Starting Over

New York City's new Office of Emergency Management bolsters the headquarters' commitment to preparedness.

BY SALIM ATILEH, P.E., TIAN-FANG JING, P.E., AND RON CHECK

NEW YORK CITY'S OFFICE OF EMERGENCY MANAGEMENT (OEM), LOCATED IN WORLD TRADE CENTER BUILDING NO. 7, LOST ITS HEADQUARTERS ON SEPTEMBER 11, 2001. The agency chose the abandoned, city-owned American Red Cross building at Cadman Plaza in Brooklyn as the site of its new headquarters. Although the building was in disrepair, the structure was basically sound. A thorough search uncovered the original 1954 structural drawings in the building's basement. Under the direction of the City's Department of Design and Construction, Weidlinger Associates began the structural design for the $43.3 million project, a sign of New York's determination to move forward from the past and recommit to emergency preparedness and response. The new OEM headquarters opened this fall.

Rebirth with Steel

OEM's project criteria called for a reclad gut renovation of the existing building, with a new 25-ft extension that runs the length of the building. The completed 65,000-sq.-ft facility was to house a state-of-the-art city Emergency Operations Center within the OEM.

The original 1954 structure was a three-story concrete building with a 76-ft by 178-ft footprint, and columns spaced approximately 19 ft on center in the east-west direction and 23 ft on center in the north-south direction. Slab thickness throughout was 6 ½ in., with 4 in. of fill and finish.

The program requirements included changing the existing central core to a side core, which necessitated the creation of an 8,000-sq.-ft addition on the structure's south side. Another program requirement was the creation of a 70-ft by 100-ft open space in the existing building for the new Emergency Operations Center. This entailed removing the concrete roof slab, beams, and columns without detrimentally affecting the stability of the existing building. This long-span requirement, along with the need to minimize any additional loads on the existing structural components and an extremely fast-track schedule, dictated a steel scheme for the new construction.

The structural system of the addition consisted of steel moment-resisting frames supporting the composite infill beams, which in turn supported the steel deck. All of the girders in these frames were connected to the existing concrete building at the same location as the columns on each level, to minimize the need to drill extra holes into the existing structure. The girders were W18 steel sections, with the exception of two third-floor girders that needed to be heavier in order to support the W8 steel posts and to accommodate the setback of the steel deck at the main roof level.

Shelf angles to support the new facade were attached to the existing concrete using Hilti anchors.

The completed limestone exterior is shown in this view of north facade.

Lateral Loads

Although the original building was not designed for lateral forces covered by the New York City building code, the design criteria stipulated that the existing structure and new addition be designed to resist hurricane Category 2 wind pressures on the main wind-force-resisting system, computed in accordance with a basic wind speed of 110 mph per ASCE 7-02, *Minimum Design Loads for Buildings and Other Structures*. This results in wind pressure varying from 23 psf to 30 psf. For the exterior wall system, adherence to ASCE 7-02 results in wind pressure up to 45 psf.

To analyze and design the enlarged structure, the engineers created a 3-D model using ETABS, a finite-element program. All of the elements were designed in accordance with the NYC building code. The structural steel used throughout the project was ASTM A992 Grade 50 for shapes, 50 ksi steel joists, ASTM A36 for plates and angles, ASTM A500 Grade B for HSS, and ASTM FI554 Grade 36 for the anchor rods.

Opening Up

Creating a 70-ft by 100-ft open space for a new high, long-span roof structure over the Emergency Operations Center required steel joists 40LH16 spaced at 6 ft, 5 in. on center. These joists, which proved to be an economical solution for such a long span, were supported by new steel W21×50 beams that spanned 19 ft, 3 in. and rested on the existing concrete columns. These columns were originally designed for additional loads to allow for possible future expansion such as added roof fan rooms and cooling towers. This reserve capacity was able to accommodate the new loads without the need to reinforce any existing vertical members. All of the W21×50 beams around the perimeter of the opening were moment-connected to provide the expanded structure with sufficient lateral stiffness to meet all NYC building code requirements.

Interface Issues

Attaching new steel additions to an existing concrete structure posed many challenges. Sound concrete is necessary to ensure strong, safe connections between new steel beams or columns and existing concrete elements. The project called for demolition of more than half of the existing roof and removal of most of the interior beams and columns, as well as the existing facade. The primary challenge became to ensure that all of the concrete remained sound. Extra care was taken during demolition to avoid causing cracks in any of the concrete. Hilti anchors—types HY-150 and RE 500—played a critical role not only in connecting the new addition to the existing building through the steel girders, but also in connecting the steel shelf angles, which support the new limestone facade around the building perimeter. The anchors also allowed the design to be adapted to field conditions, as care had to be exercised to avoid drilling through existing rebars.

The new Emergency Operations Center (shown nearly completed, top) required a 70-ft by 100-ft open space.

Looking Good

The building is located near the foot of the Brooklyn Bridge, making it visible to many commuters. Because of this, there were stringent aesthetic considerations as to the placement of mechanical equipment and IT/AV antennae. A 15-ft-high steel parapet was designed to shield the equipment, constructed out of W8 posts spaced at 5 ft to 6 ft on center, which were then cantilevered from existing concrete beams or columns and designed to carry the prescribed wind loads.

Real Value

At the conclusion of the design development phase, the project was value engineered by both the Metropolitan Transit Authority and a value engineering team consisting of representatives from the design firms and the construction manager. Although some value engineering suggestions were incorporated in the final project, changing the steel framing was never even considered. MSC

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Structural Engineer
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Engineering Software
ETABS V8.5.6

General Contractor
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