

Kingsbury On the Park

Joseph Burns, P.E., S.E., A.I.A., Garret Browne, S.E. and Andrew Kern



This residential tower in Chicago features exposed steel balcony supports and concealed multi-story mega-braces for lateral force resistance.

Chicago's River North neighborhood has another new addition—Kingsbury on the Park. It is a mid-rise condominium that accompanies several recent developments in an area of the city that was formerly a light industrial zone. Located at 653 North Kingsbury Street, the 25-story building is clad in glass with horizontal precast spandrels and vertical steel balcony structures attached to its perimeter. The building's design complements the exposed steel braces of an adjacent development, Erie on the Park (featured in *Modern Steel Construction*, May 2002, available at www.modernsteel.com).

Kingsbury on the Park, conceived by the same design team as Erie on the Park, is a rectangular structure constructed with 18 stories of composite steel framing above a seven-story cast-in-place concrete base. The typical residential floor-to-floor height is 11'-4". The lateral system consists of concrete shear walls at the base and three-story steel mega-braces in the upper levels. The foundation system is comprised of grade beams and caissons, with a slab-on-grade at ground level.

The developer's main objective was to maximize use of the site, which measures approximately 100' by 140'. The site is bordered by Erie Street to the north, Kingsbury Street to the west, an adjacent building to the east, and an alley to the south. The majority of the ground level is set aside for retail use, while the remainder includes a lobby for the residences and several mechanical rooms. A split-level parking garage was constructed between floors two and six, with ramps connecting north and south half-levels. The residences begin at the seventh floor and continue up to the 25th floor, with an exterior balcony and/or terrace at each unit. The residences and parking garage are served by two elevators within the

building's core, as well as the two required fire stairwells.

The footprint of the building encompasses the entire site from ground level up to the seventh floor. Perimeter concrete columns and walls are supported by grade beams that cantilever over caissons. Caissons were constructed as close to the property lines as possible, with the bell diameter of the caisson determining its final location. Additional grade beams support interior shear walls and transfer columns.

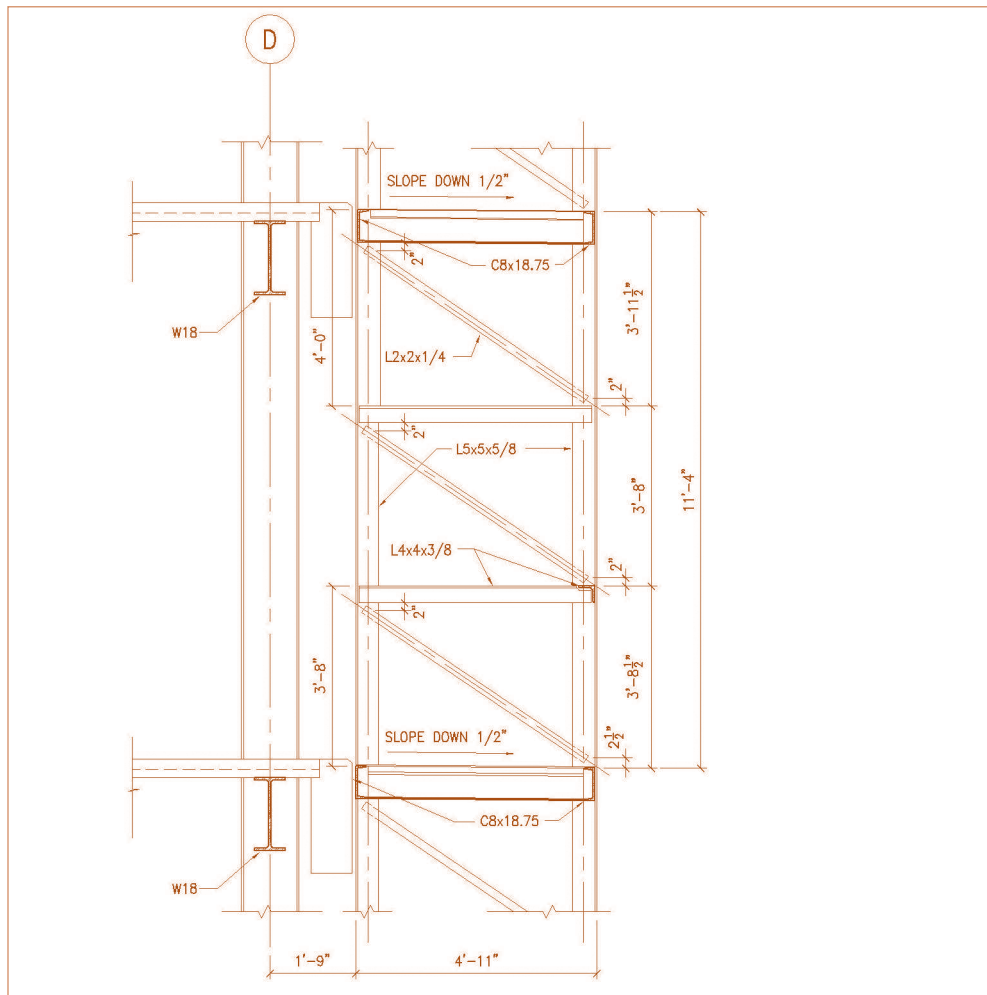
The split-level concrete parking garage occupies floors two through six. The seventh floor serves as the transition from parking garage to residential units. The last level of concrete framing supports outdoor terraces created by the setback of the residential tower, which measures approximately 90' by 100'. The terraces, located at the north, south, and east sides of the building, are designed to accommodate the snowdrifts caused by the tower, as well as the dead load of outdoor gardens and patios. Concrete beams near the perimeter of the seventh floor support the gravity loads from the vertical balcony structures that rise up the four faces of the residential tower.

BIG BRACING

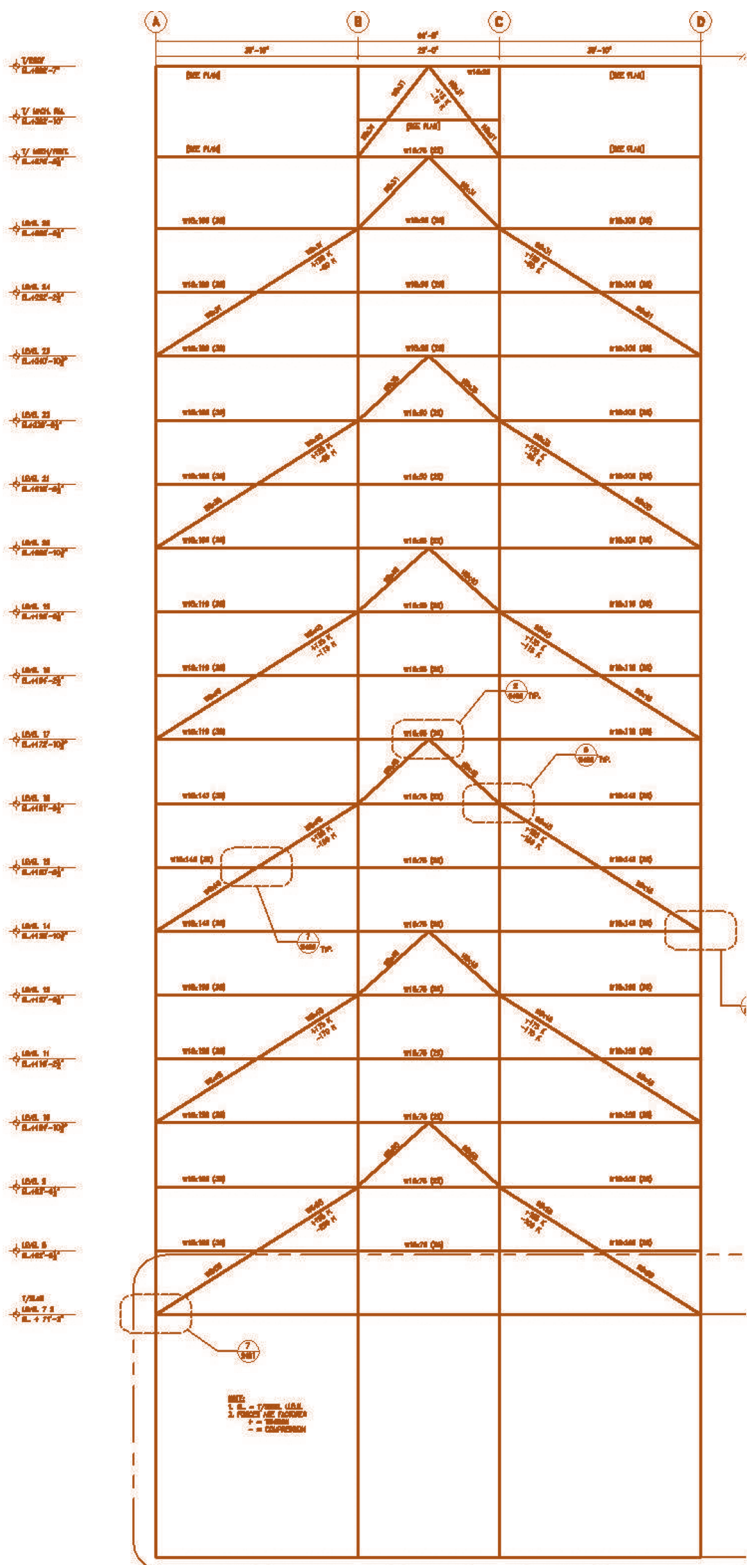
The steel mega-braces from the tower lateral system frame into concrete shear walls at the seventh level. The three-story-high chevron steel braces in the upper tower are located in the interior of the building, permitting uninterrupted views of the Chicago skyline at the building perimeter. This location worked well with the layout of the condominium units that were designed around the central elevator core. Each chevron spans across the full width of the building and consists of two 42'-long diagonals and two 17'-long diagonals at the peak of the chevron. There are six three-story-high mega frames in the upper tower to prevent lateral drift from exceeding ac-



Slotted holes allow the self-supporting (for gravity) balcony structures to receive lateral support from the building while accounting for thermally induced movement.



The exposed steel balcony structures are framed with hot-rolled steel angles. Minimum member thickness is 1/4" to meet Chicago code requirements for exposed structural steel.



Three-story steel mega-braces from the tower's lateral system frame into concrete shear walls at the seventh level.

ceptable limits. Due to the great distance between exterior columns in the bracing lines and the high dead load inherent to the large bays of the project, there was no net uplift on the steel structure. The lateral system was analyzed using ETABS.

The residential tower is composed of 2½" lightweight concrete on 2" composite metal deck supported by steel-rolled shapes, providing a one-hour fire rating to the floor assembly. The tower had originally been designed using lightweight steel joists, but the developer decided to switch to rolled shapes. Erie on the Park was built using steel joists and ½" deck to maximize the efficiency of floor construction for the workers, who would be able to handle the lightweight structural members with greater speed. However, due to the high winds experienced during the construction of Erie on the Park, the contractor was forced to delay the placement of the ½" deck and steel joists until the weather calmed down. This also caused the developer to adjust the floor construction of Kingsbury on the Park to the heavier 2" deck with steel-rolled shapes in order to reduce the delays. RAM Structural System was used to analyze and design the gravity system.

The perimeter of the steel tower at Kingsbury on the Park consists of precast spandrels spanning from steel columns. Thornton-Tomasetti Engineers worked closely with Zalk Josephs Fabricators and Dukane Precast to develop the connection details of this system. Precast panels were erected in conjunction with the steel frame. The precast spandrels serve as support for the exterior glass walls of the building, as well as a pour stop for the concrete floor slabs at each level.

EXPOSED BALCONIES

The most striking architectural feature of Kingsbury on the Park is the exposed steel balcony structure. There are eight vertical balconies of varying width connected to the perimeter of the building. The steel balconies are attached at each floor for lateral support only, with the seventh-floor concrete structure serving as the gravity bearing support. Each balcony is designed in the image of a truss and framed with single-angle steel members. At each floor level, the balconies were laterally

connected by shoulder bolts through a vertically slotted hole in the posts and into a bent plate embedded into the floor slab. The slotted holes were designed to accommodate the thermal movement that the exposed steel balconies will experience throughout their life span, as the posts are fixed at the seventh floor, and free to expand and contract from that point. Other loads imposed on the balcony structures include a live load of 100 psf, snow loads, and snowdrift as required by the Chicago Building Code. Ice loads were calculated using ASCE 7 to account for frozen rain and sleet that could collect and adhere to the exposed steel frames. Each structural member of the balcony was designed to resist the forces imposed upon them, but a minimum member thickness of ¼" was regulated by the Chicago Building Code requirement for minimum thickness of 0.23" for exposed structural steel.

Through the use of a variety of structural systems, Kingsbury on the Park achieves the goals set forward by the owner and architect to create an interesting building structure while maximizing the use of the site. ★

Joseph Burns, P.E., S.E., A.I.A. served as principal in charge of the project; Garret Browne, S.E. served as project manager; and Andrew Kern was a design team member. All are with Thornton-Tomasetti Engineers in Chicago.

Owner and Developer

Smithfield Properties, Chicago

General Contractor

Wooton Construction, Ltd., Chicago

Architect

Lucien Lagrange and Associates, Ltd., Chicago

Structural Engineer

Thornton-Tomasetti Engineers, Chicago

Steel Fabricator/Steel Detailer

Zalk Josephs Fabricators, LLC (AISC member), Stoughton, WI

Engineering Software

ETABS, RAM Structural System