Connecting the Campus With Steel

BY NORM AIDUN, LEED AP, AND JASON EDSALL

A congested site and a need for unification set up the perfect challenges now being met by a new steel-framed building at Cornell University.

DESPITE THE ECONOMY, university construction is still going strong as schools strive to provide high-end, innovative amenities to meet the high demand from current and potential students. This fall, a good example of this can be found in Milstein Hall at Cornell University, Ithaca, N.Y., where design students are learning in this brand new, state-of-the-art building designed with the future in mind.

With much of the steel exposed throughout the structure, visitors see and feel its strength, stability, and prominence, which would not be the same had another medium been used. However, erecting the steel was no easy task at the small site, which is positioned between three existing buildings, beside another construction site and across from a deep gorge.

Milstein Hall, named for philanthropist Paul Milstein, is the most recent addition to the university and offers students of the Cornell College of Architecture, Art, and Planning (AAP) an inspiring facility in which to study, attend seminars, and exhibit their works. The 47,000-sq.-ft building, which broke ground in 2009, hosts a glass, marble and concrete façade over two stories with a sub-basement. Both floors, referred to as the upper and lower plates, have an open-air design. The lower plate boasts a distinctive auditorium with a concrete dome that provides elevated seating as well as an unusual ceiling in the gallery space, where a bridge first crosses, then descends through the concrete dome to the lowest level. It also features partition walls to allow for ever-changing studio and critique spaces.

Milstein Hall is a connecting building. The upper plate, mainly designed for flexible studio space, physically connects two other separate AAP buildings and simultaneously creates a cohesive complex of all the buildings in the arts quad. Designed in this way, this one system of buildings is coordinated to share resources and promote interdisciplinary interaction.

The architect's vision was such that conventional materials are used in unconventional ways and act as a blank canvas of sorts for students to display their models, plans, and projects.

"Visitors to Milstein Hall will be struck by the beautiful combination of steel, glass, concrete, and stone, which define the building's look and feel," said Aaron Goldweber, the director of communications for the Cornell University College of Art, Architecture and Planning. "Paradoxically, the massive steel trusses, painted white, work to actually give the building a light, floating feeling as it cantilevers over University Avenue."

Design and Transportation Considerations

The open, exposed trusses were a design feature in the architect's plan to provide a space that is aesthetically pleasing while not limiting the overall flow. That plan also included two cantilevers, the longest extending 48 ft over a busy campus road and walkway.

One of two cantilevers for the new Milstein Hall on the Cornell University campus.

Shipping large truss sections limited the amount of field welding, which was an important factor given the heavy wide-flange sections that were involved and a high probably of less than perfect weather.

The structural engineer designed the single-story trusses composing the structure of the second floor and roof as a five-part hybrid system incorporating both Warren truss and Vierendeel truss sections. The resulting large member sizes—standard wide-flange sections with the largest being a W14×730—made shop fabrication into truss sections preferable to field assembly of smaller components, although it increased the transportation challenge. Even so, splicing the 17 truss sections together on site required 165 full and partial joint penetration welds.

The 1,100 tons of steel for the project was supplied by Nucor-Yamato Steel Company, Armorel, Ark., and fabricated in Quebec City, Canada. The scheduling and logistics of the delivery and installation of the 17 truss sections, each weighing between 23 tons and 65 tons, was a significant factor in the construction. In extensive pre-planning meetings Welliver and Cornell University project teams carefully mapped out a controlled transportation plan. Each truss section was delivered individually by truck, escorted to the U.S.-Canadian border by the Canadian police, then met by New York State Police and escorted to campus. From there, the police team merged with Cornell campus police to navigate the steep, twisting roadways across the campus to its west side where the Milstein project site was located.

For four weeks in the spring of 2010, the truss pieces traveled to Ithaca, N.Y., with three to four arriving each week. With no laydown area and surrounded by busy occupied buildings, timing had to be just right for each truss to be erected before the next one was delivered. A 600-ton hydraulic crane, the largest in the state, was brought in from nearby Syracuse to lift and hold the pieces as crews set them in place.

"There was no room for error and timing had to be on point," said Welliver's general superintendent Terrance "Spike" Fisk. "With so many parties involved in the steel deliveries, the margin for error was much greater. However, deliveries were well coordinated and we were able to mitigate major traffic and campus disruption."

Milstein's design called for all MEP systems to be integrated into the flooring, working through the truss pieces. Ductwork is exposed but remains on the same plane as the ceiling materials, running through the steel framing. Specific clash-detection analyses were performed, utilizing a local Navisworks consultant, to virtually map out all MEP systems before the steel design was finished. The structural engineering team performed advance coordination for the integration of these systems into each truss.

"Other challenges of Milstein Hall have been managing the prototype design, procurement and installation of custom products from many

Fabricated structural steel truss sections trucked to the site on a closely coordinated schedule kept the main framing erection to just four weeks.

Ironworkers erecting one of the 17 truss sections for Milstein Hall.

Norm Aidun, LEED AP, is vice president of project management with Welliver and is currently the on-site project executive at Cornell University. Jason Edsall, project manager with Welliver, is also part of the on-site project team for Milstein Hall and other ongoing Cornell projects.

The distinctive vegetated roof of Cornell University's new Milstein Hall, which connects two older buildings, as seen from Baker Laboratory.

Sustainability on Campus

Sustainable buildings are becoming increasingly important to higher education institutions. Cornell University's Milstein Hall is on track to receive LEED Silver certification. Sustainable aspects incorporated into this project include skylights designed to provide natural light toward the center of the building, where light from the floor-to-ceiling glass exterior does not reach. A green vegetated roof running across the entire top plate provides visual appeal while also controlling rainwater runoff.

Milstein Hall also takes advantage of the university's lake-source cooling system. Water from a nearby lake flows into chilled beams in the ceiling to cool the building, minimizing the requirement of a traditional forced-air system. Conversely, heat for the upper plates is integrated into the concrete slab flooring as radiant heating for the open, flex space. A sunken garden provides green space within the lower plate atrium near the exterior stair tower.

This unique design sets the precedent for a new realm of modern construction on Cornell's campus. The design architect is Pritzker Prize winner Rem Koolhaas of the Office of Metropolitan Architecture, New York, who studied at Cornell.

The last of 17 large steel truss sections installed for Milstein Hall.

"The massive steel trusses, painted white, work to actually give the building a light, floating feeling as it cantilevers over University Avenue." (Aaron Goldweber).

international firms," Fisk said. "The occasional language barrier, constant metric conversions, and conference calls with stakeholders in multiple time zones have not stalled the progress of the build but only added another layer of effort on the construction team's part."

Safety management played an important role in this project, which has been highly visible on campus to students, staff, and visitors, local and international alike. Building with numerous trades on site at any one time is no easy task and safety was a critical concern. The Milstein Hall project recorded no lost-time injuries at any point during construction.

Even with its distinctive design and extensive construction requirements, Milstein Hall is still about the students. Since the planning stages, Cornell students, faculty and alumni have been watching—and learning—from its construction. "When students see firsthand the execution of sophisticated engineering and construction, it grounds their education in reality," said AAP's Goldweber.

Although Milstein Hall may look abstract, this facility is a realistic look into how a talented team can make typical foundational materials to the world of construction—concrete, glass, stone, and most importantly, steel—act in atypical scenarios. MSC

Owner
Cornell University, Ithaca, N.Y.

Design Architect
Office of Metropolitan Architecture, New York

Construction Architect
Kendall Heaton Associates, Houston

Structural Engineer
Robert Silman Associates, New York

Erector
Fast Trek Steel Inc., Coxsackie, N.Y.
(AISC and IMPACT Member)

Construction Manager
Welliver, Montour Falls, N.Y.