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10. Three First National Plaza, Chicago, IL (USA)

Owner:	*Gerald D. Hines Interests*
Architects-Engineers:	*Skidmore, Owings & Merrill, Chicago, IL*
Contractor:	*Turner Construction Company, Chicago, IL*
Completion date:	*1981*

The Three First National Plaza Building is located in the central business district in the downtown area of Chicago, Illinois. It consists of a 57-story office tower and an adjacent 13-story office building interconnected by a 10-story entry atrium space. The office tower rises 229 m above grade level (Fig. 1). The tower measures 50.28 x 50.28 m in plan, however, the southeast corner is chamfered at 45° approximately between the middle points of the south and east faces (Fig. 2).

Structurally, the tower utilizes the composite tubular system, with an exterior concrete frame tube and an interior structural steel floor framing system. The tower is clad in granite and double glazed windows. The tower provides about 115,000 m² of office space.

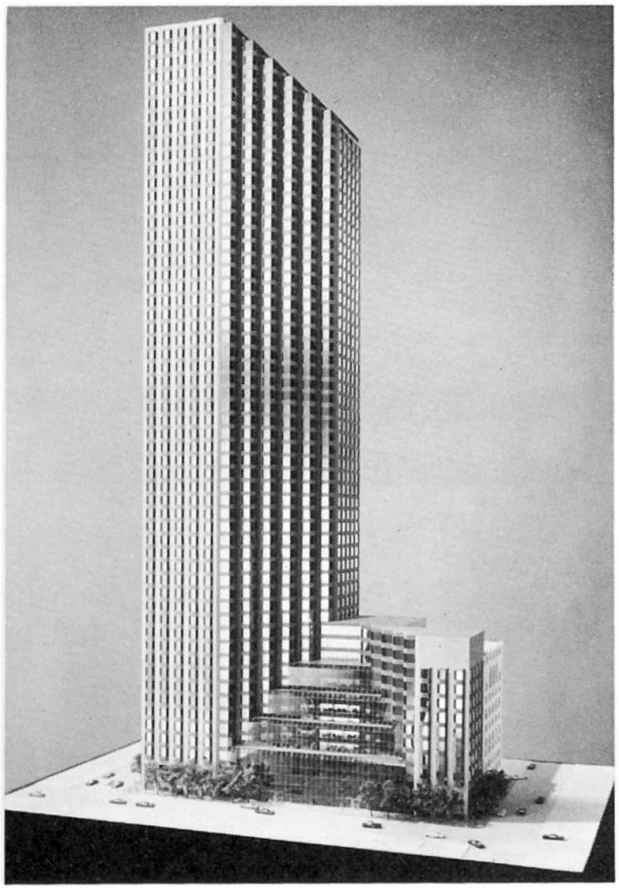

Fig. 1 Three First National Plaza Tower, Chicago, Illinois

Structural System

The composite structural system developed for the tower was chosen because it provides maximum flexibility of architectural planning and optimum structural efficiency. The plane shape and the profile of the tower was derived from an architectural context related to the site, neighboring tall buildings, views to the Lake and traffic considerations. The ability of the structural frame to be molded around the shape in reinforced concrete with interior framing being in steel made it natural for use on this project. The asset of the system structurally is its high torsional and lateral rigidity for wind forces and the use of simple steel framing on the interior. Another advantage of the exterior concrete system is to provide an excellent support for the granite cladding. The steel floor framing provides for long clear spans, allows for tenant modifications and variations to the floor layout. The exterior reinforced concrete frame tube, by virtue of its high rigidity, effectively resists all lateral loads and controls lateral drift with minimum additional reinforcing steel over that required for gravity loads.

The exterior framed tube utilizes reinforced concrete with strengths from 7,500 PSI (52 Mpa) at the base to 5,000 PSI (35 Mpa) at the top for both beams and columns. The columns are spaced at 4.53 m centers on the orthogonal faces and 6.83 m on the diagonal face. The columns are of rectangular cross-sections except along the diagonal face on which they are of an L-shape to provide for support for the cantilevered bay windows.

The interior structural steel system uses all standard rolled shaped (ASTM A36) beams and (ASTM A572, Grade 50) column sections utilizing simple, single shear connections. The structural steel beams and girders act compositely with the metal deck floor slabs through standard shear studs.

Construction Procedure

The steel frame was erected up to 12 stories in advance of the exterior reinforced concrete frame, thereby providing rapid working-level platforms at each floor for other trades, such as HVAC, Electrical and Plumbing (Fig. 3). To facilitate the advance erection of the structural steel, small, wide flange, steel columns were incorporated as part of the steel frame and were placed at the location of each exterior concrete column. These steel columns were designed to support 12 levels prior to transferring the perimeter loads to the enclosing concrete column by utilizing standard shear studs. The structural steel frame was stabilized during erection by a temporary system of diagonal bracing. The typical sequence of construction had the erected steel frame four floors in advance of the metal deck placement which was four floors in advance of the completed com-

posite concrete floor slab, which was four floors in advance of the completed exterior reinforced concrete frame. To keep pace with the steel erection, the formwork for the exterior concrete frame utilized steel gang forms with a semi-automated hydraulic form handling system.

Summary

The composite structural system utilized for the tower of the Three First National Plaza Building represents the simplest and most efficient system taking into consideration the plan configuration, construction time and architectural flexibility. The exterior concrete frame provides an excellent system for the granite cladding.

(Hal Iyengar)

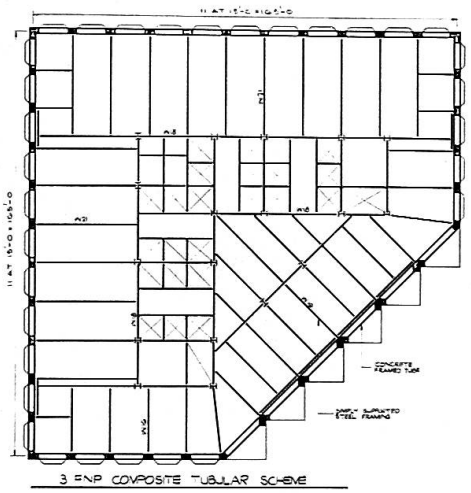

Fig. 2 Typical Tower Floor Plan

Fig. 3 Tower under Construction