SCHOOL OF AMERICAN BALLET

May I Steel This Dance

Clockwise from top left
The 44-foot long, W36x328 beams were delivered on site by truck, then crane lifted and inserted through a window in the building.

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On a recent morning at the School of American Ballet (SAB) at New York City's Lincoln Center, a dozen pairs of toe shoes gracefully cross the studio floor. The dancers leap and *jeté* in formation; each movement is as muscular as it is weightless. Watching the class, it is easy to understand the idea behind the school's two new dance studios, designed by architect Elizabeth Diller, cofounder of Diller Scofidio + Renfro, to fit within the existing structure: The glass walls of the new spaces pull back from the building perimeter and the volumes appear to float. This effect is made possible by the curving steel beams that shoulder the studios' loads as gracefully as a pirouette.

The SAB was founded in 1934 by choreographer George Balanchine and Lincoln Kirstein, for whom the new wing is named. The prestigious academy trains dancers that go on to perform with New York and nationally based professional ballet companies. Although the school moved into the Samuel B. and David Rose Building in 1991, it quickly outgrew its facilities and needed to expand. By floating smaller studios inside the larger existing studios, the renovation increases the number of dance spaces from five to seven.

Diller developed the 8,200-square-foot project (the new work is 3,200 square feet) in close collaboration with SAB artistic director Peter Martins. The pair shared an interest in how bodies move through space—it is a thread that runs through much of Diller + Scofidio's early, avant-garde work. But how to create a scheme that works within the limitations of an existing structure while still providing a ceiling height high enough to accommodate the lifts and extensions of a ballet duet? A mechanical plenum located above the original, 16-foot-high studios proved the solution. The architects gained headroom by removing the plenum and rerouting new return ductwork around the perimeter. This move created ten additional feet of floor-to-ceiling clearance.

Six large steel beams, three for each studio, support the newly created upper level. These 44-foot-long W36x328 sections might seem the antithesis of weightlessness, yet Ove Arup and Partners deftly engineered a structure that never appears heavy. "The beams were there from the outset of the project," says structural engineer Robert Pallmann. "I remember doing concept sketches—we wanted a floating jewel box." But the existing building almost immediately posed a problem. Windows run across the north, west, and east facades with sill heights several feet below where the proposed structure would intersect with the wall. The designers made the decision to run the beams straight across the space from the north to the south walls, but even this conflicted with the window penetrations, threatening to drastically reduce natural light. In answer, the designers curved that end of the steel beams downward to avoid the windows. It was a necessary adjustment to solve a technical problem, but also a gesture that echoes the extensions of dancers' limbs. The beams were fabricated from ASTM A992 Grade 50 steel, treated with Carboline intumescent paint with a two-hour fire rating. The members' significant thickness also allowed the designers to keep the intumescent paint coating relatively thin.

The SAB is located on the fifth floor of the Rose Building, so DR+S worked with project manager Seamus Henchy and Associates and structural steel fabricators Gold Coin Iron Works to orchestrate the beam installation. Care was taken to not disturb the existing building: All of the curtain wall cladding remained in place and only one window was removed in each studio for access. A crane was used to lift each structural member and then guide it through the window opening. Inside, the beams were held in place by a gantry system temporarily attached to the existing concrete waffle slab before they were welded to the north and south walls. An 8-inch thick concrete slab acts as a diaphragm to stabilize the steel beams. On top of it sits a custom sprung wood floor.

The engineers determined that the Rose Building's structure was robust enough to take the load of the new studios. "We knew that the columns were big, but since the location of the main beams didn't line up with existing columns, the problem was getting the forces to them," explains Pallmann. The northern facade was opened up from the inside and beams fabricated from 36x8x1.25 HSS sections were used to transfer the dance studio loads to the columns.

Top On the north side, the beams attach to a 36x8x1.25 HSS that transfers loads to the building's columns.
Bottom On the south side, the beams attach to imbeds in a shear wall.

A concrete shear wall on the south side meant that the beams could be welded to 1.5-inch-thick steel plates embedded in the wall with shear lugs and epoxy. Non-destructive testing determined the location of existing rebar and the detail was field adjusted accordingly before pockets were chopped out of the concrete.

Throughout the project, a unified materials and color palette was used to conceal all of these structural gymnastics beneath clean modern finishes. SAB's director of public relations, Amy Bordy, neatly sums up the new design: "We've overcome the nostalgic idea that you need a grimy studio with a leaky radiator in order to preserve the dance." A simple flight of stairs equipped with a maple handrail that resembles a ballet bar leads to an elegant lounge between the two upper rooms. There, dancers can sit and put on their shoes. Walls of liquid crystal glass—the high-tech material that can change from clear to opaque with the flick of a switch—separate the lounge from the studios, giving the ballet teachers the ability to control classroom privacy. These walls moderate sound bleed and let light spill in from the existing windows. But when the curtain goes down, it's structural steel's ability to easily adapt to existing structures while handling heavy loads that deserves the real applause. Structural steel, take a bow. **M**

Top and above Removing a mechanical plenum and rerouting return ventilation to the peremeter of the room gave the designers the space they needed to insert the floating studios.
Left A flight of stairs leads to a lounge between the two floating studios.

SCHOOL OF AMERICAN BALLET

Owner: **School of American Ballet**, *New York, NY*
Project Manager: **Seamus Henchy and Associates**, *New York, NY*
Architect: **Diller Scofidio + Renfro**, *New York, NY*
Structural and Mechanical Engineer: **Arup**, *New York, NY*
Miscellaneous Metal Engineering: **Leslie E. Robertson and Associates**, *New York, NY*
Acoustical Consultant: **Jaffe Holden Acoustics**, *Norwalk, CT*
Lighting Consultant: **Tillotson Design Associates**, *New York, NY*
General Contractor: **Alcon Builders Group**, *New York, NY*
Curtain Wall Consultant: **R.A. Heintges Architects Consultants**, *New York, NY*
Structural Steel Erector: **Gold Coin Iron Works**, *Elmsford, NY*
Miscellaneous Metal Erector: **Gold Coin Iron Works**, *Elmsford, NY*
Curtain Wall Fabricator: **Neversink Construction Corp.**, *White Lake, NY*