



THE PLAZA HOTEL

Steel Grandeur

For more than 100 years the Plaza Hotel has stood as New York City's landmark of luxury. But even with several modernizations over the years, the hotel's opulent interiors were beginning to show their wear when Elad Properties purchased the building in 2004 for \$675 million. With the Plaza its flagship property, the Israel-based developer set forth to return the fabled institution to its original 1907 splendor. As part of its exhaustive \$400 million renovation and expansion to transform the space—formerly home to 800 hotel rooms—into 182 luxury private residences and 282 hotel rooms and suites, the developer added a new floor to the top of the building's 5-story mansard, increasing the height of the Plaza from 19 to 20 stories, and creating a new spa and garden above the historic Palm Court. Throughout the project, extreme care was taken to replicate the building's sumptuous detailing with historical accuracy. The same was true when it came to framing the new spaces, where the engineers chose structural steel for its ability to seamlessly adapt to the existing structure.

Elad hired Costas Kondylis & Partners, along with landmark architect Walter B. Melvin, interior design architect Gal Nauer, and a host of restoration specialists, to complete the redesign. The job of managing the ambitious restoration and expansion went to Tishman Construction, which assembled an all-female structural engineering team dubbed "the women of steel." The team included Maggie

M. Kwan of Tishman; Rodica Kestenband, Katalin Palyi-Hoppe, and Olga Gologorskaya of structural engineer WSP Cantor Seinuk; and Liz Huddy of steel erector DCM.

Before framing out the additional spaces, the existing structure had to be modified to accept the addition of new structural members. The team did extensive research, searching through city files for drawings of the original Plaza Hotel. Even after this considerable effort, the team encountered many surprises during the demolition of the interior, including the existence of walls and structural elements that didn't show up in the original drawings. "We had to evaluate the existing members on a case-by-case basis," says Kwan, "in order to determine where reinforcement was necessary and where structural elements needed to be removed and replaced entirely." The engineers' evaluation of the existing steel concluded that it is equivalent to A-36 material; all new members were fabricated from ASTM A992 Grade 50 steel.

Connections between new and existing steel elements were made in two ways: For one, DCM welded clips to the existing steel and took field measurements to which the new members were fabricated. When the members arrived on site, DCM set them and field bolted them to the welded clips. In other instances, the subcontractor used drop-in frames, which they fillet welded to existing members, a technique that allowed flexibility of location within the Plaza's frame. In either case, the new steel was



Previous The Plaza's mansard was completely replaced and a floor was added.

Top left and bottom right A Vierendeel truss added in the Plaza's courtyard created space for a spa and garden. **Middle and bottom left** New steel framing on the 19th and 20th floors.

delivered to the site via truck and lifted to where it was needed using a crawler crane and highline hoists. Most lifts were done on weekends to limit disruption to pedestrian traffic. A490 high-strength bolts were used throughout the project.

Opening up the new penthouse floor raised the hotel's landmarked mansard roof by 14 feet. Designed with sloping glass setbacks that take advantage of the stunning park views and maintain the roof's original sight lines, the penthouse level was added after the original roof was removed. Tishman installed temporary shelters over various sections of the building to avoid exposing the whole area to the elements for a long period. Some of the 19th floor columns had to be strengthened to accept the additional load of the 20th floor, as well as the load of new mechanical systems that were added to the roof. Some of the 19th floor was reframed in order to level the floor. The new members ranged in size from W8x15s to W24x29s. The smaller members were used for the penthouse floor's columns, whereas the larger members were used for girders from which the team hung the additional space created for the floors below.

Adding the new spa and garden was slightly more complicated, as the floor loads associated with these spaces had to be carried by spanning the entire courtyard to avoid dropping columns into the restored Palm Court. The engineers decided to employ Vierendeel trusses, using their rectangular openings to create useable floor space for the spa. The trusses, which measure 96 feet long and



Right A sloping glass wall on the new penthouse floor maintains the Plaza's historic sightlines.

15 feet high, are made up primarily of W27 chords and columns, though member sizes vary depending on loads, from W24x94s and W30x235s. All connections between columns and chords are bolted moment connections.

Getting these 165-ton trusses into the courtyard presented a challenge of its own. The solution devised by the team used crawler cranes to slide the top and bottom chords through the Plaza's windows on 59th Street, where cables suspended from ceiling framing picked them up and delivered them to the courtyard. Once in the courtyard, cables suspended from above held the trusses in place while ironworkers aligned, infilled the columns, and connected them to the existing structure. DCM made these connections by cutting holes in the existing built-up members, threading gusset plates through, and welding the plates to both sides of the columns. Then the trusses were bolted onto the plates. Once pinned in place the team bolted the columns into place between the chords. The operation, carried out on a weekend so that street traffic would be light, was particularly daring because extra caution was needed to protect the Palm Court from threat of damage. Before this could take place, the existing columns had to be encased down to the foundation to handle the extra loads imposed by the new spaces.

Looking at the Plaza today, you would never know that its roof had been completely removed and replaced, one floor higher, or that its interiors had been entirely gutted and redesigned. The team's attention to detail and historical sensitivity was such that the venerable structure appears the same now as it does in archival photographs from early in the 20th century. It's a tribute to the properties of structural steel, which integrated easily with the existing structure, that the landmark's faded grandeur has not just been restored, it has been expanded in new ways. ■



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 Mechanical Engineer: **Flack & Kurtz**, New York, NY
 General Contractor: **Tishman Construction**, New York, NY
 Facade Consultant: **David V. Abramson & Associates**, Newark, NJ
 Structural Steel Erector: **DCM Erectors, Inc.**, New York, NY
 Miscellaneous Metal Erectors: **FMB, Inc.**, Harrison, NJ;
United Iron Inc., Mount Vernon, NY
 Architectural and Ornamental Metal Erector:
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