



# Inside the Box

W. John Powell

Replacing a deteriorated structural system with steel framing gives a 19<sup>th</sup>-century New York City town house a new lease on life.

In early 2000 Pei Partnership Architects was approached with an exciting and difficult challenge: to convert a New York West Village town house in bad repair into a state-of-the-art modern residence, while preserving and restoring the major historical elements. The client envisioned converting the building into a “vertical loft”—a multi-story building with spaces that flowed together, like other converted loft spaces now common in Manhattan.

Early in the design process Robert Silman Associates, PC was brought on board as the consulting structural engineer. It was clear that the best way to address the design goals was to demolish the majority of the building and re-build it using steel-framed construction.

## HISTORIC MARKER

A sailmaker had built the existing Federal Style residence in 1806. It was a freestanding wood structure, with a

front façade constructed of 12” of solid brick using Flemish bond coursing typical of the period. The remaining exterior clapboarded walls were constructed of half-timbered framing with brick infill (known as “nogging wall” construction). The building had been designated as an historic landmark of New York City and was given a plaque from the New York Community Trust and the New York Landmarks Commission in 1966, recognizing its value as a typical representative of the Federal Style.

In the years that followed its construction, both the building and its surroundings underwent many changes: neighboring buildings were constructed so that the freestanding building became a row house; the basement was filled with ash in 1912; and a garage door was cut into the front façade to allow the building to be used as a drive-in warehouse, the first of many conversions that transformed the building back and forth between com-



Built in 1806, the town house had been altered many times and was in poor condition prior to its reconstruction.



mercial and residential use. Virtually all of the original construction was replaced over the years with the exception of the front brick façade and one of the three nogging walls.

At the time that the client purchased the house, he was attracted to the historic and eclectic neighborhood, the charm of the exposed nogging wall on the interior and the simple beauty of the Federal brick façade. The remainder of the house had been so altered over the years that there was little of value to be salvaged.

In order to satisfy both the client's wishes and the New York City Landmarks Commission's stringent requirements, Pei Partnership developed a program that included preserving and restoring the front brick façade; making a feature of the exposed two-story interior nogging wall; maximizing usable floor area by excavating the filled-in basement and adding a half-story penthouse study to the top; and creating an envelope for the building that was both modern and sympathetic to the original Federal architectural style and the surrounding neighborhood.

### STEEL CHOICE

A steel structure with concrete deck was the choice to meet these goals. To achieve the client's desire for a vertical loft, the architect took advantage of the structural properties of steel to create a sense of lightness in the interior elements of the house. This tied the spaces of the house together. A cantilevered dining mezzanine would overlook a double-height living room. These spaces were connected to the floors above by a feature stair leading through an atrium space to a 7'-by-10' skylight constructed of minimal stainless steel framing in the penthouse ceiling. The stair was conceived as highly transparent, and floating through space with custom stringers and handrails made of non-directional stainless steel, guards of tempered glass, and wood treads with open risers.

Neither the brick façade nor the nogging wall was in a condition to serve as a structural bearing wall. They both required structural support to hold them up. In addition, the New York City Department of Buildings required the installation of sprinklers at the nogging wall and the construction of a separate fire-rated structure for the



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Modern architectural details, such as this rear garden, maintain the simple and elegant aesthetic of the original Georgian façade.

house. Only in this way could the brick and timbers remain exposed while maintaining the required two-hour-rated fire separation between the building and the adjacent town house. A steel frame provided the only reasonable solution to these structural requirements.

The double-height space at the first floor was designed to feature the exposed two-story interior historic wood-and-brick nogging wall, which runs the entire 30' depth of the house. The design intent was that this wall would be free of any structural columns that would obstruct it along its length. Because of space constraints at the bedroom floor immediately above the nogging wall, there was not enough room for a beam that could span the 30'. Instead a W24x84 was designated to achieve this span at the study level, using steel hangers on roughly 7'-0" centers to suspend the W8 framing of the bedroom floor below it.

It was essential that the house have an aesthetic that reflected uncluttered simplicity and elegance. One way this was achieved was through the use of Fire-Trol pre-fabricated steel fire-rated columns. These 4" by 4" columns have an outside dimension of 6" by 6" when fireproofing and sheathing are included. These columns were arranged so that they disappeared into the few 6" stud partitions in the project, which were used sparingly to maintain an open feel to the interior space. Traditional steel columns with spray fireproofing would have required a greater overall cross-section dimension and would have compromised the design.

### **ON-SITE CHALLENGES**

Space was at a premium on the 30'-wide by 46'-deep site; the footprint of the finished building is only 1,000 sq. ft. To complicate matters further, the vertical dimensions for the floor-to-floor heights were limited by the existing locations of the windows on the front façade and visibility concerns from the Landmarks Commission that impacted the height of the roof on the new study. Steel allowed a structure that had minimal impact on the floor plan while maximizing floor-to-ceiling heights.

Unlike new construction and larger projects, the constraints of the site and the fragility of the existing historic

walls resulted in difficult challenges in coordinating the structure, the mechanical system, the plumbing and the lighting in a manner consistent with the aesthetic intentions for the project. All parties worked closely to develop a design that consisted of a rigorous geometry of clean lines, planes and surfaces. To meet the challenge, Silman's office devised a structural frame that consisted of a complex series of offsets and cantilevers.

The collaboration continued into the construction phase as Pei Partnership Architects, Robert Silman Associates and Pavarini McGovern, the Construction Manager, responded to challenges that came up in the field. Because of the constraints of the site and the fragility of the historic construction, structural steel bracing was installed from a temporary concrete footing in the center of the building before demolition of the rest of the structure. This bracing was fixed to the front façade and the interior nogging wall. Once demolition of the building and the excavation of the basement were completed, the steel structure for the new house was built around the bracing. This was attached to the two historic walls before the steel braces were removed. Construction proceeded from there.

Later in the project, some movement was detected in both of the historic walls. To stabilize the nogging wall without compromising the design, the chimney for the fireplace was used to conceal a vertical steel truss connected to the slab below and steel above. This was done with minimal modifications to the original design of the sheetrock-enclosed sculptural form of the flue. The truss successfully secured the nogging wall, preventing further lateral movement.

Even before construction began, it was apparent that the front façade had bent backwards at a "hinge" point at the second floor level. During construction the monitoring of this wall indicated that it was continuing to move out in this location, leading to serious concerns for the wall's structural integrity. The solution was to install extra steel supports from floor to floor behind the wall. Four historic replicas of cast iron anchor stars were bolted to these supports with stainless steel rods to secure the wall.

In many ways the issues inherent in any major design or construction project involving existing conditions were made more difficult on this project by the fragility of the existing construction, the small size of the building footprint and vertical constraints of the floor-to-floor heights. This resulted in a complex coordination in order to achieve the design goals for an open, flowing space while accommodating the structural requirements for the preservation of the historic fabric.

The success of the finished product, however, is the apparently effortless harmony of the relationships of the finished forms. Steel construction is successful here in its ability to act as an invisible armature for a building that is modest and appropriate to its historical context on the exterior, and ambitious and contemporary in the flowing modernist space within. ★

*W. John Powell, of Pei Partnership Architects, New York City, was project architect on the West Village town house project.*

### **ARCHITECT**

Pei Partnership Architects,  
New York City

### **STRUCTURAL ENGINEER**

Robert Silman Associates, PC,  
New York City

### **CONTRACTOR**

Pavarini McGovern, New York City



# FULL METAL JACKET

The Fire-Trol columns used on the West Village town house project are sometimes used as a substitute for other types of fire protection in steel-framed buildings. They are steel members enclosed by a cementitious insulating material and a steel shell or jacket. The shell provides a smooth steel surface on the exterior of the column, while the insulation provides fire protection for the column inside. The column has three UL ratings: Design X106, X104 and X101, for two, three, and four-hour fire ratings.

"The insulation is a lightweight cementitious material, that's not quite plaster, not quite concrete, but somewhere in between," said Steve Bacho, of Dean Lally, LP, a Fire-Trol manufacturer based in Orland Park, IL. "It enters in a liquid state, mixed-up like concrete, but there's no aggregate. Then it cures as a solid and that's what provides the insulation."

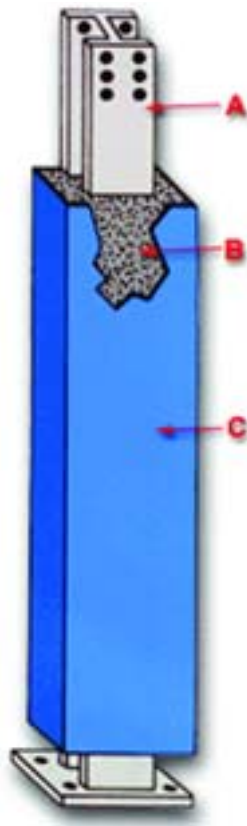
Black Rock Column, Inc. in Bridgeport, CT, fabricates similar columns, which use a vermiculite-based additive for the interior insulation. "Vermiculite is mined from the ground and then placed in a furnace, where it enlarges and becomes very light," said company President David Aldo. "It's mixed with a small amount of cement and water until it becomes a pumpable solution, like a slurry. We pump it in [between the steel members and the steel shell]. It weights about 1800 lb. per cubic yard, less than half of what concrete weighs, at 4000 lb. per cubic yard."

Distributors of Fire-Trol and comparable columns work with steel fabricators to deliver their product according to a building's structural and architectural requirements. "We fabricate the column, so that when it goes out to the site, it's ready to stand up on the site," said Norma Hughes, of Dean Steel Co. in Warwick, RI. "We work directly with steel fabricators, almost as a sub to them. They create all the shop drawings, and we fabricate according to their specifications."

The columns are useful for a variety of reasons. "They are good for durability," said John L. Ruddy, principal of Structural Affiliates International, Inc., a firm that partly specializes in fire engineering. "The jacket gives protection to the columns and the fireproofing, so they are good for projects in industrial areas, where columns might get damaged."

The columns are frequently used in prisons, schools and large warehouses, where the shell prevents damage and tampering with the insulating material.

Further, the Fire-Trol column design reduces the amount of field fire protection required for architecturally exposed steel columns. The



The Fire-Trol column is (A) a steel member enclosed by (B) an insulating material, usually cementitious, and (C) a steel shell or jacket. Image courtesy Dean Lally, LP, Orland Park, IL.

columns are prefabricated and insulated, so their inherent fire protection can reduce time and labor costs. However, other forms of field fire protection are still required on non-architecturally exposed components of the columns (at the connections, for example) in order to meet fire-rating requirements for the overall structure.

One of the biggest benefits of the columns is their usefulness for projects in which steel is an important part of the structure's architectural expression, but requires fire protection. This was the case for the West Village Town House.

"When we started out, we had a 200-year-old building, and we were trying to preserve two walls of it," said project architect W. John Powell. "One of the walls had brick and timber in it, so even though we built the whole building out of steel and concrete, the building was classified as combustible construction. Because it's a town house, with walls adjacent to the building next to it, those exterior walls needed to carry a two-hour fire rating. As a combustible building, the structure that supported the exterior walls had to carry the same rating. So our entire structure

had to carry a two-hour fire rating—the floor joists, the steel deck, and the columns."

The fire protection requirements of the New York City codes had to be balanced with architectural goals. "Aesthetically, we wanted to make the structure disappear entirely, for the building to be visually effortless," Powell said. "The beauty of the steel in the project was that it made the structure disappear. If we hadn't used steel, the structure would have been a lot heavier and a lot more apparent. Steel allowed us to create a building that was delicate, with very thin floor plates and walls. We did a lot of careful re-arranging of the columns so that they would disappear into the walls. Because the space in this town house was so tight, we wanted something that would fit within a 6" stud wall. A 4"×4" Fire-Trol column in its finished dimension [with the steel jacket] was 6"×6". That was something that we couldn't achieve with a regular column and spray-on fire protection as UL required."

The columns are also useful for applications where steel is architecturally exposed. "The exterior shell can be used in a lot in applications where steel is exposed," Hughes said. "You can paint it to match [the building's architectural features] or we can blast them. It looks like a regular steel column once you put the shell around it."

"They are popular in buildings with atriums where all columns are exposed to view," Aldo said. "We can provide many different shapes—round, square, even octagonal shells. We can modify the shape and size as long as we maintain the minimum clearances required by UL."

One downside to the Fire-Trol columns can be difficulties with field connections.

"A drawback of the system is that there is little room for error or flexibility for field changes," said project structural engineer John Gianetti, of Robert Silman Associates. "If there is a field change or error in locating the connections, then the insulating material and exterior shell must be removed and restored after the new connection is made."

However, in the case of the West Village Town house, there were no such problems, and the project team was satisfied with the columns. "The field supervisor on the project was so happy," Powell said. "[There were] no worries about fire proofing or knocking it off."

—Beth S. Pollak

For more information about pre-fabricated fire-protected columns, visit:

- [www.deanlally.com](http://www.deanlally.com)
- [www.dean-steel.com](http://www.dean-steel.com)
- [www.blackrockcolumn.com](http://www.blackrockcolumn.com)