Adapt & Re-use

By Peter Wilk

Structural steel met the triple challenges of time, space, and budget during the renovation and adaptive re-use of this vintage New York City townhome.

One by one, 70 wide-flange steel members were carried by hand into the new Marymount Middle School in Manhattan, as part of the renovation and expansion of a beaux-arts building. The job's tight site and the building's historic elements prevented the use of heavy cranes and equipment during construction. A strategic design and careful planning made the project a success, meeting the school's functional and aesthetic goals.

In 2000 the Marymount School had acquired the six-story mansion, which was built originally in 1900 as a private residence before being converted into an apartment building in 1939. The structure is considered a "Contributing Building" to the Metropolitan Museum Historic District, and the New York City Landmarks Preservation Commission observed the restoration.

The building's wooden structure was

deteriorated from water damage and age, and its floors sagged. Some decorative elements were damaged or missing, and the exterior required extensive repairs and preservation.

Steel was considered the best choice for the retrofit, said Architect Sam West, of Platt, Byard, Dovell, White Architects. "The floors of the existing building were framed in wood, the bearing walls in masonry. Steel was compatible with both. Our schedule did not allow for the time required for poured-in-place concrete to come up to strength, there was no room to post-tension concrete, and pre-cast was inappropriate because we needed to bring the structural elements into the building in relatively short pieces [and then connect them]."

"Steel was the best solution in terms of overall weight and required strength, versus wood or concrete construction," said Structural Engineer Chris Anastos. "The weight of the new structure had to be minimized so as not to overstress the existing walls and footings."

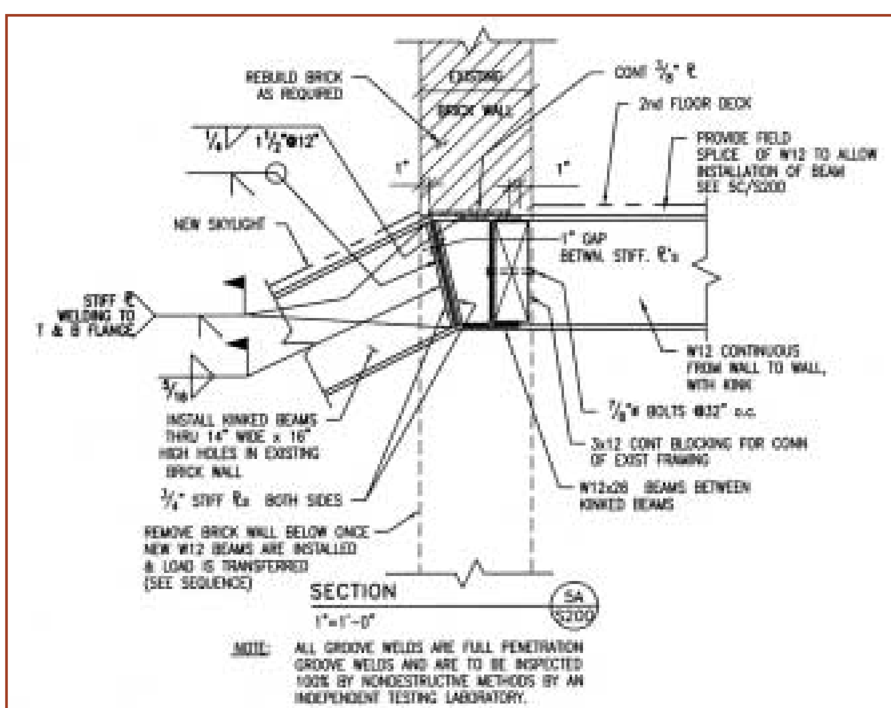
Design Challenges

From a planning perspective, the architect needed to fit the academic program of a freestanding school into a structure originally designed as a single-family residence. The school's space program had to be accomplished without expanding the building's exterior envelope above the first floor. The new use had to conform to contemporary codes, including requirements for stairs, elevators, bathrooms and corridors, all within a fixed width established by existing party walls. Within the constraints of a narrow sidewalk, the school had to provide barrier-free access, even though the building's first floor is 3' above street level. The New York City Landmarks Preservation Commission would not allow any changes to the entrance.

The greatest design challenge involved the introduction of modern utilitarian elements—fire stairs, elevators, lockers, science and computer classrooms—into a building that the client chose for its Beaux-Arts interiors. The architect developed a two-tiered approach. The team identified the most historically valuable and best-preserved original rooms, and assigned to them "soft" new uses, such as homerooms, the reception room, and the library. These rooms underwent a restoration, received compatible lighting fixtures, and their new infrastructure was concealed.

Above: New steel framing supports five floors above—and a masonry bearing wall—to provide column-free space and skylights for the new ground floor Commons Room (*inset*).

Below: New steel beams with a fabricated "kink" support the existing brick masonry wall where the lower portion has been removed.



Rooms and spaces that did not allow this preservation approach were assigned "hard" uses, such as food-service facilities, the science laboratory, the technology room, and art rooms. These rooms now feature new interiors with contemporary, but historically sympathetic designs.

Structural Redevelopment

The renovation process required the removal of most of the original wooden structure, and installation of the new steel structure. Structural elements were installed one floor at a time, beginning with the first floor. Due to a very tight site, limited access to the building, and the need to preserve the façade and interiors, structural steel elements had to be moved-in by hand through window and door openings and then up through the inside of the building. Installation of the entire new steel structure took eight weeks.

The most interesting aspect of the structural steel design involved the creation of the dining commons at the ground floor rear. During the programming and planning phase, the school determined that the building would need to feature a dining room large enough to accommodate half of the students and half of the faculty at one time. For planning reasons, the dining room had to be located in the rear of the first floor, directly above the kitchen.

In order to meet the school's needs, the team decided to expand the width of the building's rear portion from 17′ to the full extent of the 25′-wide lot. The expansion process necessitated construction of a new foundation and introduction of a steel structure to support five floors above, while allowing a column-free span below. The added foundation is 25′ wide by 10′ deep. The new concrete spread-footing foundation is anchored to the bedrock that is 3′ below the surface level. The building's footprint is now approximately 25′ wide by 60′ deep.

The large steel members were fabricated in multiple pieces, each one small enough to carry in through the front door and window openings, as there was no other access, and the team did not want to impact the existing period woodwork of the front lobby.

Standard bolted field connections were used for much of the structure, and shop connections were welded. The majority of steel-to-wall connections were bearing plate connections pocketed into existing masonry walls. The pockets were approximately 8″ deep by 12″ wide by 14″ high. The laborers then installed 12″-by-8″-by-1″ steel plates on the bottoms of pockets in the walls. The beams were placed on top of the plates and welded to them using stick-welding techniques.

The project required fabrication of approximately 70 W12×45s. Construction of the building's rear extension required fabrication of "kinked" beams to support the existing five-story brick bearing wall. The W14×65 beams extend straight from the pre-existing rear wall and then "bend down" at an approximately 45-degree angle to connect with the new concrete wall erected above the new foundation. The beam had to be stiff enough to minimize its deflection and eliminate the possibility for cracking of the existing brick wall. The fabrication of kinked beams involved cutting the ends of two beams at 22.5-degree angles and welding the ends to create the 45-degree angle. The kinked beams also are connected to both pre-existing and new walls through bearing plate connections. The connection to the new wall is approximately 11′ above the ground level.

When the new steel structure was installed, the ICS construction team gradually transferred the weight of the five-story extension onto the new steel bents. Steel was coated with a spray-applied fire-protective coating to give it a two-hour fire rating. The last phase in the structural redevelopment involved the demolition of the old masonry foundation walls below.

Challenges and Solutions

The biggest challenges of the renovation were its location, limited site access, tight schedule, and historical preservation requirements.

"Project location in the dense and historical neighborhood of Manhattan's Upper East Side restricted ICS Builders' site access and work time," said Ted O'Rourke, senior vice president for ICS.

Noisy construction activities were timed to accommodate the surgery schedule of a physician whose office was located near the construction site.

The lack of materials storage space required close coordination with subcontractors and vendors. The steel fabricator could not make deliveries before 7:30 a.m. With virtually no storage space at the site, ICS Builders scheduled deliveries of steel elements at the time each piece was to be installed in the structure. "The majority of materials and equipment were carried into the site and installed immediately upon delivery," O'Rourke said. "The entire process of construction and deliveries was managed through a complex, closely controlled schedule."

There was no space on the street to erect a permanent crane. However, a mobile crane installed the 50-ton rooftop unit on a Saturday morning, when street traffic was lighter than on weekdays. The installation was performed while the street was closed to traffic for three hours.

Construction of scaffolds added to the logistical challenges. A neighbor on the south side prohibited access to his site, forcing the contractor to install the scaffold above the adjacent property. The team devised and installed a hanging scaffold system suspended from the roof on that façade. On the west side, the team erected a conventional scaffold.

Exterior restoration interfaced with interior work. At the roof area, new structural steel was required to support the rooftop HVAC equipment. Agreements with neighbors required that new HVAC units fall within certain heights. Interior ceiling heights also were regulated, which required careful coordination of duct passages and penetrations.

The project received the New York City Landmarks Conservancy 2003 Lucy G. Moses Preservation Award. ★

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