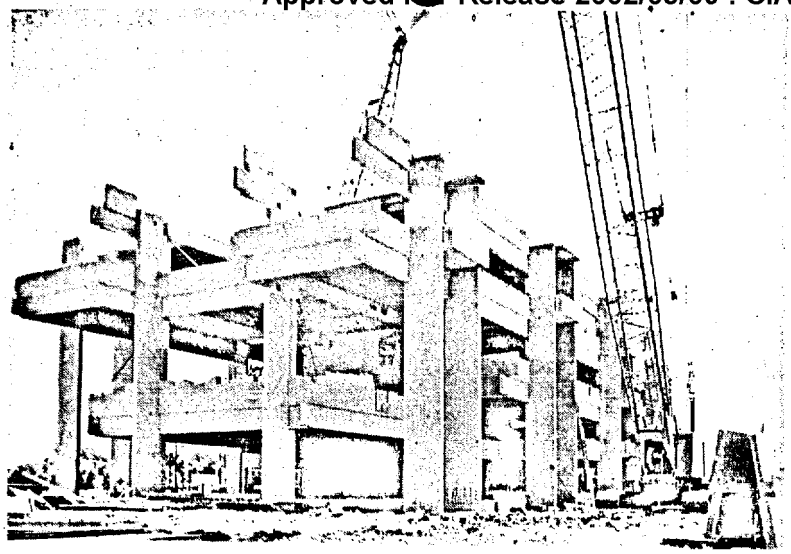
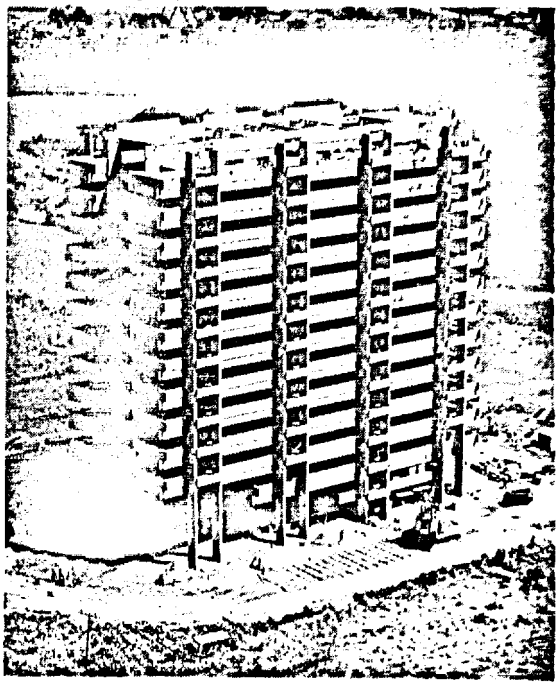


HUGE precast members are assembled like a building block set.



CONCRETE structure nears its full 16-story height.

Building System Given Dual Role

A building system that has produced 2,000 dwelling units now is being used in the construction of a 16-story office building, the first of four towers that will be erected using precast components.

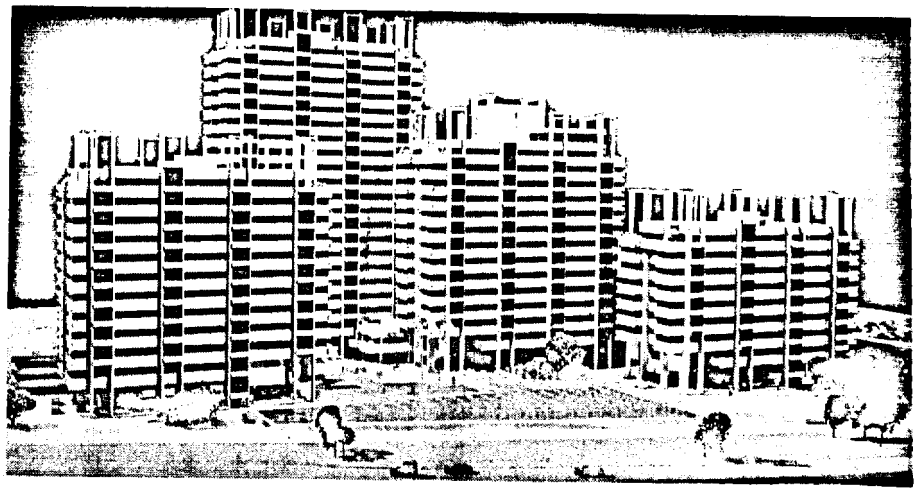
The system is the Firnkas System of Modular Construction. The building is One Brookhollow Plaza, a 130,000-sq-ft structure consisting largely of precast concrete members, including the walls of the 56 x 30-ft core. The core floor at each level, however, is a cast-in-place concrete slab on metal deck supported by structural steel framing.

In addition to being used on the 2,000 completed units, the system, developed by Boston consulting engineer Sepp Firnkas, is being used in another 3,000 dwelling units either under way or in design, in the U.S.

Firnkas had to turn his system around, however, for use in the Brookhollow project. The system, as applied to housing, employs the wall bearing principle. But on the Brookhollow project the bearing walls are replaced by 8-ft-high column-supported spandrels that support hollow core precast concrete planks.

The four buildings in the $20-million project will range in height from nine to 22 stories. The four will be constructed with the Firnkas system, but only the building under way will have a precast concrete core.

The size and weight of typical core units, 25 ft long by 13 ft high by 12 in. thick, and weighing 43,000 lb, proved difficult to handle, thus slowing to some extent work on the project. The units are delivered directly from



OFFICE complex evolving from a building system was developed first for housing.

general contractor, Hayman-Bryant-Andres, Inc., of Dallas, therefore suggested that the core in the other three buildings be cast in place.

• **Building block set**—The 237-ft-high building, 75 x 158 ft in plan, consists of 25 different precast elements per floor, with a total of 3,000 precast components. This led the owning company, a subsidiary of Texas Industries Inc. (TXI), of Dallas, to describe the building as the product of a giant building block set.

Precast units for the $3.5-million building were hauled 10 miles from the plant of TXI, a cement, aggregates and precast products producer, at a rate of about 10 truckloads a day. The precast the truck into position in the structure. Stockpiling of components at the site was kept to a minimum.

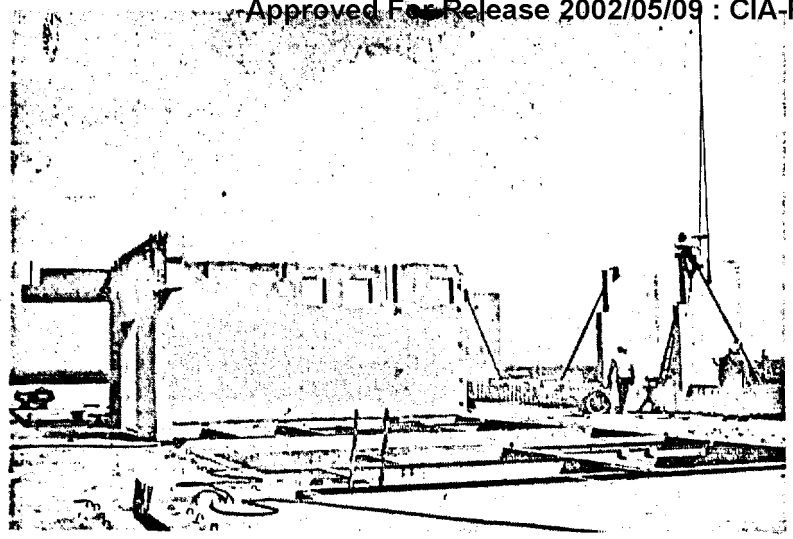
Erection was handled by two cranes; one a 150-ton-capacity unit with a 213-ft tower and a 110-ft jib boom, the other a 100-ton rig with a 230-ft boom.

The building has no basement, the foundations consisting only of piers drilled 10 ft into rock, which underlays 65 ft of expansive clays and hard blue shale. The soil beneath the ground floor slab was stabilized by injecting lime to a depth of 10 ft. In addition, the elevator pit 20 ft below grade is completely surrounded by granular fill placed at a 45-deg angle.

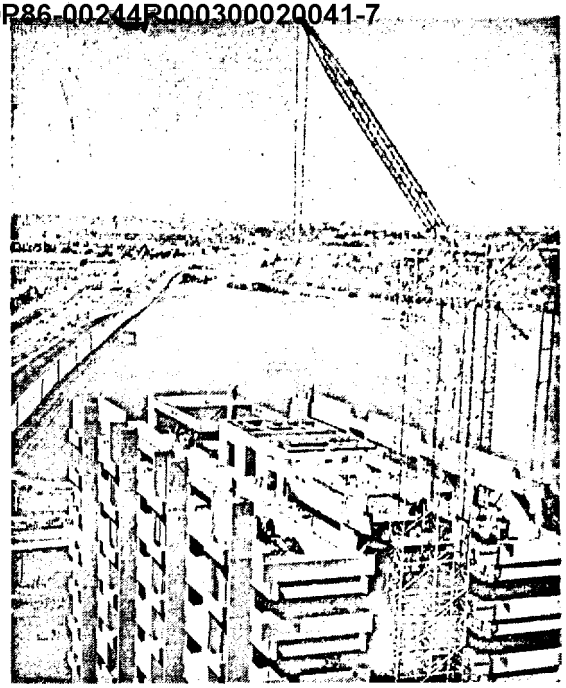
The building has 20 post-tensioned, load-bearing exterior columns, eight on

(Continued on p. 34)

Approx. $27 per sq. ft.



PRECAST core-wall component with a cantilevered arm.



TYPICAL FLOORS include 25 different precast units.

each of the long sides and two on each end. Workers set the columns around the perimeter on pier caps containing anchors with threaded couplings linking the post-tensioning rods in the column sections.

The columns, 6 ft wide by 1 ft thick on the long dimensions of the building, and 7 x 1 ft at the ends, extend beyond the building line with no grade beam tying them together. Instead, Firnkas and T. Y. Lin & Associates-Dallas, called for a 3-ft-high pedestal to be cast along two sides of each column. The pedestals, 18 in. wide and 6½ to 7½ ft long, depending on the adjoining column size, permitted the pedestal reinforcing to enclose the base of the columns.

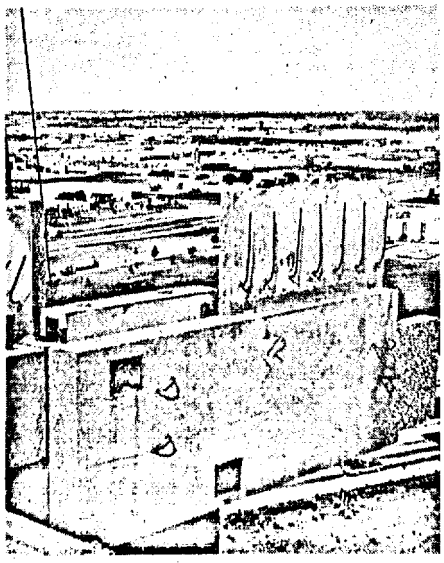
Columns, typically 13 ft high, were cast with two sleeves to receive the stressing tendons which were post-tensioned to 81,000 lb, and then grouted. The columns, and also the core walls, have a full bearing surface of grout when the bars are tensioned at each elevation.

• **The core**—An unusual feature of the core is a cantilevered arm extending 6 ft from two end walls to carry a 55-ft beam spanning the columns at one end of the building. The beam on the opposite side of the building rests on the wall. By employing the cantilevered arm, the architects eliminated the need for a column that would otherwise have been located in a circulation area of each office floor.

The arm is heavily reinforced, and includes nine No. 11 bars, four of them bundled across the top and three bent downward into a No. 6 looped stirrup welded to the top flange of a structural steel beam. This structural member, a 10 WF 45 beam with two ¼-in. plates welded on each side and No. 8 stirrups welded on the flange faces, extends the full length of the arm and into the core wall to transfer shear stresses from the notch into the main wall.

Core wall sections were cast with hollow tubes to receive the steel tendons, which were post-tensioned after erection of the wall. Throughout the building, components were connected with bolts, dowels and grout, tying the members together so that in concert they perform as a reinforced concrete structure. Each of the eight components making up the core walls at each typical floor has two vertical tendons, one at each end.

Floors at each level in the core, which will contain emergency stairs, four elevators and rest rooms, are cast-in-place slab on metal deck supported by structural steel framing. These floors and the 2-in. topping on the hollow core plank deck in the office areas were the only cast-in-place concrete operations above grade.



DETAIL of beam, column spandrel unions

• **The flooring job**—Holes, 4 in. in diameter and 16 in. apart, were formed in the 4-ft-wide hollow core floor planks so that the topping concrete could be pumped into the plank's void to form a T-section with the plank's supporting beam, which is of composite design. Voids were stuffed with excelsior 2 ft back from the top of each plank. When the concrete was pumped in, it created a 4-ft T. Shear steel emerging from the top of the beam completes the tie with the concrete.

A 2-in. concrete topping for the precast hollow core planks was pumped about two floors behind erection. Topping reinforcement consisted of 4 x 4-in. 10/10 woven wire mesh with No. 4 reinforcing bars over beams to provide negative reinforcing.

The contractor averaged seven working days per elevation, including grouting, tensioning and placement of the topping. Labor disputes and adverse weather conditions added to delays, so the original construction schedule of 13 months has not been met. Work started in September 1968, with occupancy now scheduled for next March.

All exterior surfaces have an exposed limestone aggregate finish tan in color. Double-glazed insulating solar glass of of bronze tone will complement the exterior finish.

Architects for the project are Harwood K. Smith & Partners, of Dallas, and Paul Rudolph, of New York. Herman Blum Consulting Engineers, of Dallas, serve as mechanical and electrical engineers. TXI was subcontractor for the casting and erection of the com-