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8. One Shell Square, New Orleans, Louisiana (USA)

Owner: *Gerald D. Hines Interests, Houston, Texas*

Architects-Engineers: *Skidmore, Owings & Merrill, Chicago, Illinois*

Contractor: *Gervais F. Favrot Co., Inc., New Orleans, LA*

Completion date: *1972*

The 52-story One Shell Square building in New Orleans is an office tower, rising about 700 ft. (213 m) above ground (Fig. 1). The tower measures 130 x 180 ft. (39.63 x 54.88 m) in plan (Fig. 2). Structurally, the tower uses a composite tubular system. Exterior corners of the perimeter columns are chamfered at 45° to create an architectural articulation. The tower is clad in travertine marble and reflective glass. Total framed area is 1.4 million sq. ft. (130,100 m²). Precast-prestressed concrete friction piles driven to a record depth of 210 ft. (64.02 m) support the tower columns loads.

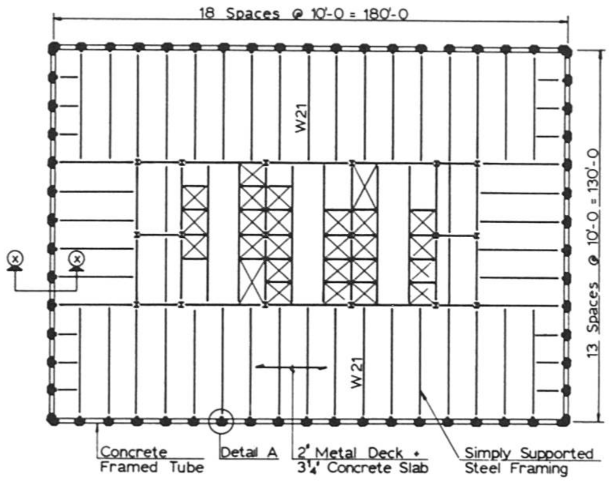

Fig. 2 Typical floor framing plan — One Shell Square building

Structural System

The composite tubular system was conceived to combine the best merits of steel and concrete structural systems. Reinforced concrete framed tube is an extremely efficient form to resist lateral loads because of its massivity and ability to create monolithic joints. The steel framing offers advantages of spannability, lightness and possibility of electrified metal deck for floor slab. This mixed steel-concrete construction eliminates labour-intensive construction work, such as concrete floor framing and steel joint welding, required if one material alone is used to form the total system.

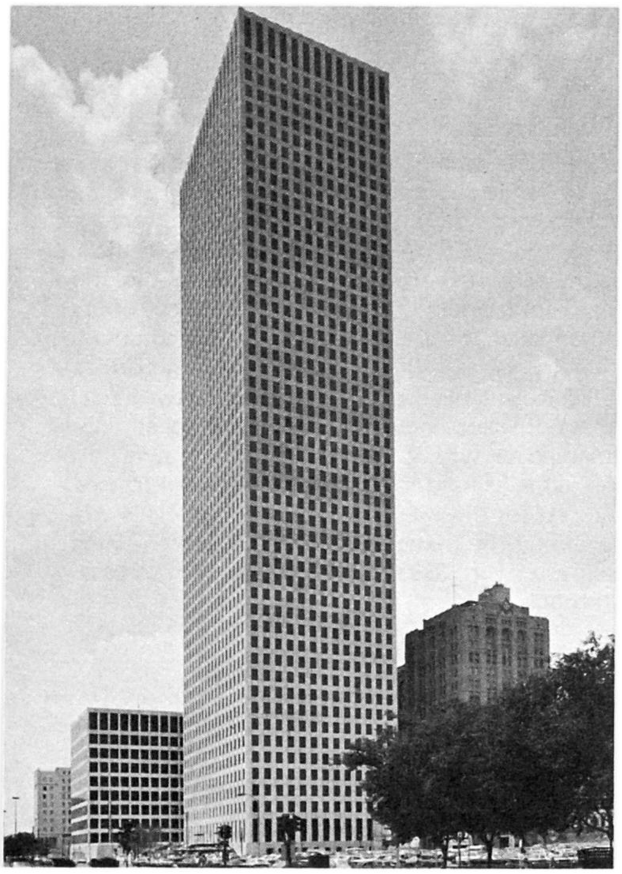

Fig. 1 One Shell Square building, New Orleans, Louisiana

One Shell Square is one of the first structures in which composite tubular concept was put into practice. The exterior framed tube resists wind loads. The framed tube is formed by spacing 4 ft. (1.22 m) wide columns at 10 ft. (3.05 m) on centers along building periphery (Fig. 2). Column thickness is 3.75 ft. (1.14 m) at ground level which reduces to 2.6 ft. (0.79 m) at the 18th floor and then remains constant for the rest of the building's height. The exterior columns are connected by deep spandrel beams. The continuity and rigidity at the joints are obtained from the natural monolithic character of concrete. Typical spandrel beam and exterior column details are shown in Fig. 3. The exterior tube and the interior steel columns are connected together by 40 ft. (12.2 m) simple span steel beams spaced at 10 ft. on centers. Composite steel deck with lightweight concrete was used to span between the steel beams.

Construction Coordination

The interior steel frame construction was allowed to proceed in advance of reinforced concrete tube for a certain number of stories. The frame is then enveloped by the reinforced concrete tube, as shown in Fig. 4. This was made possible by incorporating a

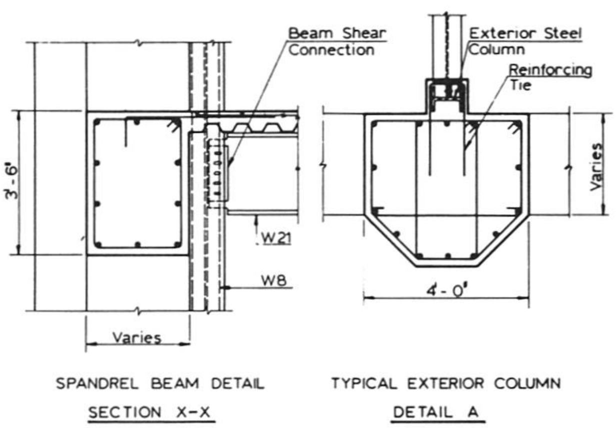

Fig. 3 Exterior beam – column details

small steel column as part of steel frame, which is later encased by the tube. A separation of 8 to 10 stories between steel and framed tube working levels was generally required. Metal deck installation followed behind steel at closed intervals. Concrete on the deck was placed next, completing the floor slab diaphragm. The completed slab is also used as a construction platform for lifting prefabricated reinforcement cages and gang forms for the construction of the framed tube. Adequate bracing was provided for the steel frame above the completed framed-tube to resist hurricane loads during construction.

Foundation

One Shell Square site in New Orleans is marshy sand and clay, and there are no underlying strata of bedrock within reasonable distance. The key to foundation design in New Orleans, in most cases, has been friction pile. Earlier buildings were limited in size and height by the design rating of available foundation piles. Foundation design of One Shell Square required months of study by structural-foundation engineering team to develop piles capable of withstanding greater loads. The selected piles sustained a load test of 700 tons. Each pile used in One Shell Square was designed to carry 280 tons with a factor of safety of 2.5. More than 500 of these precast-prestressed piles were driven to a depth of 210 ft. (64 m) into the ground and then tied together with an 8 ft. (2.44 m) thick reinforced concrete mat to stabilize the structure and distribute the load.

Summary

The 52-story One Shell Square tower is an excellent example of the combination of reinforced concrete and structural steel subsystems which together provide an effective economical solution to high-rise buildings. This system offers considerable opportunity for plan shape modification. The structural system used in One Shell Square tower has broken the traditional barrier for use of all-steel and all-concrete systems and is a forerunner for a whole series of mixed steel-concrete systems.

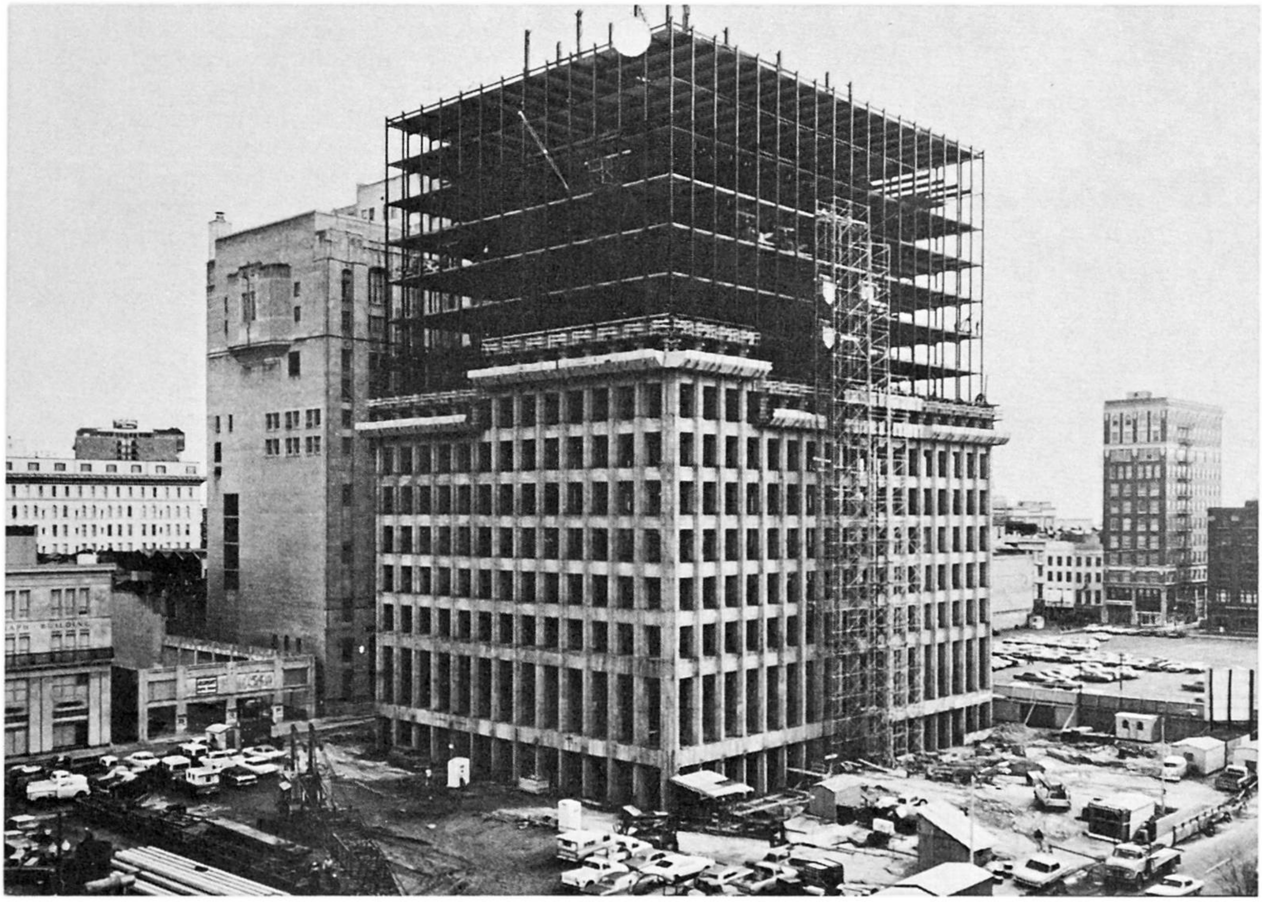

Fig. 4 One Shell Square building under construction