

METALS IN CONSTRUCTION

THE STEEL INSTITUTE OF NEW YORK
THE ORNAMENTAL METAL INSTITUTE OF NEW YORK
211 EAST 43RD STREET, SUITE 804
NEW YORK NY 10017

PRSRT STD
U.S. POSTAGE
PAID
PERMIT NO. 161
LANCASTER, PA

METALS IN CONSTRUCTION

PUBLISHED BY THE STEEL INSTITUTE OF NEW YORK AND THE ORNAMENTAL METAL INSTITUTE OF NEW YORK
SPRING 11



**HYPAR PAVILION / LEARNING SPRING SCHOOL /
BARNARD COLLEGE DIANA CENTER / 8 SPRUCE STREET /
ATLANTIC TERMINAL PAVILION / CCNY MARSHAK SCIENCE BUILDING /
HARLEM HOSPITAL NEW PATIENT PAVILION /
PALL CORPORATION HEADQUARTERS**



CONTENTS
SPRING 11

1
EDITOR'S NOTE

2
HYPAR PAVILION

10
LEARNING SPRING SCHOOL

16
BARNARD COLLEGE
DIANA CENTER

22
8 SPRUCE STREET

28
ATLANTIC TERMINAL PAVILION

34
CCNY MARSHAK
SCIENCE BUILDING

38
HARLEM HOSPITAL
NEW PATIENT PAVILION

42
PALL CORPORATION
HEADQUARTERS

48
EVENTS



Above The Barnard College Diana Center's glass and aluminum facade.

Frederick Charles, cover, Albert Vecerka/Esto

EDITOR'S NOTE
University lecture series

MEETING INDUSTRY LEGENDS can help shape the lives of students and motivate them to learn. This year, in conjunction with Pratt Institute's School of Architecture, the publishers of *Metals in Construction* underwrote lectures by famed architect Frank Gehry and innovative structural engineer Guy Nordenson. Interviewed by *The Architect's Newspaper's* executive editor Julie V. Iovine following an introduction by Thomas Hanrahan, dean of the school, Gehry impressed upon students the importance of accepting the responsibilities of being a working architect. Sage advice from faculty and practitioners, but hearing it from a designer famous for "creating curvy buildings from crumpled paper," can be more illuminating. The hallmark of Gehry's 8 Spruce Street project, as written about in this issue, is not just its rippling facade, but also its completion on time and within budget. Renowned structural engineer Guy Nordenson gave the second of this lectures series (structural engineer Cecil Balmond will speak in the fall) presenting his "Patterns and Structure" to illustrate the unique collaborations that contribute to design. A professor of architecture and structural engineering at Princeton who founded his own firm after working with some of the best minds of the generation, Nordenson stressed that "there is an energy in collaboration." Working with Japanese architect Yoshio Tani-

guchi, who sought to make the Museum of Modern Art's lobby curtain wall "virtually disappear," he met the challenge of engineering reed-thin steel to support Taniguchi's oversize glazing. Nordenson also stressed the value of the idea that a structure can have "more than meets the eye." Collaborating on the Hillhouse Bridges design for the Yale University campus, he conceived of corrugated steel plate girders with diamond-shaped perforations in the webbing to serve as both as railing and main structural support. An elegantly simple solution, nothing could better illustrate the insightful and collaborative thinking—and thinkers—that our future architects and engineers will recognize in their own work someday.



Gary Higbee

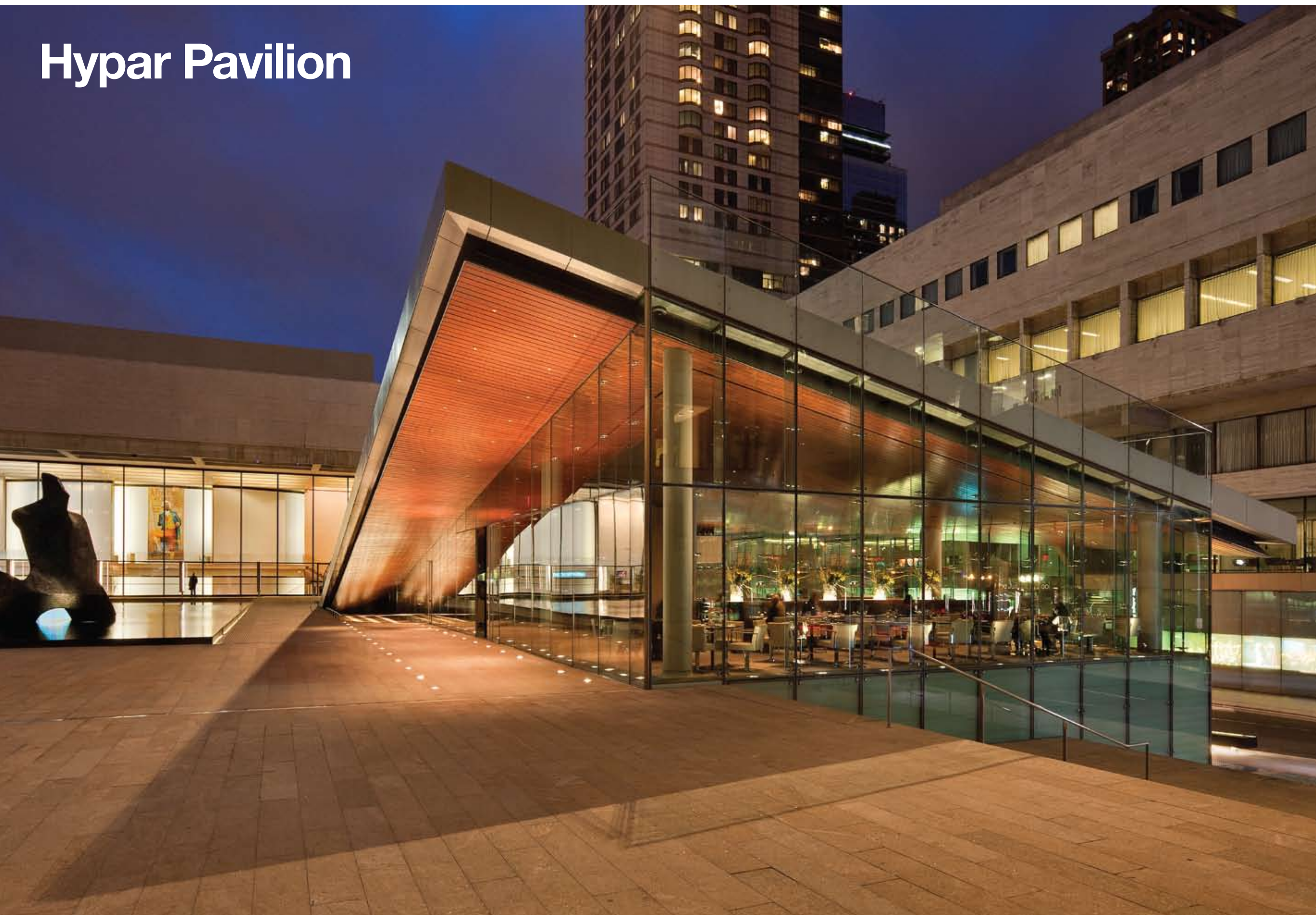
Gary Higbee, AIA, Editor
higbee@siny.org/
higbee@ominy.org

Copyright ©2011 by The Steel Institute of New York and The Ornamental Metal Institute of New York

Published by The Steel Institute of New York and The Ornamental Metal Institute of New York

The information contained in this magazine is merely general and illustrative in nature. The Institutes assume no responsibility for either the design or actual cost of any structure resulting from the use of the information contained herein, nor should anything herein be construed as either an endorsement or disapproval of any systems or designs indicated. Anyone relying upon or making use of this information does so at his or her own risk and assumes any and all liability or consequences resulting therefrom.

Hypar Pavilion



Lincoln Center's new restaurant and rooftop lawn relies on structural steel to create a valuable public space and a reinvigorated campus.

THE HYPAR PAVILION, A slanted green roof that shelters a glass-enclosed restaurant below, is a crucial piece of Lincoln Center's move to reunite the north edge of its campus with the surrounding neighborhood. The design, by Diller Scofidio + Renfro in collaboration with FXFowle, is focused on "engagement, transparency, bringing life from complex to street and from street to complex," says Heidi Blau, the partner in charge of Lincoln Center Redevelopment for FXFowle.

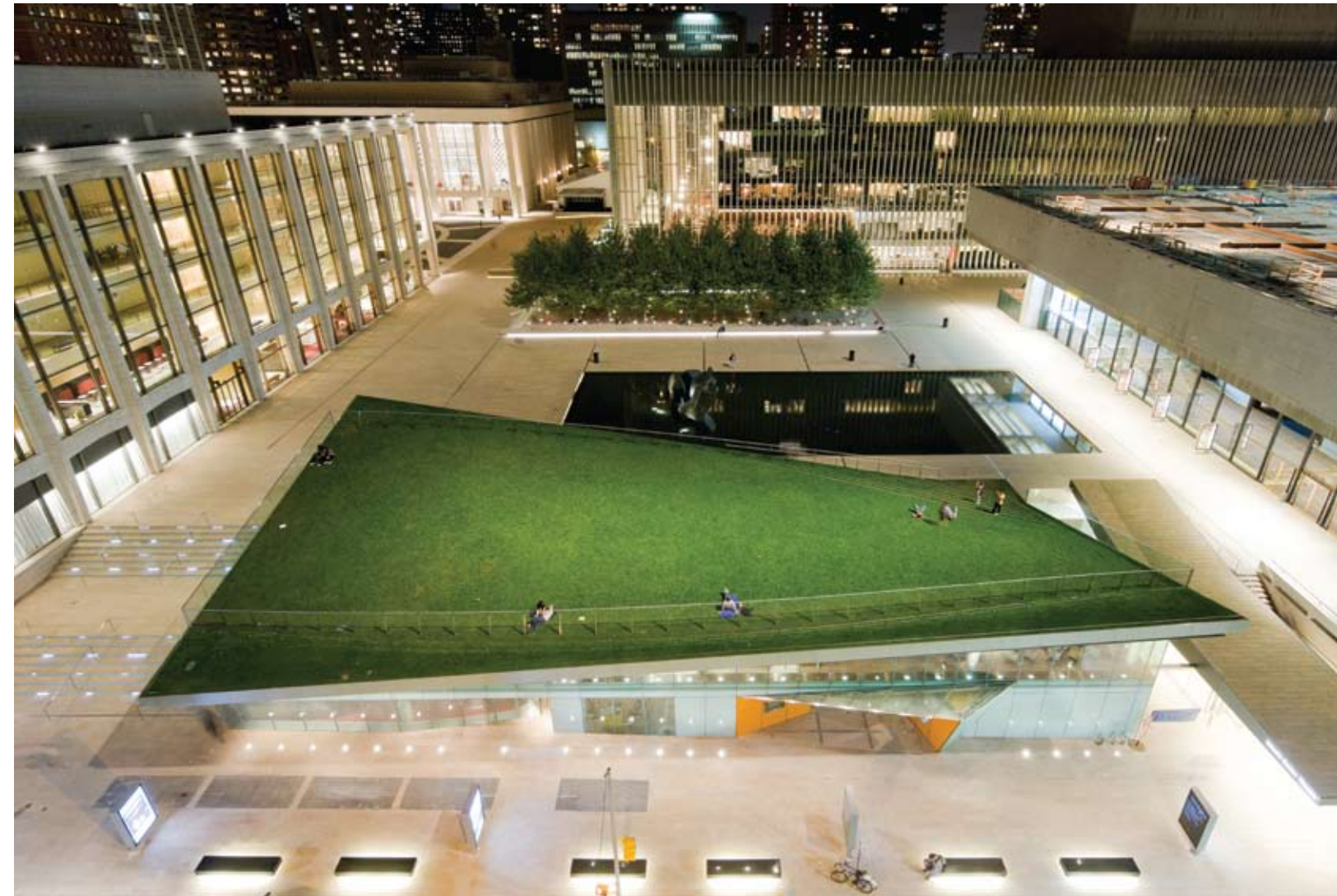
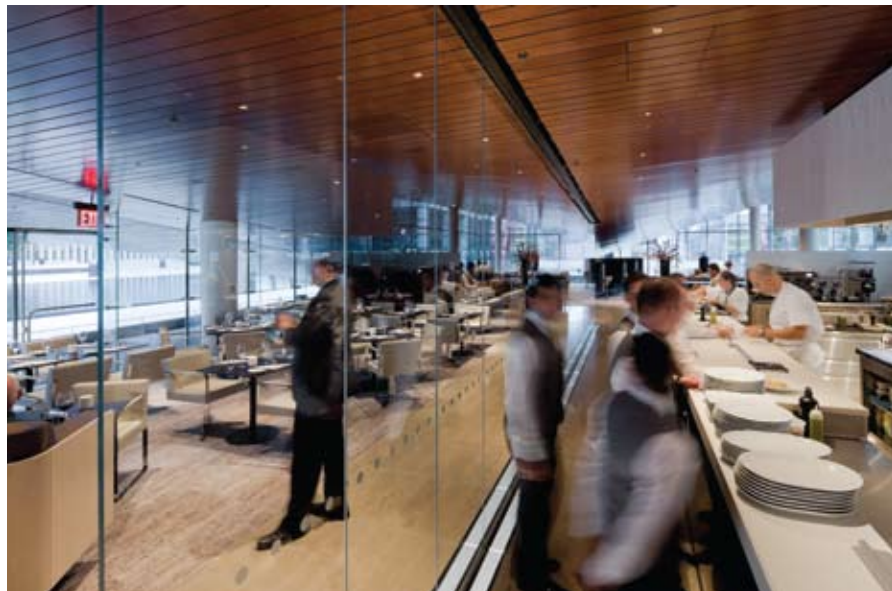
With a roof that "tilts and peels upwards," describes Blau, the 7,200-square-foot pavilion lawn, officially named the Laurie M. Tisch Illumination Lawn, appears to be made of a single curved plane. Although the design team considered using thin-shell concrete to create the hyperbolic paraboloid form, they chose instead to construct the shape using straight steel members. "Steel seemed to be more economical," says Blau. "And we could keep a very sleek profile through the edge of the shape. We wanted the lawn to hover and not look like it was attached to the plaza. Main beams were tapered on the edges to maintain the structural portion's vertical height, which we couldn't have achieved with concrete."

In addition to allowing tapered edges, the steel beams accommodated web through-cuts for the rooftop drainage systems and Lincoln Restaurant equipment and ductwork. Steel was also a lighter-weight solution when compared with the amount of concrete that would have been needed to support a foot of soil and growing medium atop the roof. "The weight of a structural concrete member would have added tremendously to the weight of the structure," says Blau.

"The thoughtful rationalization of the architectural form simplified fabrication and enabled rapid



This page Lincoln Restaurant's ceiling, a continuation of the exterior soffit, emphasizes the hovering plane of the pavilion roof.
Previous spread A tilted structural steel frame creates the roof of the restaurant.



Above A hyperbolic paraboloid-shaped roof forms the Laurie M. Tisch Illumination Lawn.

construction of the pavilion," explains Markus Schulte, structural engineer and principal-in-charge for all of Arup's work at Lincoln Center. "The steel structure solved the challenge of building atop Lincoln Center's existing podium and its densely packed network of existing columns and mechanical spaces." Sharing 3-D models with project SMEP engineer Arup along with steel contractors further facilitated interdisciplinary coordination between the trades and sped up fabrication.

Though design and construction activities related to the project were carefully scheduled and sequenced over a period

of five years—first renovation of the existing underground mechanical plant, then work for the center's new subterranean Film Society space—the steel erection happened quickly. "The steel hypar was put in place over the course of three weeks because all of the members were fabricated and delivered to the site ready to be installed," says Schulte. Maintaining the correct sequence of activities and staying within the allocated tight time frames was critical, as Lincoln Center was to remain open during the entire design and construction phase.

"The steel beam grillage is composed of W12 and W24

sections, A992 Grade 50 beams, ranging from 27 to 32 feet in length, approximately 150 tons overall," explains Schulte. Beams spaced approximately 10 feet apart were field-bolted to W12 columns using high-strength A325 and A490 bolts. The steel superstructure of the hypar transfers vertical loading into the existing concrete columns below. Additional heavy transfer beams, built-up out of steel plates, transfer the load around the new movie theaters and an existing mechanical plant. At the west end the hypar dives down, transferring lateral load into the existing plaza, while at the 10-foot cantilevered south end of the pavilion, braced

Previous spread: Chris Cooper; this spread: Iwan Baan

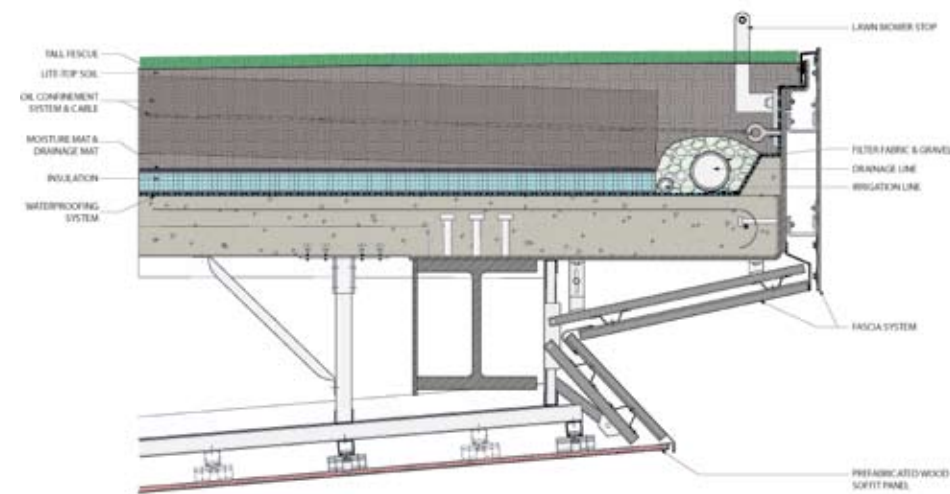


Left A soil confinement system, a honeycomb-like web, is stretched over the roof to stabilize the soil until roots are established.
Below A section of the typical Illumination Lawn shows the roof's waterproofing systems and roof assembly installation.

frames transfer lateral loads into the concourse level underneath.

The lawn-edge fascia was crucial to maintaining the pavilion's appearance of weightlessness. The steel beams were chamfered along the edge to reduce their height and to achieve the architect's vision. A bird's-mouth finish Grade A316 stainless steel shoe sits above the roof soffit. It is field-bolted to the roof's edge beams with A315 bolts. Below, tempered insulating glass units (IGUs) span from street level to the soffit, or on the east, west, and part of the north sides, past the rooftop to act as a guard-rail. The system is laterally supported by 12-inch-deep glass fins attached with point fittings on the interior, maximizing the curtain wall's transparency. "The effect that we were going for was pure glass, uninhibited," says Blau.

Detailing the roof guardrail was equally important to the public lawn's appearance, as well as its safety. Atop the roof's waterproofing membrane are two ½-inch-thick painted and galvanized base plates to which the ¾-inch stainless steel rail stanchion is fastened using stainless

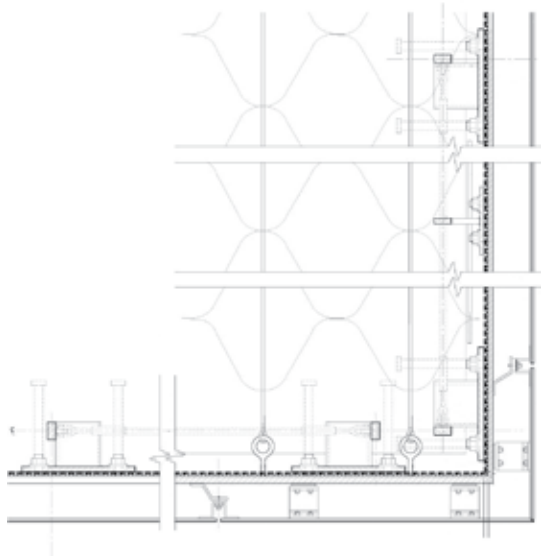


This spread: FXFOWLE

Right The completed steel frame is covered with a concrete deck; zigzag elements are future "check-dams" that divert storm water to strategically located drains.
Below The roof geometry called for straight steel pieces to be rotated against one another to create the hyperbolic paraboloid form.

steel bolts and neoprene spacers. Vertical grain stainless cable mesh infill is stitched to the 1¼-inch-diameter stainless steel pipe rail welded to the top of the stanchion. All of the stainless steel is Grade 316. The mesh is anchored above the grass by a continuous 12mm, 1x19 stainless strand cable, fastened to the base plate with cable brackets and stainless bolts. Though the angle between the mesh and stanchion is constant, the angle of the stanchion and the lawn surface varied due to the hyper's shape, making precise detailing even more important to achieve the desired appearance.

Now that the restaurant and rooftop have been open for several months, it is difficult to imagine the campus without it. Crowded with lunchtime visitors enjoying the sunshine, the tilted lawn has already achieved its purpose of unifying the Lincoln Center campus with the city around it. "It was incredibly rewarding to help reshape these spaces for Lincoln Center and create a place where a lot of people enjoy visiting," says Blau.





This page The lawn's stainless steel rail and mesh infill required precise detailing because the angle of the stanchion to the lawn surface varied between points.



“The steel structure solved the challenge of building atop Lincoln Center’s existing podium and its densely packed network of existing columns and mechanical spaces.”

Markus Schulte, Arup



Above The pavilion rises next to the Paul A. Milstein Pool and Terrace. The light-weight steel structure allowed the design team to build atop Lincoln Center’s existing podium and columns.

HYPAR PAVILION

Location: **Hearst Plaza and 65th Street, New York, NY**
Owner: **Lincoln Center for the Performing Arts, New York, NY**
Developer: **Lincoln Center Development Project, New York, NY**
Architects: **Diller Scofidio & Renfro, New York, NY**,
in association with **FXFOWLE Architects, New York, NY**
Structural and Mechanical Engineer: **Ove Arup & Partners, New York, NY**
Construction Manager: **Turner Construction, New York, NY**
Curtain Wall Consultant: **R.A. Heintges & Associates, New York, NY**
Structural Steel Erector: **Capco Steel Co., Providence, RI**
Miscellaneous Iron Erector: **Capco Steel Co., Providence, RI**
Architectural Metal Erector: **Permasteelisa North America, Windsor, CT**
Curtain Wall Erector: **Tower Installation, Windsor, CT**
Metal Deck Erector: **Capco Steel Co., Providence, RI**



Learning Spring School



A sheltering facade of zinc panels and aluminum louvers lets filtered daylight in while keeping autistic students focused on the lessons at hand.

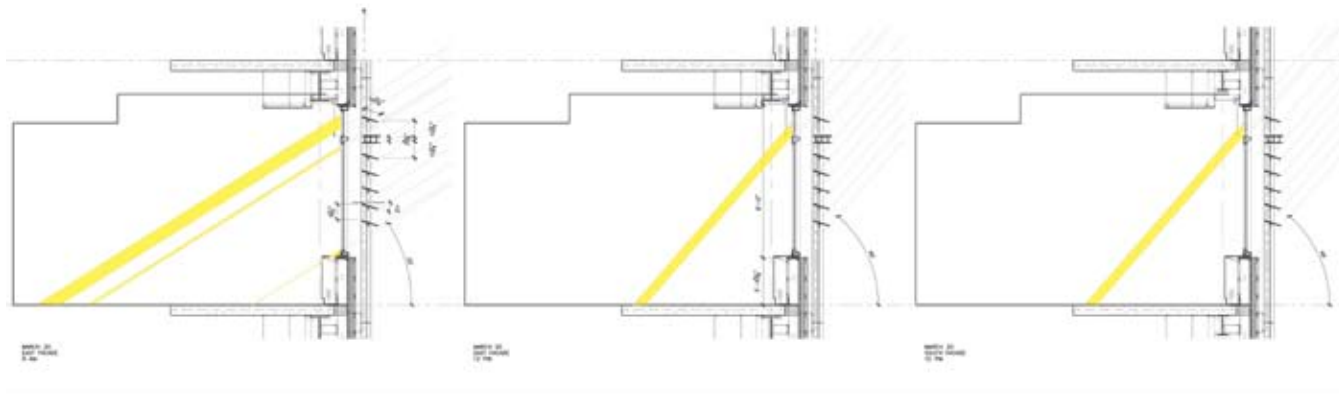
THE LEARNING SPRING SCHOOL (LSS) IS NOT your average New York City independent educational institution. Established by a group of concerned parents in the fall of 2001, LSS was conceived, built, and staffed for children with high-functioning autism spectrum disorders. Not long after opening up in a commercial building on 29th Street, the school realized that its facilities were inadequate to meet the very specialized needs of its student body. Adding to the challenge, as early intervention for children in the autism spectrum became more and more prevalent, admissions applications began pouring in, and enrollment quickly exceeded the space’s capacity. To address both of these shortcomings, LSS commissioned New York architectural firm Platt Byard Dovell White (PBDW) to design a dedicated building that would meet the school’s growth projections and create an environment conducive to educating children with autism. Their success at creating this environment was in no small part owing to a custom curtain wall design—a sheltering system of glass, zinc, and aluminum sunshade system that lets filtered daylight in while keeping autistic students calm and focused on the lessons at hand.

What makes the facade unusual is that such systems are not generally used to enclose educational settings. However, to help foster LSS’s mission of enabling autistic children to succeed academically as well as socially and emotionally, PBDW laid out an extensive 34,000-square-foot program accommodating occupational therapy, drama and music, lifestyles, culinary arts, fine arts, science and computer labs, and a library—with every space geared to fit the unique qualities exhibited by children with autism. Among the most critical of these is the tendency to become overwhelmed by sensory stimuli.

“Generally when we design spaces for kids with

Facing Zinc spandrel panels, operable windows, and aluminum louver solar shades are designed to make the interiors feel both well lit and sheltered.
Above The school sits at the corner of Second Avenue and 20th Street.

This spread: Frederick Charles



Above Studies of sunlight hitting the east and south facades.

Left Insulated glass units with low-e coatings on the #2 surface are structurally glazed to the framing. Terra cotta accents the building's corners and street level facade.



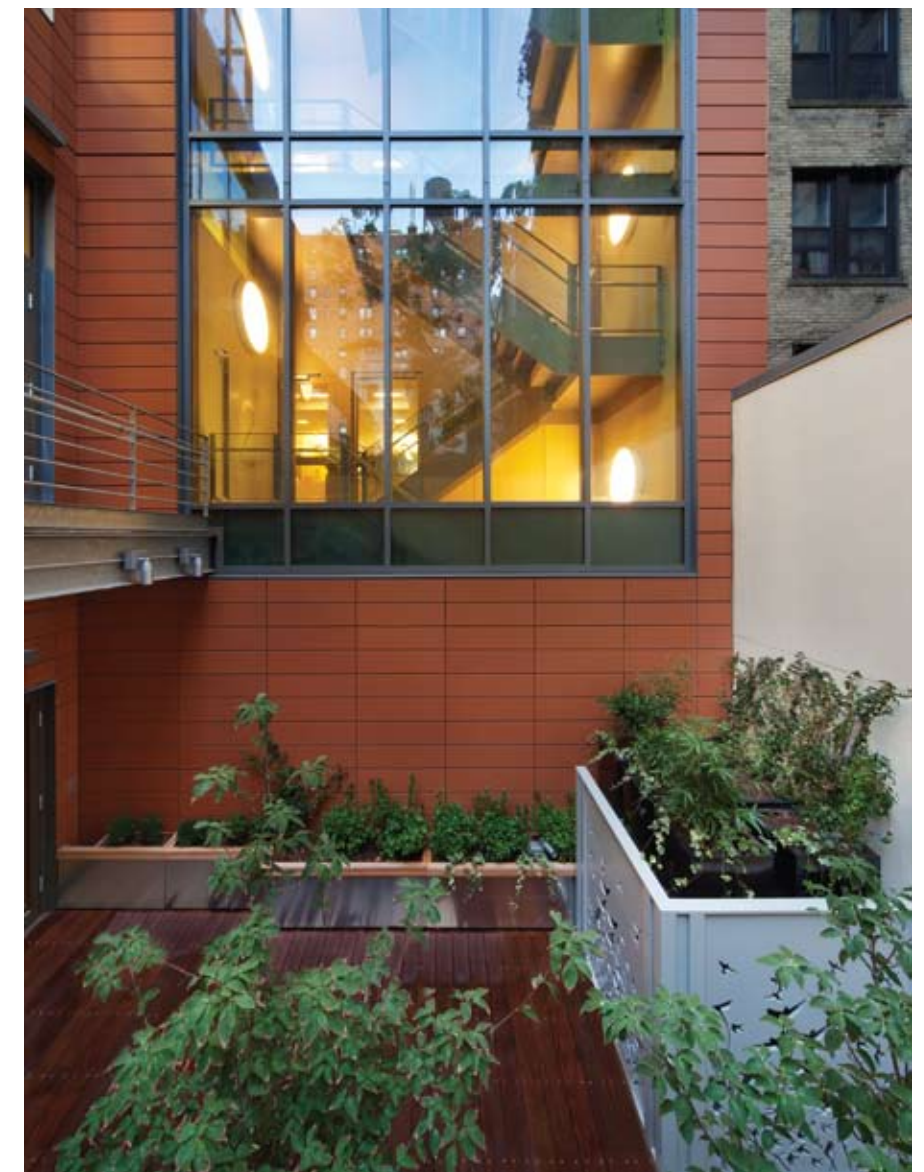
autism we try to play down the environment,” explains Matthew Mueller, an associate architect at PBDW. “A lot of kids have sensory issues with their visual surroundings and others have issues with things that are too tactile or too rough. We tried to make the interiors calming, using materials that are not too distracting to help keep the students focused.”

Nowhere was this rationale of minimizing stimulus more conspicuous than in the design of the cladding enclosure system. “The building facade allows nice light in, but you feel there’s an internal focus to rooms,” says Mueller. “It’s not about views, it’s about mitigating light, eliminating glare, and making an environment that’s comfortable so students can focus internally.”

PBDW began designing the facade as a window wall system with framed spandrel panels, thinking that it would be less expensive to construct than curtain wall. However, exterior enclosure contractor Jordan Installation Services recommended to the firm that, in fact, an integrated curtain wall system would be a better option during the construction

“Building the wall as essentially one type of assembly enabled us to create the expression we wanted.”

Matthew Mueller,
Platt Byard Dovell White



Above The school's interior courtyard lends to its serene learning environment.

and for the lifetime of the building. “We all felt that utilizing a curtain wall assembly would ensure a more reliable wall in the long run,” says Mueller. “When you transition between different wall assemblies, it creates more opportunities for leaks and defects. Building the wall as essentially one type of assembly lessened this risk and still enabled us to create the expression we wanted.” This solution lent itself to improved construction, better coordination, and more control over the finished product as the sequencing involved only one primary trade. In the end, while the curtain wall was more expensive, the client and the design team felt that the upfront expense would minimize maintenance costs in the future, providing a long-term return on investment.

The architects developed a scheme using zinc spandrel panels, operable windows, and aluminum louver solar shades, all designed to make the interiors feel both well lit and sheltered. The system is not unitized, but stick-built with aluminum mullions attached to building anchors. Anchors handling gravity loads are used every other floor, while

on the intervening floors clips that only manage wind loads are used. The operable windows—Guardian Solarban insulated glass units with ¼-inch inner lites, ½-inch gaps, and ¼-inch outer lites with low-e coatings on the #2 surface—are structurally glazed to the framing. The 1-millimeter quartz-zinc spandrels are a rain screen system with an 18-gauge galvanized steel back panel, insulation, and vapor barrier, an air space, and then the exterior cladding. The back panel is glazed into the curtain wall pockets at the spandrel areas. Then vertical aluminum girts fasten to flanges on the back panel. The zinc panel attaches to these vertical girts. They are interlocking with concealed fasteners that attach them and feature cutouts allowing the supports for the aluminum sunshade system—which are welded directly to the steel substructure—to penetrate through the wall. The sunshade systems, which are built from ⅝-inch-thick aluminum plates, span the 18- to 20-foot column bays. They hang from their own dedicated support system, which delivers all of its loads back to the main building structure rather than the curtain wall assembly. The

Top: Platt Byard Dovell White; left: Frederick Charles

Frederick Charles



Facing Sunshades built from 5/16-inch-thick aluminum plates span 18- to 20-foot column bays.

Above Along with the building's other environmentally friendly features, such as operable windows for natural ventilation, low-flow fixtures, and high-efficiency HVAC equipment, the facade has put the project on track to receive a Gold LEED for Schools rating.

span proved to be a bit extreme for the aluminum plates, which deflected from their own weight, raising concerns about how the louvers would react to wind loads. In response, the designers placed stainless steel tension rods running vertically through the sunshade system at the midpoint of the spans, holding them rigid in the face of wind and gravity. The rods are fabricated from solid 3/4-inch diameter 316 Grade stock.

This primary wall assembly is accented by terra cotta rain screen details at the building's corners, as well as a channel glass corner and bookends. In addition to its tasteful, modern appearance from the outside, and calming effects on the inside, the cladding design had an environmental payoff. The building's corner site at Second Avenue and 20th Street faces southwest, putting it right in the line of fire of New York's most punishing daylight. The system's aluminum sunshades, low-e coated insulated glass units, and zinc rain screen spandrels help to cut solar gain significantly. Along with the building's other environmentally friendly features, such as operable windows for natural ventilation, low-flow fixtures for water savings, and high-efficiency equipment for energy savings, the facade has put the project on track to receive a Gold LEED for Schools rating—and a gold star from the instructors.

Learning Spring School

Location: **247 East 20th Street, New York**
Developer: **The Learning Spring School, New York, NY**
Architect: **Platt Byard Dovell White Architects, New York, NY**
Structural Engineer: **Leslie E. Robertson Associates, New York, NY**
Mechanical Engineer: **AKF Group LLC, New York, NY**
Construction Manager: **Cauldwell Wingate Company, New York, NY**
Curtain Wall Consultant: **William G. Young of Axis Facades, New York, NY**
Structural Steel Erector: **Metropolitan-Walters LLC, New York, NY**
Miscellaneous Iron Erector: **Metropolitan-Walters LLC, New York, NY**
Architectural Metal Erectors: **Metropolitan-Walters LLC, New York, NY;**
Jordan Installation Services, East Northport, New York
Ornamental Metal Erectors: **Metropolitan-Walters LLC, New York, NY;**
Jordan Installation Services, East Northport, New York
Curtain Wall Erector: **Jordan Installation Services, East Northport, New York**
Metal Deck Erector: **AC Associates, Lyndhurst, NJ**

This spread: Frederick Charles



Barnard College Diana Center

The school's new multidisciplinary building relies on a steel structure to meet its complex and tightly packed programming requirements.

THE ONE-BLOCK CAMPUS OF Barnard College is so compact you could easily overlook it. Thanks to an adventurous new arts building and student center designed by Weiss/Manfredi this distinguished private women's college affiliated with Columbia University stands a little taller next to its much larger neighbor. A shimmering composition of colored, translucent, and transparent glass with a series of dynamic cantilevered circulation and studio spaces, the building, known as the Diana Center, asserts its contemporary sensibility in the mostly masonry campus. Clever use of color—which shifts in shades of red and brown throughout the day—means it also relates to its brick neighbors.

"We had initially looked at precast concrete [for the exterior], but it lacked a sense of mystery," says Michael Manfredi, a principal at Weiss/Manfredi. "It needed to be a contemporary building that acknowledged the context of the largely brick campus." The architects wanted a building that balanced both contemporary and contextual. In order to achieve the effect they desired, the firm used mock-ups to test the color in various light condi-

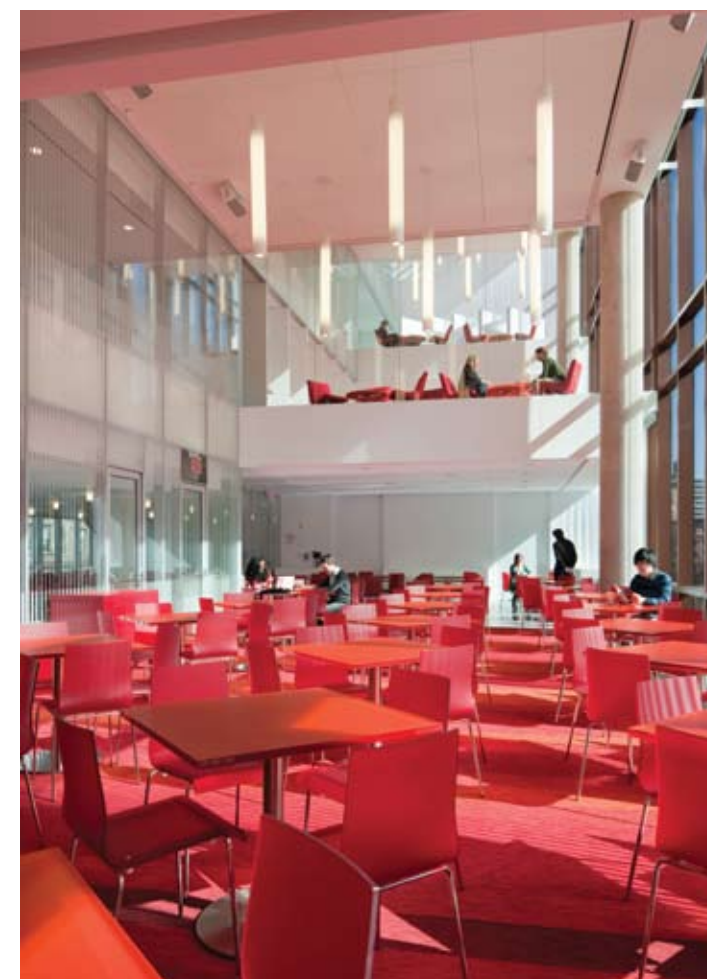
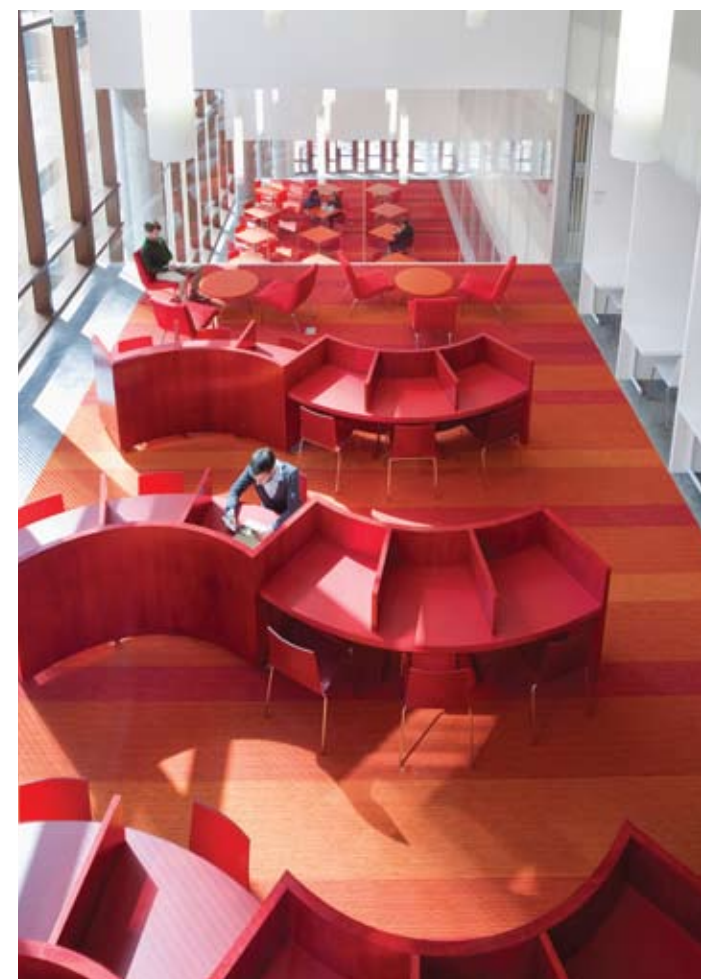
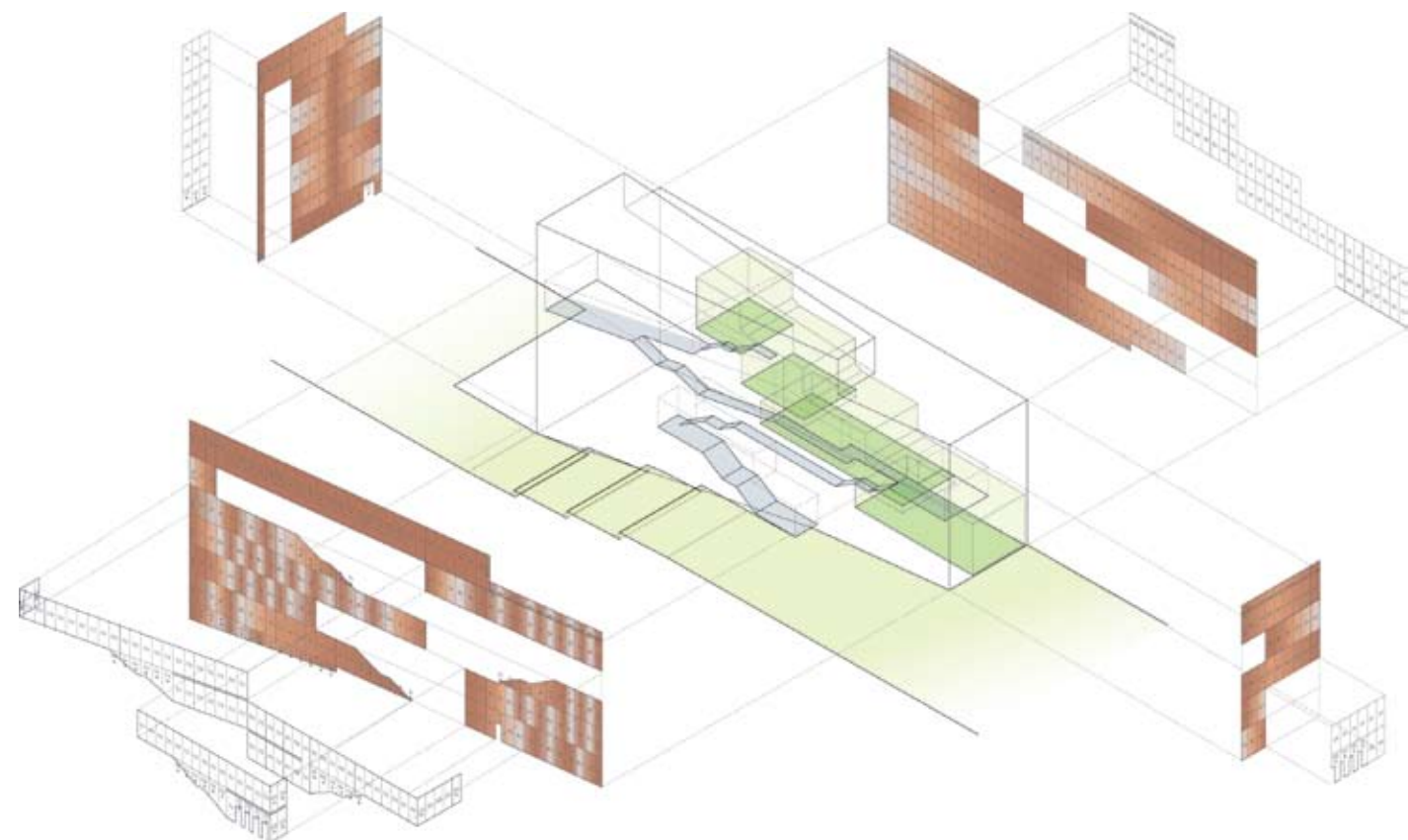
tions. They settled on a panelized system of transparent, fritted, and translucent glass over colored back-panels. The acid-etched #1 surface evokes the look of opaque masonry while still reflecting light. The building's color is created by a pale terra cotta-colored frit on the #2 surface and the bright red painted back panel beneath.

The panels are set in a bronze-colored anodized aluminum frame. The effect is warm and varies throughout the day and across the seasons. "Without the translucent glass, the back-panels are an almost lurid orange," Manfredi says. Had they used a brick red color on the back-panels, the building would have looked much darker due to the way the glass filters the color.

Composed of economical 5-foot-tall modules, the facade's 1,154 panels respond to interior programming with variations in transparency and opacity. But the building's steel structure is what allows the school to accommodate a wide range of academics within its walls; just as the campus is tightly packed, the 98,000-square-foot Diana Center is tightly programmed. Behind those colorful facades a complex hive of activities keeps the building humming throughout the day and long into the night. The center includes a café, multi-purpose spaces, classrooms, art and architecture studios, offices, an auditorium and a black box theatre. Spaces, including the double height café, are stacked and interconnected, with glazed dividing walls offering

Facing The seven-story Diana Center occupies the same footprint as the two-story concrete building that preceded it, made possible by the lighter weight of its steel framing.

Albert Vecerka/Esto



This page: Weiss/Mantredi

This page: Albert Vecerka/Esto

Facing above An exploded diagram of the Center's stacked programming.

Facing left The entire building acts as a moment frame; W-section beams and plate girders distribute lateral loads across the building, eliminating excess structure keeping the building envelope thin.

Above Interior spaces, including a double-height café, multi-purpose rooms, art and architecture studios, offices, an auditorium and a black box theatre are stacked and interconnected, with glazed dividing walls offering views throughout the building.

views throughout the building. The design and engineering team looked at using concrete for the structure, but a number of factors, including quicker construction times, made steel the best solution for achieving the building's sleek design.

Because the building is so tightly programmed, every decision made by the engineer, Manhattan-based Severud Associates, counted. "There's not a lot of space for wind bracing," says Edward Messina, a principal at Severud Associates, the project's structural engineers. The whole building acts as a moment frame, with W-section beams and plate girders that distribute lateral loads across the building, eliminating the need for extra structure and helping to keep the building envelope thin.

The auditorium created more

daunting structural challenges. The largest space in the building, the auditorium required a large transfer girder with a 40-foot span that could support the three floors above as well as the planted and habitable roof. Because the floor heights above could not be impacted, the engineers had to calculate the optimum dimensions for the 200-by-60-foot, A992 50 ksi steel transfer beam, while keeping it as slim as possible. The project uses nearly 600 tons of steel in all.

The roof of the building is a planted oasis in the city, a teaching space, and a social hub for the school. Faculty in environmental science and biology departments use the planted roof as a part of their curriculum. A portion of the roof is covered with pavers for film screenings and small social events. The con-



Right A panelized system of transparent, fritted, and translucent glass over colored back-panels creates the facade's unique color.

crete deck over steel roof deck had to be engineered to support extra loads for soil and plants, as well as bodies. "Its designed for much heavier loads because of the use," Messina says. The roof offers expansive views of the campus, the city beyond, and the domes and spires of Columbia.

Taking the building from a rendering into real life took a close and collaborative rapport between the architects and engineers. "Severud is very sensitive to the relationship between architecture and structure," Manfredi says. "They also have lots of experience working on tight urban sites and navigating the bureaucratic complexities of New York." Though taller than the previous building on site, the seven-story Diana Center occupies the same footprint of the two-story Brutalist concrete building that preceded it, a condition made possible by the lighter weight of steel framing.

Like the best stereotypes of the graduates of this famed Seven Sisters women's college, the cleverly executed Diana Center is dynamic and full of ideas. The project, which achieved LEED Gold rating and won the 2011 AIA Honor Award, was also satisfying for the architects and engineers. "I like the building very much," Messina says. "That's the great thing about this business. You start out with an idea and you end up with a building." Some of the artists and scholars training in the building likely will find equally satisfying creative and analytic projects. Good design and engineering played an important role in giving them a top-quality learning facility to pursue their work and become the leading women of the future.



This page The building's facade responds to the context of its masonry neighbors.

This spread: Albert Vecerka/Esto

BARNARD COLLEGE DIANA CENTER

Location: **3009 Broadway, New York, NY**
 Owner: **Barnard College, New York, NY**
 Architect: **Weiss/Manfredi, New York, NY**
 Structural Engineer: **Severud Associates, New York, NY**
 Mechanical Engineer: **Jaros, Baum & Bolles Consulting Engineers, New York, NY**
 Construction Manager: **Bovis Lend Lease, New York, NY**
 Curtain Wall Consultant: **R.A. Heintges & Associates, New York, NY**
 Structural Steel Erector: **Car-Win Construction, Mount Holly, NY**
 Miscellaneous Iron Erector: **Summit Group II LLC, Duncan, SC**
 Architectural Metal Fabricator and Erector: **Champion Metal & Glass, Deer Park, NY**
 Ornamental Metal Erectors: **Summit Group II LLC, Duncan, SC;**
Champion Metal & Glass, Deer Park, NY
 Curtain Wall Erectors: **Enterprise Erectors, Inc., New York, NY;**
Egan Architectural Metal & Glass, Yonkers, NY
 Metal Deck Erector: **Car-Win Construction, Mount Holly, NJ**



David Sundberg/Esto

8 Spruce Street

Frank Gehry’s new shimmering stainless steel facade makes waves in downtown Manhattan.

THEY’RE CALLING IT “NEWYORK BY GEHRY.” A COLLISION OF Manhattan’s famously vertical cityscape and Frank Gehry’s equally famous geometries, 8 Spruce Street lives up to the billing. At 867 feet (one foot higher than Trump World Tower) with 76 total stories, it’s New York City’s tallest residential tower, and undeniably its most distinctive.

That distinction is mostly owing to the Gehry-designed facade, an undulating mass of 16-gauge 316L stainless steel with an angel hair finish that suggests a silky fabric draped over the building’s T-shaped footprint. Inspired by the so-called “hard folds” in the work of Baroque sculptor Gianlorenzo Bernini, which Gehry contrasts with the “soft folds” of Michelangelo, the facade presents a surface that is both sharply angular and whimsically organic—a uniquely post-modern synthesis of monolith and mischief. This play of forms, stretching 319,000 square feet up and across seven sides of the eight-sided structure, is brought into stark contrast by the south face of the building, which is flat. Gehry designed the south face to lend 8 Spruce Street a sense of drama, creating a rare geometric juxtaposition of exuberance and restraint.

The architectural bluster rises for 70 stories, but rests on an unassuming six-story masonry pedestal, the future home of a public elementary school and additional offices for nearby New York Downtown Hospital. The masonry construction integrates the building with its surroundings: a cluster of turn-of-the-century Beaux Arts structures, the hospital, and the campus of Pace University. For all its formal gusto, 8 Spruce Street is firmly grounded in function. The high-art facade was inspired by Gehry’s appreciation for the bay window, a design element that gives one the sensation of “walking out into space,” he says. As much as a bay window looking out over New York City might appeal to potential renters, the all-unique floor plans promise to make the building one of the most coveted residential addresses in Manhattan. These not-a-one-like-the-other floor plans are created by

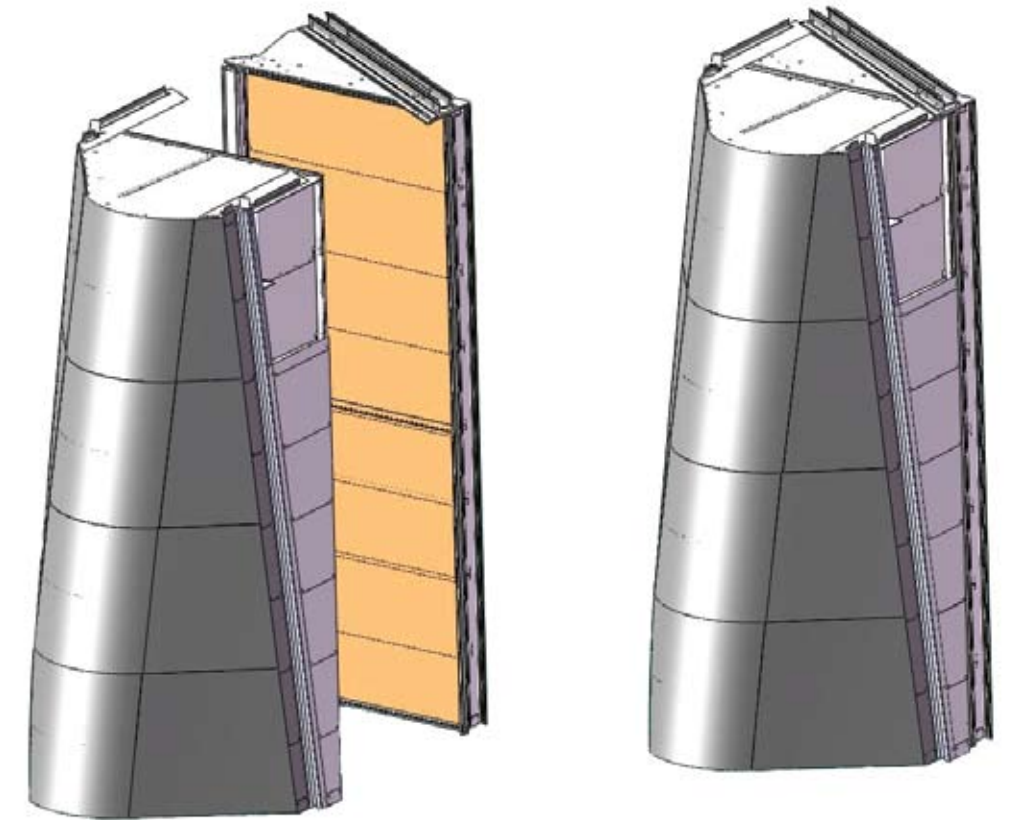
a structural slab system that traces the folds of the facade.

Developed by Forest City Ratner companies, 8 Spruce Street was slated to be a Gehry building from the start. Other members of the design and construction team included internationally accomplished structural engineers WSP Cantor Seinuk, New York construction management stalwarts Kreisler Borg Florman (KBF), and game-changing curtain wall fabricators Permasteelisa North America, all of whom played crucial roles in the design-assist phase. An estimated 10,000 hours of engineering and weekly design meetings went into developing a scheme that would adhere to the architect’s vision while restraining the costs usually associated with such grand built gestures.

The KBF-managed construction process went as smoothly as any major Manhattan project in years. That the project reportedly produced less than 100 RFIs is a testament to the exacting work of the team as a whole and to that of KBF specifically. Surprisingly enough, representatives from KBF stated that the greatest coordination challenge between the design and construction teams was ensuring that the 14,000 embedded aluminum brackets used to attach the curtain wall to the slab edge were properly spaced. Improperly spaced brackets would create a significant lag in the wall’s erection.

Frequent collaborators with Gehry Partners, Permasteelisa was key to the curtain wall design. Parent company Permasteelisa International has been working with Gehry since 1992, when his “El Pez” debuted at the Barcelona Olympics. More recently, Permasteelisa NA fabricated the stainless steel shapes for Gehry Partner’s Walt Disney Concert Hall in Los Angeles. Permasteelisa representatives called working with Gehry an easy process, streamlined by the long-time familiarity of both parties.

Permasteelisa used several software platforms in completing the design: CATIA, a 3D modeling program widely used in the automotive and aerospace industries and appropriated by Gehry decades ago to realize his unorthodox undulating shapes, was employed for surfacing; SolidWorks was used for all-important parametric modeling; and AutoCAD for submission to the architects at Gehry Partners.



Construction of shaped column unit with stainless steel panel rainscreen.



Above Curtain wall erectors install 9-foot-10-inch-tall curtain wall sections ranging in width from 3½ to 5½ feet high above lower Manhattan.
Left Each of the building's 70 stories was enclosed in four to five working days.
Opening page The undulating facade of 16-gauge 316L stainless steel was inspired by the hard folds in work by the Baroque sculptor Gianlorenzo Bernini.

This spread: Permasteelisa

In order to translate Gehry's complex geometries into sections that could be fabricated on a scale commensurate with a 70-story tower, the design-assist team established a number of guidelines, allowing them to tweak the design within established parameters. Each section would consist of a ruled surface, eliminating the compound curvatures that complicated fabrication. Rain screen panels can curve out as much as 6 feet or as little as 6 inches. Additionally, all of the 2,400 glazed panels would be normal, or perpendicular, to the ground plane and rectangular in shape.

The stainless steel shapes that would make up the rain screen were fabricated according to their radii. Soft radii sections were cold-formed and moderate radii sections were passed through a pyramidal roller and then cold-formed, leaving the tightest radii sections to be formed by cyclonic rollers. The curtain wall connections were generally conventional. In the case of tight radii sections meeting along the curtain wall, cap features were used. Permasteelisa refers to these as knife's-edge connections.

To reduce the cost of erecting a curtain wall in the cheek-by-jowl built environment of Downtown Manhattan, the team opted for a unitized curtain wall system over one that was stick-framed, a choice growing in popularity for residential tower construction. Fabricated at Permasteelisa NA facilities scattered across the continent from Montreal to Miami and at the firm's headquarters in Windsor,

Connecticut, 9-foot-10-inch-tall curtain wall sections ranging in width from 3½ to 5½ feet came off the line ready to install, reducing the cost of on-site staging.

A typical air-and-water barrier is positioned behind the expressive steel, which serves as the building's rain screen. The steel's angel hair finish, achieved with machinery that etches the surface with a fine pattern, will diffuse light and prevent glare on the facade. In the shop, these sheets were riveted to aluminum rain screen sub-frames, then attached to flat unitized curtain wall panels. More than 10,900 rectangular panels were manufactured for the 427,743-square-foot tower, but only 1,888 are exactly alike. All panels have interlocking male-female mullions and a mating horizontal stack. The assemblies account for the building's staggered floor plates, which are also all different, with stack joints that can shift in plane depending on the floor. Each floor plate was enclosed in four to five days.

Crucially, the head-turning facade did not exceed the estimated cost for a basic facade of the same scope and material. Forest City Ratner, Gehry Partners, Permasteelisa North America, WSP Cantor Seinuk, and Kreisler Borg Florman proved that a combination of skillful and efficient design-assist work pre-construction and crystal-clear coordination between all project participants can produce architecture that is cost-efficient, utilitarian, but also allows for aesthetic risk-taking. It's the meeting of no-nonsense and no-limits—it's New York by Gehry.



This spread: David Sundberg/Esto



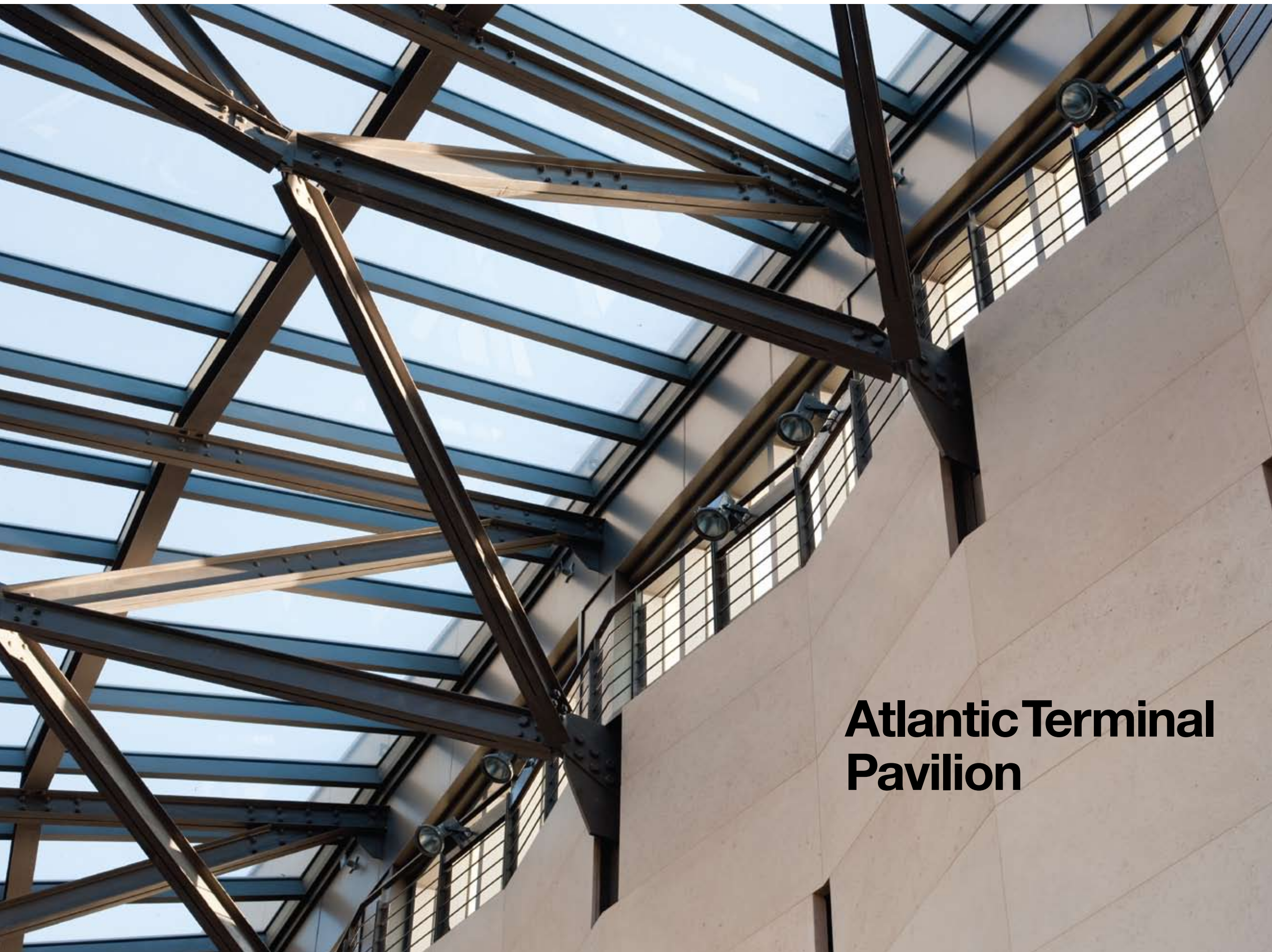
Facing The city's tallest residential tower rises above its downtown Manhattan surroundings.

Above Of more than 10,900 rectangular panels manufactured for the 427,743-square-foot tower, less than 2,000 are exactly alike.

The head-turning facade did not exceed the estimated cost for a basic facade of the same scope and material.

8 SPRUCE STREET

Location: **8 Spruce Street**, New York, NY
Developer: **Forest City Ratner Companies**, Brooklyn, NY
Architect: **Gehry Partners**, Los Angeles, CA
Structural Engineer: **WSP Cantor Seinuk Group**, New York, NY
Mechanical Engineer: **Jaros Baum & Bolles Consulting Engineers**, New York, NY
Construction Manager: **Kreisler Borg Florman**, Scarsdale, NY
Curtain Wall Consultant: **Gehry Technologies**, Los Angeles, CA
Curtain Wall Fabricator: **Permasteelisa North America**, Windsor, CT
Curtain Wall Erector: **Tower Installation LLC**, Windsor, CT
Curtain Wall Stud Erector: **AC Associates**, Lyndhurst, NJ



Atlantic Terminal Pavilion

Nothing says New York City transportation like structural steel.

THE RECENT COMPLETION OF THE LONG ISLAND Rail Road (LIRR) Pavilion at the Atlantic Terminal Complex, on the corner of Flatbush Avenue and Hanson Place near downtown Brooklyn, has brought back to life a civic presence that graced the site from 1877 until 1988. Formerly known as Flatbush Terminal, the station connects the western-most terminus of the LIRR with ten New York City subway lines. When designing the pavilion, which serves as a entrance of sorts for a larger retail and office complex, architecture firm di Domenico + Partners and joint venture partner Parsons Brinkerhoff, along with structural engineering firm Stantec, had little to deliberate about when it came to material used for the structural system. The material had to offer the team the ability to bridge long spans, connect seamlessly to the existing office/retail complex's steel structure, achieve a more slender profile than concrete, and, perhaps most notably, further the tradition of steel structures established by the city's classic transportation architecture.

"It was important to the railroad and to us to create an open space, an atrium, which first and foremost would draw people arriving at street level to the lower level concourse, but would also create a vessel to bring natural light down to the terminal and subway," explains John di Domenico, principal of di Domenico + Partners. "Structural steel allowed us to span the distance. It is also the material of transportation in New York City, which is all about great steel structures."

The pavilion welcomes visitors with a stately curving facade of glass and Indiana limestone. Inside, the relatively small footprint (roughly 40 feet deep by 110 feet wide) is given heroic proportions by a soaring 65-foot-high atrium walled in Mirabella limestone and capped by a sloping glass skylight. A large stair strengthens the space's grandeur, following the curve of the facade as it descends into the concourse below. An aperture in the pavilion's granite floor surrounding the stair—an area known as the "Overlook"—opens the lower level to views from street level as well as to daylight streaming in through the glass curtain wall and skylight. It also presents an opportunity for commuters on the way to make a connection to look up through the transparent facade at the impressive bulk of the neighboring Williamsburg Bank Building and to the apex of the atrium, where exposed steel trusses embody the strength and grace that has been the hallmark of the city's transit structures for more than a century.

The pavilion's steel structure presented some noteworthy challenges for the team. "The new structure, which has a complex geometry, was built partially on and adjacent to an existing subterranean



“Structural steel allowed us to span the distance. It is also the material of transportation in New York City, which is all about great steel structures.”

John di Domenico, di Domenico + Partners

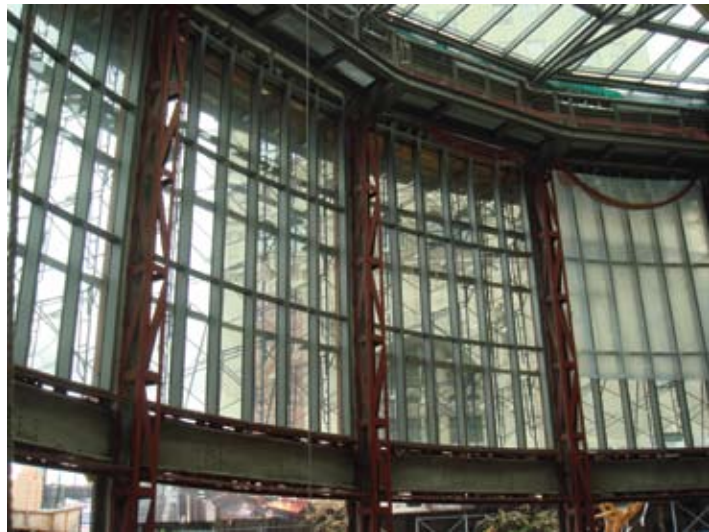
This page Structural steel had the ability to bridge long spans and connect seamlessly to the office and retail complex’s steel structure.

Opening spread A soaring 65-foot-high atrium floods the pavilion with natural light.



Above The station links the western-most terminus of the LIRR with ten New York City subway lines.

Above right A diagram of the pavilion. Transfer girders distribute the pavilion’s gravity loads to the station below.



Previous spread: Rob Wilson; This page: di Domenico + Partners

Above left: Rob Wilson; above right: di Domenico + Partners

transit station,” says Stuart Lerner, a vice president at Stantec. “Extensive engineering efforts had to be made to avoid overloading the transit structure below. This involved analysis to distribute the loading to specific beams and columns in the transit station that had the required structural capacity.”

Avoiding overload of the existing transit station’s structure was not the only concern, however. Lerner continues, “The design with the large open atrium required extensive analyses to minimize deflections so as to avoid any negative issues with the extensive amount of glass that was used.” Fortunately for the team, the flexibility and high strength-to-weight ratio gained by using structural steel allowed them to meet these challenges with ease and without sacrificing the design intent.

By way of example, transfer girders were needed to distribute the pavilion’s significant gravity loads to the transit station below. The girders were fabricated

from rolled sections of various sizes with depths ranging from only 20 to 36 inches. Wide flange sections make up the structure’s primary framing elements, but the careful engineering analysis allowed a range of weights to achieve graceful appearance of exposed members. Columns vary drastically in weight from W14x61 to W14x211 depending on the loads they manage, and beams exhibit similar variety, with sizes that range from W18x46 to W30x173. The majority of the structural steel is ASTM A572 Grade 50, and for the most part the members are bolted together with A325 bolts, though in some cases A490s were used for extra load carrying capacity.

While the team could have used solid members to support the skylight, a central element in the design, it chose to employ trusses instead. The exposed trusses hearken back to the history of New York City transit architecture, but there were also



This spread: Rob Wilson



Facing Allan Wexler and Ellen Wexler's granite-clad "Overlook" installation was commissioned by MTA Arts for Transit.

Above The pavilion's steel structure distributes loads to specific beams and columns in the transit station.

practical factors that influenced the decision. "The truss was used to keep the weight down while limiting deflections," says Lerner. "Additionally, the trusses were designed with careful consideration of horizontal axial loads in combination with vertical roof loads due to the way these trusses act to brace perimeter columns." The truss members are composed of built up sections, typically back-to-back C10x20 and C10x25 channels with ½-inch-thick gusset plates in between at connection locations. WT sections were also used at selective locations to facilitate connections. They were able to be left exposed by treating them with intumescent coating, which delivers a one-hour fire rating. The trusses were prefabricated, the trucked to the site, where they were picked into place by cranes.

The success of the LIRR Pavilion, as with all architecture, can only be measured in the reactions of its users. And by that standard, it has proven to be a huge success. Since its opening in January 2010, the pavilion has become a favorite meeting spot for rail passengers and pedestrians alike, all of whom are drawn to the space's heroic scale, timeless finishes, and abundant natural light. The airiness afforded by using steel trusses played a key role in creating just the right conditions for those factors to come together, and has helped to add another jewel in the great crown of New York City's transit system.

ATLANTIC TERMINAL PAVILION

Location: **Atlantic Avenue and Hanson Place, Brooklyn, NY**
Owner: **MTA Long Island Rail Road, New York, NY**
Architect: **di Domenico + Partners LLP, Long Island City, NY**
Structural Engineer: **Stantec, New York, NY**
Mechanical Engineer: **Chu & Gassman Inc., New York, NY**
General Contractor: **Stonewall Contracting Corp., New York, NY**
Curtain Wall Consultant: **R.A. Heintges & Associates, New York, NY**
Structural Steel Erector: **Lago Steel Products, Glendale, NY**
Miscellaneous Iron Erector: **Lago Steel Products, Glendale, NY**
Architectural and Ornamental Metal Erector:
Neversink Glass Corp., White Lake, NY
Curtain Wall Erector: **Neversink Glass Corp., White Lake, NY**
Metal Deck Erector: **Lago Steel Products, Glendale, NY**



Above Recladding the Marshak building will increase its energy efficiency and prevent further deterioration of its 40-year-old lightweight concrete facade.

CCNY Marshak Science Building

Ahuja Partnership Architects

One of the university's largest buildings finds new life with a steel-reinforced re-skinning of its deteriorating concrete facade.

AS THE CITY COLLEGE OF NEW York's largest graduate science teaching and research facility, the 13-story, 600,000-square-foot Marshak Science Building is the most visible structure on campus, standing out from the surrounding Gothic buildings completed more than 100 years earlier.

Designed by Skidmore, Owings & Merrill in 1971, the building's facade was built with lightweight concrete, an innovative material at the time that was intended to lighten the weight of the building since it rests on a complicated system of transfer girders above the plaza level. However, as with many structures of that period where lightweight concrete was used in an exposed condition, the diffusion of water through the porous aggregate together with chloride accelerators used in the mix proved to be the building's own worst enemy. Within ten years of the building's completion the exterior concrete had begun to spall and crack revealing extensive reinforcement corrosion. As the exterior conditions worsened and the corrosion became more widespread, the college sought to determine the causes of the deterioration. After an initial assessment by engineering consultant Stone & Webster (now Shaw Consultants International), New York-based Ahuja Partnership Architects (previously APA Architects) and structural engineer RSD Engineering PC, were called in to analyze the problem, determine its causes, and develop design alternatives for a permanent solution.

The team had an extensive series of tests of the concrete conducted by an independent lab. These revealed that not only was the aggregate highly porous, but also that carbonation and high chloride concentrations were present throughout the concrete structure. Carbonation is a corrosion-enhancing process whereby dissolved atmospheric carbon dioxide in the pore water reacts with the cement paste

to increase the concrete's acidity. When this is combined with the chloride ion's mobility in solution, which further promotes acidity, a particularly aggressive corrosion environment exists. In the absence of water neither process can occur, explaining why no interior deterioration or corrosion occurred. To worsen matters, 3-foot-wide perimeter gutters at each level, originally designed to act as sun shades over the building's recessed windows, had no slope and essentially acted as bathtubs for collecting snow and rain, further deteriorating the concrete.

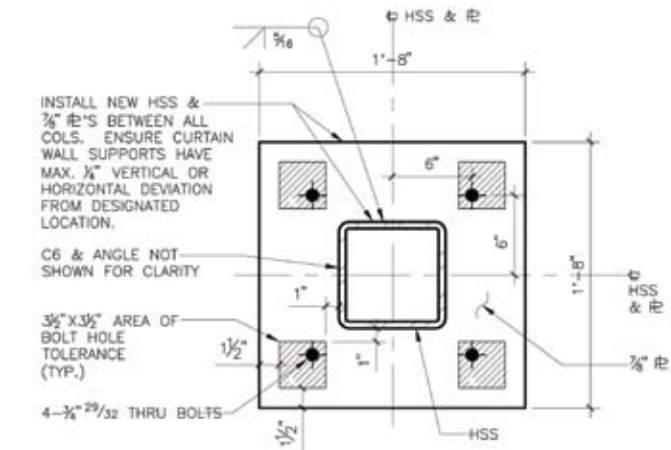
Structural engineer RSD Engineering concluded that the condition had to be dealt with immediately because the exterior slabs were so damaged that they could not be relied on to adequately brace the columns. To stabilize the columns until a permanent solution was found, RSD designed exterior, story-high steel trusses and beams, which were installed in 2000. "As the exterior columns and gutters were structural in nature and there was no permanent way to arrest the concrete deterioration and solve the drainage issues resulting from the 'bathtubs,' repairing the exterior structural frame and encapsulating the building with a new curtain wall was found to be the only economical and practical solution," says APA founding principal Raj Ahuja. The design team advised the school to install an exterior glass and aluminum curtain wall to protect the concrete members from natural elements, a solution which permitted the building to remain fully occupied. APA's design for the exterior of the building would not only create a more fitting architectural expression for this imposing structure, but also provide for an energy efficient building envelop using tinted insulated glass with low-e coating.

Execution of APA's proposed design presented some challenges, as testing had established that the concrete deterioration was so extensive at the exterior slabs that the building's new curtain wall could not be supported on the slab edges. Instead, 8-by-8-inch HSS box sections were installed spanning between columns, which were designed to transfer the load



Above HSS box sections spanning between columns will transfer the curtain wall load directly to the existing columns without transferring any new load to the slab edges.

Below A diagram detailing the new curtain wall's HSS support installation.



of the curtain wall directly to the existing columns without transferring any new load to the slab edges.

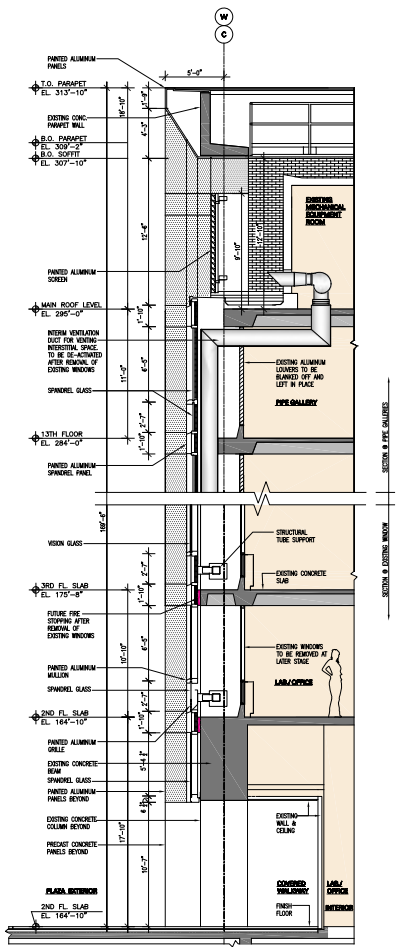
The box sections also fulfill the function of bracing the existing concrete columns. They are connected to each column by means of 24-inch-square by 7/8-inch-thick end plates sized to achieve high fixity, thereby reducing deflections and economizing on HSS size. Controlling deflections was critical in ensuring serviceability of the curtain wall. Plates on opposite sides of the columns are bolted together with high-strength, corrosion-resistant A588 through-bolts torqued to 130 foot-pounds. Locations for the through-bolting were first established by pachometer to minimize cutting the column reinforcement.

At the parapet level, new HSS trusses provide additional bracing for deteriorated concrete columns in addition to adding a decorative architectural feature to the building. APA chose coloration for the modern building's new glass and aluminum com-

ponents that would complement the terra cotta and New York schist stone facades of the neighboring historic Sheppard Hall.

To minimize construction time, the glass and aluminum curtain wall was designed as a unitized panel system, factory assembled and glazed spanning the nearly 11-foot floor heights and supported on outriggers attached to the HSS. Vertical mullion spacing within the curtain wall was designed to align with the existing window mullions. As part of the future renovation, the owners plan to remove the old windows altogether, freeing up space for new HVAC units. Though not required at this point, the curtain wall is also designed to receive fire stopping at the floor lines and vertical jamb of each window bay and at each floor level once the interior windows are removed.

Along the north and south elevations, the existing solid wall sections at the four corners of the building are designed to be clad in aluminum panels, which continue horizontally



Clockwise from top: RSD Engineering; Ahuja Partnership Architects; Ahuja Partnership Architects

at the roof level to create a portal-like expression along the east and west facades. As of June 2011, construction was largely complete, with most work carried out while the science center's computer, medical, and laser labs, in addition to more than two hundred teaching and research labs, remained fully operational.

The carefully designed details for permanently repairing the existing exposed building structure and a new curtain wall envelope will result in a fresh architectural identity for the dated building. A structure that was at one time facing demolition has been given a new life ahead of it as the City University of New York undertakes its "Decade of Science," with renewed attention and funding to research in math and science.

"Steel saved the day by allowing us to brace the building and save the curtain wall," says RSD founder Richard Donald. "We saved the concrete using steel."



Above left A typical curtain wall section.

Above Existing solid wall sections at the four corners of the north and south elevations will be clad in aluminum panels.

CCNY MARSHAK SCIENCE BUILDING

Location: 137th Street and Convent Avenue, New York, NY
 Owner: Dormitory Authority of the State of New York (DASNY), New York, NY; The City University of New York (CUNY) Department of Design, Construction and Management (DDCM), New York, NY
 Architect: Ahuja Partnership Architects, New York, NY
 Structural Engineer: RSD Engineering, New York, NY
 Mechanical Engineer: Genesys Engineering, Pelham, NY
 General Contractor: Whitestone Construction Corp., Woodside, NY
 Construction Manager: URS Corp., New York, NY
 Miscellaneous Iron Erectors: Whitestone Construction Corp., Woodside, NY;
 Metro-Tech Erectors Corp., Glendale, NY
 Architectural Metal Erector: Whitestone Construction Corp., Woodside, NY
 Curtain Wall Erector: Whitestone Construction Corp., Woodside, NY

Harlem Hospital New Patient Pavilion

Modernization of the more than 100-year-old teaching hospital's campus makes room for improved patient care and community outreach in Harlem.

HARLEM HOSPITAL CENTER'S NEW PATIENT pavilion project is proving that modernization need not be at the expense of historical significance. The project's design, undertaken by HOK's New York office in association with Bronx-based architect Jack Travis of Studio/JTA calls for constructing a new six-story, 150,000-square-foot pavilion to connect the existing Martin Luther King Pavilion at West 135th Street and Lenox Avenue. The MLK pavilion will be renovated with the existing Ron Brown Ambulatory Care Pavilion, which is set back from Lenox Avenue on 137th Street. Scheduled for completion in 2012, the project will house new emergency and surgery departments, diagnostic and treatment services, a critical care suite, and a modern radiology center, all centered around an expansive full-height atrium to create a unified health care complex out of seven disparate structures spread over two city blocks.

Though the plan is rooted in bringing the most up-to-date medical care and teaching facilities to Harlem, at its creative center is the restoration of the hospital's historic WPA-era murals painted by some of the most famous African American artists of the 1930s, including Charles Alston and Vertis Hayes. While the original artwork, depicting themes of medical science, life in Harlem, and experiences of black people in America, will be displayed in the new pavilion's lobby gallery, Hayes's work *Pursuit of Happiness* is replicated on the building's six-story curtain wall facade in the form of a 180-by-65-foot glass mural mounted on a concealed steel structure.

The unusual project posed several challenges to the design team, who worked with structural engineer Robert Silman & Associates to realize the new pavilion's structural design. Pavilion spaces needed to be organized to flow into existing portions of the hospital campus. Perhaps most importantly, the design had to anticipate plans to build two additional floors atop the new pavilion in the future. Using steel for the structural frame provided the necessary flexibility in both cases, but the team found that the unique mural curtain wall design prevented them from using more efficient cross-braced frames to address lateral loading. Therefore, the building's lateral system (with the exception of a double-height mechanical space) is designed as a series of moment frames. This required large W14x342 columns

and W24x117 girders, both of Grade 50, A992 steel, to keep lateral drift to acceptable limits. The double-height mechanical space at the seventh floor created a "soft story" where moment frames were inefficient, so the design team instead used perimeter-braced framing for better lateral load resistance.

With the facility's expansion goals in mind, the structure is designed to carry two more floors in the future. To anticipate the additional stresses on the building the future floors presented, the team developed several structural models to determine appropriate seismic and wind requirements both before and after their addition. Because the hospital is set back one bay at the sixth floor, large W44x335 transfer girders support the new floors and potential floors above.

Column layout also presented a challenge to the design team. Because of the hospital's desire to create open, light-filled spaces in line with modern health care standards, the architects set column lines on the north and west sides of the building 9 feet 6 inches back from the building edge. The design team used cantilevered stub beams moment connected to the columns to create corridor areas free of vertical structural elements. The unique space, along with fluorescent backlighting, will help show off the hospital's new glass mural wall to Lenox Avenue.

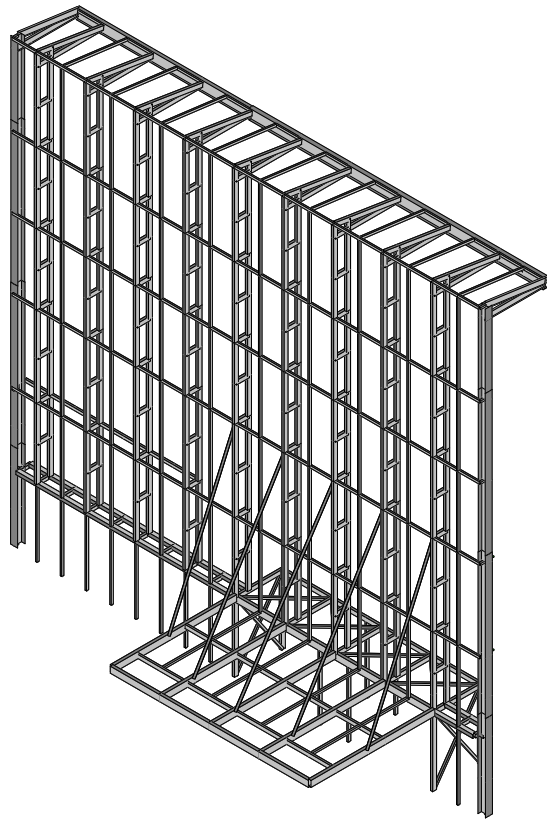
The pavilion's five-story central atrium required another structural steel solution. "Early on in the design, the team made the decision to treat the main pavilion and the atrium as one whole building, rather than splitting the two with an additional row of columns to create a seismic joint," said Silman engineer Tom Reynolds. Because of this decision, the design team had to drag the lateral load from the frames in the main pavilion to the frames at the perimeter of the atrium using a horizontal roof truss. The roof truss was composed of 5x5 angles bolted to gusset plates that were field bolted to the wide flange members at the roof.

In total, the project comprises more than 2,000 tons of structural steel: Grade 50, A992 for all wide flange sections, ASTM A500, Grade B, for all hollow sections, and A36 for all channels, angles, plates and other miscellaneous metals. Typical infill beams are compositely designed W18x40, and typical girders are compositely designed W24x68. Most columns are W14x342 and smaller, with the largest, a W14x426 column, placed in the center of the basement level. At the foundation the design team used large W36 (328, 260 and 280) beams encased in concrete and embedded in the ground to support the atrium column line that was placed



Above Vertis Hayes's *Pursuit of Happiness* is digitally printed on the building's six-story glass facade mounted on a concealed steel structure.

Dominick Reda/TDX Construction Corporation



Clockwise from top Atrium HSS framing; the horizontal roof truss takes lateral loads from the main pavilion frames and transfers them to frames at the atrium perimeter; web penetrations; the atrium truss meets the mural wall truss.

Right The 150,000-square-foot pavilion will connect to the existing Martin Luther King with steel bridges at each floor.



against the existing MLK building. Large, kinked, 60-foot-long W36 members created the bridges connecting each floor of the new pavilion to the MLK structure.

To accommodate the building's show-stopping curtain wall, bent plates of $\frac{3}{8}$ -inch-thick A36 steel form the edge of slab at the West facade. Three-quarter-inch diameter, embedded headed steel studs (attached to the inside face of the bent plates) provide the additional capacity necessary at the slab edges for the curtain wall attachment. Because the printed curtain wall was part of a separate design-build contract, Silman's engineers worked with curtain wall engineer Arup to develop connections to the bent plates that could accommodate the necessary vertical deflection at the slab edge, as well as the lateral movement of the building.

As with many design-build curtain wall systems, the hospital's steel sub-frame needed to be designed for maximum flexibility at the attachment points. Because the slab edge at the west mural wall was cantilevered out as much as 1 foot, 10½ inches, the spandrel beam design uses HSS members connected with full-height stiffeners to keep them from rotating.

The west-facing portion of the atrium is framed vertically with full-height HSS 9x5x5/8 Vierendeel trusses of ASTM A500, Grade B, HSS, placed at 9 feet 6 inches on-center, which are attached to W27x84 Grade 50, A992 wide-flange beams at the atrium roof. These HSS were specified as AESS and were erected and fabricated according to those strict tolerances.

Aside from visible horizontal mullions at each floor line, the atrium's west wall is structurally glazed, presenting an uninterrupted canvas for Hayes's work. Each of the curtain wall's 429 panels was printed with a new digital, direct-to-glass

printing technology called Alice, which works much like an inkjet printer. The pattern is printed on the #3 surface of the six-layer insulated glass units, directly under a PVB interlayer laminating it to the outer lite. Because interior corridors pass behind the glass, it will remain unobstructed by furniture. At night, the back-lit image comes alive thanks to the illuminated column-free space behind it, highlighting the historic scene from the past—the hospital's new face—for all who pass by.

HARLEM HOSPITAL NEW PATIENT PAVILION

Location: **506 Lenox Avenue, New York, NY**
 Owner: **NYC Health & Hospitals Corporation, New York, NY**
 Developer: **Dormitory Authority of the State of New York (DASNY), New York, NY**
 Architect: **HOK, New York, NY**
 Associate Architect: **Studio JTA, Bronx, NY**
 Structural Engineers: **Robert Silman & Associates, New York, NY;**
Trevor Salmon Associates, New York, NY
 Mechanical Engineers: **Kallen & Lemelson, New York, NY;**
Lakhani & Jordan, New York, NY
 Construction Manager: **TDX Construction Corporation, New York, NY**
 Curtain Wall Consultant: **Ove Arup & Partners, New York, NY**
 Structural Steel Erector: **Brooklyn Welding Corporation, Brooklyn, NY**
 Miscellaneous Iron Erector: **Capco Steel Co., Providence, RI**
 Architectural Metal Erector: **Brooklyn Welding Corporation, Brooklyn, NY**
 Curtain Wall Erector: **W&W Glass Systems/Metal Sales, Nanuet, NY**
 Metal Deck Erector: **AC Associates, Lyndhurst, NJ**

Clockwise from top: Robert Silman Associates; Robert Silman Associates; Dominick PedarTDX Construction Corporation

HOK

At the fluid management company’s new campus, expansive curtain walls enhance wayfinding and energy efficiency.

YOU NAME IT, THE PALL Corporation purifies it. A 66-year-old fluid management company based in Port Washington, Long Island, it realizes \$2.4 billion annually selling filters used in installations ranging from municipal water plants to micro devices that separate blood and trap pathogens. This circus-tent approach to the filtration business was an apt metaphor for Pall’s existing 221,000-square-foot-facility on its 18.5-acre Port Washington, New York, campus. “People used to get lost in the building, because they couldn’t orient themselves in the hodgepodge of space,” says Joseph Randazzo, of Spector Group, the architecture and planning firm engaged to address the problem.

In October 2009 Spector Group completed a consolidation of Pall’s Port Washington and East Hills, New York, offices into one world headquarters. In doing so the design team, led by Randazzo, expanded the existing facility; the new facility now totals 276,000 square feet. More important, it makes sense of old and new wet labs, research rooms, and administrative spaces, by effectively inserting a main street into the facility’s major east-west axis. (The original east-facing entrance was also recast as the executive entrance, and Pall’s 500 employees arrive at work via a new portal on the west elevation.) A two-story visitor entrance intersects the new corridor near its center,





This page The main entrance and the rectilinear cafeteria curtain walls are secured by connections to the addition's 20-inch-diameter structural-steel columns. Horizontal 6-inch-diameter schedule 80 steel pipes are welded to the columns with a steel connection plate between the pipe and the column.

Previous spread The new 55,000-square-foot addition creates a new entrance for Pall Corporation's Port Washington headquarters.



the corridor terminating at one end in an equally soaring employee cafeteria.

Curtain walls distinguish the two volumes, covering approximately 17,500 square feet of surface. Each wall provides abundant diffuse daylight that enhances the main street's job of orienting building users while capitalizing on reduced lighting costs, boosting the facility's sustainability profile. Both are constructed as stick systems that are thermally broken and glazed with float glass sputter-coated in vacuum-deposited metallic oxide nitrate. The low-E coating blocks approximately 60 percent of solar energy and results in a total U-value of 0.29. YKK AP America's YHC 300 SSG structural silicone system was specified for both stick systems.



One of the most important features of the systems is their design for rigorous wind and impact loading. "We're within a certain distance from the water and in a high wind zone, so new portions of the building have to be prepared for hurricanes or similar impacts," says Randazzo.

Appropriately, the YKK product is ASTM E 1886/1996, TAS 201, 202, 203 +70/-90 PSF (Large & Small Missile), and approved by Miami-Dade NOA and the State of Florida. ASTM B 221 (ASTM B 221M), 6063-T5 aluminum alloy mullions engage 3-by-5-foot insulated glass panels, each of which comprises a 1/4-inch layer of exterior glass and, on the other side of a 1/2-inch air space, a pair of 3/16-inch glass panels sandwiched by .070-inch SAF-Glas clear polycarbonate laminate.

Previous spread: Pall Corporation; This page: Spector Group Architects

This page The building lies in a high wind zone close to the water, so curtain walls meet rigorous wind and impact loading requirements.

The segmented main entrance and the rectilinear cafeteria walls are all held in place via connections to the addition's 20-inch-diameter structural-steel columns. Horizontal 6-inch-diameter schedule 80 steel pipes are welded to the columns with a steel connection plate between the pipe and the column that was designed and fabricated to allow for easy attachment. Quarter-inch-thick custom steel brackets project outward from the pipes and attach to the 3-inch-wide mullions by through-bolting. Brackets are either fixed to the mullion or, where wind load demands it, include a slotted connection that allows the mullion to move. In either case, a nylon washer separates the aluminum mullion from the steel bracket, thereby preventing the electrolysis and corrosion that would come from direct contact.

In another example of customization, Spector Group worked with YKK to design an elliptical extruded-aluminum cover that snaps onto the horizontal mullions, and which connects in series by silicone butt joint. The exterior finish on the snap-on covers is a factory-applied three-coat PPG Duranar XL, while interior aluminum elements are double coated in the high-performance fluoropolymer. The cold-rolled steel members were sandblasted in the YKK factory and electrostatically painted to match the aluminum.

The entry includes a canopy of custom tapered structural steel with 2 1/2-inch-diameter steel pipe running perpendicularly

This page: Pall Corporation





Above The entry canopy is supported by custom tapered structural steel; 2½-inch steel pipe runs perpendicularly through the members. The frame is suspended by ¾-inch-diameter stainless steel rod with turnbuckles.

Facing The completed addition enhances wayfinding on the campus and puts a sleek face on the company's state-of-the-art facilities.



through the members. The frame is suspended by ¾-inch-diameter stainless steel rod with turnbuckles, and it cantilevers from the building via a 14-inch-tall bracket. Pin connections at the junctions put less stress on the structural system, especially when wind pushes the canopy upward. Half-inch-thick laminated sheets of glass attach to the frame by #4 stainless steel spider fittings.

While the canopy adds a flourish to the curtain walls, the south elevation also includes a more straightforward counterpoint. The addition features approximately 2,200 square feet of punched and strip windows. In addition,

there is a separate system comprising 21,000 square feet of 0.236-inch-thick Alcan Composites Alucobond. This rout and return, integral-gutter system includes panels triple-coated in PPG Duranar XL finish ranging from 3 feet wide to 9 feet wide—to achieve consistency with the 3-by-5-foot glass panels, but also to create diversity on the facade. The combination of crisp opaque and transparent expanses, Randazzo says, “emphasizes Pall’s state-of-the-art technology” and breathes new life onto a once-nondescript suburban headquarters.

This spread: Pall Corporation

PALL CORPORATION HEADQUARTERS

Location: **25 Harbor Park Drive, Port Washington, NY**
Owner: **Pall Corporation, Port Washington, NY**
Architect: **Spector Group Architects, New York, NY**
Structural Engineer: **Office of James Ruderman, New York, NY**
Mechanical Engineer: **Lizardos Engineering Associates, PC, Mineola, NY**
Construction Manager: **JT Magen & Company Inc, New York, NY**
Structural Steel Erector: **Piermount Iron Works, Wayne, NJ**
Miscellaneous Iron Erector: **Piermount Iron Works, Wayne, NJ**
Architectural Metal Erector: **Egan Architectural Metal & Glass, Yonkers, NY**
Curtain Wall Erector: **Egan Architectural Metal & Glass, Yonkers, NY**



Julie V. Iovine and Frank Gehry

Frank Gehry Lecture

On November 10, 2010, Frank Gehry took the stage of Pratt Institute's Higgins Hall for a conversation with *The Architect's Newspaper's* executive editor Julie V. Iovine and author Yael Reisner. Speaking to a packed auditorium of students and community members, Gehry reminded the audience that at the end of the day, his job is about delivering a high-quality and unique product to his client. Gehry went on to discuss the important role that material exploration plays in his work, a topic also integral to the values of lecture sponsors the Steel and Ornamental Metal institutes of New York.

Guy Nordenson Lecture

Guy Nordenson, structural engineer and Princeton University professor, lectured at Pratt Institute April 14, 2011, to a crowd curious to hear more on his topic, "Patterns and Structure." He spoke about the unique use of structural steel in several projects, including Yoshio Taniguchi's MoMA curtain wall and Stephen Holl's Simmons Residence Hall at MIT. The event was the second in a series of lectures sponsored by the Steel and Ornamental Metal institutes of New York. For information on upcoming lectures and events, visit www.ominny.org/events or www.siny.org/events.



Guy Nordenson

SteelDay 2011: Friday, September 23

SteelDay is the largest educational and networking event the structural steel industry has ever seen, and is your chance to see how steel contributes to building America. The American Institute of Steel Construction (AISC) and the Steel Institute

of New York invite you to save the date for SteelDay 2011 in NYC: Friday, September 23. To learn about hosting a SteelDay event in your city or about attending an event near you, visit www.aisc.org/steelday or www.siny.org/events.



Steel Camp 2011

Co-sponsored by the Steel Institute of New York, AISC's Steel Camp 2011 in New York City provided two days of continuing education to an audience of architects and engineers. The program, consisting of three lectures and a panel discussion, took place at McGraw-Hill Auditorium and covered five different topics presented by top design professionals and academics in the structural engineering field. Speakers included: James M. Fisher, PhD, PE; Michael A. West, PE, AIA; Donald Sherman, PhD, PE; Charlie Carter, PhD; and Louis F. Geschwindner, PhD, PE. Visit www.aisc.org/steeltcamp or www.siny.org/events for more information.

Steel Institute of New York

Lawrence Weiss, Chairman
A.J. McNulty & Co., Inc.
Maspeth, NY

Jake Bidosky
American Bridge Company
Coraopolis, PA

Terry Flynn
Tutor Perini Corporation
Peekskill, NY

Stephen J. Hynes
Midlantic Erectors, Inc.
Roselle, NJ

Stephen Isaacson
Skanska Koch, Inc.
Carteret, NJ

Robert Koch
Skanska Koch, Inc.
Carteret, NJ

Rich Lucas
Northeast Structural Steel Inc.
Mt. Vernon, NY

Randall Ment
Ment Brothers, I.W. Co., Inc.
New York, NY

Robert Samela
A.C. Associates
Lyndhurst, NJ

The labor to erect the structural steel on projects featured in this publication was provided by the following labor unions:

LOCAL UNION NO. 40
International Association of Bridge, Structural Ironworkers & Riggers
451 Park Avenue South
New York, NY 10016
(212) 889-1320

Robert Walsh
Business Manager and
Financial Secretary-Treasurer

Kevin O'Rourke
President and Business Agent

Daniel Doyle
Recording Secretary and
Business Representative

LOCAL UNION NO. 14
International Union of Operating Engineers
141-57 Northern Boulevard
Flushing, NY 11354
(718) 939-0600

Edwin Christian
President and Business Manager

LOCAL UNION NO. 361
International Association of Bridge, Structural Ironworkers & Riggers
89-19 97th Avenue
Ozone Park, NY 11416
(718) 322-1016

Richard O'Kane
Business Manager and
Financial Secretary-Treasurer

Matthew Chartrand
President and Business Agent

Anthony DeBlasio
Business Agent

LOCAL UNION NO. 15 & 15-D
International Union of Operating Engineers
265 West 14th Street
New York, NY 10011
(212) 929-5327

James Callahan
President and Business Manager



www.siny.org
Steel Institute of New York

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
- 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

Ornamental Metal Institute of New York

Herbert K. Koenig, Chairman
Tower Installation LLC
Windsor, CT

Peter Carriero
Post Road Iron Works
Greenwich, CT

Harvey A. Heffner
Empire City Iron Works
Long Island City, NY

Randall Ment
Ment Brothers I.W. Co. Inc.
New York, NY

Randy Rifelli
United Iron, Inc.
Mount Vernon, NY

Arthur Rubinstein
Skyline Steel Corp.
Brooklyn, NY

The labor to erect the architectural and ornamental metals on projects featured in this publication was provided by the following labor union:

LOCAL UNION NO. 580
Architectural and Ornamental Ironworkers
501 West 42nd Street
New York, NY 10036
(212) 594-1662

James Mahoney
Business Manager and Financial
Secretary-Treasurer

John Busch
President

Robert Benesh
Business Agent

Peter Creegan
Business Agent

Peter Myers
Business Agent

Dennis Milton
Business Agent



www.ominny.org
Ornamental Metal Institute of New York

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

211 East 43rd Street, Suite 804
New York, NY 10017
T 212-697-5553/5554
F 212-818-0976

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

William Shuzman
Executive Director
Gary Higbee AIA
Director of Industry Development

Institute ads appear regularly in New York-area industry publications to let readers know that we can help turn their design aspirations into realities.

IT'S ACADEMIC

Usually it's what is inside a school that counts. But at Manhattan's **Learning Spring School**, the exterior promotes learning as well. Established for children diagnosed on the autism spectrum, the school needed a facade that could limit the effects of external stimuli and help students focus on the lessons at hand. To meet this challenge in a way that would function both academically and architecturally, architect **Platt Byard Dovell White** wrapped the zinc and terra cotta facade with an aluminum and stainless steel sunscreen, creating a sheltered **LEED for Schools**-certified environment inside, and a new vision for learning in the heart of Gramercy.

Transforming design into reality

For help achieving the goals of your next project, contact the Ornamental Metal Institute of New York.

Ornamental Metal Institute of New York

Publisher of Metals in Construction
211 E 43 ST | NY, NY 10017 | 212-697-5554 | www.ominny.org

Architect: Platt Byard Dovell White Architects
Photo: Frederick Charles

Congratulations to the winners of
AIA National Chapter
2011 Honor Awards
Kohn Pedersen Fox
Associates and
Weiss/Manfredi Architects

More on their winning projects
One Jackson Square and
Barnard College Diana Center
online and in *Metals in Construction*

Ornamental Metal Institute of New York

www.ominny.org

GRASS ROUTES

Creating green space in New York is not always a walk in the park. Challenged with drawing activity to its campus from 45th Street, **Lincoln Center** commissioned **Diller Scofidio + Renfro** and **FXFOWLE** to design a restaurant that would allow street life and arts events to come together, enlivening pedestrian paths while adding valuable public space. The team's unique solution was an elegant parabolic-roofed pavilion that grows out of the Center's plaza, creating a lawn for those who wish to lounge, and a canopy for those who wish to lunch. Steel's slender, lightweight profile made the project possible by enabling the structure to bear on existing foundations, a new stage among many that give the performing arts center its life.

Structural Steel Right for any application

For help achieving the goals of your next project, contact the Steel Institute of New York.

Steel Institute of New York

Publisher of Metals in Construction
211 E 43 ST | NY, NY 10017 | 212-697-5553 | www.siny.org

Architects: Diller Scofidio + Renfro with FXFOWLE
Structural Engineer:
Owens Corning Fiberglas
Photo: Ivan Rian

Congratulations to the winners of
AIA New York Chapter
2011 Design Awards
Diller Scofidio + Renfro,
FXFOWLE Architects,
and Architecture
Merit Award winner
Ennead Architects

More on their winning projects
Hypar Pavilion and **The Standard**
online and in *Metals in Construction*

Steel Institute of New York

www.siny.org

Jennifer K. Gorsche, Dominique Nabokov, AISC