



## **WSP USA retrofits core of Hudson Commons; A 17-story office tower**

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Manhattan, NY The vision of constructing a 17-story skyscraper on top of an existing office building is nearly a reality, thanks in part to WSP USA's innovative approach to retrofitting the building's core.

Since it first opened as a warehouse in 1962, the original eight-story building at 441 Ninth Ave. has been a functional, understated presence in the downtown area. Even when it was reconfigured as an office building in the 1980s, the building still retained much of the architectural character from its original era.

When the building was acquired by Cove Property Group in 2016, they planned a vertical expansion of their property, now known as Hudson Commons. While such a move often requires demolition of the existing structure, Cove sought the most cost-efficient solution to achieve the maximum rentable area, which required the rehabilitation, retrofitting and reuse of the existing structure.

As the structural engineer for KPF—the design architect for the new tower—WSP was tasked with finding the best feasible options to build a modern tower atop an existing 55-year-old cast-in-place concrete building.

“With few precedents for such an ambitious project, this was not going to be a simple task,” said Joseph Provenza, associate at WSP and project manager for Hudson Commons.

“This is a very special project,” Provenza said. “The complexities of articulating old and new—not to mention the mixing of steel and concrete—are very particular to the structure and the client’s needs. I have never seen anything quite like it before.”

For the project to succeed, several challenges had to be addressed, from precise demolition procedures without the use of interior shoring, and retrofitting the existing columns, slabs and foundation systems; to the articulation of the new building core.

“Shoring can be very costly, so it was important to the owner that we approached the project with a plan for shoring-free demolition to accommodate the new core,” Provenza said. “In lieu of shoring, the existing slabs were reinforced with a combination of temporary and permanent steel members that provided the required support of the structure.”

A 125 ft. by-25 ft. area inside the existing building was demolished from ground floor to roof to allow for the installation of a new reinforced concrete core, which provided adequate lateral stability and stiffness for the new, taller building. To achieve this, the existing floor slabs around the new core were reinforced with steel members above and below the slab, some of which remained in place as part of the new core.

The demolition process also included the careful removal of two existing columns, a meticulous exercise of coordination with the construction team.

### Offsetting the Cost

To support the increased load demands of the new tower, existing concrete columns were retrofitted with shotcrete jacketing, and large-diameter bars run through the existing slabs from foundation to the lowest level of the new tower.

“We used higher capacity steel bars—almost two inches in diameter—for reinforcement of the larger column jackets,” Provenza said. “Even though these large-diameter bars are not readily available, are more expensive than standard sizes and were custom-ordered for the project, fewer holes were required to be drilled through the existing slabs than if we had used smaller-size reinforcement.

He added that the decision to go with the large-diameter bars was also driven by the client’s desire to minimize the size of column jackets, which were ultimately kept at 12 inches or less.

“This strategy allowed us to complete the column retrofitting more quickly, offsetting the cost of the custom steel,” Provenza said. “Besides, in a job like this, speed is everything.”

Shotcrete was used to place the column jackets, and existing column capitals were rebuilt to pay tribute to the 1960s aesthetics of the original columns.

### Foundation Retrofitting

Existing column foundations were retrofitted to support the new loads of the larger building. Column foundations near or within the footprint of the new core were articulated with a new cast-in-place foundation mat bearing on rock, including rock anchors at key locations to control uplift.

“Now, a new cast-in-place concrete core is threaded through the existing structure from foundation to the new roof, providing lateral stability and adequate stiffness to the new larger building,” Provenza said.

The new steel tower sits atop the existing roof, and the column grid of the new tower is carefully coordinated with the existing column locations below. The steel tower has fewer columns than the existing structure, providing more expansive tenant spaces, thus optimizing the tower footprint.

“To maintain a continuous load path, the columns of the new steel tower are sloped to meet the

locations of those in the existing building so that no heavy transfers are required,” Provenza said. “Built-up beams on the ninth floor transmit the horizontal forces from the sloped columns to the core and reconcile elevation differences between the existing roof and the new building. The intersection of these structural elements was carefully detailed to meet the engineering requirements while also being cognizant of constructability aspects.”

The ground floor was partially lowered to allow for new spaces with taller ceilings, including the lobby and additional amenity spaces. The existing slab was reinforced with steel members below, and a new steel structure was installed for the new lowered ground floor area.

“These solutions not only saved the owners considerable time, but millions of dollars as well,” Provenza said.

### Something Elegant

Another feature included in the project is the potential to turn outdoor open areas on the ninth and 25th floors into green spaces for the tenants.

“The existing structure has been reinforced, and the new one is designed to allow for landscaping that could include grass, trees and other green uses,” Provenza said. “It will be the decision of the tenants on those floors, but the structure has been fitted to allow for the creation of something quite elegant on those spaces.”

To support the significant load of a fully landscaped area on the original building’s roof, the existing slab was retrofitted with a new steel sub-structure and was detailed in such a way as to not penetrate the existing roof, which would have added significant cost to the project.

Nearly every level of the new building features terraces or balconies, and the tower’s eccentric core configuration preserves city and river views. An exposed stairway encourages daily use and communication between floors and contributes to the interior’s bright, open expanse. Floor-to-ceiling windows also enhance daylight coverage on each floor.

The green roof, daylighting architecture and plans for efficient energy and water systems are features that the designers hope will lead to Leadership in Energy and Environmental Design (LEED) Gold certification from the U.S. Green Building Council, and Wired Platinum certification.

### Old and New

Top-out of the new 25-story building is expected to be completed by October, and the owner plans to have most of the 700,000-square-foot office building operational and occupied by next summer.

“Though there have been challenges that arose throughout the project, we have addressed them as they were brought up to us and, in all cases, met the owner’s expectations on all aspects,” Provenza said.

One of his favorite features of the building—located at the gateway to the Hudson Yards development and a few blocks from Penn Station—is how the owner and architect’s vision is intertwined with the urban fabric of 9th Avenue at its base, while the tower speaks to the new development rising just beyond. Despite this stylistic juxtaposition, the clean lines elegantly tie the building together as a cohesive structure.

“As both an engineer and an architect, it has been personally gratifying to see this project come to fruition,” Provenza said. “One rarely comes across a project that mixes steel and concrete while combining old and new with this much attention to detail. Seeing this project develop and mature has been an invaluable experience.”

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