Park Avenue Premiere

BY TIM BRADSHAW, PE

AlanSchindler

The full-block 425 Park Avenue tower stands tall thanks to a collaborative approach and ASTM A913 Grade 70 steel—a first for the Big Apple.


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425 PARK AVENUE is the first new full-block office tower built on Manhattan's Park Avenue in decades. And it's also the first in New York to implement ASTM A913 Grade 70 steel.

The original 1957 office tower that called the block home, once the pinnacle of modernity, has been reinvented via a partial demolition and a dramatic restructuring. The plan involved incorporating a minimum of 25% of the original structure into the new office tower, essentially melding the former into the latter.

The 815-ft-tall, 42-floor tower is topped with three steel-framed fins that soar 160 ft above the roof level. At ground level, occupants and visitors enter the building via a 45-ft-tall lobby featuring sky gardens. The design acknowledges both the building's current surroundings and the site's history, incorporating horizontal window bands that reference the Universal Pictures Building to the north, as well as vertical white mullions as a modern reimagining of the original office building at the site.

In addition, the building was designed to achieve LEED Gold certification and lead the sustainable skyscraper pack as New York's first WELL-certified building. The WELL Building Standard takes a holistic approach to health in the built environment, putting occupants' and visitors' health and wellness at the center of a project's design. Features like bicycle storage, changing rooms, a high-energy performance envelope, and tall ceilings facilitating abundant natural light all contribute to the project's goal of meeting both certifications.

Structural System

The new tower replaces a 35-story building built in the 1950s while retaining 25% of the existing structure as its base. The existing structure was partially demolished down to the 17th floor, and

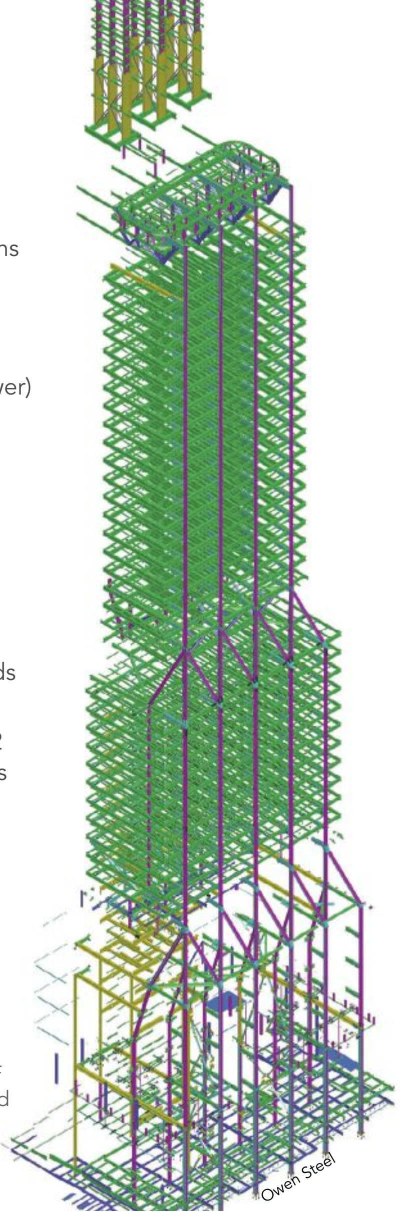
opposite page: The 815-ft-tall, 42-floor tower is topped with three steel-framed fins that soar 160 ft above the roof level.

above: The tower's vertical white mullions are a modern reimagining of the original office building at the site.

- 8,000 structural tons
- 83,314 detailed pieces
- T.O. St. elevation: +729 ft 2½ in. (tower)
- T.O. St. elevation: +892 ft 6 in. (fins)
- 126,265 bolts
- Heaviest member: 39.8 tons
- 12 columns touch foundations
- 48 total anchor rods in the foundations
- A913-70 and A992 structural members
- A572-65 and A572-50 plate material

right: A 3D structural model of the steel framing system.

below: The temporary steel elements, some of which were incorporated into the tower's final framing system.



the remaining 17 floors of the existing construction temporarily stayed in place while the new building structure was erected around and inside of it. As a result, by the end of construction, the goal of preserving 25% of the original building was achieved, and this existing space was seamlessly integrated into the new building.

The structural system consists of complex structural steel framing connected to a concrete "spine" shear wall located at the back of the building. W14×873 to W14×283 members were used for the columns, and W14 to heavy W36 members were used for the beams. In addition, the framing also incorporated multiple 30-in.-deep steel plate girders with 4×24 flanges.

In order to achieve the large flexible floor plate and the column-free space in the high-rise portion, steel was the natural choice with its high strength-to-weight ratio and long-span capability. In addition, the construction sequencing required the use of members that could both act in compression during construction and then in tension once the temporary truss system was removed, as floors for the mid-rise portion (with a floor-to-floor height of 44 ft) hang from the truss system located between the 20th and 22nd floors.

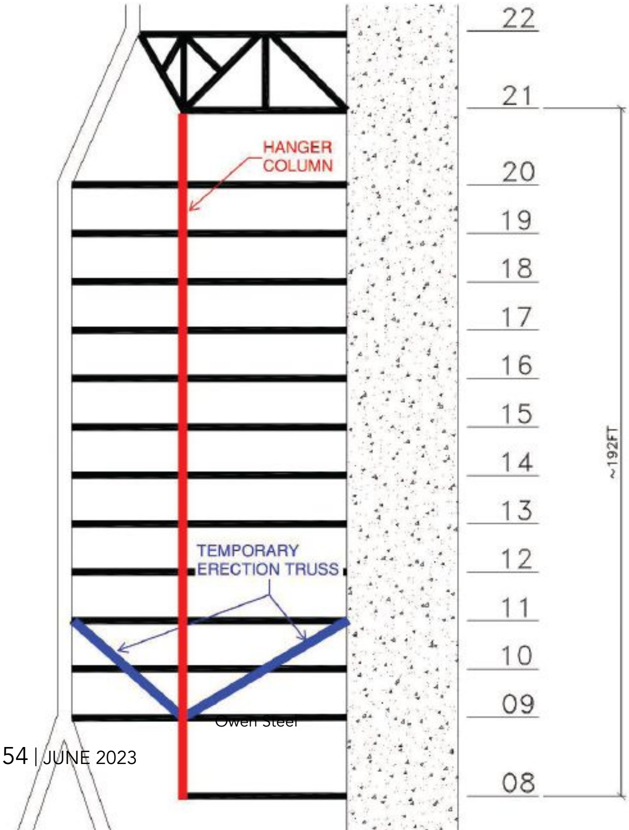
Once steel was determined to be the best fit, the design team specified ASTM A913 Grade 70 steel—a first for a New York project—for the larger column elements to further take advantage of steel's strength-to-weight benefits and to reduce the weight of the structure. This resulted in a roughly 30% savings on the steel package. In addition, the recycled content of the structural steel (the project incorporates approximately 8,000 tons in all) was a contributing factor in the goal of achieving LEED Gold certification.

The decision to locate the core at the rear of the building was a departure from the typical tall building practice of using a central core and a perimeter structure with columns at each corner. The core walls were erected first, and adjacent wings followed close behind. The existing structure was locally demolished down to the grade level to allow unimpeded access when it came to construction equipment and unobstructed placement of the core foundation mat. Temporary steel bracing was introduced to make up for the loss of the existing building's core.

While the concrete core was being erected, the new building's foundations were being installed. Temporary transfer structures were created where needed to allow excavation under the existing columns, and foundation work was followed by the erection of new steel columns that would support the office floor plates that were needled through the existing structure. Once those were secured in place, concrete framing of the seven-story base was poured over the existing structure at every other existing floor to form the new building's gravity system while leveraging the existing structure to eliminate formwork and drastically reduce shoring.

Recessed central and high-rise blocks were framed with long-span steel and concrete composite girders. Each recess was achieved by incorporating a set of exterior sloping columns, all of which were placed at the outside of the office floor plate to maximize available tenant space while creating a prominent feature for the building thanks to the metal cladding wrapped around them. The cladding, including insulation, tolerances, and connections, had to fit into the architectural vision, requiring members and connections to be compact and shaped in a special manner. Solid steel nodes located at the transitions between regular and sloped columns were sculpted to match the shape of the sloping façade (the columns are sloped at 65° and the slope of the diagrid plane is 71°).

Given that the exterior columns are integrated with the cladding system, their footprint was kept to a minimum, again, by incorporating ASTM A913 Grade 70 steel. In addition, the team



Solid steel nodes located at the transitions between regular and sloped columns were sculpted to match the shape of the sloping façade.

Owen Steel

Fabricating a node in Owen's shop.

Owen Steel

Erecting one of the building's sloped columns.

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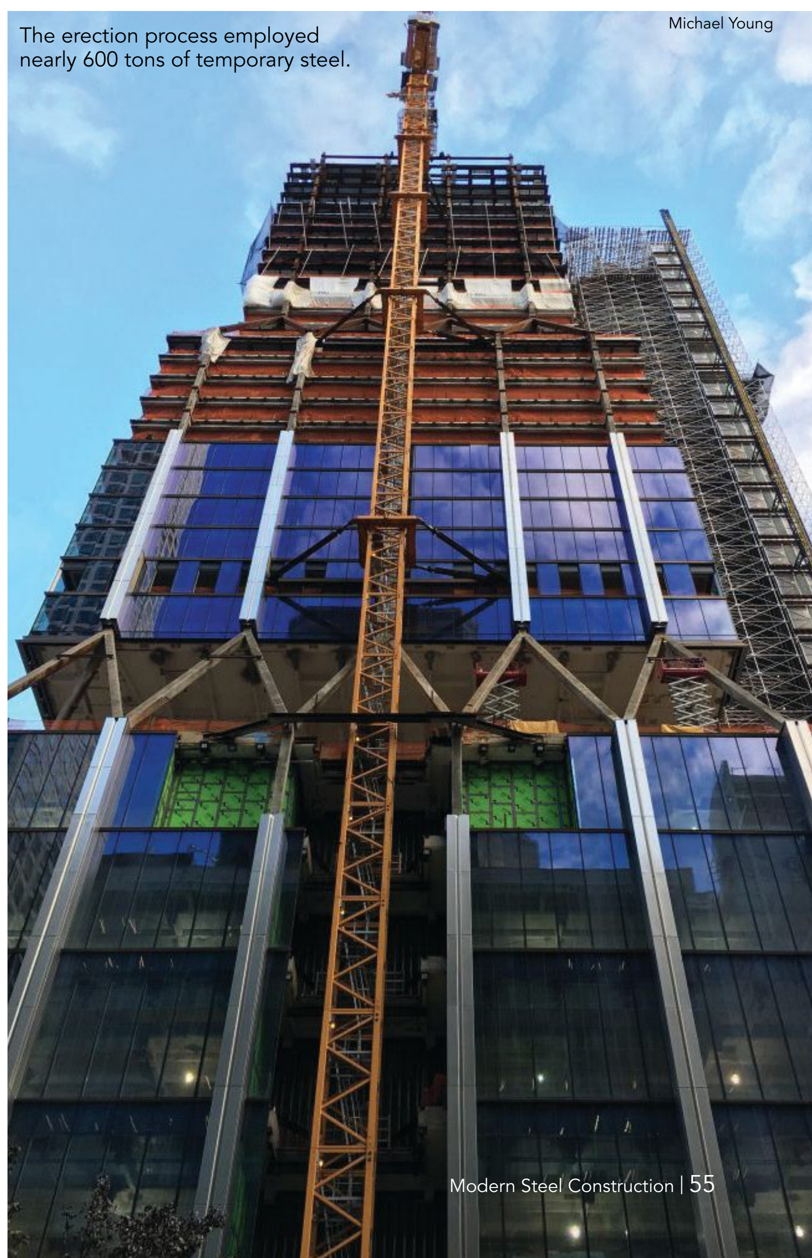


The erection process employed nearly 600 tons of temporary steel.

Michael Young

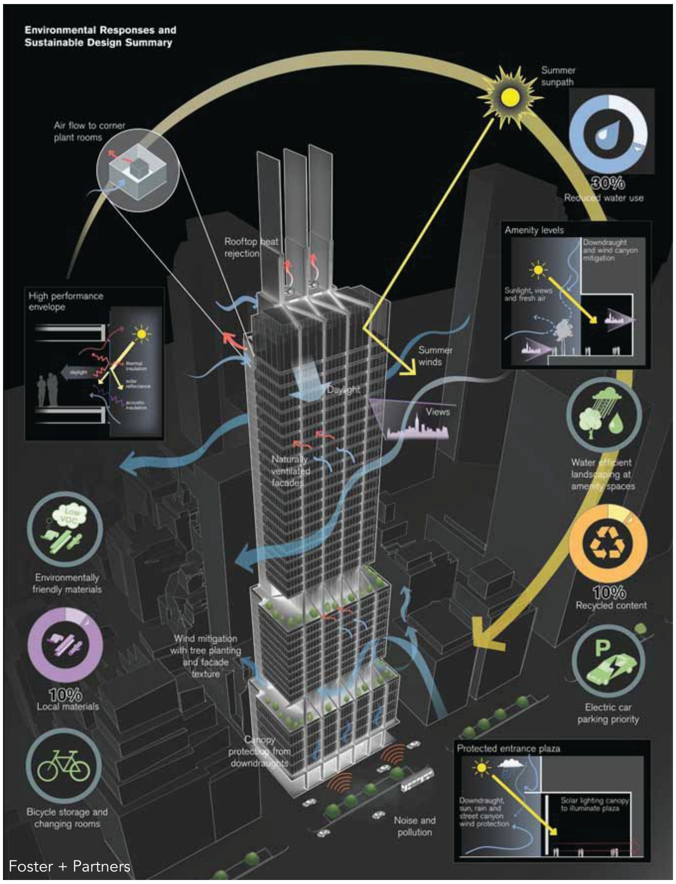
went with ASTM A572 Grade 65 plate to form large laminated shapes in the exterior columns and the laminated sculpted nodes in the lower tiers. The team turned to Tekla Structures modeling software to achieve a high level of coordination between the structural steel portion and all the other trades.

Meeting the Vision

The building's structural elements are primarily shaped around the architect's vision of a 21st-century column-free office space with abundant natural light. All office floor plates are framed with long-span girders (up to 60 ft) and 16-ft cantilevers to maximize the column-free spaces available to tenants. In fact, all office floor space on the upper tier levels is completely column-free.

The two mechanical floors, located respectively above double- and triple-height amenity floors, are contained within bathtub-like structures and suspended from the building's 22-ft-tall outrigger trusses—which support suspended mechanical spaces and ten office floors below as well as the 20 floors above them—to maximize the natural light available in those amenity spaces. All existing columns in the base of the original structure were cut back, resulting in existing floors being suspended from the new framing above, leaving only six interior columns within a space originally supported by 28 columns.

The successful design and installation of the welded steel plate nodes located at the transitions between regular and sloped columns were the result of a team effort between structural steel fabricator Owen Steel and structural engineer WSP. Mockups of the building nodes were developed to determine preheat requirements, and alternate acceptance criteria were developed ahead of erection to avoid the potential of unnecessary remediation of any weld defects.



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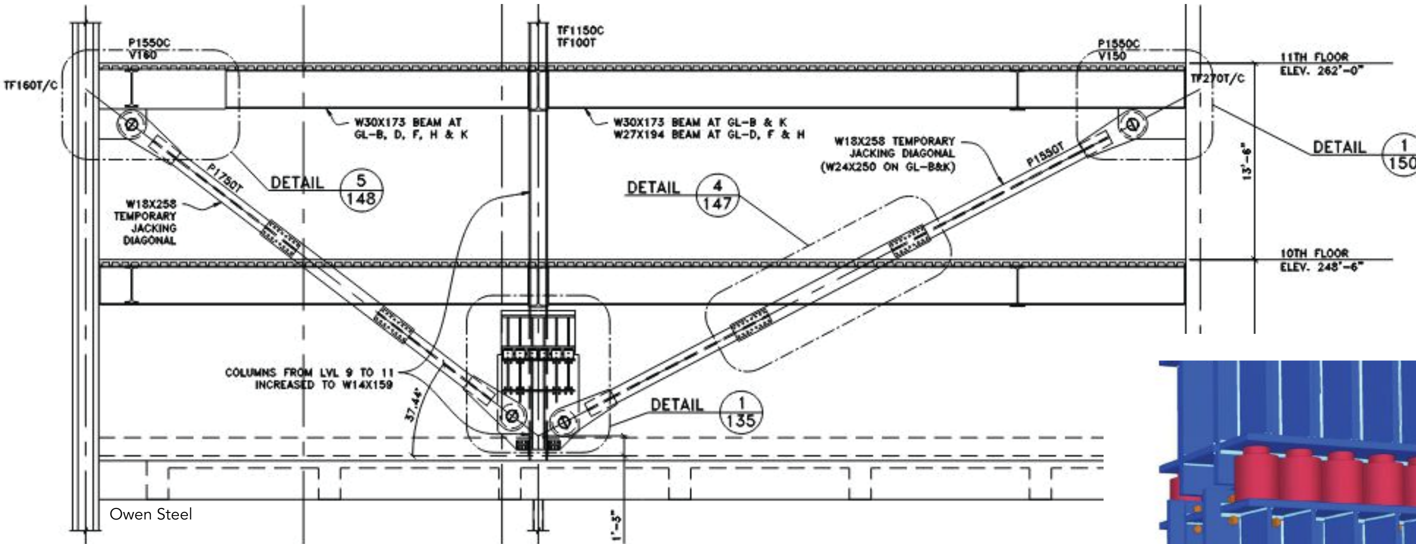
The erection engineer also worked very closely with Owen Steel and WSP to evaluate the load requirements for the various stages of construction. Members that eventually became hangers supporting the floor system were initially used as compression members to temporarily support the floors during erection. Once the erection was complete up to the supporting truss, a progressive jacking system was used to establish a preset elevation for the floor framing so that when the temporary supports were removed and the stress in the member reversed from compression to tension, the floor framing would be at the correct elevation.

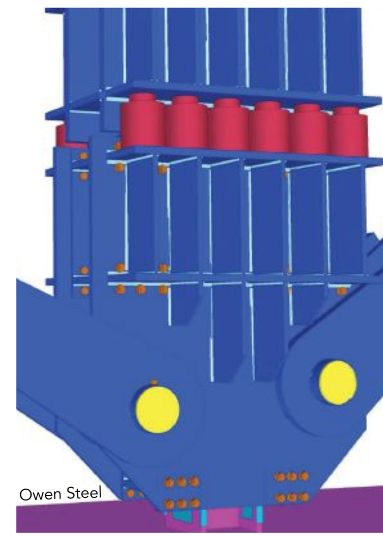
In addition, in order to install the large plate girders into the existing structure that was retained, steel "runways" with rolling trolleys and overhead rails with hoists were incorporated into the design of the new structure. This system allowed the new plate girders to be slid into the existing structure horizontally and moved laterally into their final installed positions. In all, 590 tons of temporary steel was required to install and stabilize the


Owen Steel



above and below: Temporary jacking for a truss.

right: A jacking node.



existing and new structures during erection. All of this temporary steel then had to be removed after erection was complete, with much of it being cut into small pieces and removed using the construction elevator.

Given the big aspirations for an iconic new tower, together with the mandate to meld the new structure with the existing old one, the design and construction team did an excellent job meeting its goals—thanks in part to the implementation of ASTM A913 Grade 70 steel. The 425 Park Ave tower is a superb example of design excellence achieved through focused, innovative structural design solutions and determined teamwork. ■

Owner
L&L Holding Company, LLC, New York

General Contractor
AECOM/Tishman, New York

Architect
Foster + Partners, New York

Structural Engineer
WSP, New York

Erection Engineer
Zieman Engineering, LLC, Stamford, Conn.

Steel Team

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Erector
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Detailer
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