A residential tower and commercial building are the first phase of the 1.8-million-square-foot Flushing Commons mixed-use complex at Union St. and 39th Ave.

Flushing Commons

New York City's Flushing Commons embraces steel framing for the differing uses and layouts of a mid-rise residential tower and commercial building.

SITUATED RIGHT IN THE HEART of the Big Apple's most populous borough, the first phase of the much anticipated 1.8-million-square-foot Flushing Commons mixed-use complex is rapidly taking shape at Union St. and 39th Ave., just a few blocks away from the USTA Billie Jean King National Tennis Center and Citi Field, home of the New York Mets.

By 2021, the five-building complex in Queens will house a residential building and office, retail, parking, and community space. For now, a steel-framed 670,000-square-foot 14-story residential tower, 11-story office building, and a 4-story 270,000-square-foot below-grade garage opened for occupancy earlier this year.

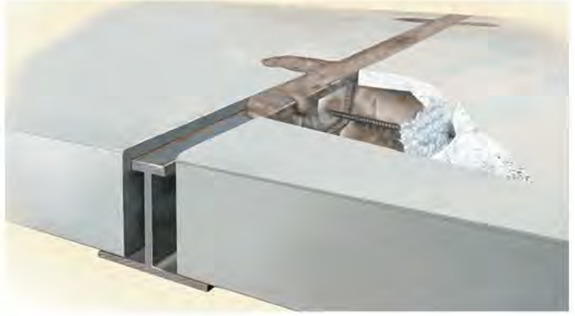
Among the challenges facing architect Perkins Eastman and structural engineer DeSimone Consulting Engineers was designing the structural steel system to optimally support both the commercial and residential towers.

While a steel framing system allowed for larger spans inside the residential tower, this created a challenging planning module for the residential space as typical parking and retail column grids often don't meld with the column spacing required for residential units.

Generally speaking, the columns for residential buildings are tucked away within the architectural elements inside the rooms. This places restrictions on the floor layout when making the columns compatible with the commercial column grids.

To solve this quandary, DeSimone went with the innovative Girder-Slab system—an assembly of asymmetrical steel beams, referred to as "D-Beams"—fabricated from a standard rolled wide-flange section and a flat bar.

"The proprietary system for gravity framing uses the D-Beam, which supports hollow-core precast plank on the bottom flange," says Amit Mavalankar, P.E., senior project manager for DeSimone. "The commercial building is designed using the composite wide-flange steel beams carrying a slab on metal deck with lightweight topping concrete."



This page from top: Girder-Slab Technologies; DeSimone; Girder-Slab Technologies; Facing; Opening spread: Matthew Johnson

Because a building's floor height is a function of the building's usage, the Girder-Slab system was ideal as it limited the column transfers normally required with a flat-plate concrete structure over a steel retail podium.

"The Girder-Slab system allows longer spans with smaller slab thickness than that of a conventional concrete flat plate system," explains Mavalankar. "It is good choice for a mixed-use projects where lower levels are utilized for the commercial or parking structure and residential units are situated on upper levels."

While the Girder-Slab system solves a lot of challenges, the building team still had to work with the ground-floor slab within a retail footprint and its associated level changes and slab drops.

Furthermore, the plaza slab outside the building footprint needed to support fully loaded concrete trucks, a surface detention tank, and a below-grade detention tank above the first parking level.

In order to make all of this work, "the architect, civil engineer, and our office performed extensive coordination during the design phase to ensure all conditions were thoroughly detailed and transitions between different systems were addressed," says Mavalankar.

Furthermore, the routing of mechanical systems required additional coordination due to miscellaneous steel framing for plank openings and beam lines, according to Michael Lew, a principal with Perkins Eastman.

DeSimone minimized and designed brace frames at locations near the elevator and stair core where they would most easily be concealed and not affect the layout of residential or commercial spaces.

"All braced frames needed to be within demised partition and cores with none permitted on the exterior," emphasizes Lew. "DeSimone was able to locate the brace frames within these guidelines."

The steel brace frames were also used as a lateral force-resisting system for each of the buildings and designed to react to wind loads. The concentric frames use brace and column sizes up to W14×370.

Because the system is predominantly drift-controlled, fewer braced frames were required to control both the overall and inter-story drift. Concrete shear walls were used below grade, in the parking garage. Brace frames were used for structure, above grade, and were transferred at the ground-floor level on the shear walls via strap beams.

For the gravity system, D-beams on the residential levels support 4-foot-wide, 8-inch-deep planks spanning 28 feet, and match the column spacing in the retail levels and parking garage. In the other direction, the beams span 18 feet to 20 feet between the W12x230 columns. The columns reduce in size for the higher floors to W12x87.

Facing from top A steel-framed 670,000-square-foot 14-story residential tower, an 11-story office building, and a four-story, below-grade garage opened for occupancy earlier this year. Concrete shear walls were used for the below-grade parking garage; above-grade brace frames are transferred at the ground-floor level on the shear walls by utilizing strap beams (pictured). A rendering of the Girder-Slab system.
This page Construction of the office and residential buildings. To optimize the use of structural steel for both buildings, structural engineer DeSimone specified the Girder-Slab system, an assembly of asymmetrical steel beams fabricated from standard rolled wide flange section and a flat bar.

In order to meld into the surrounding neighborhood, the residential tower was designed as a window wall, blending in with a brick veneer and glass. The edge of the floor system supports the facade panels which are attached to perimeter W10x39 beams in the north-south direction. "The embed plates were cast in the slab on metal deck as well as precast hollow-core planks for the attachment of panelized brick and curtainwall system," says Mavalankar.

To optimally locate the embed plates to support the panelized facade system with structural interfaces, and for ease of coordination between the trades, a 3D TEKLA model was created and used exclusively by the steel fabricator and erector, Berlin Steel Construction. To optimize the MEP design and coordination, the design team utilized Revit.

"The mechanical openings were coordinated early on and fabricated while casting planks, thereby minimizing the need for field cores for the openings," says Lew.

Overall, utilizing the Revit model early on during the preliminary design phase helped resolve clashes between the structural and MEP components.

The construction manager, Tishman Construction, and design team used project-management software Constructware as a submittal tracking system, which helped expedite the construction administration process. "Use of BIM models, as well as scheduling and submittal tracking software, helped support efficiencies," adds Lew.

Ultimately, the choice of steel framing met Flushing Commons' unique structural requirements with its restricted overall building height and need to minimize foundation loads. The shallow foundations were used to support superstructure loads along with individual footings and mat footings supported by soil.

By specifying the Girder-Slab system for the residential tower and conventional steel for the commercial building, the project serves as a strong example of successfully coordinating both residential and commercial usages within a structural steel frame.

Above When the second design phase of this LEED-certified project is realized, a one-acre open space will serve as a welcome breather to the congested downtown Flushing area. **Facing** Phase 1 of the project used approximately 4,500 tons of steel.

This page: Perkins Eastman Architects; Facing: Girder-Slab Technologies

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>
> Amit Mavalankar, DeSimone

FLUSHING COMMONS

Location: **138-35, 39th Ave., Flushing, NY**
Owners: **F&T Group**, *New York, NY*; **The Rockefeller Group**, *New York, NY*; **AECOM Capital**, *New York, NY*
Architect: **Perkins Eastman Architects**, *New York, NY*
Structural Engineer: **DeSimone Consulting Engineers**, *New York, NY*
Mechanical Engineer: **AKF Group LLC**, *New York, NY*
General Contractor: **Tishman Construction**, *New York, NY*
Structural Steel, Miscellaneous Iron, and Architectural Metal Fabricator and Erector: **Berlin Steel Construction Co.**, *Kensington, CT*
Metal Deck Erector: **Berlin Steel Construction Co.**, *Kensington, CT*