



U.S. DISTRICT COURTHOUSE CADMAN PLAZA

Steel Structure Adapts to Security and Design Upgrades

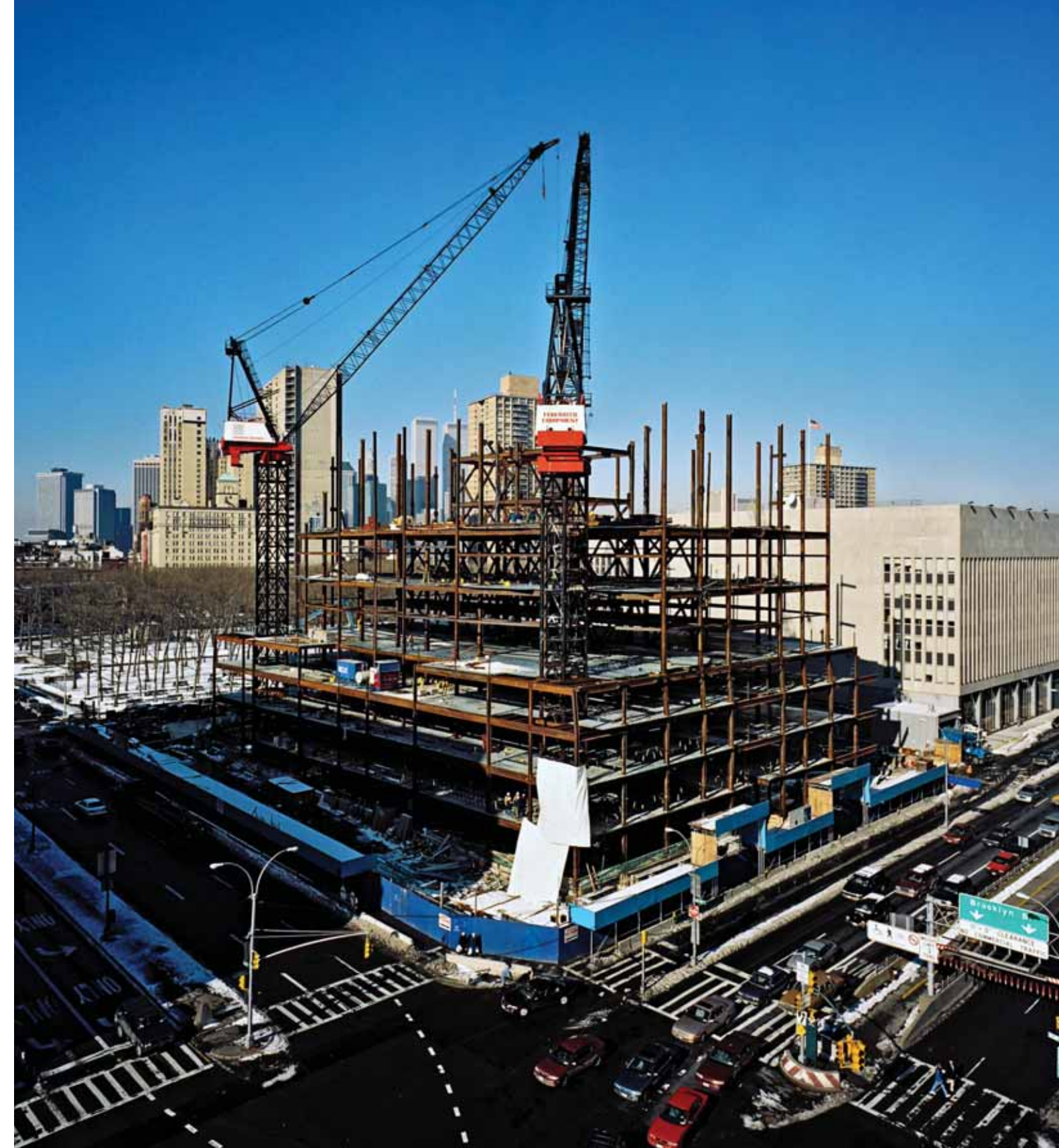
In the ten years it took to build Brooklyn's newly opened U.S. District Courthouse at Cadman Plaza a series of terrorist incidents here and abroad compelled the team to incorporate ever-increasing security measures. On April 19, 1995, only a month after Cesar Pelli & Associates (now Pelli Clarke Pelli) began its design work on the project, came the bombing of the federal courthouse in Oklahoma City, and the subsequent focus on protective glazing and resistance to progressive collapse. Three years later, the U.S. Embassy bombings in Africa sent shockwaves through the design world, raising new security concerns for public buildings. And finally, the World Trade Center attacks of September 11, 2001, horrible in both their scope and proximity to the courthouse, abruptly brought about a national reassessment of high-rise building safety. Shortly thereafter, the Anthrax scare necessitated the incorporation of new screening and circulation solutions into lobby design.

By September 11, 2001, the courthouse project had erected the 15th and final story of its structural frame. Construction at that point halted

so that the erection crew from DCM could help clear Ground Zero and search for remains. Though the designers and engineers on the project could not discuss in detail the structural and design changes these events demanded, they did acknowledge that without the flexibility and inherent strength of structural steel, the retrofitting undertaken during the design and construction process could never have been accomplished. "Every time we had to change things—from the introduction of progressive collapse criteria all the way to bomb blasts and back," explains Robert Collegio, a project manager with the U.S. General Services Administration (GSA), "the structural engineer would go and check the integrity of the steel design, and each time it was still intact."

The response to these human tragedies with design features that could help mitigate them was immediate. It also brought financial challenges. John Gering, principal in charge for executive architects HLW International, points out that ADF erected the steel structure in record time. Had the building been constructed reinforced concrete, it probably

OPPOSITE The 15-story tower encloses 16 U.S. District courtrooms, nine magistrate courtrooms, and 28 judges' chambers, as well as administrative offices and circulation.



ABOVE The designers employed many means to give the building extra stiffness, including using large members and welding the frame and the floor plate together with shear connectors.

ABOVE Two tower cranes erected the structural steel members.

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ABOVE AND OPPOSITE Running HVAC through penetrations in the structural steel girders allowed the designers to maximize ceiling heights.

would have still been rising when the curtain wall contractor and subsequently the general contractor was forced into bankruptcy, an outcome that could have further delayed or imperiled the project's realization. ADF's continued heroics, along with the expert management of the GSA, ensured not only the project's completion but led to the courthouse opening on time, a fact the building's occupants and the public can no doubt appreciate given the stellar building that now stands at Cadman Plaza. "I personally think we saved a lot of time with steel over formwork and concrete," Collegio says.

In spite of the added security requirements, the courthouse's design goals remained the same: As design architect Cesar Pelli wrote after the project's completion, "It is a noble structure that conveys the majesty and openness of the American judicial system." The design achieved this through a careful combination of modern glass tower elements and features that pay respect to such iconic Brooklyn landmarks as the Williamsburg Bank Building. One of the most important of these is the base of the courthouse building, a four-story limestone plinth that mirrors the subtle brutalism of the original six-story courthouse next door. "Once the plinth was set," says Gerring, "we could define the building as its own while still respecting the context of the neighborhood." An all glass tower wouldn't have been appropriate. Up from the base, a more typical Pelli building rises: a glistening, curvilinear glass tower punctuated by limestone columns that weave the courthouse into the fabric of downtown Brooklyn.

The architects arranged the courthouse's program elements within a series of setbacks. The tower rising above the four administrative and circulation floors at the base houses 16 U.S. District courtrooms, nine magistrate courtrooms, and 28 judge's chambers. To help reduce the floor plate, the courtrooms were arranged four to a floor and the chambers were placed on intervening floors. This makes for seven district floors setback from the base and four magistrate floors receding behind those. At the top is a final setback for the double-height mechanical floor, visible from the street as a solid limestone cap.

This layout necessitated beams of different sizes and capacities for the appropriate floors. On the typical floor, beam sizes vary from W21x145 to W24x182, while the girder sizes vary from W24x182 to W27x584. Most of the columns vary from jumbo W14x928s down to W12x148 shapes, though the braced core, which handles all of the structure's lateral loads, has even heavier members. There the columns range from W14x1,493s down to W14x324s, and the diagonal braces range in size from W8x101 to W12x348. Generally, A325 and A490 high-strength bolts were used to connect the structural members. All of the structural steel used in the project was Grade 50.

To give the building extra strength throughout in answer to security concerns, structural engineers Narov Associates designed the structural members to work compositely with the floor slabs, a system that increased the structural members' capacity by 25 to 30 percent. This was achieved through the use of 4 1/2-inch-long by 3/4-inch-diameter shear connectors that were welded to the beams and cast into the slabs. The beams were also cambered during fabrication. "Cambering the beams gives them an initial upwards sweep, so that when they are loaded they come down to a flat position," says Fruma Narov of Narov Associates. "This significantly reduces the deflection of these beams under the full loading."

One of the greatest design challenges of the project was achieving the 16-foot floor to ceiling heights that the GSA called for in the courtrooms, while staying within a building height set by the budget. As Narov says, "You're always trying to raise the height of ceilings without actually raising the height of a building." To accomplish this the designers raised the ceilings between beams, reducing the thickness of the floor slab down to 6 inches and creating the open inviting space that courts seek to inspire comfort. Here, again, steel's inherent strength and flexibility aided the designers in realizing their solution: A series of penetrations in the beams and girders allowed the HVAC to be fed through the building without lowering the ceilings below the bottoms of the structural members. "With the penetrations all lined up like soldiers, it made the follow-up trades that much easier," Collegio attests.



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U.S. DISTRICT COURTHOUSE, CADMAN PLAZA

Owner: **United States General Services Administration** New York, NY
 Design Architect: **Pelli Clarke Pelli Architects** New York, NY
 Architect of Record: **HLW International** New York, NY
 Structural Engineer: **Narov Associates** New York, NY
 Curtain Wall Consultant: **Gordon H. Smith Corp.** New York, NY
 General Contractor: **Bovis Lend Lease** New York, NY
 Inspection: **URS Corp.** New York, NY
 Steel Inspection: **Cole Consulting**
 Structural Steel Fabricators: **ADF Steel Corp.** Canada
 Structural Steel Erector: **DCM Erectors, Inc.** New York, NY
 Miscellaneous Steel Fabricator and Erector: **Post Road Iron Works** Greenwich CT
 Architectural Metal Fabricator and Erector: **Airflex Industrial, Inc.** New York, NY
 Ornamental Metal Fabricator: **SRS, Inc.** Metuchen, NJ
 Ornamental Metal Erectors: **Airflex Industrial, Inc.** New York, NY;
SRS, Inc., Metuchen, NJ
 Curtain Wall Fabricator: **LBL Sky Systems** Bois-des-Filion, Quebec, Canada
 Curtain Wall Erector: **Solera/DCM** New York, NY
 Metal Deck Erector: **Walker/ Solera/DCM** New York, NY

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