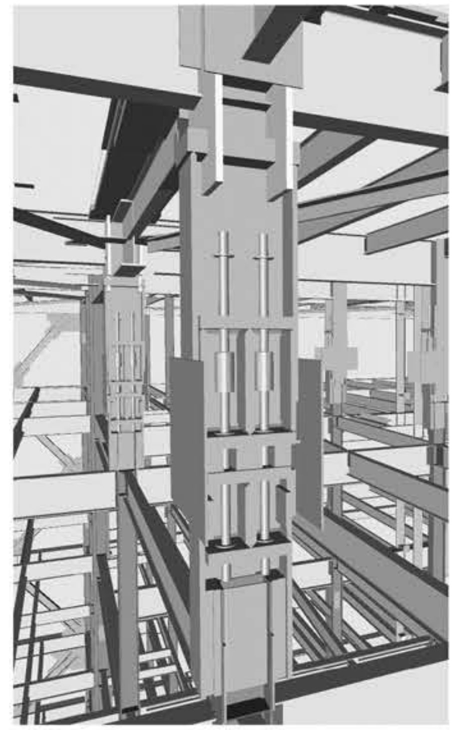
Putting their heads together, the building team developed and coordinated a system of adjusting the elevations of steelwork after erection. In particular, all of the hanger columns supporting the steel-framed operating room floors below the trusses were detailed to allow for their up- and down-elevation adjustment prior to the casting of floor slabs, according to Gonzalez. By utilizing high strength threaded bars that could be jacked, this allowed for adjustments as much as 1½ inches, which greatly smoothed out the podium floors' levelness.

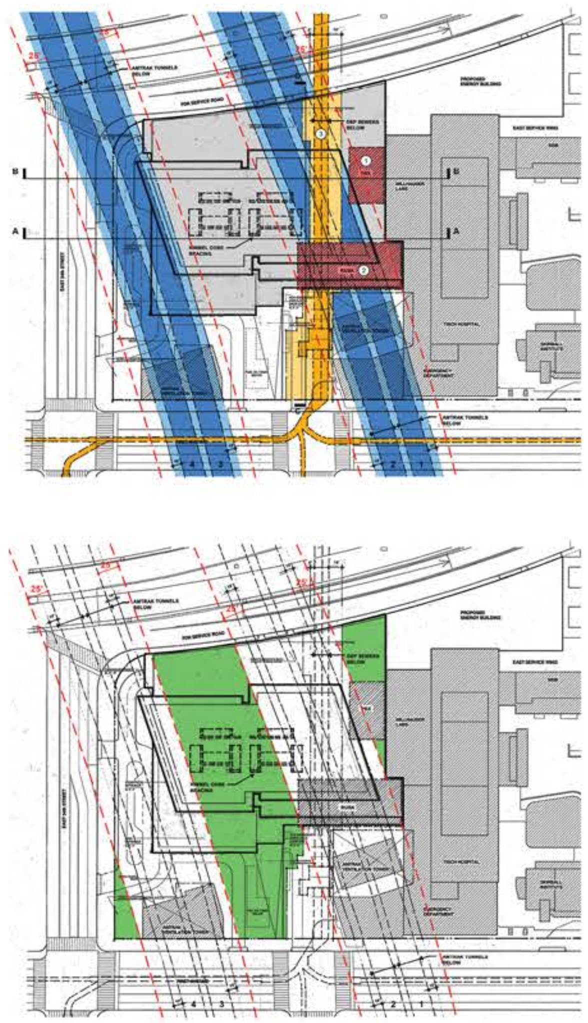
When the team evaluated vibration concerns, the trains running through nearby tunnels weren't an issue. There was some concern about the vehicular traffic driving down Franklin D. Roosevelt East River Drive, but analysis concluded that there were negli-

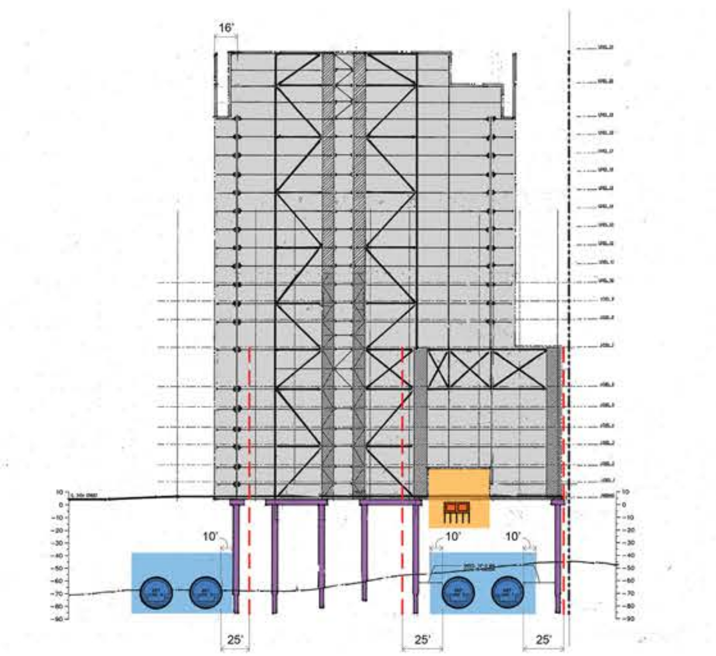
Opening spread and this page: © Jeff Goldberg/ESTO

Site diagrams: Courtesy NYU Langone; adjustable hangers diagrams and photo: Courtesy Ennead; closing spread: © Jeff Goldberg/ESTO









Top In order to meet required tolerances, high-strength threaded bars that could be jacked served as adjustable hangers and worked to smooth out the podium floors' levelness.

Above and left Thirty-four-foot-high transfer trusses between the 6th and 7th floors support the lower floors and transfer the structural support for the floors above.

gible effects on the building from traffic vibration. Consequently, no structural enhancements were required to meet the Kimmel Pavilion's second-floor operating room needs.

Because resiliency became a top priority after Langone's experience with Hurricane Sandy, the building was designed for flood-level waters with an allowance for sea-level rise by providing a building-wide, resilient "bathtub/boat" system to keep flood waters out of the building. In addition, critical MEP services and hospital functions were located above the ground floor.

At the ground level, "a building-wide spanning pressure slab with additional mini-caissons resist uplift from hydrostatic pressure and flood walls were designed for lateral hydrostatic and dynamic wave loads," says Gonzalez. "At the building perimeter, multiple types of deployable flood barrier are used at entrances and openings, while long segments of cantilevering concrete flood walls, supported by the pressure slab, are integrated behind facade elements."

In order to accommodate the 114-foot long perimeter at the main canopy and storefront entrance, the team designed a self-rising flood barrier. Essentially, this is an above-grade passive wall made from fiberglass-encased foam, which is less dense than water and will rise with water levels.

As a result of these efforts, in addition to other campus resiliency upgrades including an 11 MW capacity combined heat and power plant, NYU Langone received Platinum certification under U.S. Green Building Council's Performance Excellence in Electricity Renewal (PEER) v2 standard, and has been recognized as the first medical campus in the world to achieve this accreditation.

"As the first certification program that measures and improves power system performance, PEER recognizes industry leaders for improving efficiency, day-to-day reliability and overall resiliency when it comes to severe events, such as flooding and hurricanes," explains Match Suna.

As for meeting LEED Platinum sustainability criteria, the facade's triple-silver low-E glass coating played a key role in reducing solar heat gain and the number of air changes required to condition the facility's interior spaces.

"The curtain wall also permits large areas of vision glass, allowing visitors and staff of the Pavilion ample views outside, and reducing artificial lighting requirements at the building perimeter," says Pachuta.

With a high percentage of post-consumer recycled material, the structural steel design also helped to garner crucial points within the materials category.

"The infrastructure and efficient operations we've implemented on the Main Campus will help us meet our 50 percent carbon reduction goal by 2025," adds Match Suna. With an eye on the future, NYU Langone believes that sustainability and resiliency go hand in hand.

A long-span, structural steel bridge—made from steel trusses between 104 feet to 140 feet long and 34 feet deep—provide the required structural support for this challenging site.

NYU LANGONE KIMMEL PAVILION

Location: **424 East 34th St., New York, NY**
Owner: **NYU Langone Health**, *New York, NY*
Architect: **Ennead + NBBJ**, *New York, NY*
Structural Engineer: **LERA Consulting Structural Engineers**, *New York, NY*
Mechanical Engineer: **JB&B**, *New York, NY*
General Contractor: **Turner Construction Company**, *New York, NY*
Curtain Wall Consultant: **Heintges**, *New York, NY*
Structural Steel Fabricator and Erector: **Canam/Stonebridge**, *South Plainfield, NJ*
Miscellaneous Iron Fabricator and Erector: **Empire City Iron Works**, *Long Island City, NY*
Architectural Metal Fabricator and Erector: **Jonathan Metal & Glass**, *Queens, NY*
Curtain Wall Fabricator and Erector: **Enclos**, *New York, NY*

The new, Skanska-built Kosciuszko Bridge (right) pictured alongside the former Kosciuszko Bridge (left).

Kosciuszko Bridge: Phase I

Replacing an outdated truss bridge with two elegant cable-stayed bridges, an all-star design/construction team overcame demanding site conditions and introduced innovative features to minimize maintenance and smooth traffic flow.

THE EXPERIENCE OF DAILY LIFE in a city depends on the attributes of its infrastructure—functional practicality and aesthetic inspiration alike—no less than the design of its buildings. Among the indignities associated with driving in New York City, the Kosciuszko Bridge has long ranked high on the aggravation scale. Built in 1939, the original Kosciuszko was a through-truss design supporting six vehicular lanes, a 1.1-mile viaduct connecting the Greenpoint and Maspeth segments of Interstate 278 (the Brooklyn-Queens Expressway) above Newtown Creek. It was named for Polish military engineer Tadeusz Kościuszko, whose contributions to the American Revolution included destroying bridges to impede British troops. More than a few drivers—whether or not they knew what he'd achieved, or how to pronounce his name (Kosh-chush-ko)—cheered on October 1, 2017, when a controlled implosion brought his namesake bridge down as well.

The "K Bridge," the busiest of the four Brooklyn-Queens bridges, was a notorious congestion pinch point. With its steep grade, poor sightlines, narrow lanes, and lack of shoulders or a drainage system, it was not up to Interstate specs; originally designed for 10,000 vehicles per day, it couldn't handle the 160,000 to 180,000 a day it eventually carried. Replacing it was a high priority when Gov. Andrew Cuomo announced the $1.2 billion New York Works program in 2012. When work began in 2014 on a two-part cable-stayed bridge (CSB), says Wahid Albert, chief engineer for the state's Department of Transportation (DOT), the Kosciuszko became "the largest single contract in the history of New York State DOT." Phase I, which opened in April 2017 and initially holds three lanes in each direction (converting to all-eastbound service to Queens once the partner bridge opens), cost $550 million; the winning bid for Phase II, the westbound bridge to Brooklyn that will occupy the old bridge's footprint, was $318 million. Considering the risks, not just nuisances, associated with failing infrastructure—as well as the new bridge's functional upgrades, elegant aesthetics, and 50 percent increase in lane capacity when completed—this is a well-timed investment.

The new Kosciuszko is New York City's first major bridge in over half a century, the last being the Verrazano-Narrows in 1964. It is also the first pure CSB to grace the skyline, reflecting a preference by both state officials and community members for CSBs' harplike profile and low-maintenance requirements. The directive to build a CSB was built into the RFP, chosen over box girder, deck-arch, and through-arch options. Hans Hutton, engineer of record for architects HNTB, notes that while cable-stayed and arch designs are both economical, "cable-stayed bridges can be built using a balanced cantilever style of construc-

tion, which minimized temporary falsework." Phase I construction proceeded one lane at a time, a replace-in-place strategy, without closing I-278 or requiring a temporary bridge; the computationally intensive but materially efficient design was realized seven months ahead of schedule.

When Phase II is complete, the eastbound bridge will hold five vehicular lanes, and the westbound will include four plus a 20-foot protected pedestrian and cycling path on the Manhattan-facing side, increasing motor-vehicle capacity from six total lanes to nine while offering a popular feature for citizens who favor self-powered travel. If the 1939 Kosciuszko reflected the teeth-gritting endurance of 20th-century New York's uneasy accommodation to motorism, today's version suits a 21st-century city upgrading its quality of life.

The Kosciuszko's cost is high, yet several decisions kept it from being higher both up-front and long-term, particularly the cable-stayed design and the structuring of Phase I as a single lump-sum design-build contract. Led by a joint venture combining Skanska, Kiewit, and Ecco III (SKE) and HNTB, the Phase I partnership "locks in project costs and avoids major overruns," Albert notes. "We estimated at that time [the contract announcement] that we will save three to four years on the completion of both phases of the K Bridge." Phase I, the city's first major design-build project, was completed in April 2017, packing design and construction (including most connectors for both bridges) into 36 months. With a similar design for Phase II on a "design-bid-build best-value" plan and a shorter construction period (about 22 months), he adds, "that will definitely be a record of building a cable-stayed bridge with this much approach to it in the country."

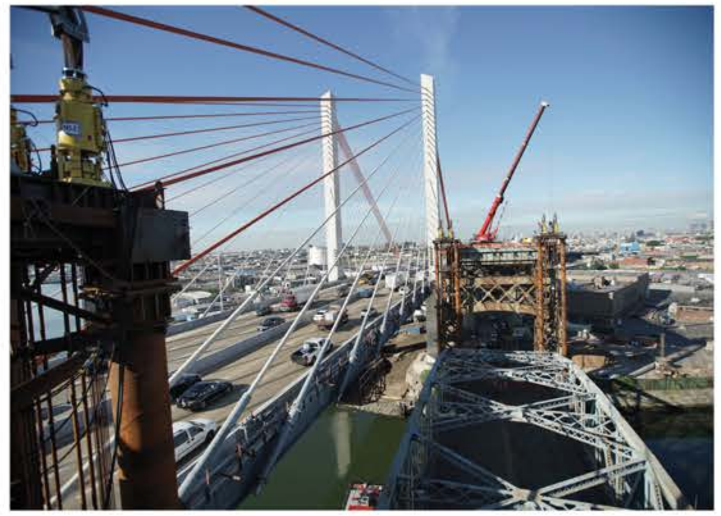
"Design-build usually achieves some innovations," Albert continues, "and typically you don't see that in design-bid-build as much." The new Kosciuszko features numerous details intended to control maintenance costs. There are no expansion joints on the approach spans, he reports. "Every joint leaks eventually, and deteriorated substructures are mostly attributed to leaky joints with [a] high salt concentration of water. Over time it just eats up the concrete and then gets into the steel, and that's how we lose substructure prematurely .... No joint is a good joint," he continues, "no matter how expensive and modern it becomes." Thermal expansion in the approach superstructure (which sits on steel multi-rotational or disk bearings installed at both abutments and anchor piers) is handled by the tall concrete piers: "You can accommodate some of that expansion by flexibility, designing the piers as flexible as possible, and still get the strength you require." Tolun Tuglu, project manager at Skanska USA Civil, adds that CSBs generally need less maintenance than suspension bridges, having fewer anchor points and moving parts, and that the Kosciuszko's slender columns "allow the structure to move as a whole, as opposed to the individual parts of the structure with much sturdier columns, as you might see on other bridges."

The main span of the new bridge deck before its final connection to the Queens-side approach in March 2017.

Durable materials are an essential priority here. "On a bridge that carries 180,000 cars a day, we do not want to be going out there and doing maintenance work," Albert comments. The reinforced-concrete pylon towers are anchored in drill shafts extending 170 feet into ground and 13 feet socketed into rock. The roadway deck has high-performance, low-permeability concrete with stainless steel reinforcement; "on top of that," he adds, "we put a 1-inch-thick polyester polymer concrete overlay on the main-span roadways to reduce life-cycle costs and provide a more robust corrosion barrier." Hutton describes the roadway in detail: "The superstructure is composed of a 10-inch precast, post-tensioned concrete deck, made composite with the edge girders and floorbeams by cast-in-place closure strips. The deck is protected by the use of stainless steel reinforcing .... The post-tensioning runs longitudinally throughout a majority of the deck, with the tendons spaced at 10 to 20 inches. The edge girders are 7 feet deep, built of primarily of grade 50 steel, with grade 70 steel used in a few strategic locations. The floorbeams were also 7 feet deep, constructed of grade 50 steel."

Opening spread and this page: courtesy Skanska USA

This page: courtesy Skanska USA; closing spread: Edom31/Wikipedia Creative Commons



This page, clockwise from top New bridge deck construction over Newtown Creek. Skanska USA lowers the 2,400-ton span of the former Kosciuszko Bridge onto two barges below. The old (right) and new (left) Kosciuszko Bridges pictured side-by-side as the old bridge is lowered. Exposed steel of the new bridge's main span.

The bridge's upper superstructure consists of 56 stay cables, 28 on either side of a single vertical 287-foot concrete pylon tower (nearly the height of the Statue of Liberty) on the Brooklyn side, solid from the footing up to an elevation 109 feet above Newtown Creek and hollow above that point. Cables vary in length from 128 feet closest to the pylon to 612 feet for the last pair crossing the creek; their upper ends are secured inside steel anchor boxes embossed in the towers, and their lower ends are secured in anchorage assemblies attached to "S" girders connecting at roadway level. The cables range from 18 to 92 strands of 0.62-inch diameter 270 grade ASTM A416 steel, with seven-wire strands, Hutton says, individually greased and sheathed; each cable has a viscous damper to mitigate vibrations and instability. All in all, the eastbound Kosciuszko includes "approximately 1 million linear feet of steel strands," Albert reports. "That's more than 188 miles ... enough to circle the perimeter of Manhattan six times."

Steel components are metalized to protect against corrosion, a new technology for DOT at the outset of the project and one that Albert finds superior to either painting or weathering steel. Metalizing, as a thermal spraying process rather than dipping in a tank (as in galvanizing), can be done either in a shop or in the field for touchup work, with no limit on piece size. Among the technologies used here and applicable on future projects, "the biggest bang for your buck," Albert summarizes, "is metalizing the steel structures and stainless steel reinforcements in the deck," followed by the polyester polymer concrete overlay. "In my opinion, steel is the best type of superstructure for longer spans," Albert says, noting that the team envisions a service life of 100 years for the bridge's non-replaceable components.

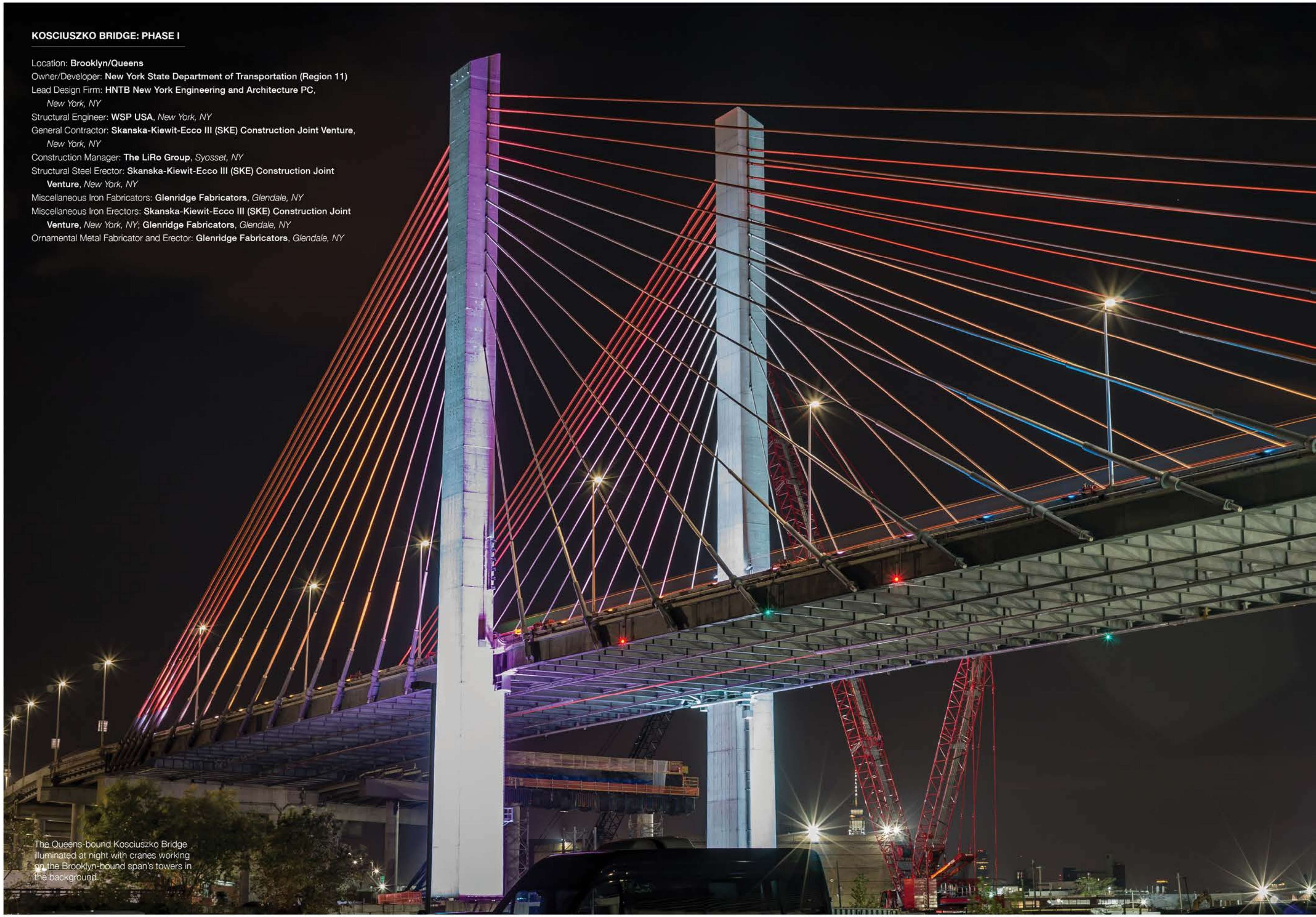
The clearest improvement from motorists' perspective is the roadbed's lower vertical profile, 90 feet above mean high water rather than the old bridge's 125. The 1939 bridge's height, says Tuglu, was initially designed to allow passage of tall warships in an era when the city had good reason to suspect Nazi U-boats lurking in its waters, presumably no longer a pressing concern. On the old Kosciuszko, Albert recalls, "trucks had trouble getting to the crest of it, especially if they were loaded." The sharp incline reduced sight distances, and drivers' tendency to slow down in narrow shoulderless lanes exacerbated congestion, particularly when a collision or breakdown blocked a lane. The new Kosciuszko is not a magic bullet against tie-ups: volume remained dense after it opened, and induced-traffic phenomena may kick in when six total lanes become nine. Still, its gentler incline and Interstate-standard 10-foot shoulders are conducive to fewer crashes and calmer nerves. "Trucks love us," Albert says, "because they don't have to hit the gas as hard to go up that hill." The design accommodates traffic projections for 30 years past the construction year.

Nearby flight paths to LaGuardia Airport required coordination with the Federal Aviation Administration and limited pylon-tower height to avoid interfering with cockpit-to-control-tower communications. Erection of the asymmetrical spans, 624 feet on the main span and 377 feet on the back span, proceeded in segments allowing for the weight disparity, Hutton says, "alternating between the main span and the back span to keep the dead load balanced about the pylon. No temporary falsework was required other than a single temporary bent in the back span to keep the bridge stable during a possible high-wind event until it was fully erected." Demolition of the old bridge combined lowering the main span onto a barge for flotation to a New Jersey steel-scrap recycling facility, then controlled implosion ("energetic felling") of the rest of the structure: another first for the city, Tuglu reports, performed after extensive environmental-impact studies.

The new bridge includes aesthetic flourishes. "We felt the high towers and the cable-stays are a fantastic, dramatic visual experience for the community," Albert comments. "It has a sophisticated lighting system; we can change the color from our office on a daily basis. On either side of the pylons, the top five cables are colored burnt umber, an orange tone contrasting with the natural metallic gray of the nine cables below; the musically inclined will read the five parallel orange lines as a staff, and when viewed against a blue sky, they also allude to the Dutch-derived orange and blue scheme of the city flag. (Resemblance to the colors of the Mets, Knicks, and NYCFC, Tuglu notes, was unintended but a welcome afterthought.) At least in this part of the regional transportation complex, however, after decades of making New Yorkers swear, the Kosciuszko just might make some of them want to sing.

KOSCIUSZKO BRIDGE: PHASE I

Location: **Brooklyn/Queens**
Owner/Developer: **New York State Department of Transportation (Region 11)**
Lead Design Firm: **HNTB New York Engineering and Architecture PC**, *New York, NY*
Structural Engineer: **WSP USA**, *New York, NY*
General Contractor: **Skanska-Kiewit-Ecco III (SKE) Construction Joint Venture**, *New York, NY*
Construction Manager: **The LiRo Group**, *Syosset, NY*
Structural Steel Erector: **Skanska-Kiewit-Ecco III (SKE) Construction Joint Venture**, *New York, NY*
Miscellaneous Iron Fabricators: **Glenridge Fabricators**, *Glendale, NY*
Miscellaneous Iron Erectors: **Skanska-Kiewit-Ecco III (SKE) Construction Joint Venture**, *New York, NY*; **Glenridge Fabricators**, *Glendale, NY*
Ornamental Metal Fabricator and Erector: **Glenridge Fabricators**, *Glendale, NY*



The Queens-bound Kosciuszko Bridge illuminated at night with cranes working on the Brooklyn-bound span's towers in the background.

The patterns on the west and east facades, formed from 337,500 small tabs set at angles, are derived from landscape photographs. The double-skin facade contributes to the building's Net Zero energy plan.

Emma and Georgina Bloomberg Center at Cornell Tech

The first academic building to open on Cornell Tech's Roosevelt Island campus aims for net-zero energy performance, a mission that drives its advanced aesthetics. Its facade of pixelated perforated aluminum and curved glass provides both thermal protection and inspiration.

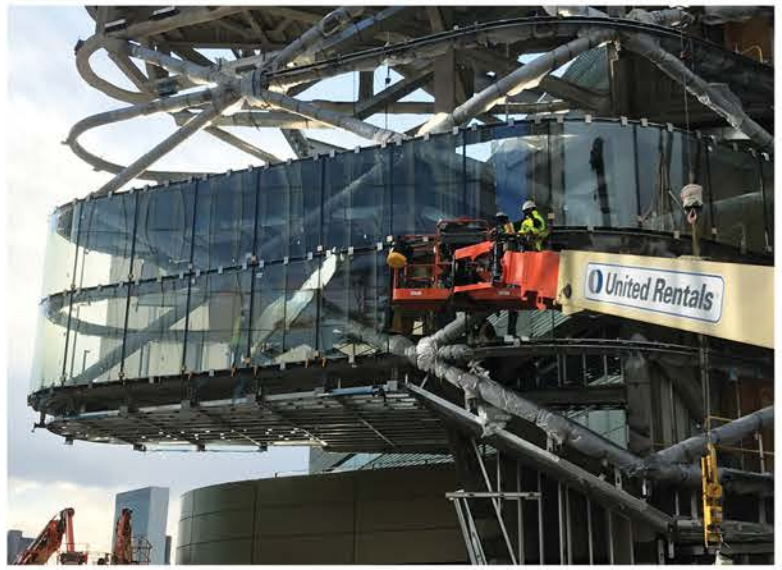
A STROLL THROUGH CORNELL TECH'S new campus, which opened in the fall of 2017, reveals surprises practically everywhere the eye lands. One is a ping-pong table. Beside a walkway near The House (the residential tower by Handel Architects) and The Bridge (the Weiss/Manfredi academic/corporate co-location building, now renamed the Tata Innovation Center; see *Metals in Construction* Winter 2018, p. 14), with a direct view of the Bloomberg Center, stands a futuristic German outdoor table with a metal net. It's not just sturdier than fabric nets; it's a hint that this campus values quality-of-life details and puts materials to unexpected uses.

The Bloomberg Center, the four-story, 160,000-square-foot academic and research facility named for the former Mayor's daughters and designed by Morphosis, is the most visually adventurous of Cornell Tech's buildings, thanks largely to an aluminum-and-glass facade that combines complex digital patterns with distinctive, ever-changing coloration. Like all buildings erected here to date, Bloomberg meets rigorous standards for energy performance (not just LEED Platinum here but Net Zero, generating as much power as it uses). "We were given not so much of a cost budget," says Ung-Joo Scott Lee, Morphosis's project principal, as "an energy budget, so we kind of have to work backwards from a restrictive amount of energy consumption."

Beginning with that core mission, the design and construction team devised strategies that went beyond the familiar. Photovoltaics were always part of the sustainability plan, Lee recalls (along with an 80-well closed-loop geothermal system providing all heating and most cooling, a rainwater harvesting system to reduce potable-water usage, low-energy workstations and LED lighting, a facade designed to minimize solar heat gain, and an all-electric power system avoiding fossil fuels altogether)—yet the architects, he says, rejected "the original concept, which was to put all of these solar panels down on the field and cover the greenscape of the campus. We wanted to do a little bit better than that, and we actually wanted everything that talks about sustainability to be integrated into the identity of the building." The PVs form a roof canopy instead; "it's a building that actually begins from the top down," Lee comments. Observers may read its profile, at first glance, as a building wearing a scholar's mortarboard; the 1,465-panel PV canopy, a companion to the one topping the Tata, proudly proclaims both the Bloomberg's cerebrality and its commitment to renewables.

With exceptional coordination among the architects, engineers, fabricators, general contractor, and others to align decisions with energy goals, Lee says, the Bloomberg Center embodies a broad definition of resilience. Along with the rigorous metrics, he observes, "there's a lot of hype about the Net Zero thing," but "we wanted to prove that a Net Zero building is actually a healthier building": better-lit, more livable, and more productive than ordinary facilities. "If you have a building that is wonderful, it spends no energy, but it's awful to be [in] because it's dark, there's no lights, or it's just kind of unpleasant, there is really no point." Intangibles like views, artwork, program-tailored rooms, elegant structural members, and smoothly curved volumes all contribute to its performance. The Bloomberg is sustainable not in an eat-your-vegetables sense of constraints, but in the heady atmosphere of a clean green future.

The facade, 60 percent opaque and 40 percent transparent, controls energy demand through shading and achieves a form of dynamism without



Above Installation of the curved glass and aluminum panels over the building's feature stair.
Above right A detail of the louvered perforation patterns on color-shift iridescent painted aluminum panels.

moving parts. On a gateless campus that emphasizes "porosity and access and public space," Lee says, circular perforations in the aluminum panels made conceptual sense; the facade simultaneously breathes, functions as a rainscreen, and suggests streaming bits of information. It also shimmers: iridescent PPG polymer coating on the aluminum shifts color along a green/brown/copper continuum as lighting conditions and viewing angles vary.

The aluminum came pre-finished in huge rolls resembling paper products, Lee recalls. The design team had the idea of "imprinting the facade with some kind of pixelation ... we wanted to perforate it, but keep the remains of the hole [as] a little tab." Though the multi-angled tab patterns were created robotically with fabricator A. Zahner's Louvered ZIRA (Zahner Interpretive Relational Algorithm) system, Lee likes to "debunk the myth a little bit." Zahner had "a very old welding arm that wasn't even being used in their shop ... collecting dust in the corner, and one of the fabricator guys said ... 'we could probably program it ... and we can 3-D print a little nozzle that we could attach to the arm,'" turning it gently to shape the tabs. Staffers with Cornell and MIT tech backgrounds connected the device to an old laptop and wrote some quick scripts.

Voila: a repurposed welding robot. "All the advancement was only on this programming and scripting command," Lee recalls; "the infrastructure to execute the fabrication was all there." The patterns on the west and east facades, respectively, are derived from landscape photographs of the Manhattan elevation as viewed from the site, "a reflection of the exterior imprinted back to the building," and, facing Tech Walk on the campus interior, an image of an Ithaca gorge near Cornell's main campus. Overall, the facade has 337,500 tabs: pores in the skin of an organism, pixels composing images that hover between familiarity and abstraction.

Opening: Matthew Carbone/Morphosis; top right: Bill Millard; left column: courtesy W&W Glass

This page: Bill Millard; following pages: Matthew Carbone/Morphosis

The feature stair cantilevers over the pedestrian path between Bloomberg Center and the neighboring Tata Innovation Center.

Another distinct feature is an arrestingly cantilevered curved-steel staircase hovering to the southeast, using the most complex of the building's three categories of Guardian low-emissivity, low-iron glass fabricated by Cristacurva, a specialist in glass bending. The strip windows, curtain walls, and skylights are SNX 62/27 insulating glass units (IGUs) with argon fill and warm-edge spacers (double SentryGuard Plus [SGP] laminated makeup on inboard and outboard lites for strip windows and curtain walls; SGP laminated makeup on inboard lites for skylights). "The Stair 5 structure was treated almost as its own job by itself," notes Corey Weakley, project manager for W&W Glass; that area used custom-bent SN 68 IGUs.

The shapes involved compound bends, Weakley says, with a regular radius at the nose of the stair and "trapezoidal shapes that are also curved" at its bottom skirt. "We had a very challenging time engineering the substructure to that glass, and then actually the thickness of the glass and the strengthening process to be able to withstand the loads to be imposed" by Roosevelt Island's winds. "I've never seen a building like that. It's almost shaped like the Millennium Falcon from 'Star Wars.'"

"When they engineered the building," Weakley continues, "it's like a gigantic truss, and it's designed so that when there's six stories of glass hanging on it, it'll drop ... two inches here, an inch and a half here." The team installed the panels out of level, anticipating the drop when all panels were stacked. The steel diagrid structure at the second and fourth levels "cantilevered as it came up to the nose of the structure; we had to pre-tension that" to 725 pounds per cable, the engineered weight of the glass, using tension cables and Jersey barriers on the ground as dead weight, slowly releasing tension as glass was set. "If we didn't simulate the weight of the glass, the tabs would have been off. I mean, those things moved over ¾ inch from the weight of the glass." Further complications included the lack of a floor carrying through the structure, as in a conventional stairwell (Weakley and his surveyor devised a waterjet-cut template attached to the parapet wall to hold control lines) and keeping intumescent paint on custom steel members watertight before installing the glass.

Every aspect of the project, Lee reports, involved high awareness of sustainability and constructibility in all their forms. At the schematic-design stage, he recalls, Superstorm Sandy struck. The architects re-evaluated program/space relations, moving most mission-critical equipment to the penthouse, elevating pumps and other basement gear onto pads, and specifying some items as submersible. Other measures tailored to the conditions of Roosevelt Island included offsite construction of "unitized or modulized" facade systems to be transported via temporary barge—

Every aspect of the project involved high awareness of sustainability and constructibility in all their forms.

not trucked, since the island has only one access road. These measures offered other advantages: "You can quality-control, you can build them inside a heated warehouse, you're not trying to stick-build this thing over the wintertime. You load it up as efficiently as you can, and then you start just clipping the thing: once they start clipping the facade, it goes very quickly." The facade's support system is "a unitized stud panel with continuous insulation outboard of the studs, so we could get a really good continuous-envelope perimeter insulating line," with a Fabreeka pad providing a thermal break at the tricky transition point where a structural column emerges through the roof to support the PV canopy.

Cornell Tech prioritizes collaborative project work over disciplinary boundaries and top-down information delivery, Lee says, hailing Dean Daniel Huttenlocher as the architect of this curriculum. The interiors correspondingly downplay "sage on the stage" unidirectional lecture halls for "guide on the side" communal spaces, scaled and proportioned appropriately. Public amenities on the ground floor include a lecture hall, a "galleria" running the length of the building for impromptu meetings, and a large café offering wide views to Manhattan and Queens. Embracing the quirks and vulnerabilities of its midriver site, the Bloomberg Center expresses openness on multiple levels, with an edgy design that fuses today's technology with tomorrow's purpose.

Above The center's lobby and circulating staircase.
Right The Bloomberg Center was the first academic building to open on Cornell Tech's new Roosevelt Island.

EMMA AND GEORGINA BLOOMBERG CENTER AT CORNELL TECH

Location: **2 W. Loop Road, Roosevelt Island, New York, NY**
Owner: **Cornell University**, *New York, NY*
Architect: **Morphosis Architects**, *Culver City, CA*, and *New York, NY*
Structural Engineer: **Arup**, *New York, NY*
Mechanical Engineer: **Arup**, *New York, NY*
Construction Manager/General Contractor: **Barr & Barr**, *New York, NY*
Preconstruction Construction Manager: **Tishman Construction**, *New York, NY*
Curtain Wall Consultant: **Arup**, *New York, NY*
Structural Steel Erector: **Stonebridge Steel Erection**, *South Plainfield, NJ*
Curtain Wall Fabricators: **A. Zahner**, *Kansas City, MO*; **Island International Exterior Fabricators**, *Calverton, NY*
Curtain Wall Erectors: **W&W Glass**, *Nanuet, NY*; **Island International Exterior Fabricators**, *Calverton, NY*

The training center's circulating stair is enclosed within a fire-rated glass wall, allowing it to double as an exit stair.

Electrical Industry Training Center

At the new home of Local Union 3, design and engineering (not to mention a little historic research) combine to transform a former factory building into a high-tech educational center for electricians-in-training.

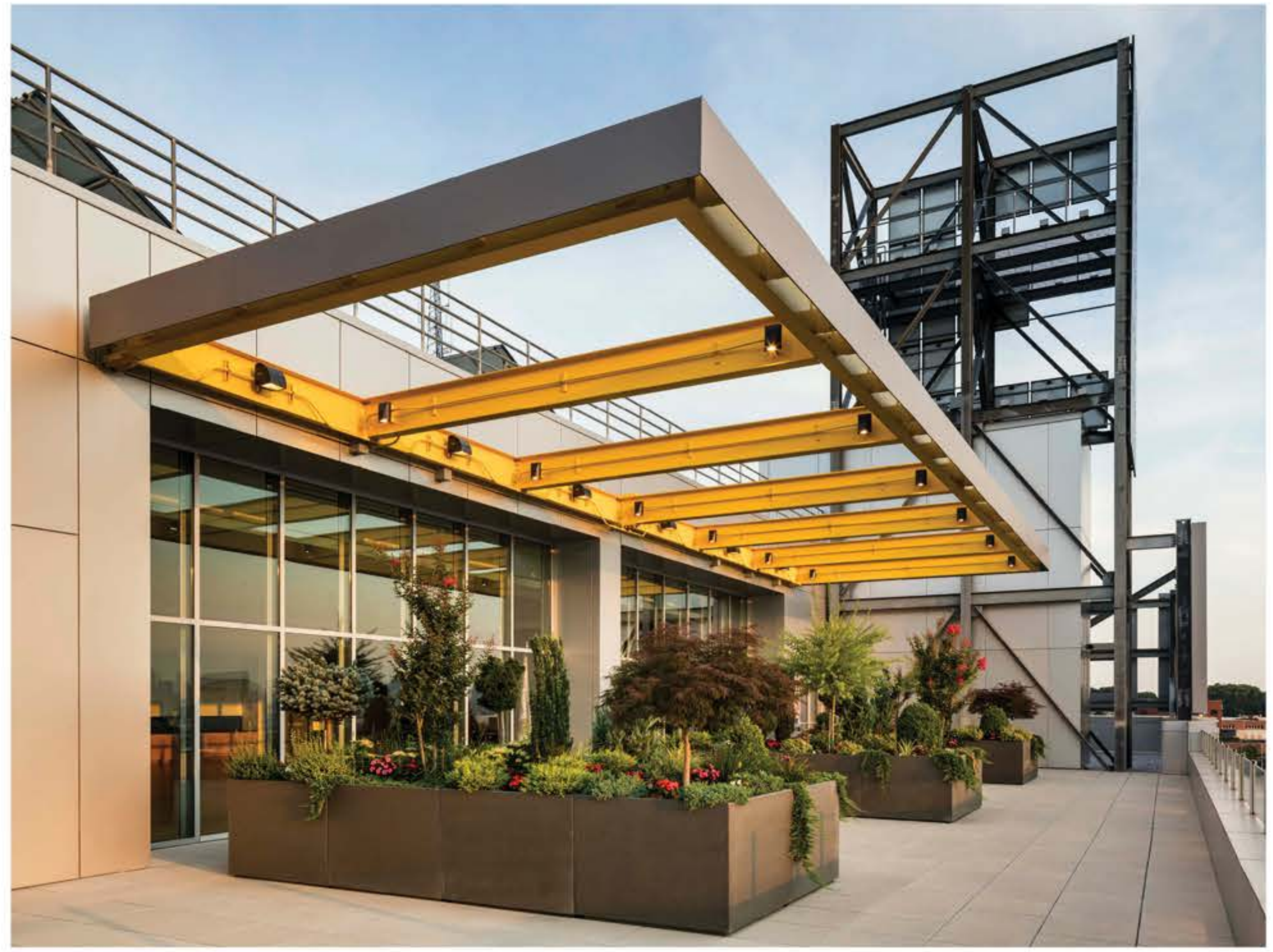
A CITY'S LIGHTS DON'T RUN on their own—neither do its power supplies, train signals, and high-speed internet connections. Behind New York's humming streets and brightly lit buildings (and even the New Year's Eve ball drop in Times Square) is a legion of electrical engineers, many of whom have trained at the home of Local Union 3, the Electrical Industry Training Center (EITC) in Long Island City. The center's new home evokes the energy of its mission to train the best in the field thanks to a renovation, led by the Educational and Cultural Trust Fund of the Electrical Industry and designed by Gensler, that added a new event-space level to a former T-shirt screening factory's concrete structure and sliced the building open at its northeast corner to create a double-height atrium and glass-enclosed circulating staircase. Now, the training center has an outward face that represents the forward-thinking culture of the union and the innovative profession it represents; it also stands as an example of the ways in which existing concrete buildings, notoriously difficult to retrofit, can be updated with structural steel architecture.

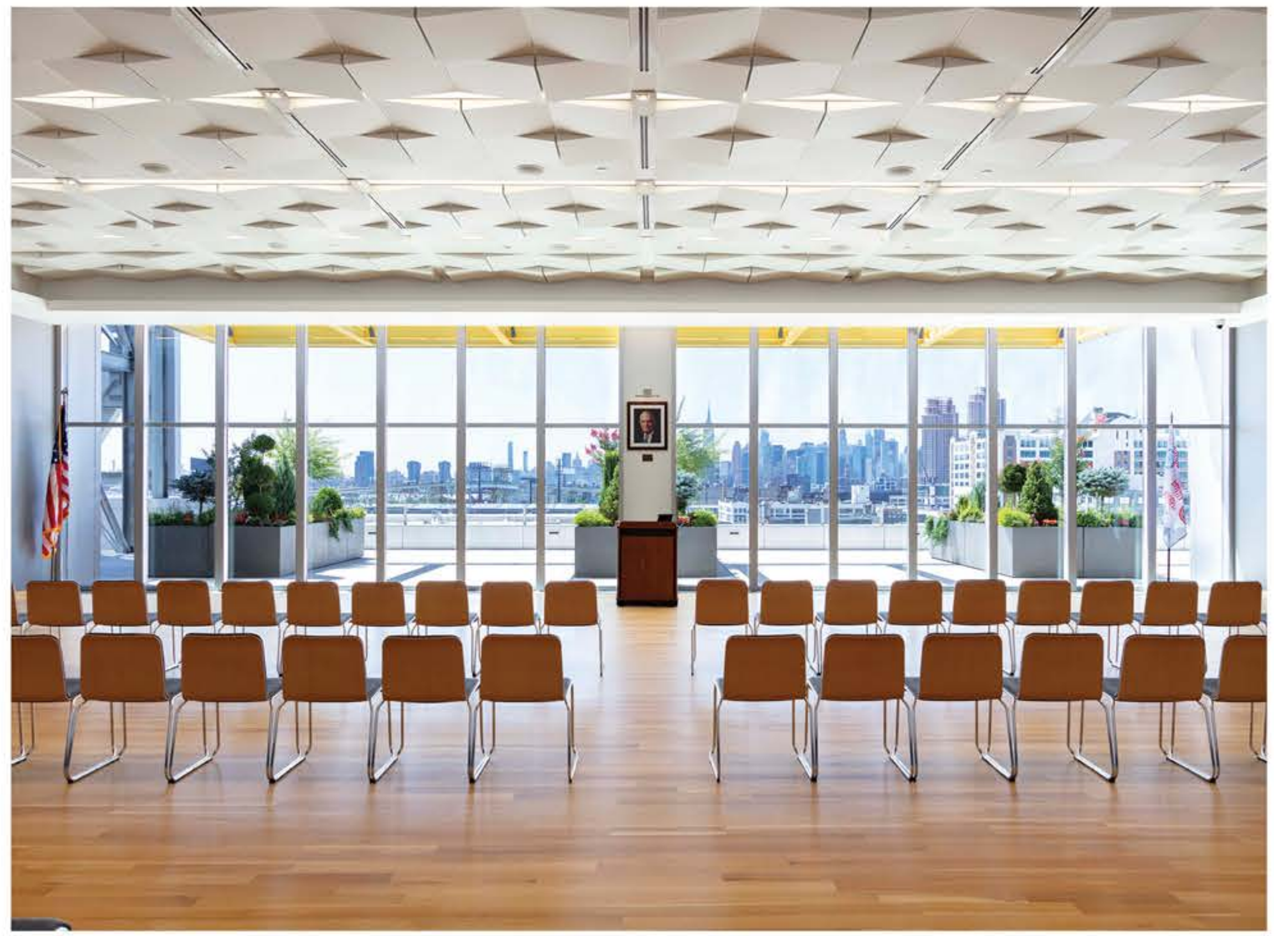
Built in the 1970s, the original 30,000-square-foot structure was essentially two stories with a cellar that was partially below-grade. "One of the things we addressed right away was the fact that they wanted to add onto the building, but there wasn't a lot of additional FAR," says Peter Wang, the project's design director for Gensler. In order to achieve the client's wish of adding a third-story event space for large meetings and galas, they were able to discount the portion of the building that was partially below-grade, as well as a portion that was reallocated for parking, which allowed for the addition of a third level over more than 50 percent of the building footprint—a strategy that was verified and approved through the help of a land-use attorney.

The rooftop addition is framed in structural steel. "We always consider steel because it's lightweight and it's flexible, so later on if you needed to do any reconfiguration it would be much easier to deal with," says Wang. But before plans could be finalized, structural engineers at Shmerykowsky Consulting Engineers had to determine whether the existing structure could withstand the load of an additional floor.

With a new building, "The design team can relatively easily move things around to make the collective result work," says Marco Shmerykowsky. "With an existing building, which has limited or no existing drawings, the challenge is deeper and greater. Not only do you have the typical new-construction challenges, but you must adapt the solutions to mesh with something that already physically exists. Existing elements cannot always be moved to make way for new elements. Everything has to fit, live, and work together. Also, before you can modify the existing, you must understand how the object was originally designed and constructed. You must be a historian, an archeologist, and an engineer."

Because a comprehensive set of original drawings was unavailable, Shmerykowsky put on his historian-archaeologist hat and consulted the building's original column schedule and certificate of occupancy, which indicated that all levels, including the roof, had been constructed to handle live loads of up to 200 pounds per square





Top Steel framing of the training center's new multipurpose level.
Above Structural steel framing for the rooftop beacon tower.
Facing top A steel canopy shades outdoor space on the center's rooftop.
Facing bottom The new multipurpose space faces views of Manhattan.

foot (psf). This is typical for the building's original industrial use, and left ample load capacity to work with after meeting the 50 psf required for a commercial space like EITC. The third-floor addition could move forward.

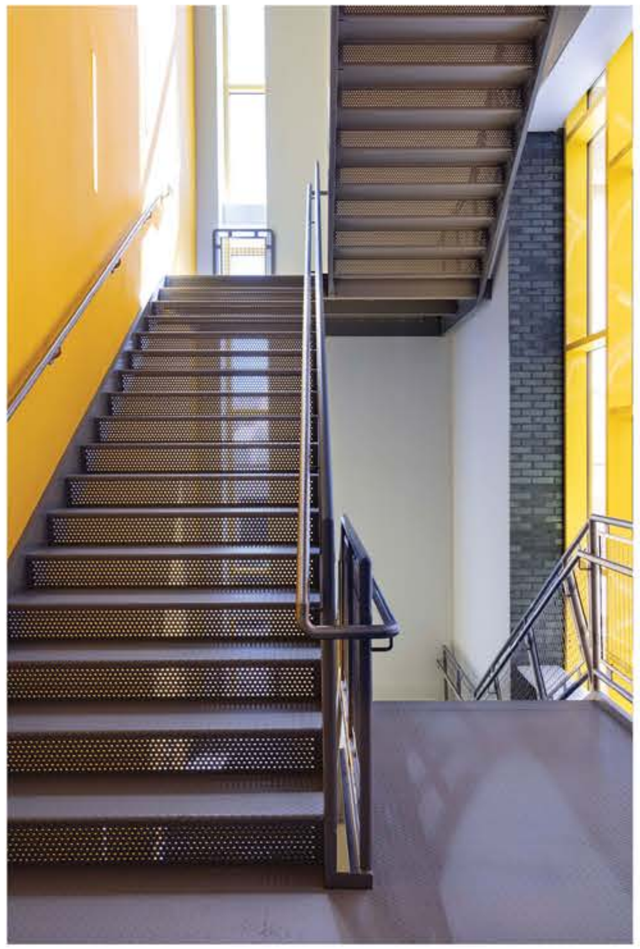
New steel columns are located directly above existing concrete columns below and secured to the waffle slab with expansion anchors. To create the open event space envisioned by the client and architects, the structural team chose W30 girders spanning approximately 60 feet across the floor, with the lateral load-resisting system created with braced frames and supplementary moment frames.

The new space sits atop the building with expansive glass and an open-air deck facing west to the Manhattan skyline. Because the addition shares the rooftop level with new mechanical equipment, the architects designed a concealing decorative screen of perforated yellow metal panels for the east and south sides of the rooftop. On the eastern elevation, W8 vertical diagonal members, which brace the screen, were designed to terminate above the existing concrete columns so that their vertical reactions would be transmitted into the columns below; this configuration avoided having to reinforce the existing waffle-slab structure. Due to the layout of new mechanical equipment on the remaining roof area, an alternative bracing system was required: W8 steel members connect horizontally from the screen wall to an intermediate W10 column and then to another W10 column that is part of the new level's framing system, thus bridging over the equipment.

A steel beacon tower at the building's southwest corner is clad in photovoltaics, giving a glimpse at the energy-conscious electrical education being presented within. The 60-foot-tall tower posed a structural challenge, however, because of a staircase bulkhead at its base. The tower is composed of three steel vertical X-braced frames running north-south, spaced 12 feet, 6 inches apart, and two vertical steel chevron frames running east-west, spaced 12 feet apart. While X-braced framing would have also been an ideal lateral-support solution for the short-spanning direction of the tower as well, the X-braced framing for the westermost side of the structure is the only north-south frame which is not interrupted by the bulkhead and which extend to the main roof level. For the other two braces, an alternative system was required. The engineers designed what they call an "external superbrace" made of a diagonal W10 brace running down from the southwestern W12 tower column to one of the W12 columns that supports the decorative screen wall. At that point, another W10 brace connects to the existing roof slab above one of the building's existing columns. Shmerykowsky describes the overall effect as an unobtrusive structural support system that maximizes the architectural impact of the beacon tower on the rooftop.

While the rooftop interventions perhaps had the most impact on the building's presence in the neighborhood, another structural update at the building's northeastern corner has drastically changed the

Opening: Chris Leonard; this page: Marco Shmerykowsky; facing top: Paul Rivera; facing bottom: Chris Leonard



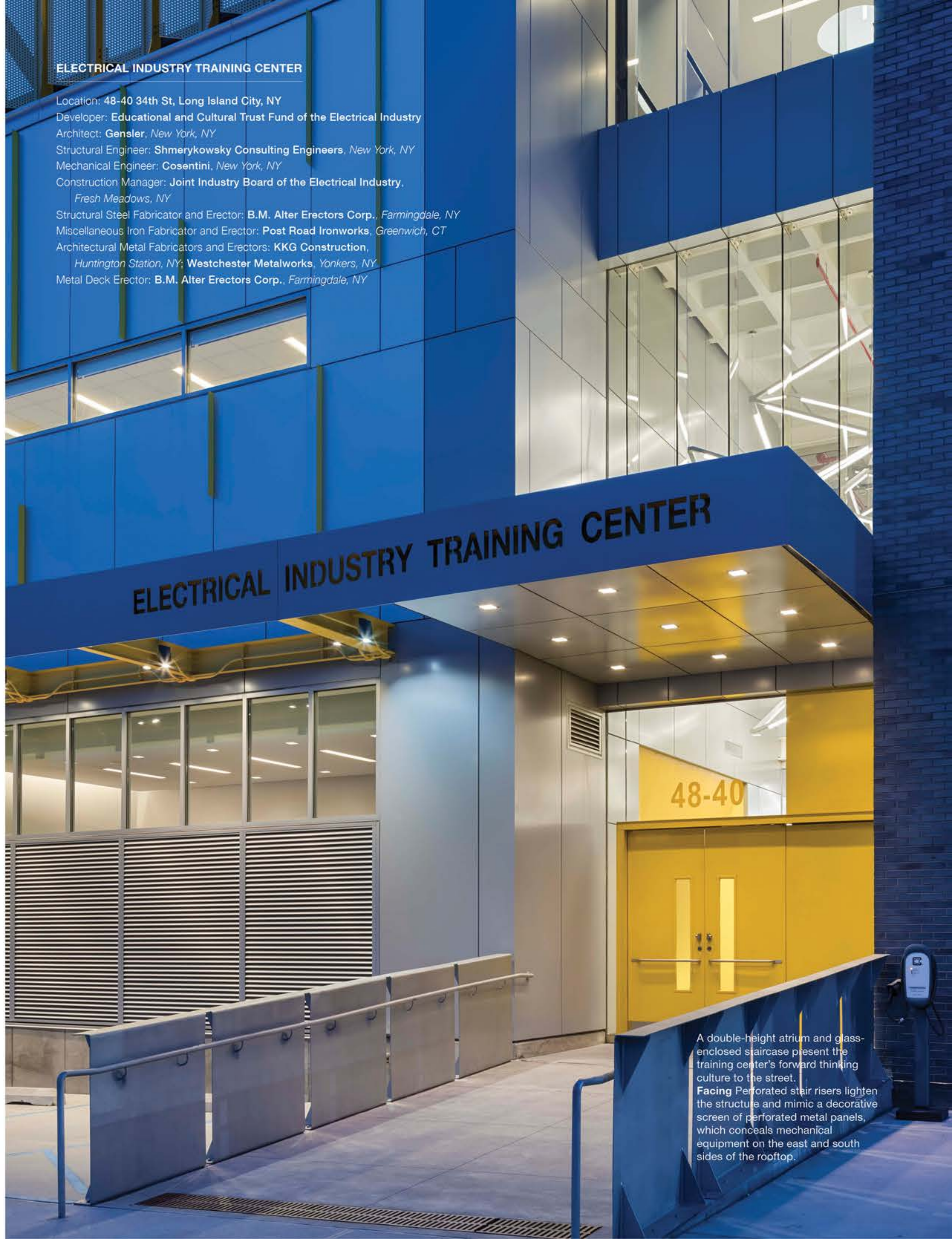
> “The entire building has become a tremendous recruiting tool.”
>
> Peter Wang, Gensler

experience of those entering the school. Where a nondescript door once led into the facility, a two-story glass atrium now invites apprentices and instructors inside. A brick-clad volume represents a new core for the building; the architects replaced an oversized cargo elevator with two passenger elevators and four bathrooms and reimagined an existing fire stair as a light-filled circulation staircase with views to the street. The double-height glass wall that separates the staircase from the atrium is made possible, from a code-compliance standpoint, by fire-rated glass, which allows the stair to do double-duty as a fire exit. “It’s not the cheapest thing,” says Wang, “but it was fantastic to be able to open up the stair like this.”

To create the atrium space, the structural team removed a rectangular portion of the existing waffle slab on the second floor and the roof level and shored the remaining slab. The resulting openings were reframed with W14 steel beams framed into new steel columns. “To accommodate the new stair, existing openings were widened and reframed with heavy W14 and Hollow Structural Section (HSS) members designed to span between supports without the benefits of a braced top flange (HSS sections were used in locations where torsional rigidity was required),” says Shmerykowsky. These members frame into new steel columns that were installed along the perimeter of the stairway opening. Elements of this framing system also function as support for the stair’s stringers. Underneath the stringers at the second and third floors, north-south-spanning W12 beams frame into the foundation wall.

The stair’s exposed structure hints at the openness and high-tech aesthetic the renovation brought to the rest of the training center, where classroom and workshop space was also fully renovated. In some hallways, overhead ductwork and electrical conduit are exposed behind mesh ceilings, allowing them to become real-world examples for apprentices. “The entire building has become a tremendous recruiting tool,” says Wang. Because the existing brick facade was deteriorating and uninsulated, the architects elected to use two-tone aluminum composite panels (ACM) to reclad most of the facade. “Using ACM panel on the facades was not only cost-effective and provided a visual contrast to the surrounding context, using it on insulated stud wall framing was a lightweight facade solution that also allowed us to make the building energy efficient,” he says. As reducing energy consumption becomes more of a priority across all professions, it’s an important lesson for any training program to impart on its students.

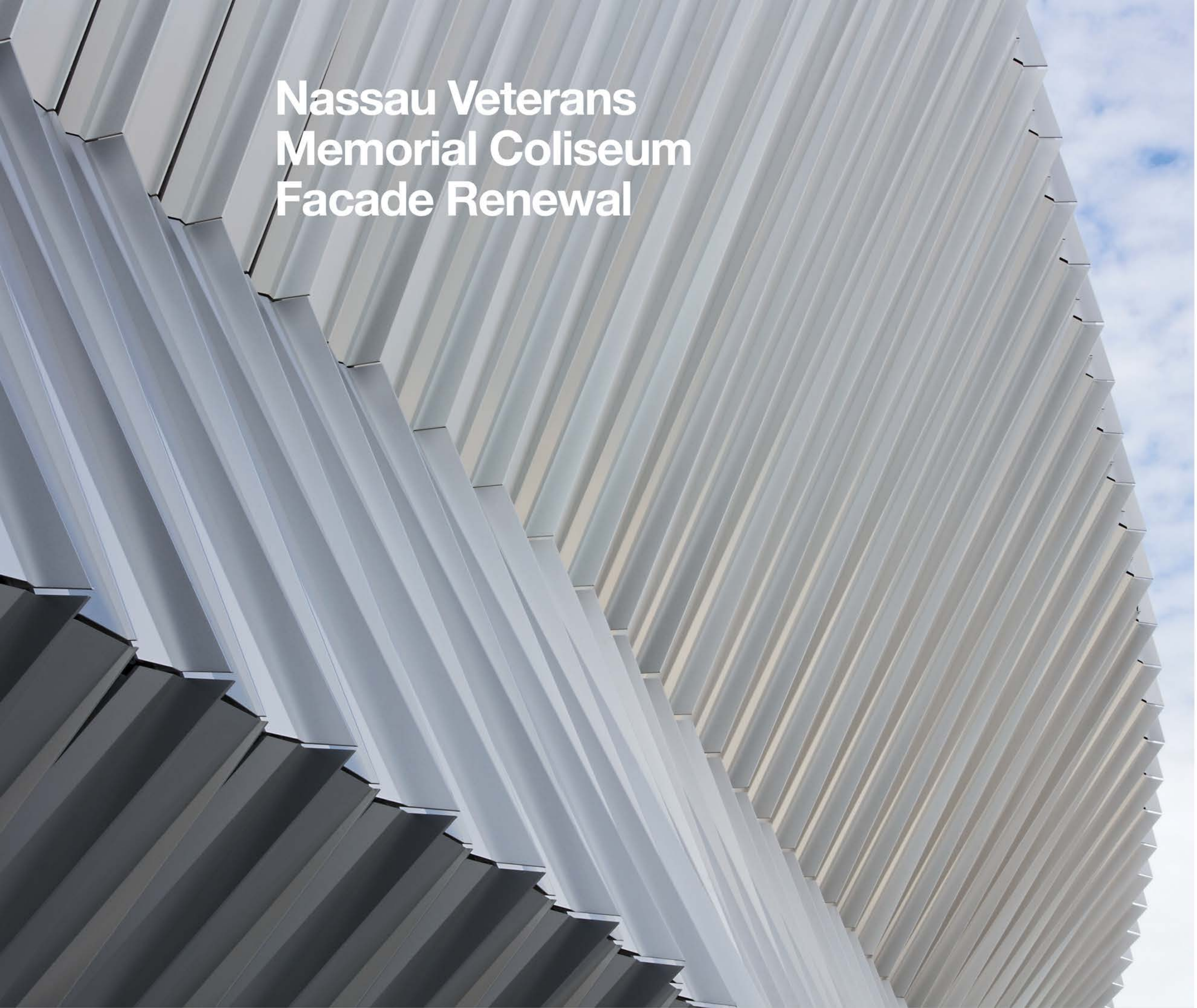
Top: Chris Leonard; bottom: Paul Rivera; facing: Paul Rivera



ELECTRICAL INDUSTRY TRAINING CENTER

Location: **48-40 34th St, Long Island City, NY**
Developer: **Educational and Cultural Trust Fund of the Electrical Industry**
Architect: **Gensler**, *New York, NY*
Structural Engineer: **Shmerykowsky Consulting Engineers**, *New York, NY*
Mechanical Engineer: **Cosentini**, *New York, NY*
Construction Manager: **Joint Industry Board of the Electrical Industry**, *Fresh Meadows, NY*
Structural Steel Fabricator and Erector: **B.M. Alter Erectors Corp.**, *Farmingdale, NY*
Miscellaneous Iron Fabricator and Erector: **Post Road Ironworks**, *Greenwich, CT*
Architectural Metal Fabricators and Erectors: **KKG Construction**, *Huntington Station, NY*; **Westchester Metalworks**, *Yonkers, NY*
Metal Deck Erector: **B.M. Alter Erectors Corp.**, *Farmingdale, NY*

A double-height atrium and glass-enclosed staircase present the training center’s forward thinking culture to the street.
Facing Perforated stair risers lighten the structure and mimic a decorative screen of perforated metal panels, which conceals mechanical equipment on the east and south sides of the rooftop.



Nassau Veterans Memorial Coliseum Facade Renewal

A new folded-ribbon facade of composite aluminum fins connects to the original structure with a minimum of intervention, ensuring thoughtful reuse of a venue that still has a lot of wins in its future.

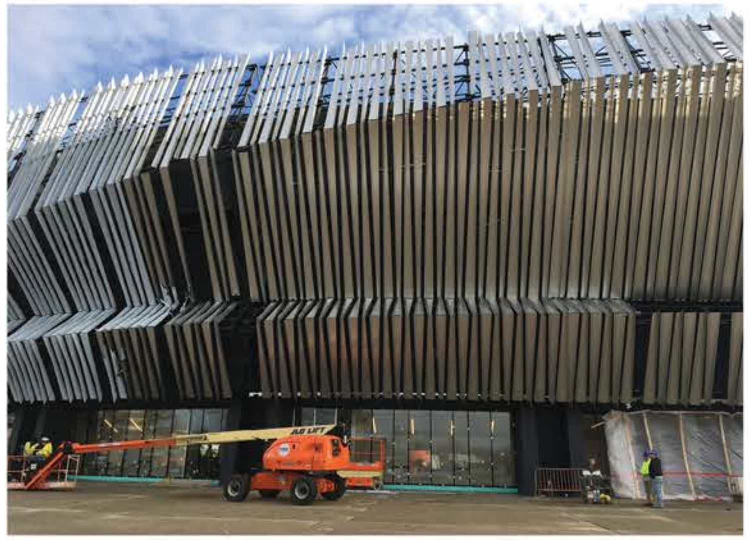
THE NASSAU VETERANS MEMORIAL COLISEUM is a beloved fixture of Long Island life. So treasured is it, the Uniondale, New York, multipurpose arena even has pet names—most famously Fort Neverlose, which hockey fans coined in the early 1980s in the midst of the New York Islanders' four consecutive Stanley Cup victories. Yet emotional attachment never spared the Welton Becket–designed concrete bowl from criticism. Sportscaster Marv Albert reportedly called Nassau Coliseum "a dump" at its 1972 ribbon cutting, and property owner Nassau County had batted around redevelopment plans for the facility and its 77-acre site since at least 2000.

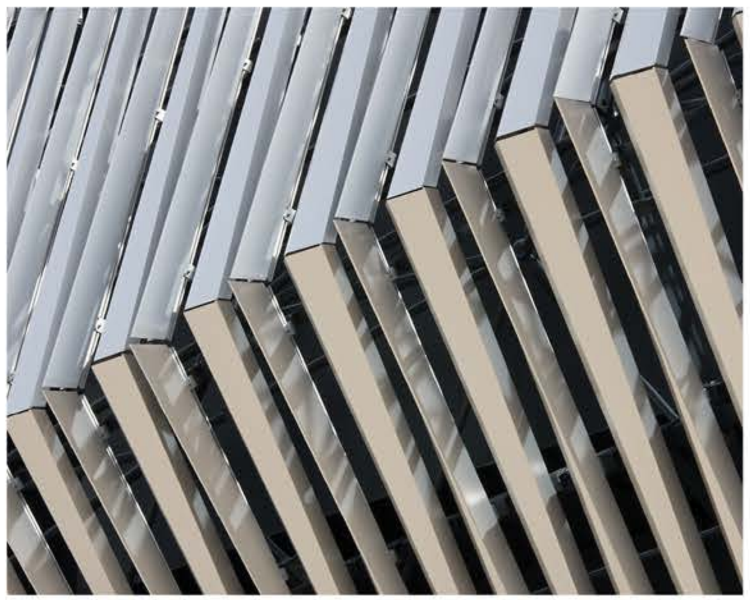
With a renovation by Forest City Ratner Companies completed in April 2017, Nassau Coliseum now boasts an architectural identity as bright as its reputation. Thanks to an over-cladding designed by New York–based SHoP Architects, the 416,000-square-foot venue shines literally, as well. The new exterior is a folded ribbon comprising 4,700 individually unique Alucobond fins. SHoP coated the bowl's original concrete siding and 32 perimeter piers in black paint to bring out the composite's brushed aluminum shimmer.

When Nassau County issued this project's underlying redevelopment RFP in March 2013, Forest City had its own winning streak in mind. The Brooklyn-based developer behind the swooping Barclays Center (see *Metals in Construction* Winter 2013, p. 16) reconvened SHoP, construction manager Hunt Construction, and other key players from the then-year-old arena project to respond to the suburban opportunity.

While the RFP team initially considered replicating their previous success by erecting an arena from the ground up, it instead felt drawn to consuming fewer resources and modernizing the vintage building. "Studies proved the economic viability of incorporating certain minimally invasive techniques of connecting to the existing structure, and quickly we realized that something very compelling could be done to transform it," says SHoP director of virtual design and construction John Cerone. He adds that the group still planned to emulate the Barclays Center in its digital fabrication method. As with the Brooklyn arena before it, SHoP would create the Nassau Coliseum geometry in Rhinoceros software and then plug it into a CATIA model to reconcile the new facade's mass-customization concept with performance and constructability parameters. Forest City first presented the daring over-cladding as part of a schematic design in May 2013 and won the redevelopment in September.

Post-contract bidding changed the project's structural presumptions. While the original schematic design envisioned that Nassau Coliseum's over-cladding would be highly panelized and





Opening spread A detail of the Alucobond fins that make up the stadium's new overcladding, designed by SHoP Architects to revitalize the 1972 structure.

Above The overcladding is attached to a space frame supported by the coliseum's original concrete piers. **Facing page** ShoP's models showing how the new overcladding connects with the original coliseum structure.

clipped into the concrete structure at regular intervals—taking another page from the Barclays Center—subcontractor Crown Corr submitted for the job with greater simplicity in mind. As Cerone puts it, "They came in and said, 'You set up a structural ring form from which smaller units are hung; we'd use the arena's concrete piers and span the entire system in 32 bays.' We were looking at four [panels] per bay, and they said, 'We think we can do it in one.'"

Crown Corr founded its proposal on space-frame construction. As the Gary, Indiana–based subcontractor's operations manager Kent Oprea recalls, "Nassau Coliseum's schematic design used steel structural channels, which would have encompassed going behind the existing concrete siding, and everyone was uncertain about what was back there and where it was." The company had just employed a space frame to clad a transit facility in San Francisco, and the concept seemed suited to this case, as well. "That would allow us to attach a structural lug to the concrete piers and attach the space frame to those lugs already pre-assembled with the fins," Oprea says.

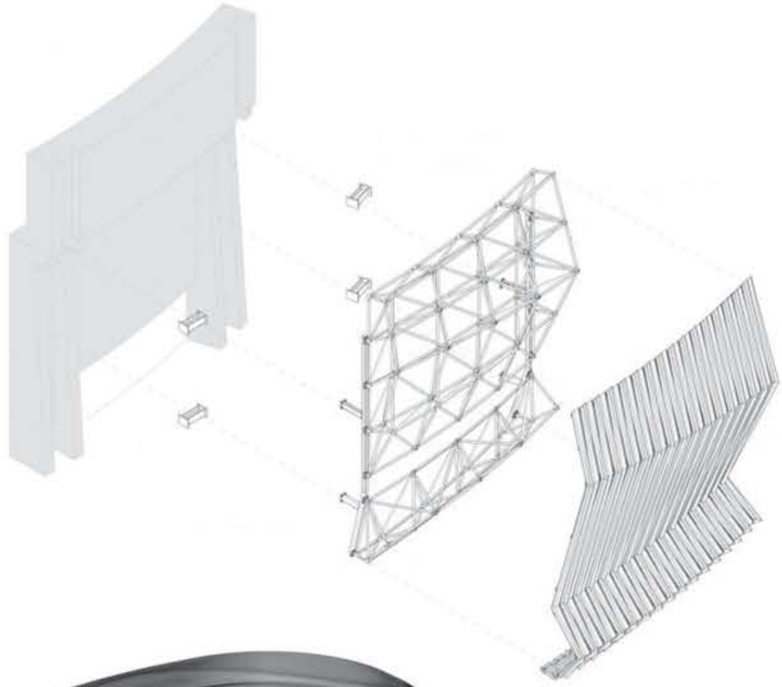
A space frame not only avoided the risk and cost of penetrating the arena, but also improved upon SHoP's vision for a reinvented skin. "Instead of channels and angles installed behind the fins, now there would be round tubes and space-frame nodes, and we wanted to understand the aesthetic implications of that," Cerone says. "It was relatively effortless to model that change, and we were happy with the results for sure." New York–based Thornton Tomasetti, which joined the project team around the same time to provide structural engineering and facade consulting services, further checked the tenability of Crown Corr's idea. As associate Efe Karanci recalls, "The first questions that came to our mind were, 'How many attachment points, and what loads do they impose on the building?'"

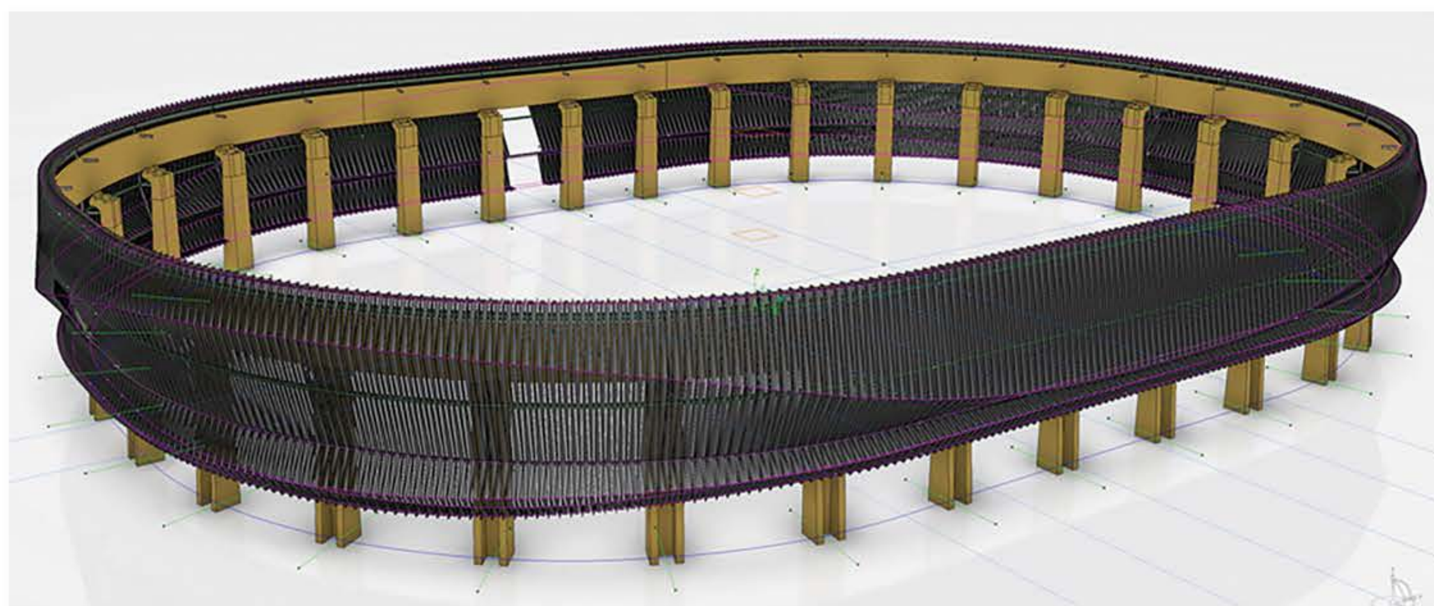
Thornton Tomasetti conducted studies in which the space frame endured wind load beyond 100 percent to confirm the capacity of the 8-foot-wide concrete piers. It also drew 16 cores from the perimeter at different heights to make sure that the concrete could handle the attachments' point loads. To attach the space frame to two points of each pier, the engineers decided to exploit one of the signatures of the Welton Becket scheme. As Thornton Tomasetti principal Jeffrey Callow explains, "Nassau Coliseum's 32 perimeter concrete piers are U-shaped in plan, with the opening of the U facing the outside of the arena, and the U-shape transitions to a solid rectangular concrete column below the main concourse level and rests on a 24-foot-square footing. We thought the space frame contractor could create a wide-flange horizontal beam spanning the inner faces of the U-shaped pier to [hold] the outrigger supports." Crown Corr's structural lug comprises a W14x132 flange spanning 4-foot-wide welded endplates, which are bolted and epoxied to the concrete. Welded to the face of the W-flange are two matchplates, from which 10-inch-diameter HSS tube frames provide welded "half-nodes" for attaching adjacent space-frame panels. The attachment points are separated by approximately nine and a half feet of elevation.

Opening spread: SHoP; this page from top: Thornton Tomasetti; Thornton Tomasetti; SHoP; facing page and closing spread: SHoP

The overall form of the space frame was revised and updated as SHoP incorporated design connections and fabrication criteria into the CATIA model. Because Alucobond manufactures the over-cladding's aluminum composite in coiled sheets of a standard dimension, Cerone cites as an example, "we adapted the design so that when you unfold the sheet and fold the fin, it fits exactly on that width. You have to make minimal cuts and there's zero waste." Once the fin scheme was finalized, the frame's tubes were cut to length and sized per load path. The space frame is assembled from HSS in diameters that vary from 2.375 to 3.5 inches according to tuned-to contextual loads and load paths. The chords are threaded into spherical nodes ranging from 3.5 to 7 inches diameter. The overall project's steel types also range in specification, in response to conditions, and include ASTM A668 and ASTM A563.

Cerone says the space frame is inherently efficient and did not impact design criteria as the Alucobond had. He also notes that the interaction of Nassau Coliseum's new facade and its existing structure serves as a proof of concept for automating the design process. "What's exciting is that it reallocates time," he observes. "You can spend more time making decisions and understanding the why of those decisions—you can explore aesthetic intent, performance, and other implications when you can compress the execution." Callow believes the project bodes well for responsibly reusing mid-20th-century buildings that are approaching obsolescence: "The lesson is that you can marry a new shape and a new form to what was existing, without forcing that design upon the structure." For sports fans and concertgoers, the result may not be so heady, but it's no less momentous. Long Islanders finally have a gathering place they can root for.





The coliseum shortly before its completion in 2017.

NASSAU VETERANS MEMORIAL COLISEUM FACADE RENEWAL

Location: **1255 Hempstead Turnpike, Uniondale, NY**
Developer: **Forest City Ratner**, *New York, NY*
Interior Architect: **Gensler**, *New York, NY*
Facade Designer: **SHoP Architects**, *New York, NY*
Structural Engineer: **Thornton Tomasetti**, *New York, NY*
Construction Manager: **Hunt Construction Group**, *New York, NY*
Facade Consultant: **Thornton Tomasetti**, *New York, NY*
Structural Steel Erector: **MCLO Structural Steel Corp.**, *Ronkonkoma, NY*
Miscellaneous Iron Fabricators and Erectors: **ALC Steel Corp.**, *West Islip, NY*; **Freedom Ironworks Inc.**, *Rockville Centre, NY*
Curtain Wall Fabricator and Erector: **Crown Corr, Inc.**, *Gary, IN*

WINNER AND FINALISTS ANNOUNCED FOR METALS IN CONSTRUCTION MAGAZINE 2019 DESIGN CHALLENGE TO CREATE A NEW URBAN PATHWAY

Winning Team:
THE MIDTOWN VIADUCT
DXA Studio Team, New York, NY

Jordan Rogove – DXA studio (Partner)
Wayne Norbeck – DXA studio (Partner)
Scott Hughes – Silman (Structural Engineer)
Sarah Keane – DXA studio
Sando Thordarson – DXA studio
Shahab Heidari Faroughi – DXA studio
Roman Falcon – DXA studio
Axelle Zemouli – DXA studio
Ryan Barnette – DXA studio
Brian Hellar – DXA studio
David Scurry – DXA studio

On February 25, *Metals in Construction* magazine and the Steel Institute of New York named the winner and five finalists for its 2019 Design Challenge at the TimesCenter in New York City. The "Create A New Urban Pathway" competition challenged architects and engineers to design a pedestrian bridge that connects the transportation hub of the newly adapted Moynihan Train Hall with New York's largest development since Rockefeller Center, Hudson Yards, which is estimated to see 100,000 workers traveling from the rail station to offices there each day.

The *Metals in Construction* magazine 2019 Design Challenge was conceived to generate ideas for making foot travel a more attractive, engaging component of living and working in a city. With urban environments overly reliant on automobiles, creating elevated, landscaped thoroughfares that encourage foot travel can reduce congestion and improve the overall experience of urban life. One testament to this is the popularity of the High Line's transformation of an abandoned railroad spur into a pedestrian walkway, stimulating development in adjacent neighborhoods along the way. The High Line captivates New Yorkers in a way that few projects do. It also demonstrates the potential such projects have to revolutionize urban landscapes by serving not just as places for public recreation, but also, when properly designed, as preferred modes of travel for commuters to use on a daily basis.

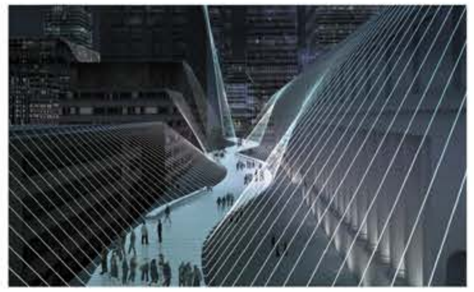
The magazine awarded a $15,000 grand prize to the design judged best at delivering this connectivity while becoming an iconic urban pathway unto itself. Titled "The Midtown Viaduct," the winning proposal "employs forward-thinking approaches to form, fabrication, assembly, and urban solutions that mitigate/synthesize the complex forces of contemporary cities," writes the team from DXA Studio (see full team information below). The jury praised the design for its structural and fabrication feasibility as well as for presenting a compelling idea for streamlined pedestrian transit that still offered opportunities for a unique urban experience.

This year's winner was chosen from a field of 45 qualifying entries. The panel of four jurors who awarded the prize come from architecture and engineering fields and include experts in urban design and infrastructure: Benjamin Prosky, Assoc. AIA, Executive Director AIA New York Chapter; Claire Weisz, FAIA, Founding Principal, WXY architecture + urban design; Enrica Oliva, M.Sc. Struct. Eng., Partner and COO, Werner Sobek NY; Paul Bauer, AIA, LEED AP, Principal, Dattner Architects. Jack Robbins, AIA, LEED AP, Principal and Director of Urban Design, FXCollaborative Architects, served as moderator for jury deliberations.

The grand prize was awarded at a half-day conference at the TimesCenter in New York City on February 25, 2019. The competition was sponsored by the Steel Institute of New York.

The *Metals in Construction* magazine 2020 Design Challenge, themed "Create A New Urban Identity," will be sponsored by the Ornamental Metal Institute of New York with the goal of reimagining the skin of an existing building in New York City. The full competition brief will be announced in September 2019.

Finalist Teams:
HIGH LINES



Lissoni Architettura Team, Milan, IT

Piero Lissoni, Principal of Lissoni.inc & Lissoni Architettura
Joao Silva, Architect & Competitions Coordinator
Fulvio Capsoni, Architect
Juan Torres, Architect
Structural engineering consultant: B&C Associati,
Antonio Capsoni

THE SPINE

Mr. Andreu Estany – Architect, working at ESTEYCO, Barcelona, ES
Mr. Joan Bardy – Architect
Mr. Paul Greenway – Student, 2nd year of Architecture at the Carnegie Mellon University in Pittsburgh
Advisor: Mr. Luis Castro - MSc Civil Engineer - ESTEYCO

TRESTLE

Andrew Barwick, Cooper Robertson, New York, NY
Iris Kim, Cooper Robertson
Jason Fung, Cooper Robertson
Shamil Lallani, Werner Sobek, New York, NY
Michele Andaloro, Werner Sobek
Nicoletta Meloni, Werner Sobek

THE NEXUS

Lukstudio Team, Shanghai, CN

Christina Luk
Mun Yee Ng
Charis Nicolaou
Edoardo Nieri
Xiaojian Yan
3D visualization: Milos Zivkovic, Bitscapes

SNAKE NY

Konrad Brzykcy, New York, NY
Bartlomiej Bogdanik

The jury, winners, and finalists in attendance at the 2019 Design Challenge awards ceremony.

Concrete-Filled Composite Plate Shear Walls Workshop

Last fall, Steel Institute of New York sponsored a workshop by Ron Klemencic, P.E., S.E., Hon. AIA, on Concrete-Filled Composite Plate Shear Walls (CF-CPSW), a revolutionary system for constructing the building core using composite structural steel framing that any fabricator can produce. The non-proprietary design is shrinking construction schedules and saving owners money. The system is currently undergoing extensive testing, funded in part by the Institute.

For more information about upcoming Institute-sponsored events, visit www.siny.org and www.ominy.org.

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The Steel and Ornamental Metal institutes of New York are not-for-profit associations created in 1972 to advance the interests of the structural steel and the architectural, ornamental, and miscellaneous metal construction industries. They serve a geographical area encompassing New York City and the adjacent counties of Nassau, Suffolk, and Westchester. Each sponsors programs to aid architects, engineers, construction managers, and developers in selecting structural systems and architectural metals for optimum building performance. Programs in which the institute is engaged include:

- Consultations extending to the preparation of preliminary design and construction cost analyses for alternative structural systems
- Consultations on design and finishes for bronze, stainless steel, and aluminum for architectural and ornamental ironwork, curtain wall systems, window walls, and metal windows and panels
- Seminars covering structural systems, economy of steel design, curtain wall systems, design, and use of alloys and surface treatments for miscellaneous iron work, and issues important to the construction industry addressed to developers, architects, engineers, construction managers, detailers, and fabricators
- Representation before government bodies and agencies in matters of laws, codes, and regulations affecting the industry and the support of programs that will expand the volume of building construction in the area
- Granting of subsidies to architecture and engineering schools and funding of research programs related to the advancement and growth of the industry
- Publication of ***Metals in Construction***, a magazine dedicated to showcasing building projects in the New York area that feature innovative use of steel

Institute staff are available with information regarding the use of structural steel and architectural metals for your project by contacting institute offices at

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The institutes are a registered provider of the American institute of Architects Continuing education system (AIA/CES).

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