METALS IN CONSTRUCTION

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SPRING 10

ALICE TULLY HALL AND THE JUILLIARD SCHOOL /
CITY COLLEGE OF NEW YORK SCHOOL OF ARCHITECTURE /
FRANK SINATRA SCHOOL OF THE ARTS / NEW YORK LAW SCHOOL /
41 COOPER SQUARE / ONE JACKSON SQUARE /
THE STANDARD HOTEL / MONROE HIGH SCHOOL ANNEX

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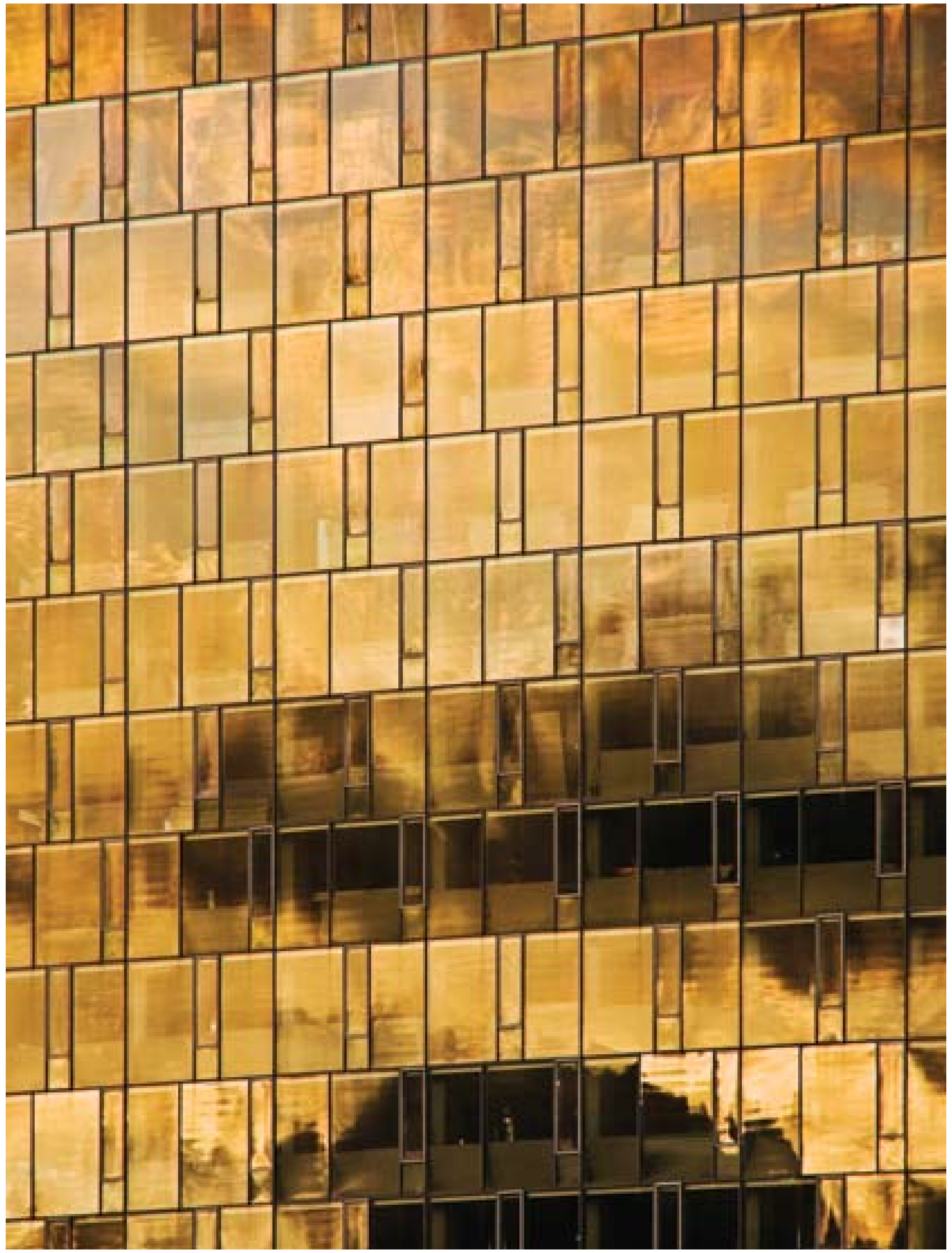
SPRING 10



Above The Standard Hotel's structurally glazed curtain wall features full-height operable windows.

Jeff Goldberg/Esto; cover: Joseph David

Adam Friedberg

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EDITOR'S NOTE

Test of strength

OVER THE YEARS, OUR building codes have expanded beyond their traditional focus on life safety to include requirements for social initiatives such as energy conservation, accessibility for the disabled, and historic preservation under their regulatory umbrella. Given this evolution, it is disturbing to find that one of the most fundamental of code concerns—validating the strength of structural materials—is dominating industry headlines. Widespread allegations of improprieties in the strength testing of concrete have resulted not only in indictments, but also in the city establishing its own testing laboratory to audit tests performed by independent companies. For owners building with steel, this issue is less of a concern because the material's production and delivery methods make it less susceptible to falsifying of reports. Nonetheless, steel and concrete rely on each other, therefore testing fraud in one industry concerns the other. Fundamentally, testing is for the purpose of establishing that the material specified and purchased is the same material that is delivered to the job site. This assurance is especially important with structural materials in order to make certain that they will be adequate to carry the design loads. It is also important that delivery of the materials to the site is timely to ensure uninterrupted progress of the work. Delays in verifying structural capacity can be costly, as many owners are finding out, and having the city introduce its own testing is unlikely to reduce them. Since virtually every structural material must undergo strength testing, it's reasonable to ask why steel isn't also at risk of testing fraud. Because of how it is produced, steel is able to be certified and verified as conforming to the required shape, size, composition, and strength before it's ever delivered to a job site. Two separate inspections provide this assurance: one by the producing mill and one by the fabricator, which wants to make sure it got what it ordered. Thus, there is no last-minute job site scrambling to obtain and validate test samples. Steel's inspection tandem is one of the underlying safeguards that enhances its defenses against falsified test reporting. Choosing a structural system with this level of oversight—whether or not the city performs its own concrete testing—is bound to reduce risk.

Gary Higbee, AIA, Editor
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higbee@ominy.org

Left Alice Tully Hall's new face exposes the lobby, and Juilliard's new floors, to Broadway.

Alice Tully Hall and The Juilliard School

The warp and weft of a cantilevered steel addition hits a high note for audiences and performers.

ALTHOUGH IT IS ONE OF THE most often used venues in Lincoln Center, Alice Tully Hall hadn't had a renovation since its opening night in 1969. And though The Juilliard School surrounding it had never faltered in its ability to develop world-famous performing artists, it was in much need of a makeover that would add practice rooms, classrooms, and office spaces. The long-overdue redesign, undertaken by Diller Scofidio + Renfro in collaboration with FXFowle Architects in 2003 and to be completed this year, strips away the opaque facade at the base of Pietro Belluschi's original scheme, revealing the entrance lobby and Juilliard's inner workings to the street. The dramatic physical, and symbolic, gesture was made possible by Arup's structural engineers, who developed a 50-foot steel truss cantilever that serves the dual purpose of creating a soaring entrance to Alice Tully Hall while expanding the school's practice space overhead.

Like the pieces performed there, the project was complex and multilayered. A tight urban site is adjacent to the subway, and a schedule accelerated to meet performance and academic year deadlines—even as the school remained fully operational during construction—presented significant challenges. Despite these, the new space is marked by a transparent, column-free lobby created by a unique geometry of intersecting tilted planes defined

by the building's north and south elevations, its Broadway property line, and a sloped and tilted soffit. "We talked about doing a big gesture, in the spirit of the big volumes of the building," says Sylvia Smith, senior partner in charge of the project for FXFowle, of the team's initial design meetings. The resulting shape reaches toward Broadway, creating a welcoming space that beckons visitors inside.

To achieve the dramatic visual and philosophical change Lincoln Center wished for, the architects designed two curtain wall systems that give the building transparency by minimizing the visibility of cables, fittings, and component transitions. For Alice Tully's lobby curtain wall, a one-way pretensioned cable wall system and large single-glazed panels minimize the number of fittings used. According to Matt Larson, senior structural engineer for Arup, the challenge to the structure is for it to resist the amount of tension exerted by the stainless steel cables because they are sensitive to building movements. The Arup team utilized a closed loop structural system analogous to a tennis racquet. Through bending of the structural elements at the head and base of the wall, the tension in the cable wall is converted to compression in the lobby columns; the cumulative load at the head is used to resist the uplift at the base. The heads of the cables are anchored between a pair of stiff ASTM A992 Grade 50 wide-flange beams that span between the lobby columns. The W24 members meet both strength and stringent deflection requirements under high pretension loads. At the base, uplift on the cables is resisted by the foundation wall spanning between the lobby columns.

Where the lobby curtain wall turns the corner on 65th Street, the facade migrates away from the main structural line and drops vertically with the sloping soffit of the expansion. Immediately south of lobby volume, the structure must support facade cables that are as much as 12 feet eccentric to the support without the benefit of a back span. The engineers utilized a system of A992 Grade 50 W14x132 outriggers that cantilever off of ASTM A53 Grade B 24-inch diameter by 1-inch-thick pipe. Bending in the outriggers is transferred in torsion by the pipe to reinforced members in the existing building frame and to members in the expansion. Challenging welds and stringent construction tolerances at the cable attachments led the structural steel erector/fabricator Metropolitan-Walters to shop fabricate the entire assembly as a single piece.

Above the three-story lobby, a hung glass-fin wall on the east elevation of the building's cantilevered portion provides natural light to the Juilliard School spaces during the day, and is washed with lights at night creating, in Smith's words, "an illuminated jewel box." For this section, the goal was to not have any visible exterior fittings, but also to have high transparency for occupants looking out. To achieve this look, the entire 48-foot-high curtain wall system is hung from a 30-inch box-shaped girder with 1 5⁄8x12-inch flanges. Special alloy stainless steel tension rods are concealed between insulating glass units to pick up the dead loads hanging from above. Despite spanning as much as 67 feet to doubly cantilevered support points (the box beam sits on beams that cantilever from the end of the cantilevered trusses), Arup was able to limit the differential deflection of the hollow structural section to 2mm per 5-foot bay. This was required to prevent the glazing edge from hitting the concealed rods. Concealed glazing clips at vertical joints transfer wind load to the glass fins via structural silicone glazed aluminum extrusions, and due to fabrication limitations for fin length, glass-to-glass splicing was used to avoid the visual disruption of typical metal splice connections.

Previous spread and this spread: Iwan Baan

Its curtain walls may expose the building's beauty, but its 275-ton system of steel trusses attests to equal endowments of brains and brawn. The trusses allow for the 50-foot cantilever to the property line, preserving exterior plaza spaces, and also for a 75-foot unsupported back span that supports as many as four stories on a single truss and creates a large, unobstructed lobby space with only three visible columns. Moreover, the steel design enabled the architects and engineers to deal with the technically demanding program in which they created a four-story expansion extending from the existing structure, whose elevations were not always at the same height. In addition to simplifying connections between new space and the original steel-frame building, the team could tightly control the geometry of custom shop-built steel assemblies to meet needs for dense mechanical distribution, theater lighting, electrical, high-tech audio-visual infrastructure as well as minimal architectural finish clearances.

Although creating a welcoming gesture was the outward design goal, the need for ideal performance spaces that were isolated acoustically from one another determined the building's framework. Steel tonnage was driven higher by the need to support solid CMU acoustic partitions, isolated acoustic concrete topping slabs, and heavy acoustic ceilings in sound-sensitive spaces for rehearsal, recording, and performance. The increased loads also required column strengthening at the interface between the new and existing buildings, where existing wide-flange columns were plated with ASTM A572 Grade 50 reinforcing plates up to 3 3⁄4 inches thick. The lateral system for the expansion was achieved by infilling north-to-south bracing in the easternmost existing column line and with three braced frames (one north to south and two east to west) in the expansion structure; the diagonal brace along the southern facade is the only exposed brace element. Duct sizes also had to be larger to contain slower-moving (and thus quieter) air, but ducts were carefully woven around the structure to maintain ceiling heights.

Facing A 50-foot steel truss cantilever creates the soaring three-story lobby in addition to expanding office space and practice rooms for the school.

Above The one-way pretensioned cable wall system uses a minimum number of fittings while resisting cantilever movements overhead.

The building's unique steel "warp and weft" allowed the architects to weave so many varied spaces into the 100,000-square-foot structure.

Above Steel framing simplified connections between the new building and the original steel-frame building. Large rehearsal and performance spaces are interwoven with small practice rooms and offices, throughout which steel members are kinked to bear the building's loads while accommodating acoustical material, electrical theater equipment, and large ductwork.

Facing The 100,000-square-foot structure, with its new elongated form, is meant to create a welcoming gesture to the public.

FXFowle Architects

Iwan Baan

Seven trusses are positioned in smaller offices and practice rooms on varying floors of the cantilevered Juilliard School space to accommodate the larger spaces required by the dance studio, a double-height black box theater, and the double-height jazz rehearsal room. Truss chords were kinked in specific areas to allow passage through the story-tall trusses, fabricated from W14 wide flange sections with maximum chord and diagonal sizes of W14x730. In select areas, steel connections were designed in very tight coordination with the architectural clearance by adjusting gusset plates or using welded connections to maximize usable space.

Steel members also had to be located to fit with miscellaneous metal assemblies like the theater lighting grid, catwalks, and multiple ceiling plane levels. Numerous steel and slab elevation changes and ramps allow these larger spaces to mesh with the existing building's floor-to-floor elevations, as well as to accommodate various acoustic and performance floor build-ups throughout the expansion.

According to Smith, it is the building's unique steel "warp and weft" that enabled the architects to weave so many varied spaces into the 100,000-square-foot structure, replacing the somewhat detached Belluschi design with a brightly lit tableau. Seen at night, the transparent building almost resembles a page of sheet music come alive as teachers and students, performers and audience members, rise and descend through its levels, honoring Lincoln Center's history while creating a new image of its future. **M**

ALICE TULLY HALL AND THE JUILLIARD SCHOOL

Location: **1941 Broadway, New York, NY**
Architects: **Diller Scofidio + Renfro**, *New York, NY*,
in collaboration with **FXFOWLE Architects**, *New York, NY*
Structural Engineer: **Arup**, *New York, NY*
Mechanical Engineer: **Arup**, *New York, NY*
Miscellaneous Metals Engineer: **Anastos Engineering Associates**, *New York, NY*
General Contractor: **Turner Construction Company**, *New York, NY*
Curtain Wall Consultant: **R.A. Heintges & Associates**, *New York, NY*
Structural Steel Fabricator and Erector:
Metropolitan Walters, LLC, *New York, NY*
Miscellaneous Iron Fabricator and Erector:
Post Road Iron Works, Inc., *Greenwich, CT*
Ornamental Metal Fabricator and Erector:
Post Road Iron Works, Inc., *Greenwich, CT*;
Metal Teck, Inc., *Bensalem, PA*
Curtain Wall Fabricator and Erector: **W&W Glass**, *Nanuet, NY*

City College of New York School of Architecture

A feat of bridge-and-stair engineering brings new life to an aging campus building.

WHEN RAFAEL VIÑOLY ARCHITECTS DECIDED to hollow out the central core of what was to become the new Bernard and Anne Spitzer School of Architecture for CUNY's City College of New York, it was to create an atrium that dramatically opened up the interior of the five-story former library building. But the decision also left them with a new design challenge: The building's core had housed much of its circulation system, and now visitors would need to travel to the far corners of each floor just to reach a stairway.

Viñoly's elegant solution was to construct a new circulation system entailing interconnected bridges and stairways that traverse the atrium of the school in a dizzying Piranesi-esque vista, linking alternating levels and opposite sides of each floor. A pair of bridges forms the system's backbone, one 75-foot span connecting the east and west ends of the third floor, and one 120-foot span connecting the north and south ends of the fifth floor. Intersecting each bridge diagonally is a stairway, one passing through the lower bridge to connect the second and fourth floors; the other passing through the upper bridge to connect the fourth floor and the roof.

A variety of materials add to the striking effect of the airy configuration. The bridge and stair railings are made of a lightweight, flexible ASTM A36 stainless steel mesh with 2-inch-square openings. "It's almost like stocking material," says Viñoly project director Fred Wilmers. The bridge deck and stair treads are fabricated from inch-thick ASTM A36 galvanized steel grating, with closely spaced ¾-inch openings. The grating yields a view of the atrium below from the vantage point of someone standing on the bridge, but appears opaque from every other angle. Bridges and stairs alike are painted with a high-performance, silver polyurethane paint.

To create the circulation system, the architects removed the building's core, by cutting large openings in the centers of existing floor slabs. They then constructed new mezzanines at the perimeter walls, sandwiched between the existing floors to accommodate the new circulation pattern. Prefabricated sections of the two bridges were hoisted up via a pulley and cable system and hung from freestanding gantries, then the bridge sections were welded together in place and connected to the perimeter floor slabs, stairways, and other reinforcements.

According to Tian-Fang Jing, a principal at Weidlinger Associates, the engineering firm that partnered with Viñoly to design the school, the upper bridge's extreme length necessitated a complex system of supports. Four sets of hangers—Type 304 stainless steel rods ¾ inch in diameter—extend downward from the roof slab and connect to the upper bridge at points 18 and 36 feet in from each of the northern and southern walls. Another set of hangers extends from the underside of the fourth floor and supports the lower bridge at its midpoint. To provide additional lateral support, a set of four ASTM A500 Grade B steel hollow structural sections run diagonally down from the top floor to brace the lower bridge system, and an additional four HSS sections run diagonally up from the second floor to brace the upper bridge system.

The fact that the team was working with the concrete frame of an existing building, rather than constructing a new school from scratch, made the job even more challenging. "We had limited places to connect the tubes to," says Wilmers. "As a result, we had to spread the load out around the existing structure." Although the concrete that makes up the building's existing frame is well-suited to bear high gravity loads, it's not nearly as sturdy against lateral force, so Weidlinger Associates had to design a customized steel connection between the support tubes and concrete columns that would capture the bridges' excess lateral movement rather than transferring it to the columns. They welded together a vertical semi-circular shell, a horizontal circular plate, and a vertical pin plate that allowed for free rotation of the HSS sections serving as the supports, and then fastened the detail to the column and floor

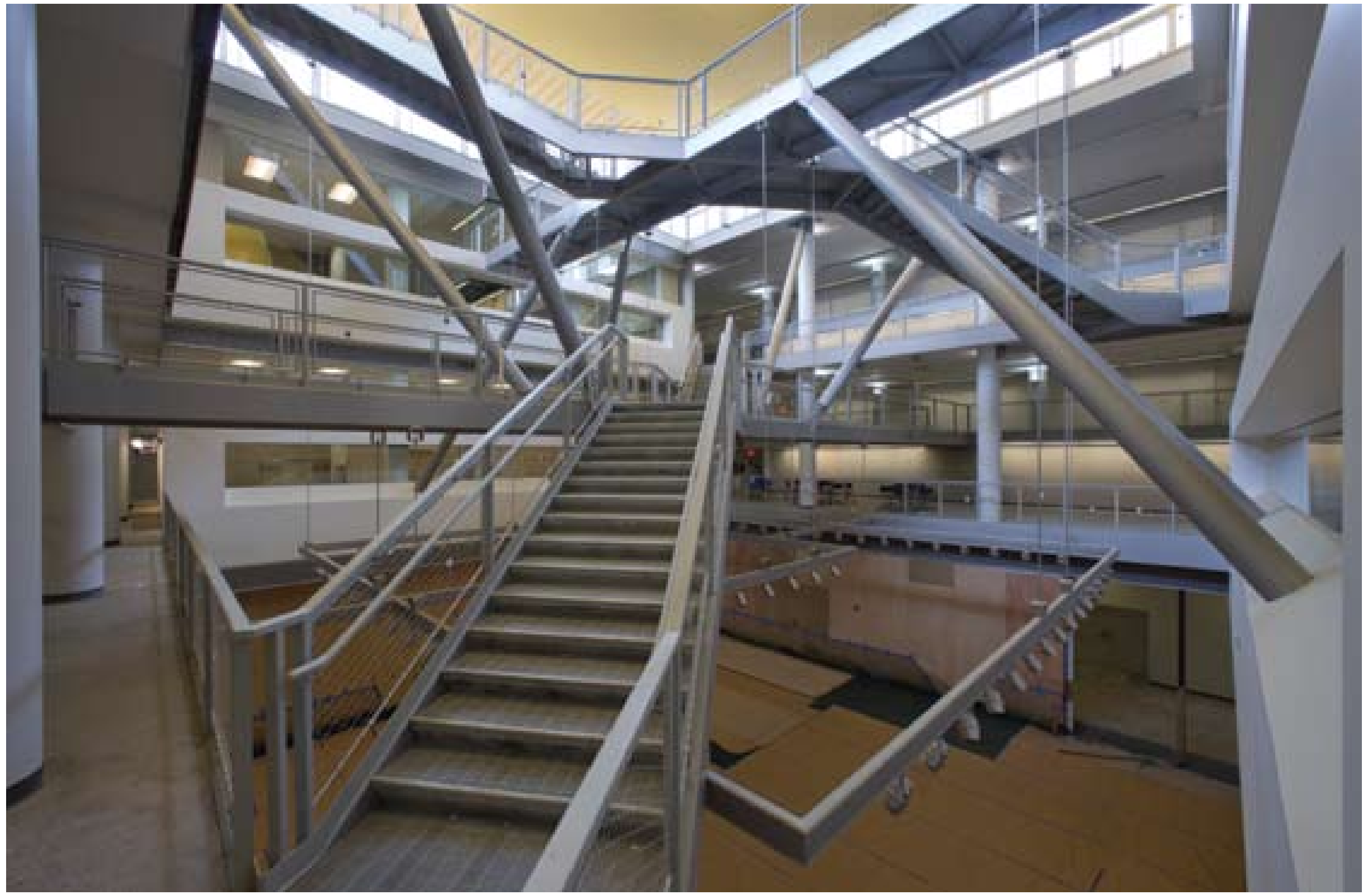
Left In the atrium, stainless and galvanized steel stairs and bridges hang from freestanding gantries above.

slab with HILTI adhesive anchor rods. To complicate matters further, the existing columns were not precisely round, so fastening the curved plates to their surface with bolts was tricky. "We had to fill some gaps with grout," says Wilmers.

Despite the array of bridges, stairs, and supports cutting across the atrium, the school's interior still feels bright and airy. Sunlight diffuses through the roof from three directions and reflects indirectly off the saffron-yellow ceiling, which doubles as the underside of the iconic amphitheater perched atop the building's roof. At the base of the atrium sits an open-air art gallery and crit space, the school's functional and physical center. To light the gallery, a set of ½-inch thick Type 304 steel rods hang down from the lower bridge to support two nested squares of track lighting, which light the gallery's interior.

An indoor bridge-and-stair system of this scale has only a few direct precedents for Viñoly. Even for Weidlinger, Jing says the project was a learning experience: "We had never built any bridge-and-stair system quite this big or complicated before." **M**

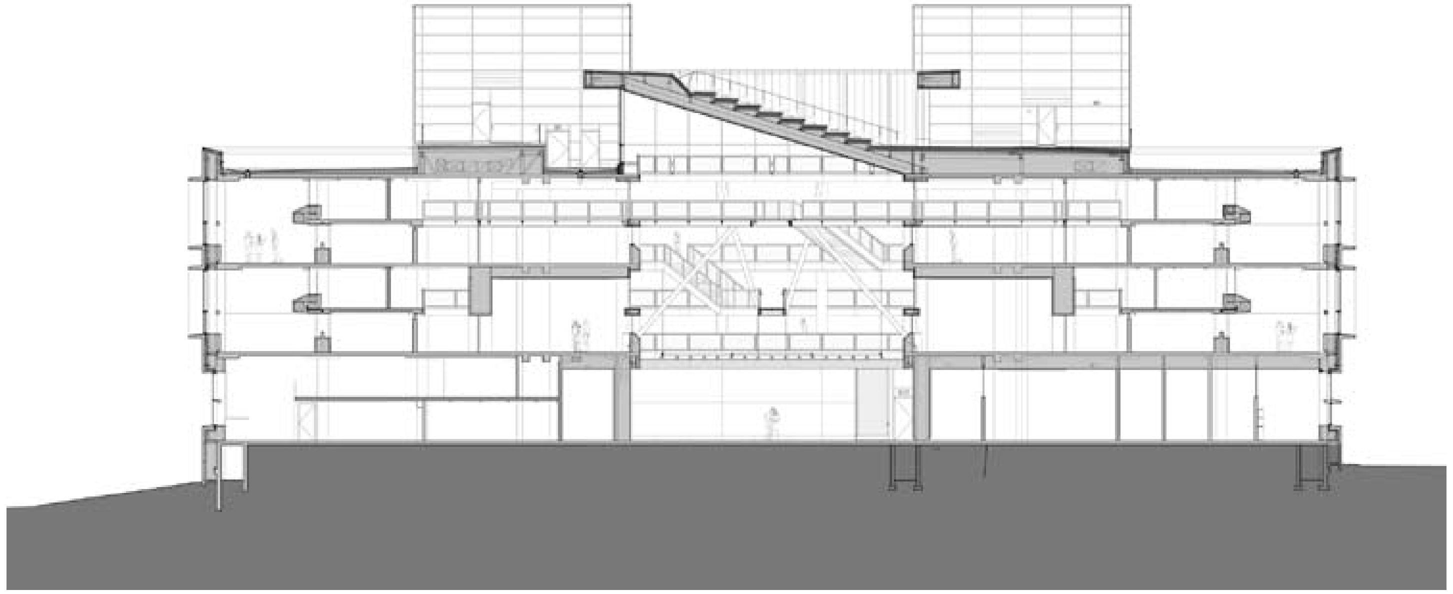
Previous spread: Bruce Damonte; this spread: Rafael Viñoly Architects PC; following spread: Bruce Damonte



Facing page Bridge sections were site-welded to each other in mid-air, then connected to the concrete slab floor, stairways, and other reinforcements.

Above A 75-foot bridge connects the east and west ends of the third floor, and a 120-foot span connects the north and south ends of the fifth floor.

Below The five-story former library building was hollowed out to create a more collaborative environment inside the 135,000-square-foot facility, while an open-air rooftop amphitheater provides additional teaching space.



Deep shelf-like windows with aluminum sun-shading louvers punctuate the building's precast concrete exterior.

CCNY COLLEGE OF ARCHITECTURE

Location: **160 Convent Avenue, New York, NY**
Owners: **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*;
The City College of New York (CCNY), *New York, NY*
Architect: **Rafael Viñoly Architects PC**, *New York, NY*
Structural Engineer: **Weidlinger & Associates, Inc.**, *New York, NY*
Mechanical Engineer: **Stanislav Slutsky, PE**, *New York, NY*
Construction Manager: **The LiRo Group**, *Syosset, NY*
Structural Steel Erector: **MoMetal**, *Varennes, QC*
Miscellaneous Iron Erector: **B&M Welding**, *Brooklyn, NY*
Curtain Wall Erector: **A.J. McNulty & Co., Inc.**, *Maspeth, NY*

Frank Sinatra School of the Arts

Astoria's newest school brings its performance to the street in a budding arts district.

WHEN A BUILDING IS NAMED after one of the most idolized singers of all time and envisioned by another, it had better perform. This was the goal of Susan T. Rodriguez of Polshek Partnership Architects when her team set about designing The Frank Sinatra School of the Arts, a new 147,000-square-foot educational facility occupying a full block on 35th Avenue in Astoria. And perform it does. Its five stories of steel-framed architecture clad in a transparent glass and stainless steel curtain wall reveals the building to its neighborhood, and vice versa, making it as much a living stage for its 1,000 students as for the community around them.

The public high school, which opened in the fall of 2009, was developed by the New York City School Construction Authority (SCA) in partnership with the Exploring the Arts organization founded by Tony Bennett and Susan Benedetto. Located between 35th and 36th Streets, the school joins the artistic community created by the neighboring Kaufman Astoria Studios and the Museum of the Moving Image. "It brings performance to the street," says Rodriguez. "It also creates a place that inspires the students. Many of them come from great distances."

To create the feeling of a welcoming arts community, three cantilevered studio spaces—for dance, music, and art—float above a double-height lobby and are exposed to view from 35th Street. Classrooms, studios, and practice spaces surround a full-height sky-lighted atrium space in which impromptu performances break out around movable pianos. More formal performances take place in an 800-seat theater in the southern half of the building, beneath a fourth-floor gym and a top-floor cafeteria. Because the 200-square-foot site doesn't include outdoor space, the architects created an uncovered rooftop terrace with a lawn and amphitheater.

Structural engineers Robert Silman Associates were charged with building the unique architecture envisioned by Polshek, but within the confines of SCA's specifications, which are geared toward cost-effectiveness and ease of construction. "We were able to work within SCA parameters while still answering the design challenges Polshek Partnership put forth," says Silman associate Mel Garber. According to Garber, steel framing is the most common structural assembly for the majority of SCA projects because it fits efficiently within the most appropriate structural grids for classroom layouts and long-span conditions over auditoriums and gymnasiums. In the case of Polshek's wish to cantilever the northern framing about 20 feet to accommodate the school's studio spaces, Silman was able to manipulate basic SCA requirements—structural steelframe and composite deck with a cross-braced lateral frame—by using the deck diaphragm and cross-brace frames to anchor the facade.

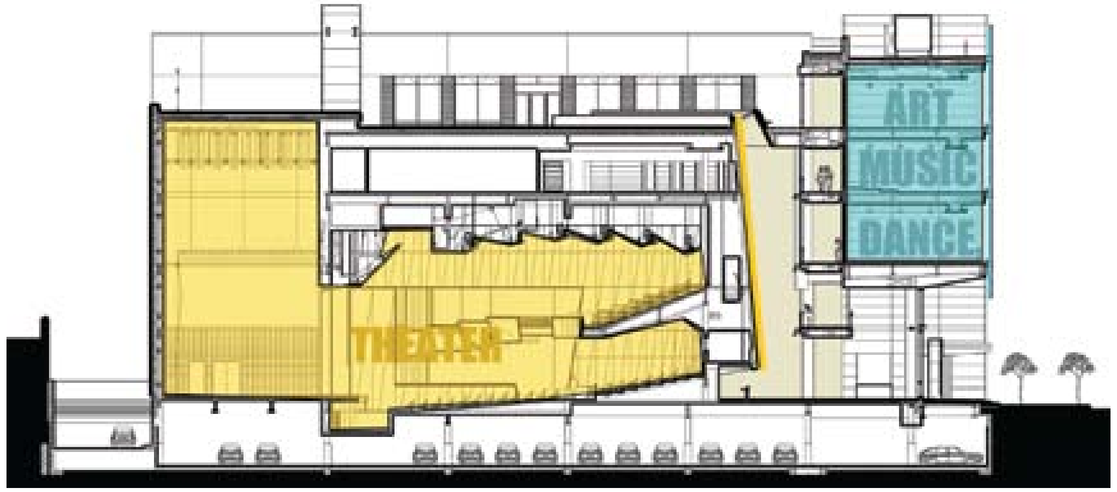
Previous spread Designed to evoke lightness, the school's curtain wall has mullions and spandrel beams that are reinforced with ASTM A36 steel plates, allowing it to have longer spans than ordinarily possible.
Left Structural engineers worked within the School Construction Authority's requirements for structural steel while staying true to the architects' programmatic vision.
Center Engineers employed typical steel framing on three sides of the building.
Bottom An 800-seat theater hangs over the parking garage atop which the school is built.

To create the professional theater space, engineers were challenged with constructing the auditorium over the 100-car parking garage atop which the school is built. (Owners Kaufman Studios sold their existing lot to the city on the condition that they could still use the underground space.) The theater contains a fly loft and a raked and cantilevered balcony, in addition to the internal structure of the most prominent design element, a sloping, four-story wall opposite the building entrance. Due to the complexity of the spaces within the school, it was necessary to use a variety of beam sizes. Custom plate girders support the cantilevered north elevation and span over the gymnasium and auditorium using W40 and W36 transfer beams. Given the long spans between columns, typical filler beams are W21 and primary beams are W24. The building's wide flange sections are all ASTM A992 Grade 50; its hollow structural sections are ASTM A500, Grade 50. In all, the project incorporates 1,400 tons of structural steel.

With so many long-span spaces inside the building, Rodriguez says her main goal for the curtain wall was to provide views into the rehearsal and studio areas for passersby, while allowing students to draw inspiration from views of the city through a foreground frit pattern of text recognizing famous artists and performers. In contrast with masonry facades on the east and west sides, the school's north curtain wall lightens the building and appears to float above the street, operating as the weather enclosure in front of the studios, and a rain screen at the top and bottom. Garber says his team worked closely with Polshek and

Previous spread: Jeff Goldberg/Esto; top: Polshek Partnership Architects; center and bottom: Robert Silman Associates

Above The theater incorporates a fly loft and a raked and cantilevered balcony.
Below Glass-enclosed studio spaces, with views to the north and east, are stacked atop a 20-foot cantilever.



Top: Jeff Goldberg/Esto; right: Polshek Partnership Architects

curtain wall manufacturer Zimmcor to test the boundaries of the standard stick system. By reinforcing mullions and spandrel beams with ASTM A36 steel plates, they were able to achieve much longer spans in the panels than normally possible. A sign band with the school's name cantilevers from the northeast corner of the facade, but the glass is broken only by slim, 10-inch ASTM A36 channels at each structural pass, reinforcing the lightness of the school's veil.

Although the project took seven years to realize, as students adapt to the space during its first school year it is revealing itself as an example of the great design that can be accomplished when pushing the limits of materials and budgets. Inside and out, "It brings a little Broadway to 35th Avenue," says Rodriguez of the lively vignette created by the stacked studio spaces behind the glass. It's one that Old Blue Eyes would be proud of. **M**

Above The design's long spans allow for optimal studio and performance space throughout the 147,000 square foot structure.
Facing By arranging the school's classroom and performance space around a full-height atrium, architects created a light-filled structure on a 40,000-square-foot site.

This spread: Jeff Goldberg/Esto

FRANK SINATRA SCHOOL OF THE ARTS

Location: **35-12 35th Avenue, Queens, NY**
Owners: **New York City School Construction Authority**, *New York, NY*;
New York City Department of Education, *New York, NY*
Developer: **New York City School Construction Authority**, *New York, NY*
Architect: **Susan T. Rodriguez of Polshek Partnership Architects**, *New York, NY*
Structural Engineer: **Robert Silman Associates**, *New York, NY*
Mechanical Engineer: **Cosentini Associates**, *New York, NY*
Construction Manager: **Leon D. DeMatteis Construction Corporation**, *Elmont, NY*
Structural Steel Erector: **North American Ironworks, Inc.**, *Ridgewood, NY*
Architectural, Ornamental, and Miscellaneous Metal Fabricator and Erector:
MoMetal Structures Inc., *Varennes, QC*
Curtain Wall Fabricator: **Zimmcor Inc.**, *Concord, ON*
Curtain Wall Erector: **East End Window Technologies**, *Saint James, NY*

New York Law School

The school's transparent curtain wall symbolizes institutional transparency while reminding law students they are part of the city.

A new school in Tribeca expresses a unique institutional identity while raising the bar for student-oriented design.

NEW YORK LAW SCHOOL'S NEW ACADEMIC building for a generic modernist box, one of the city's myriad mid-height Miesian structures that economize on materials, workmanship, and often visual interest. On detailed inspection, however, more is going on in this building than first meets the eye. Inside and out, the new NYLS building takes subtle and dramatic steps forward for both its institution and its city.

"This project is really almost close to 40 years in the making," notes NYLS president and dean Richard Matasar. Under consideration since 1970, it became financially possible through sales of air rights above the building and an adjoining parcel during the real estate boom of the mid-2000s. Groundbreaking took place in August 2006, and the new building opened last September. The program includes all of the school's classrooms, the library, auditorium, cafeteria, conference and event spaces, and several lounge areas, totaling 213,000 square feet and nearly doubling the school's size. In keeping with the school's priorities, the building is completely student-centered, with faculty and administrative offices remaining in the connected three-building complex on Worth Street (renovation of which, the second phase of the campus overhaul, will be complete by spring 2010).

The school's institutional identity stresses community involvement, and the new building consequently emphasizes transparency with a glass and aluminum curtain wall, revealing its internal activities to the neighborhood and giving students a constant reminder of where they are geographically, socially, and professionally. "Theoretically, we could just put the big box out at the end, put a couple of windows in, and the project would be done," says Matasar, "but that would not have met our subsidiary goal of talking about the transparency of our operation… letting people understand that we are a part of Tribeca."

Behind the clear curtain wall along Leonard Street is a panel of dignified cherry interior walls, forming what Matasar calls "the box within the box"; this structure creates a series of brightly lit lounges that reserve the building's prime real estate for students' use. Interior curtain-wall segments to the north present a representational frit pattern, a pixelated image of book spines from the NYLS library. Visible both from the exterior and from inside a prominent glass-enclosed staircase on the northern perimeter, the panels are fritted Viracon silkscreened monolithic glass, with high opacity white V175-custom screens provided to the company so it could create templates for various glass sizes. Turn the corner south onto West Broadway, and another fritted curtain wall encompassing the second through fourth floors forms a west-facing bookend alongside panels of stone and walls clad in Centria aluminum panels with a two-coat fluoropolymer finish containing mica flakes. Simple orthogonal volumes with ample glass and daylight create an overall atmosphere that's atypical for academic buildings: "extroverted," the

Above Students sit in a northwest corner lounge area. Most of the curtain wall's horizontal supports occur at floor level, emphasizing the feeling of openness.

Below, left Steel framing allowed the 50-foot spans necessary for Socratic-style classrooms and auditoriums.
Below, center The curtain wall appears to float above the school's first floor.
Below, right On the fifth floor, the curtain wall wraps around to form one side of an outdoor terrace.

Previous spread, this page top and facing: Jeff Goldberg/Esto; left: courtesy SmithGroup

Right The inner glass wall of the staircase maintains the view into the building.

dean and architects agree, rather than cloistered, even though four of the building's nine stories are underground.

The curtain walls, says David O'Neil, of the project's associate firm BKSK Architects, used a standard Alumicor BF-2000 unitized system with customized exterior 6-inch-deep caps (except for a cantilevered piece at the bottom of the Leonard Street wall) and metal infill panels at spandrels to allow the depth of the structure to be visible through curtain wall. That north wall at the monumental staircase presented "an atypical condition," he says, with no floor slab up against the window to support anchors; instead, rods hanging from the fifth-floor support tubes for the fourth floor, and so on. To prevent the spread of fire, the stair opening is enclosed in this area, and additional sprinkler coverage is placed at the glazed openings into stair.

Both clear and fritted segments are Viracon low-emissivity glass; the book-image fritting also assists in thermal control under direct afternoon sunlight, particularly on the west face. According to Greg Tedesco of curtain-wall erector Genetech Systems, unusually large 17-foot floor-to-floor dimensions and the architects' desire to avoid spandrel glass on the curtain walls added up to an exceptionally open appearance, outside and in. "The horizontal support member is pretty close to the floor line," he notes, creating a "floor-to-ceiling glass look; then the anchors themselves are custom, mounted at the face of the slabs, so you didn't read them up above the slabs…. When you stand in the building, there's no obstruction at all, other than the structural columns."

On the second story and above, large classroom and auditorium spaces require column-free spans of over 50 feet, with raised platforms for visibility. "Steel was the right choice for the structural system," Dahlkemper says, both for flexibility and for performance relative to weight. Classrooms are built on isolation slabs, improving acoustic integrity: Despite the nearby subway lines and rumbling trucks, every academic space is capable of studio-quality audiovisual production. Brightly day-lit corridor lounges function as additional rooms for collaborative small-group work as well as social space; the fifth-floor setback combines the cafeteria with a terrace.

From a northwest exterior view, the NYLS building reads as five complementary boxes (the two fritted "wings," the clear north curtain wall, the stone-faced southwest volume, and a mesh-enclosed upper mechanical space) containing the inner cherry-paneled core—the high-tech future protecting the foundations and precedents of legal history, the deep vertical mullions echoing the lines of the district's many cast-iron buildings from the previous century. From inside, the building creates a crisp and optimistic atmosphere for scholarly work. There are no artificial borders between the law and society at large, this building tells its students; the ideas that command their attention during their years here are not the property of a privileged guild but a set of lucid principles reflecting the real world without distortion. **M**

NEW YORK LAW SCHOOL

Location: **185 West Broadway, New York, NY**
Owner: **New York Law School**, *New York, NY*
Developer: **Studley, Inc.**, *New York, NY*
Architect: **SmithGroup**, *Washington, DC*
Associate Architect: **BKSK Architects**, *New York, NY*
Structural Engineer: **Thornton Tomasetti**, *New York, NY*
Mechanical Engineer: **Jaros Baum & Bolles**, *New York, NY*
Construction Manager: **Pavarini McGovern, LLC**, *New York, NY*
Structural Steel Erector: **J.C. Steel Corp.**, *Bohemia, NY*
Miscellaneous Iron Erector: **FMB, Inc.**, *Harrison, NJ*
Architectural and Ornamental Metal Fabricator and Erector:
A-Val Architectural Metal Corp., *Mount Vernon, NY*
Curtain Wall Erector: **Genetech Building Systems, Inc.**, *Staten Island, NY*

41 Cooper Square

A double wall of glass and perforated stainless steel conveys Cooper Union's commitment to forward-thinking education.

THE EAST VILLAGE HAS LONG been an in-your-face kind of neighborhood, where people let you know what they're all about whether you like it or not. Thom Mayne of architecture firm Morphosis took this legacy into account when designing The Cooper Union's newest building—a 175,000-square-foot facility containing studios, classrooms, and laboratories for the institution's art, architecture, and engineering programs. To convey the school's commitment to free, forward-thinking education, the architect clad the structure's warped geometry in a high-tech double wall of glass and perforated stainless steel panels. While the extra cost associated with double walls often makes them infeasible, the digitally integrated design process worked out by Morphosis in collaboration with construction manager Sciame and subcontractors W&W Glass and A. Zahner Co. streamlined delivery and kept the system within the budget, putting the building in the running to earn Platinum LEED certification—a first for an academic laboratory in New York City.

Located on the east side of Third Avenue between 6th and 7th streets, the facility is a vertical campus designed to foster cross collaboration between The Cooper Union's three disciplines. A sky-lit central atrium reaching the structure's full 11-story height illuminates a 20-foot-wide stair that ascends four floors to a student lounge that acts as the facility's social hub. The classrooms themselves are designed to be reconfigurable to meet the needs of the school's different disciplines. This flexibility was also built into the cladding system, whose two layers—one a weather barrier of glass, the other an aesthetic face of stainless steel—can adapt to environmental conditions and the position of the sun. "The perforated metal skin is operable and contributes to the

heating and cooling of the interior," explains Andrea Tzvetkov, project architect for Morphosis. "It is closed during the summer when the sun is beating down, and open during the winter to let in the sun's warmth."

Fabricated out of 304 stainless steel sheet, the metal panels were given an angel hair finish whose random grit lines conceal the scuffs and scrapes that can accumulate over time. The perforation holes are ⅛-inch diameter and cover between 50 percent and 90 percent of the panels, maintaining views through the exterior wall whether it is open or closed while at the same time reducing glare enough to make it easy to use a computer even when the sun is hitting the building full force. The panels are 2 feet by 6 feet and are affixed with stainless steel screws three at a time to aluminum frames. These unitized panel sections connect back to the slab edge through an engineered clipping system of aluminum extrusions. For the most part the metal panels are set 1 foot away from the inner glass wall, but on the west facade this distance increases by as much as 10 to 12 feet where the panels swoop out to animate the building face and form a canopy above the entrance. Electric actuators wired back to a centralized control unit operate the outer wall, and a software program tunes the facade to the season and the sun's position.

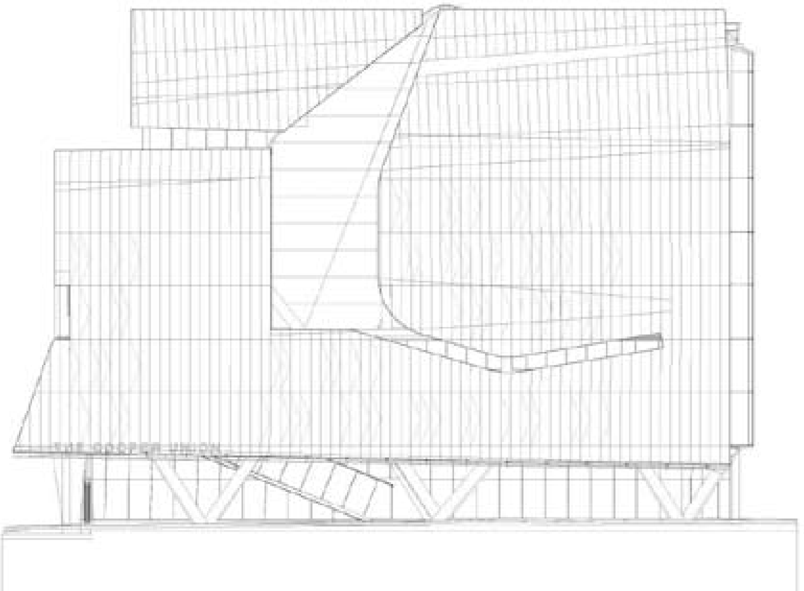
Except in a few places where the metal face pulls back to reveal all-glass sections, the building's inner wall is made up of an off-the-shelf window wall system. Spanning between the floor slabs, the system includes a black-painted spandrel unit that rises 3 ½ feet from the floor, and a 6-foot-high vision unit. The exposed glass areas are curtain walls that were structurally glazed in the field on unitized shop assembled frames. Almost all of the project's exterior glass is Viracon VNE1-63, which has a low-e coated ¼-inch outer lite, ½-inch air space, and ¼-inch inner lite. An exterior stair tower features Viracon's 9⁄16-inch HS/HS Laminated glass with a cool white interlayer.

Traditional facade systems combine two purposes: functional and aesthetic. According to Tzvetkov, the efficiency of the

Previous spread: Iwan Baan; top: John Hill; center and bottom: A. Zahner Co.

Top and center: Iwan Baan; bottom: Morphosis

Previous spread Clad in a double wall of glass and an operable metal skin, The Cooper Union's new academic building creates a new face for the school's renowned design curriculum.
Facing, top The school as seen from Third Avenue below 6th Street.
Facing, center Electric actuators are wired to a centralized control unit to operate the outer wall, which is controlled by software that monitors the season and the sun's position.
Facing, below Perforation holes are 1/8-inch diameter, covering between 50 and 90 percent of the panels to reduce glare yet maintain views.
Right A transparent facade at street level is a symbolic gesture inviting the public into the space.
Center The 2-by-6-foot panels are welded to aluminum frames set 1 foot away from the glass wall, except on the west facade where they project from the facade as much as 12 feet above the building's main entrance.
Below A schematic of the west facade.



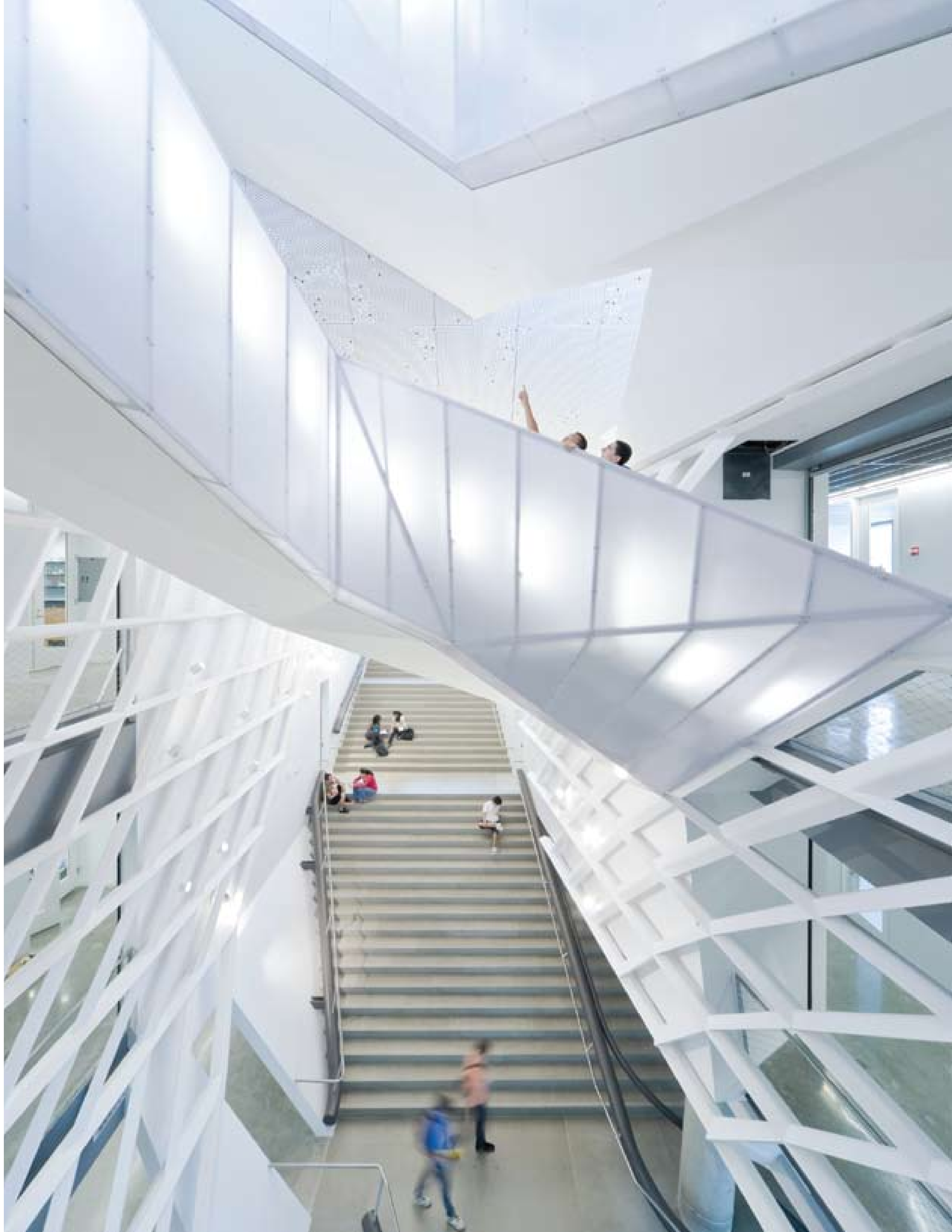
double wall system comes from separating these purposes and isolating the problems associated with each. Because the inner wall is not responsible for the looks of the building the designers were able to choose the most affordable product capable of doing the job. This freed the team up to get innovative on the design of the outer wall without worrying about performance. “That is the beauty of the double skin system,” he says. “Also, if you designate more functions to the exterior layer, such as sun shading, you‘re getting extra performance for the money you’re investing.”

On the north, east, and west faces the metal panels were installed from the inside of the building first, then the window wall was erected behind it. Only on the west face, where the outer facade reaches as much as 12 feet from the slab edge, was a crane necessary to pick the metal panels into place. A crane was also used to install the curtain wall units because their large sizes and complex geometries made them difficult to handle from inside the structure.

The digitally integrated design process used on The Cooper Union project brought all of the project’s players together early in the process. The wall’s components were outlined on the computer and sent to manufacturers who turned them into shop drawings. These then came back to the design team for accuracy checks. Through this method the team was able to keep the cost of double wall system down to about 10 percent of the overall budget, while at the same time reducing energy consumption by an impressive 30 to 35 percent. In Tzvetkov’s understated words: “That’s pretty good.” **M**

Left A 20-foot-wide stair rises through the building’s eleven-story central atrium. Seventy-five percent of the building’s regularly occupied space is lit by daylight.
Left, above A curving lattice surrounds the stair. Sky bridges cross the atrium to connect lounges, seminar rooms, and other informal spaces that overlook the space.
Facing A social gathering place in and of itself, the stair rises four stories to a double-height student lounge.

This spread: Iwan Baan



Above A digitally integrated design process kept the facade system within budget. The school is expected to be the city's first academic laboratory to gain LEED Platinum certification.

Below, left Meeting areas and lounges are organized around the atrium.
Below, right The operable stainless steel panels reduce heat gain in the summer and insulate the building in the winter.

Above An open-air terrace wraps the northwest side of the building.

Top: Joseph David; left: Iwan Baan

Iwan Baan

> “If you designate more functions to the exterior layer, such as sun shading, you’re getting extra performance for the money you’re investing.”
>
> Andrea Tzvetkov, Morphosis

41 COOPER SQUARE

Location: **41 Cooper Square, New York, NY**
Owner: **The Cooper Union for the Advancement of Science and Art**, *New York, NY*
Architect: **Morphosis Architects**, *New York, NY*
Associate Architect: **Gruzen Samton Architects**, *New York, NY*
Structural Engineers: **John A. Martin & Associates, Inc.**, *Los Angeles, CA*;
Goldstein Associates Consulting Engineers, *New York, NY*
Mechanical Engineers: **IBE Consulting Engineers**, *Sherman Oaks, CA*;
Syska Henessy Group, Inc., *New York, NY*
Construction Manager: **F.J. Sciame Constriction Co.**, *New York, NY*
Structural Steel Erector: **FMB Steel**, *Harrison, NJ*
Miscellaneous Iron Fabricators and Erectors: **Post Road Iron Works**, *Greenwich, CT*
Architectural Metal Erector: **FMB Steel**, *Harrison, NJ*
Curtain Wall Erector: **W&W Glass**, *Nanuet, NY*

One Jackson Square

Left and above The undulating facade of the building softens the shape created by an unusual site.

An undulating curtain wall brings kaleidoscope eyes to the West Village.

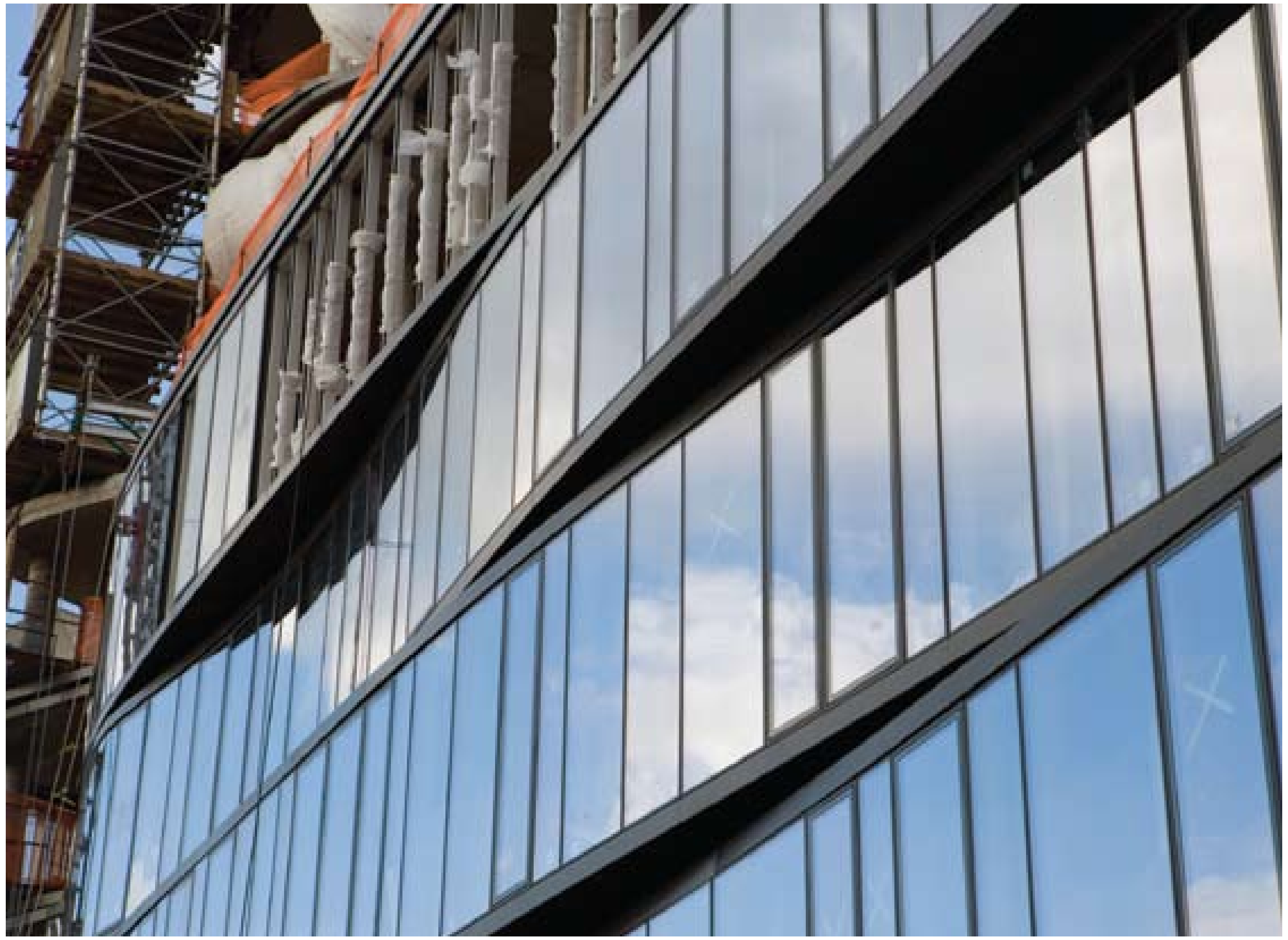
CONTEXTUALITY DOESN'T ALWAYS mean what it seems. "Contextuality oftentimes involves mimicry—but sometimes contextuality can be more successfully achieved by juxtaposition," says Bill Pedersen, design partner of Kohn Pedersen Fox Associates.

The issue was central in his firm's design of One Jackson Square, a new 68,000-square-foot condo building in Manhattan's West Village. Its location at Greenwich and 8th Avenues lies within the Greenwich Village Historic District, so the architects needed to gain the approval of the NYC Landmarks Preservation Commission (LPC). Brick would have been an obvious choice for a neighborhood dominated by historic masonry architecture, yet the site's peculiar shape—a sort of distorted parallelogram—didn't lend itself to using much of the material. Furthermore, the site falls within two different zoning areas, so one section of the building could rise as high as eleven stories, but the rest could only be seven stories tall. The client, international real estate developer Hines, naturally wanted to use all the available space, but "the shape of the zoning diagram was so unusual that we wondered how in the world we'd make a building out of it," Pedersen recalls.

The architects looked to the beauty of nature for inspiration. They envisioned the zoning volume as a rock, with an aluminum and glass curtain wall as a stream that flows over it, softening its strange, hard edges. In the final design, the band of windows along each story ripples with its own unique curves, creating a facade that's dynamic and complex enough to invite lingering looks.

One Jackson Square might not fit in exactly among the neighboring buildings, but that's all for the best, Pedersen told the LPC: "My argument was that Greenwich Village also has a large number of rather unusual exceptions to the fabric of the city.... The idiosyncratic quality of the Village is the charm and character of the Village." Another key part of his argument was that the facade, in fact, pays homage to its architectural surroundings by reflecting them in an intriguing kaleidoscopic pattern. KPF's arguments proved persuasive, and the design won the LPC's approval.

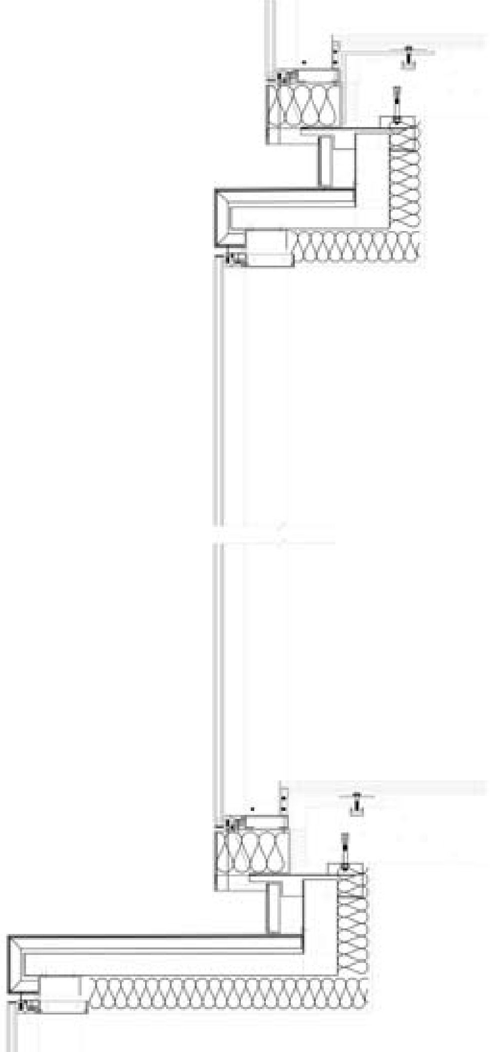
With that challenge surmounted, another lay on the horizon: how to bring this vision to reality. While the curtain wall's charm



Previous spread: Paúl Rivera; this page: Kohn Pedersen Fox Associates

Top: Kohn Pedersen Fox Associates; right: Metal Teck, Inc.

Facing, left Each mullion was custom-bent in the fabrication shop before installation.
Facing, right Curved floor slabs are irregular and vary between floors.
Facing, below Aluminum mullions range from 9 1/2 to 10 feet in length; mullions and slab-edge covers are coated in dark bronze Duranar XL paint to harmonize with the brown hues of masonry buildings nearby.
Right Most windows are 18, 36, or 48 inches wide and are arranged in a random pattern across the length of the building.
Below A detail drawing of the second-floor fixed windows.



lies in its free-form appearance, creating it required an exacting level of precision. The building team turned to American Architectural (Metal Teck, Inc.)—an ornamental metal and glass company with a history of tackling unusual projects—to engineer, fabricate, and install the unconventional curtain wall. Gilsanz Murray Steficek served as the curtain-wall consultant.

The design consists of hundreds of windows in various sizes, mostly 18, 36, or 48 inches wide. Windows of different widths are interspersed in a random order across the facade, creating a visually interesting pattern of mullions that emphasizes the horizontal lines of the building. The random pattern also allowed for easy changes if the units' sizes shifted during the design process, said Trent Tesch, senior associate principal at KPF. The windows all run from floor to ceiling in the building, which includes 32 condos and retail space on the ground floor. The aluminum mullions are 4 inches wide and 8 inches deep, and range from 9 ½ to 10 feet long. The mullions and slab-edge covers are coated with Duranar XL paint in a dark bronze color, to harmonize with the brown hues of masonry buildings nearby.

While the facade is shaped like a wave, the individual windows are flat, placed at angles to one another to follow the overall curvatures. Because the curves are irregular and vary floor to floor, the mullions each needed a transition bend that was painstakingly custom-formed in American Architectural's facility. "Out of approximately 700 windows on the job, there are only maybe four or five bends that are exactly alike," says John Melching, the company's CEO and resident architectural engineer.

Creating the steel slab-edge covers was a challenging process, too. American Architectural started out with numerous lengths that were each only as long as the width of a window. The workers welded these lengths together by hand and ground the welds smooth to create 12- to 15-foot-long segments, which would be easier to install during construction. They enclosed the low-iron, mildly reflective Viracon windows in aluminum cassette frames and did a trial run of installing the entire curtain wall, at least two stories at a time, at their Pennsylvania facility to make sure everything fit properly. Since the curtain wall was designed to a tolerance of only 1/16 inch, fabricating and installing it required a level of precision that Melching compares to a Swiss watch. After the use of computer modeling, "old-world technology took over, and it was all hand-fitted," he says.

The hybridized installation process drew upon elements of a curtain-wall system, a strip-window system, and stick system, Melching says. The facade is like a curtain wall in that the entire system passes in front of the slab edges. It resembles a strip-window system in that the workers put on the slab-edge covers and then installed the glass windows horizontally. And it resembles a stick system because, after putting in the slab covers, they put in the mullions before installing the glass.

One of the biggest engineering challenges was presented by the building's two double-height duplexes. With no slab

Above In American Architectural's facility, pieces were welded together in 12- to 15-foot-long segments and tested installation of the walls in the shop before moving the pieces to the site. The curtain wall is designed to a tolerance of only 1/16 inch.
Facing Windows for the condominium's double-height duplexes are supported without a slab by a system of steel tubes bridging between a column to the slab edge.

at the exterior wall to support them, the design team came up with a system of hollow steel sections that attached to and spanned between columns at the exterior wall, carefully welding the sections together to create the faceted shape needed to support the glass windows.

In keeping with the Village's iconoclastic spirit, the carefully crafted facade is truly one of a kind. Pedestrians walking by the recently completed building can be seen gazing at its reflective windows, which might evoke strips of celluloid film displaying successions of images of the surroundings. Along Greenwich Avenue, the building reflects back the stately forms of brick buildings on Horatio Street across the way, creating an echo of the neighborhood's architectural past, and a vision of its future. **M**

While the curtain wall's charm lies in its free-form appearance, creating it required an exacting level of precision.

This page: Kohn Pedersen Fox Associates; facing: Paúl Rivera

ONE JACKSON SQUARE

Location: **122 Greenwich Avenue, New York, NY**
Owners: **Hines**, *New York, NY*;
RFR Realty LLC, *New York, NY*
Developer: **Hines**, *New York, NY*
Design Architect: **Kohn Pedersen Fox Associates**, *New York, NY*
Architect of Record: **SLCE Architects**, *New York, NY*
Structural Engineer: **Gilsanz Murray Steficek**, *New York, NY*
Mechanical Engineer: **WSP Flack + Kurtz**, *New York, NY*
General Contractor: **Hunter Roberts Construction Group**, *New York, NY*
Curtain Wall Consultant: **Gilsanz Murray Steficek**, *New York, NY*
Miscellaneous Iron Erector:
Burgess Steel Products Corp., *Englewood, NJ*
Architectural and Ornamental Metal Erector:
Champion Metal & Glass, Inc., *Deer Park, NY*
Curtain Wall Fabricator and Erector:
Metal Teck, Inc., *Bensalem, PA*

The Standard Hotel New York

Left A steel truss anchored to the eastern concrete pier and to the Standard's western shear wall allows the hotel to make a 100-foot straddle over the High Line.

Beneath Manhattan's boldest new building, a steel truss and transfer slab does the heavy lifting.

VISIONARY HOTELIER ANDRE BALAZS' TOWERING 337-room New York Standard Hotel is anything but standard. Like a colossus boldly straddling the High Line park, an innovative public space built on a segment of abandoned elevated rail tracks threading through Manhattan's Meatpacking District, the structure stands guard over a rapidly evolving stretch of the city.

Built as a joint venture involving Greenfield Partners, HotelsAB, Dune Capital and The John Buck Company, the new 19-story, 191,000-square-foot hotel's board-formed concrete facade and vast expanses of water-white glass causally split the difference between the historic grit and burgeoning glam of New York's latest destination neighborhood. Unlike Balazs' other acclaimed properties, which retool and refurbish the latent chic of existing structures, the New York Standard is a $100 million dollar floor-to-ceiling build-out that had to contend with a number of challenges posed by its coveted proximity to the park—including a set of zoning restrictions which precluded any structural or constructive shoring off of the historic High Line.

Designed by Todd Schliemann of Polshek Partnership Architects, with structural engineering provided by DeSimone Consulting Engineers, the "Le Corbusier style" boutique hotel owes its unique height and generous span over the High Line to a hybrid concrete and structural steel truss and transfer slab which takes up the entirety of the structure's fourth floor.

"The zoning envelope for the site would have been a complete build-out with a hole in the center, which was 30 feet above the bed of the tracks and 5 feet on either side and underneath the High Line," says Schliemann. "Given the concept of the hotel, we didn't just want a building with a big hole in it, so we had to span over. The whole building had to be carried over the High Line and that's where the trusses come in."

The Standard's powerful 100-foot straddle span is made possible by a steel truss of ASTM A913 Grade 65 steel members. Anchored at the east end to the concrete pier and at the west end to the shear wall, the truss' total end-to-end length of 114 feet is constructed in two separate sections, of 65 feet and 49 feet respectively, which are joined at the center to complete the truss. Seven ASTM Grade 65 W14 members of varying lengths serve as the diagonal truss members. The majority of the ASTM A36 gusset plates and connections were shop-welded, and the intermediate framing was field-bolted with a combination of A325 and A490 bolts.

While instrumental in achieving the required span, the structural steel truss also provided the contractors with a self-sustaining scaffolding system from which the remainder of the project was staged throughout

the 24-month construction cycle. A single tower crane with an adjustable 150-foot boom erected on the northern edge of the eastern concrete pylon was used to hoist the truss members onto a series of three shoring towers and a cantilever support. Once the trusses were joined in the center and secured to the shear wall and pylon, the contractors were able to extend the boom to pick the lighter loads of the remaining material.

Effectively converting the transfer slab/truss system into a staging platform would have been impossible without structural steel. "We were planning to do these big transfer beams out of pre-stressed, reinforced concrete, which we couldn't do because we weren't allowed to shore off the High Line," says Erik Madsen, project manager with DeSimone. "Instead we used structural steel to stage everything. The trusses were erected first. Then we installed the bridging steel with metal deck to create the formwork to place an 8-inch slab on deck, which supported another 32-inch concrete pour for a 40-inch concrete platform, which is our transfer slab. From there we were able to build the rest of the building without having to shore off the High Line."

The top chords of the structural steel trusses are embedded in the transfer slab system fabricated from ASTM A611 and ASTM A653 33ksi metal deck. Shear connections of ¾-inch diameter by 5-inch headed studs transmit the shear back and forth between the concrete and the steel. The Standard's remaining fifteen floors rest atop the composite concrete and steel 40-inch transfer slab, which communicates the loads into the trusses and thereafter into the western shear wall and eastern concrete pylon.

Far from playing second fiddle, structural steel's lighter weight and incomparable strength allowed the designers and contractors to accomplish an engineering marvel while granting exposure to concrete's gritty, shabby-chic exterior. "The trusses are what made this happen," says Madsen. "Shoring over the High Line would have been nearly impossible without that Grade 65 steel, which also saved a lot of money on shipping weight and construction costs. It worked perfectly." **M**

Above Contractors were able to use the truss as a staging area once the trusses were joined in the center, installing a boom on the eastern concrete pylon to lift material onto the platform.
Facing Zoning restrictions prohibit any structural or constructive shoring off of the High Line.

Previous spread: Martin Perrin; left column: Helmark Steel Inc.; right: Todd Schliemann/Polshek

Nikolas Koenig courtesy Standard

> "The trusses are what made this happen."
>
> Erik Madsen, DeSimone Consulting Engineers

THE STANDARD HOTEL, NEW YORK

Location: **848 Washington Street, New York, NY**
Owner: **André Balazs Properties**, *New York, NY*
Architect: **Todd Schliemann of Polshek Partnership Architects**, *New York, NY*
Structural Engineer: **DeSimone Consulting Engineers**, *New York, NY*
Mechanical Engineer: **Edwards & Zuck**, *New York, NY*
Construction Manager: **Pavarini McGovern**, *New York, NY*
Curtain Wall Consultant: **R.A. Heintges & Associates**, *New York, NY*
Structural Steel Fabricator: **Helmark Steel, Inc.**, *Wilmington, DE*
Structural Steel Erector: **Falcon Steel Company**, *Wilmington, DE*
Curtain Wall Fabricator: **Permasteelisa North America Corp.**, *Windsor, CT*
Curtain Wall Erector: **Tower Installation, LLC**, *Windsor, CT*

Monroe High School Annex

Steel provides an elegant solution for the design and budgetary needs of a new high school addition in the Bronx.

THE NEW YORK CITY Department of Education has the largest construction budget in the country, spending billions of dollars a year on new facilities. But with more than a million students enrolled and a desperate need for new schools, especially as families increasingly choose the boroughs over the ’burbs, New York must stretch every dollar as far as possible. For a new addition to the James Monroe High School in the Soundview neighborhood of the Bronx, the designers built with steel because it allowed them to create a building that is both economical and elegant. Through steel’s expressive beauty, the designers were able to leave many structural elements exposed, especially in the building’s two signature spaces, the auditorium and the gymnasium, saving money in the process.

From the project’s inception, steel helped guide the design process to keep it as efficient and inexpensive as possible, including even the layout of the new school. “If you think about the most economical plan in a school, it’s a double-loaded corridor,” says Alex Diez, the principal in charge of the project at Kliment Halsband Architects. This allows for standardized layout with the steel columns, ranging from W12x14 to W21x44, evenly spaced at 30-foot spans with one classroom per bay. The columns are connected to the slab with ¾-inch diameter studs. This configuration makes for the easy placement of doors and lockers within the spans, as well as expansive windows that pour natural light into the classrooms. The system’s diagonal bracing did make for a tight layout, though it was preferable because it required less steel, and thus less money.

This relatively simple setup is not without its challenges,

Previous spread and this page: Peter Mauss/Esto

This page: Kliment Halsband Architects

Previous spread The 146,000 square foot, five-story school provides space for two independent schools of 500 students each. Students pass through a landscaped courtyard to the building entrance and a shared auditorium and gym.

Facing, top The gym's hip girder was left exposed, reducing materials costs and heightening the sense of openness. **Facing, bottom** The annex consists of three structures connected by expansion joints. The architects and engineers meticulously designed the joints to alleviate the SCA's concerns about their long-term maintenance.

as the four-story main building houses more than just cookie-cutter classrooms. It must also accommodate doublewide labs, a cafeteria, and other sundry spaces like a library, music room, and nurse's office. To address this problem, additional bracing is added to shift the loads around and create the wider spans required.

The real challenge, though, is connecting the main building to the auditorium and gym, vaulted spaces that are the centerpiece of the new school—in addition to an arts focus, for which the auditorium is key, this layout also creates a courtyard between the new school and its historic 1924 neighbor. Because the environmental loads on these grand spaces is much greater than on the school proper, an expansion joint was required to connect them. "We're basically taking three buildings and making them one," Diez says.

But that is not always an easy process, especially in light of the client. "The School Construction Authority hates expansion joints," says Cawsie Jijina, a principal at Severud Associates, explaining that the spaces can present maintenance problems down the line if poorly designed or neglected, which is why the designers were meticulous in creating their joint. As for the spaces on the other side of the expansion joint, they are the most dynamic in the school, not only for the activities that take place within—basketball games and plays—but also because of the engineering overhead. For the gym, a hip girder was used while a barrel girder was used for the larger auditorium roof. "The barrel shape gives the structure an elegant arch as well as making it stronger," says Carey Ngai, an associate principal at Severud who oversaw the project.

For the gymnasium, W12x53 flat members were used with double-angled L4x4x3/8 for the vertical and diagonal member; W12x14 beams provide lateral stiffness between the arches. The system for the auditorium was slightly more complicated, given its size and complexity: W10x68 flat members were turned on their side and attached again to L4x3x3/8, though with the long legs back to back. A conventional truss of the same composition is used at the ends of the roof for added stability as well as W10x88 horizontal braces. All trusses were bolted with 3/4-inch and 7/8-inch bolts and the barrel truss was also fillet-welded in places.

To further the efficiency of the roof systems, mechanical systems are wholly supported by the trusses—even the lighting is hung from the base of the trusses in the auditorium. The roof deck, which was also left exposed and untreated, does double duty, as well. In the gymnasium, a standard acoustical deck was used, Epic Metals' EP 300 18/20, though a special composite deck from Epic was employed in the auditorium roof, ECP324 16/18. "It eliminates the need for any acoustical insulation," Jijina says.

In addition to the design's cost savings and overall utility, Diez says it could serve another purpose: hopefully it will mint future architects and engineers. "There's all kinds of interesting stuff up there," he says. "Maybe they can understand how the large spans work. It could be a lesson for the students." **M**

Above Thirty-foot spans allow for the placement of one classroom per bay. Columns are connected to the slab with 3/4-inch diameter studs, allowing doors, lockers, and large windows to be placed in between.

This spread: Peter Mauss/Esto

This spread Thought the new school was built economically, steel allows it to accommodate the most modern amenities, including double-width labs, a cafeteria, auditorium, library, and other open spaces.

Through steel's expressive beauty, the designers were able to leave many structural elements exposed, saving money in the process.

MONROE HIGH SCHOOL ANNEX

Location: **1300 Boynton Avenue, Bronx, NY**
Owner: **New York City Department of Education**, *New York, NY*
Architect: **Kliment Halsband Architects**, *New York, NY*
Structural Engineer: **Severud Associates**, *New York, NY*
Mechanical Engineer: **Ambrosino, Depinto & Schmieder Engineers**, *New York, NY*
General Contractor: **Bovis Lend Lease**, *New York, NY*
Structural Steel Erector: **Glasmar Steel Erectors, Inc.**, *Rockville Centre, NY*

Post Ductility Conference

More than 300 students and design and engineering professionals attended Columbia University's third conference on architecture, engineering, and materials September 30 – October 2. The conference, entitled Post Ductility: Metals in Architecture and Engineering, is part of the Graduate School of Architecture, Planning and Preservation's (GSAPP) series exploring material science through events and discussions with a wide range of leading architects, engineers, and scholars.

The conference kicked off with introductory remarks by GSAPP dean Mark Wigley and a Keynote Lecture by Madrid-based architect and Harvard Graduate School of Design professor José Rafael Moneo. In his remarks, Moneo spoke about his design of Columbia's new interdisciplinary science building and its implications for the future of architectural metals.

The long list of participating architects, engineers, historians, and theorists included: Paola Antonelli, Phillip Anzalone, Michael Bell, David Benjamin, Roberto Bicchiarelli, Beatriz Colomina, John Fernandez, Kenneth Frampton, Laurie Hawkinson, Juan Herreros, Steven Holl, Keith Kaseman, Sanford Kwinter, Sylvia Lavin, Mark Malekshahi, Ronald Mayes, Rory McGowan, Detlef Mertins, Christian Meyer, Ana Miljacki, Toshiko Mori, Jorge Otero Pailos, Theo Prudon, Jesse Reiser, Leslie Robertson, Hilary Sample, Hans Schober, Matthias Schuler, Craig Schwitter, Felicity Scott, Werner Sobek, Galia Solomonoff, Man-Chung Tang, Heiko Trumpf, Nanako Umemoto, George Wheeler, Mark Wigley, and Mabel Wilson.

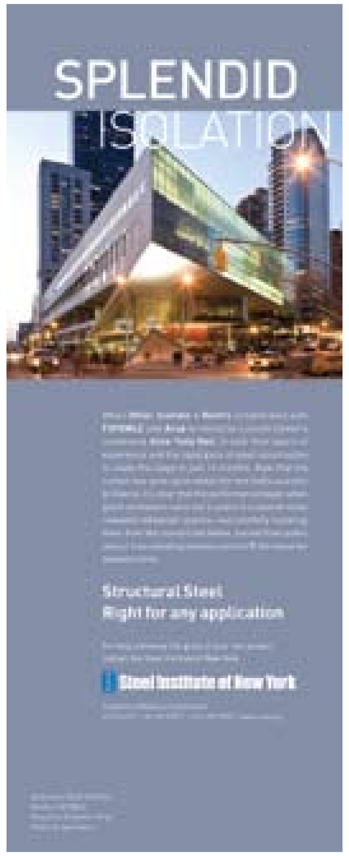
Aging Buildings: Designing for Longevity

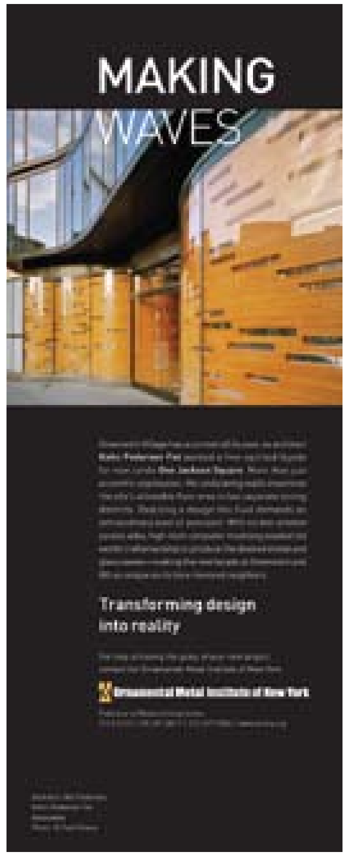
Organized by the the Steel and Ornamental Metal Institutes of New York and the Architectural Engineering Institute (AEI) of ASCE, 2009's symposium on Aging Buildings brought together eleven leading researchers and practitioners to lead a day of presentations regarding the longevity of typical steel frame structures with glass curtain wall enclosures. The symposium's speakers included: Mohammed Ettouney, Ph.D., P.E., F.AEI, Wilfried Laufs, Ph.D., LEED A.P., Thomas A. Schwartz, P.E., Israel Berger, AIA, Jeff Heymann, Ron Latanision, Ph.D., P.E., Vincent Hock, F.NACE, Michel Bruneau, Ph.D., P.Eng., David Peraza, P.E., Robert C. Field, P.E., LEED A.P., and John P. Cross, P.E.

Workshop: Advanced Stainless Steel Architectural Design

On November 19, 2009, leading architectural metal expert Catherine Houska led an all-day seminar on planning, specification, and execution of innovative stainless steel designs. The day's topics included: sustainable stainless steel design; design, selection and maintenance, stainless steel finishes, building envelopes, transit buildings and structures, interior applications, and swimming pools and water features. Houska, author of more than 100 articles, papers, and technical brochures, is expected to lead another in the fall of next year.

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





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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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