One Willoughby Square

Brooklyn, New York

Project Description

One Willoughby Square is a 34-story office tower that reaches 495 ft at its pinnacle. Located in the heart of downtown Brooklyn on Willoughby Street between Duffield Street and Albee Square, the 471,000 sf building is the first major ground-up office project to rise since Downtown Brooklyn was rezoned in 2004, and is the tallest office tower in Brooklyn. Programs include retail at the ground floor and cellar, a Pre–K to Grade 4 school on floors two through six, and Class-A office space on floors seven through 34. Constructed on a unique T-shaped lot, the stem of the "T" is sandwiched between existing buildings and houses the building's elevator and stair cores, while the school and office program occupy the main floorplate.

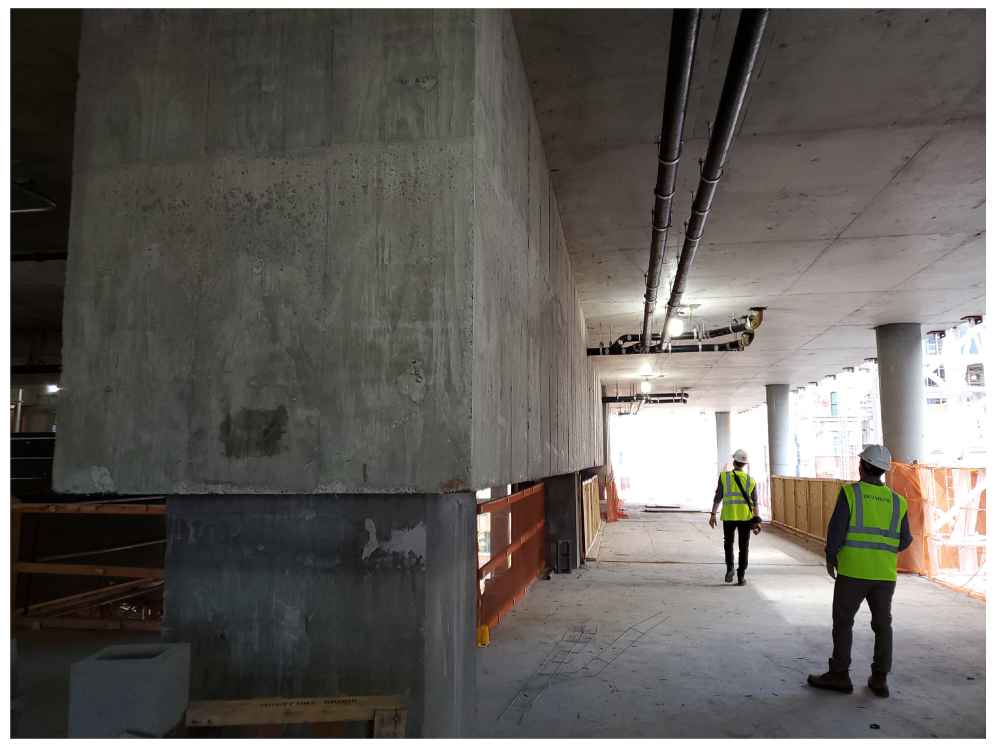
Concrete Description

The building's foundations consist of an eight-foot-thick concrete mat supported by 425-ton 30 in diameter drilled piles and 400-ton 5/8 in drilled piles under the main core walls, and spread footings supporting columns. Thickening the mat to more than 14 ft was required locally to accommodate elevator pits while minimizing underpinning of neighboring properties, and to distribute building loads to caissons within the narrow site constraints. 8 ksi concrete was utilized to construct the foundation mat. With the cellar occupying the full site and a partial sub-cellar, foundation walls were required to support large lateral surcharge loads from the tower columns.

The main structural challenge in designing the building's lateral system resulted from the shear wall core's location outside of the main tower's occupied floor footprint, which lead to large eccentricities and required additional lateral resistance to control drifts due to wind on the east side of the building. To accomplish this, columns around the main floorplate are joined by spandrel beams to form a moment frame. The building's lateral system was further complicated by double-height atrium spaces between the main floorplate and the core, on every other floor. The disconnect was bridged using an in-slab strut system on the solid floors to draw the floor diaphragm forces into the shear wall core.

The focal point of the building's program is the expansive 8,000 sf column-free floor plates dedicated to office space. While long spans in a concrete building are typically designed using post-tensioned systems, due to market constraints and construction schedule the design team chose to use more traditional methods. As such, typical office floors are supported by 36 wide x 30 in deep conventionally reinforced cast-in-place exposed concrete beams spaced at 15 ft on center. The beams span 53.5 ft clear between concrete columns located at the perimeter of the floorplate, some of which protrude past the edge of the floorplate to create architectural expression. To accommodate mechanical ducts along the perimeter of the floorplate, the long-span beams taper to 24 in deep near the supports. The floor slab is constructed with 6 in thick cast-in-place concrete slabs spanning between long-span beams, which were cambered to help control deflections. The beams were constructed using concrete strengths ranging from 9 ksi to 6 ksi, with a focus on clean finishes, given that most of the concrete was to remain exposed in the interior spaces. Cantilevered balconies used a custom Halfen thermal bridge joint to mitigate heat transfer from the interior space.

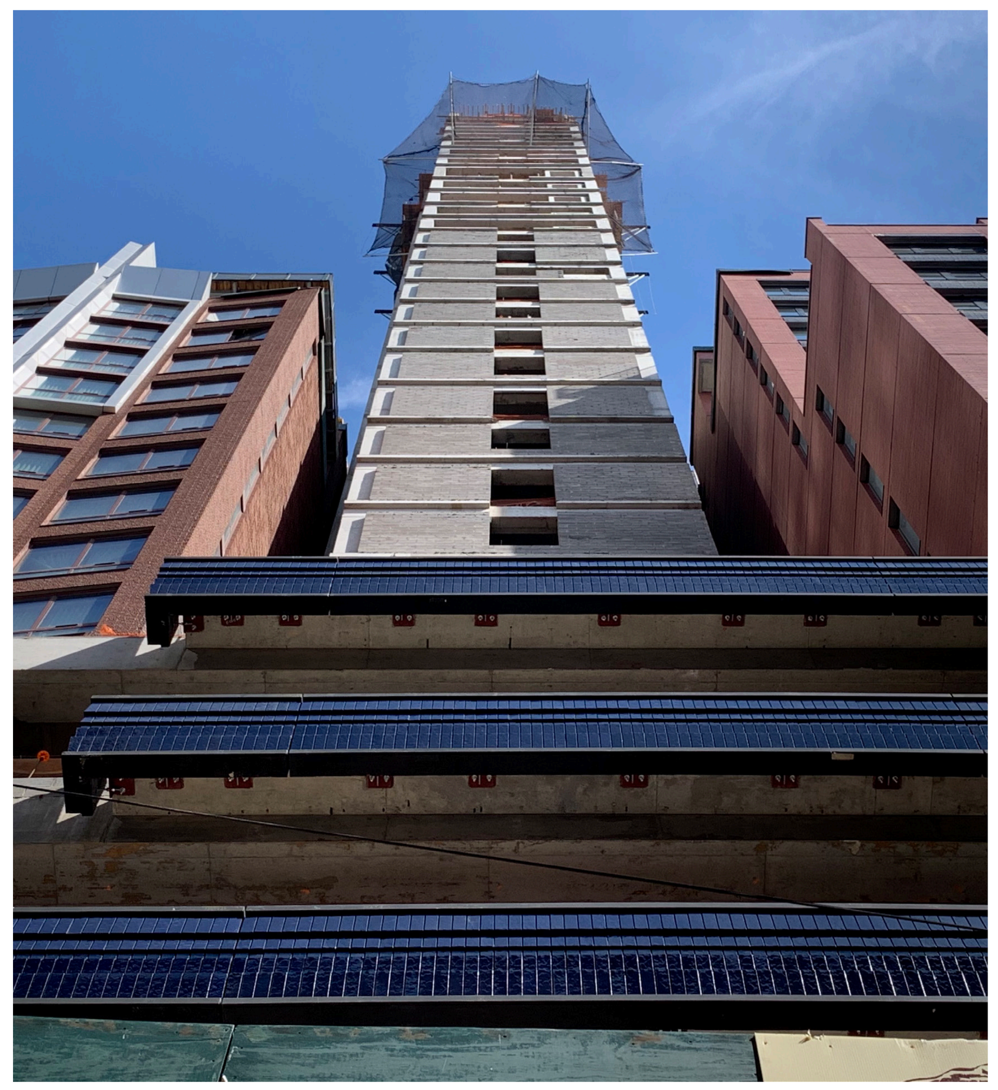
Installation of thermal bridge at cantilevered balconies



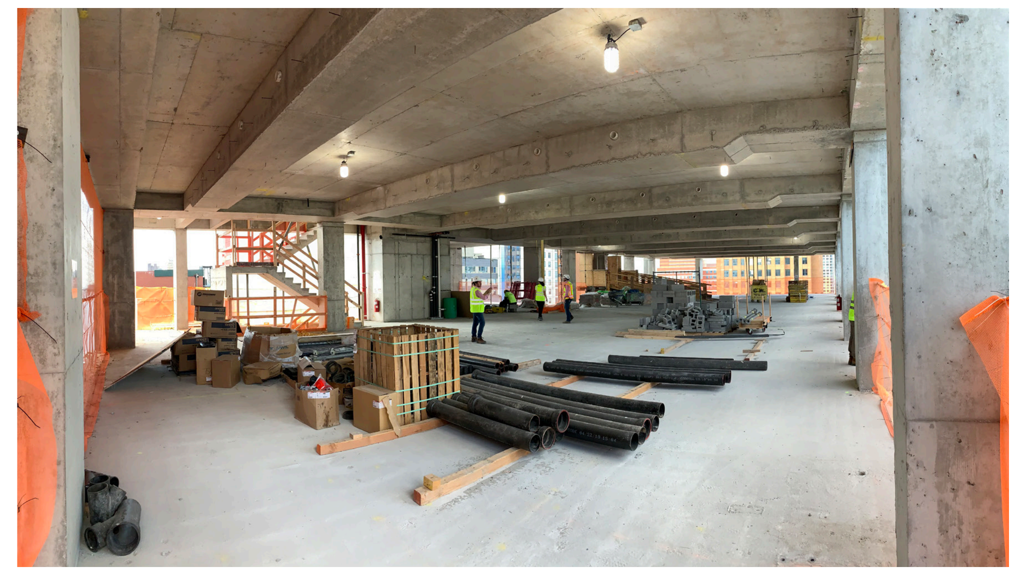
Transfer beams (66" wide x 120" deep) create column-free spaces for school program

Installation of long-span beam rebar

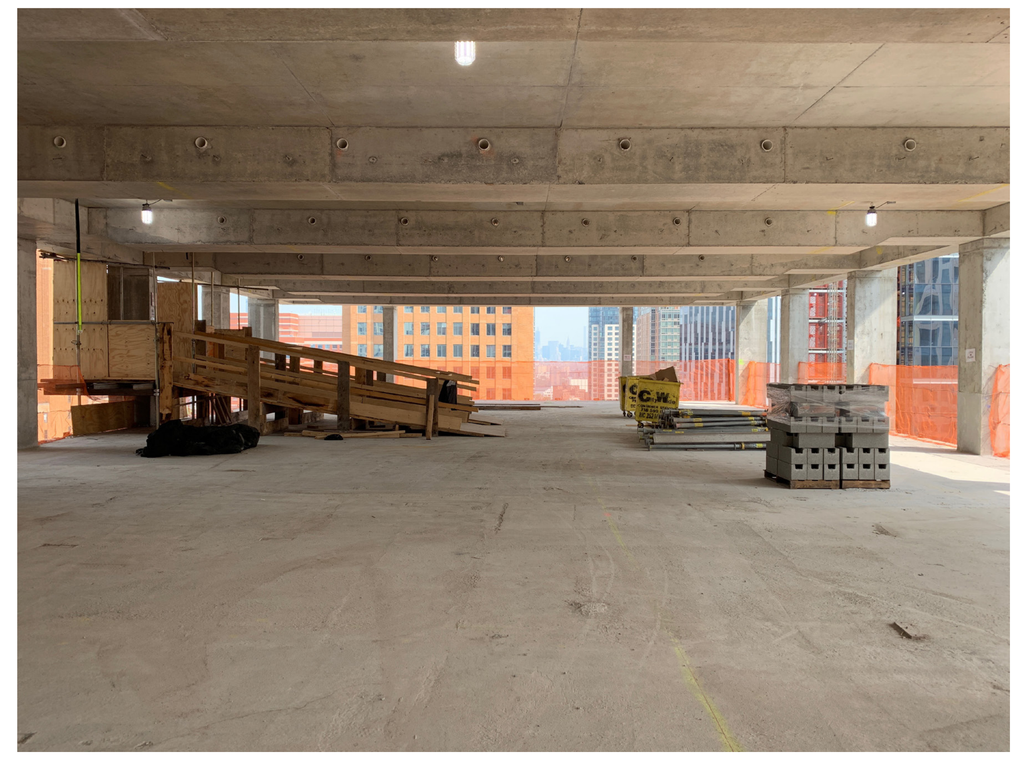
North-East corner of completed concrete structure, with ongoing precast panel and windowwall facade installation.



West Elevation of completed concrete structure; ongoing installation of precast panel

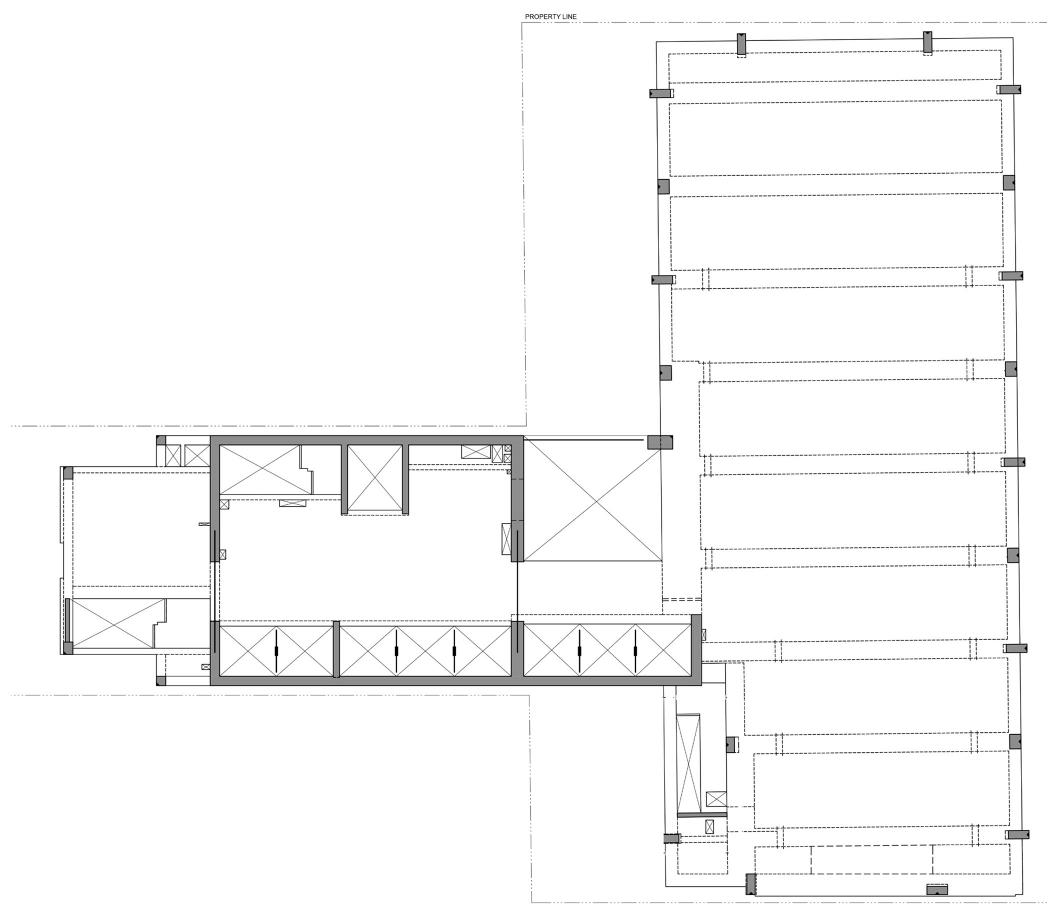


Interior space framed with long span beams.



Class-A office space featuring 53.5-foot column-free clear spans

Tapering of long span beams at perimeter for integration of mechanical ducts.



Typical Office floor plan. Separation of shear wall core and main floor plate to accommodate T-shaped lot.

Developer & General Contractor
JEMB Realty

Design Architect
FXCollaborative

Structural Engineer
DeSimone Consulting Engineers

Concrete Subcontractor (Foundation)
Civetta Cousins JV, LLC

Concrete Subcontractor (Superstructure)
Park Avenue Concrete

FIeld Testing Lab
Atlantic Engineering Laboratories, Inc.