Housing: The name of the game is changing

Construction industry statisticians have predicted an annual rate of 1,650,000 housing starts for 1969. Almost 45 percent of these will be multiple-family dwellings. Tight money, costly land and labor are some of the prime reasons architects and contractors are turning to apartments and town houses instead of single family dwellings.

Hotels have been facing rising operating costs and lower occupancies. This has led to radical changes to meet the new demands by the public. As a result of changes in the 1950's, a highly successful mutation sprang up in the form of modern motels, and now the cycle is complete with the development of the hybrid motor hotels.

DESIGN

For Prestressed Concrete

In every one of these categories, architectural precast and prestressed concrete can help the architect and the builder meet these diverse needs better than ever before. But to do so, the building should be designed to take advantage of precast and prestressed concrete's unique advantages.

Until recently, structures have been designed by substituting prestressed concrete for other materials. Architectural precast and prestressed concrete can do more than other materials, but the architectural profession must become aware of its capabilities.

For instance, repetition of shapes can lead to elegant facades with intricate patterns and to strong and lightweight structural systems if precast and prestressed concrete is used—all at lower cost due to the repetition. Precasting allows a minimum number of casting forms to be used.

Precast and prestressed concrete yields lightweight structures because of its greater strength with smaller mass. It is achieved by efficient combination of steel and concrete, attainment of optimum shapes, and the use of lightweight aggregates.

LONG CLEAR SPANS ARE COMMON

Longer spans with tees, beams, and flat slabs result from prestressing by either pretensioning or post-tensioning. Clear spans of 60 ft. or longer are common with tees. Because of these long clear spans, interior columns may be eliminated and load can be carried by wall panels or elevator cores.

Added stability is supplied by vertically prestressing shafts and walls and by prestressing floors. Floors can serve as diaphragms which tie the vertical elements together.

EXCELLENT SOUND CONTROL ACHIEVED

The concrete walls and slabs also provide excellent sound control and fire protection. In a recent survey, it was found the biggest irritant to tenants is noise, and they are willing to pay more in apartments for better sound conditioning material.

Finally, architectural precast panels, with their potential for intricate patterns or simple exposed aggregate finishes, offer the architectural profession its biggest opportunity for artistic expression in the design of the building.

Colonial Hills Town Houses, Akron, Ohio

Solid, 6-in. thick, prestressed concrete flat slab units serve as the first floor for 19 individual town houses in Akron, Ohio. Some of the flat slabs extend beyond the exterior brick walls to become balconies.

The architect had two reasons for specifying solid prestressed flat slabs for the first floors in all the town houses. First, he wanted fire resistance, and solid slabs provided the required thickness. Secondly, the architect wanted sound transmission control, and the solid units offer excellent sound control because of their density.

Solid slabs are also used in this case because a thinner slab—only 6-in. thick—can be attained. Each slab weighs 7,000 lbs., is 6-ft. wide, and varies in length up to 19 ft. The slabs are cast with a cutback at the edges so a more effective grout key can be used, thus eliminating the topping.

Each structure has a total slab coverage of 2,500 sq. ft., including balconies. Floors of two structures were completely erected per day.

Arch.: Max Ratner; Eng.: R. S. Williams; prestressed concrete by Concrete Masonry Corp.
The 23-story Marine Surf Waikiki, Honolulu, Hawaii, is a hotel-apartment building featuring prestressed double tee floors in the structural system and precast components for decorative effect on the exterior.

The underside of the double tees are left exposed throughout the lower floors because it is the architect's belief the attractiveness of these tees allows them to play a dual role: structural and aesthetic. "The inherent beauty of the double tees is sometimes overlooked," says Jo Paul Rognstad. "The major design feature of this project, the decorative screen enclosing the second floor, is based on emphasizing the structural rhythm set up by the double tee stems as they occur on the second and third floors of this building."

Rognstad used precast uprights to blend with the stem ends, permitting all concrete elements to be left exposed. The tapered shape which terminates the stem end is used as the basis for a design with a Polynesian theme to suit the building's location.

The precast panels have an exposed aggregate finish. Eleven of these panels were used, and each measures 4 in. thick, 7 ft. 8 in. wide, and 14 ft. 2 in. tall. The uprights are 6 in. by 12 in. by 14 ft. 2 in. Precast stair treads 2 in. thick, 12 in. deep, and 3 ft. long were also used.

The double tee floor system featured 68,000 sq. ft. of 5 ft. wide double tees varying in length from 11 ft. to 45 ft. Interval between stems is 30 in.

"These exposed concrete components provide the most economy in initial finishing expense and long term maintenance costs," says Rognstad.
The Voyager Inn in Banff, Alberta, Canada, is typical of the modern transient accommodations established for vacationers, travelers, and conventioneers in a resort area (Banff National Park). Besides guest rooms, the Inn has a dining room, cocktail lounge, outdoor swimming pool heated for all year use, an outdoor cocktail and dining terrace, parking, and other accommodations.

It is a two-story structure built in an H-shape, with a total of 88 guest rooms—22 to each floor in each wing. The central core has the lobby, dining room, cocktail lounge, and coffee shop on the first floor. On the second floor is a banquet room, a small reading area, a private dining room, another cocktail lounge, and a small meeting room.

The guest room wings are above the parking, and each room has its own balcony. On each floor, maximum flexibility is planned to permit rooms to be occupied as single units, to be grouped together as connecting rooms, or to be rented as suites.

With the grandeur of the Rocky Mountains as a backdrop, the attractiveness of the facility takes on added importance to the owner. Coupled with the desired interior flexibility, the need for fire safety, and a winter construction schedule, it was recommended by the architect that precast and prestressed concrete be the structural material used.

Accordingly, extensive use of precast, prestressed double tee floor and roof units and wall panels, and precast columns and beams is made in the structure of the building. The double tees are left exposed in the ceiling of the rooms, and their cantilever past the exterior wall provides "a subtle secondary rhythm complementing that of the balcony railing to the building exterior," according to the architect.

The components were cast in Calgary and trucked 75 miles to the project site. A total of 61,600 sq. ft. of double tees in 564 pieces were used. Another 4,500 lineal ft. were employed in the columns and beams.
Double tees 14-in. deep are used for the floors to help carry the load, while 12-in. deep double tees are employed for the roof. All double tees are 5-ft. wide and span a maximum of 33 ft. There is a 3-ft. 9-in. cantilever at each end to provide balcony roofs and floors.

The load-bearing double tee wall panels serve as the exterior walls of the guest rooms. The panels are cast 8-in. thick, 5-ft. wide, and 7-ft. 2\(\frac{1}{4}\) in. tall (one story).

The panels carry the precast castellated reinforced concrete spandrel beam on which the spanning double tees rest. Tees are spaced so each room has a sliding glass door full height providing access to the balconies. The castellated beam spans the doorways. It was cast in 25-ft. maximum lengths, with more than 140 pieces used in the structure.

Double tees are exposed in guest room ceilings and sprayed with an acoustical treatment. Walls between rooms and balconies consist of load-bearing double tee wall panels with short stems out. The panels carry the load of the spandrel beam and ceiling.
Honey’s Inn Motel
Gastonia, North Carolina

Honey’s Inn Motel, Gastonia, North Carolina, is a 17,775 sq. ft. building built of precast and prestressed concrete because of the following reasons, according to the architect:

1. Better sound control.
2. Decreased construction time during a winter construction schedule. The motel was finished in March, 1968, but the structural shell went up in about 3-4 weeks.
3. It offers a maintenance free exterior. Some of the precast members have an exposed aggregate finish, while other concrete elements also are virtually maintenance free.
4. There is an enhanced design with the combination of precast and prestressed material. The use of these materials also allows the basic material to be used in the interior.
5. The electric conduit can be cast in the wall panels, which decreases the expensive labor for the electrical contractor. It also allows the prestressed concrete contractor to install all members completely without waiting for the mechanical subcontractor.
6. Its better fire rating lowers fire insurance rates.
7. It provides a more durable and sound structural frame.
8. The exposed concrete surfaces can be left unfinished.

The structure is a basic column and beam design with precast, prestressed load-bearing wall panels with haunch beams to carry the hollow core slab.

In addition, the stairs, hand rails and exterior walls are all composed of precast elements. The stairs feature precast slabs, columns and beams, and rails. Wall panels have exposed aggregate finishes.
Chalet No. 5, Banff School of Fine Arts
Banff, Alberta, Canada

Chalet No. 5 (Rundle Hall), Banff School of Fine Arts, Banff, Alta., is a student residence hall being erected in three phases with precast, prestressed concrete as its structural system.

Huge precast, prestressed concrete single tee load-bearing wall panels support a column and beam structural system and 8-in. thick hollow core floor slabs. The wall panels are cast in single 49-ft. 6-in. lengths and 21-in. depths and trucked to the site.

The selection of the precast, prestressed concrete structural frame was based on four important considerations, according to the architect. First, many repetitive units could be used, making this type of frame an economical and logical choice.

Second, since the project was started in the winter in a remote area, a shortage of skilled labor for other forms of construction virtually precluded other structural systems. The winter schedule also suggested the third reason, which was the use of prebidding the precast work and allowing it to be erected in the spring.

Finally, the use of this type of structural system suited the requirement of carrying out the interior finishing through the following summer and fall with the owner's own crews at his own pace. Precast structures suit this split-contract concept.

The 5-story tall wall panels have 6-in. deep corbels moulded to their backs at each story to support the spandrel beams and floor slabs. The panels are spaced 13-ft. center to center, and each is 7-ft. wide. The 6-in. by 12-in. spandrel beam spans the 6-ft. space between panels and supports the cantilevering hollow core slab which forms 4-ft. deep balconies at every other floor.

The hollow core deck is wet-cast or extruded, depending on structural needs. The 4-ft. wide wet-cast is used for balconies and for structural areas where risers and ducts are needed. The extruded slab is 2-ft. wide and both kinds are up to 20-ft. 6-in. long.

Columns are cast in 32-ft. 1½-in. heights and conventionally reinforced. They are 16-in. wide by 14-in. deep. Interior beams are also precast in 13-ft. lengths, and are 18-in. wide and 10-in. deep.
The Arkansas Retired Teachers Home, Little Rock, Ark., is a 9-story structure built of precast and prestressed concrete because it reduced construction time by 6 months. It also lowered mechanical and electrical system costs.

The structure of precast concrete columns, prestressed beams, prestressed flat slabs, and precast exposed river run aggregate wall panels was erected in 9 1/2 weeks. This means about a floor a week was erected for the 60-ft. wide by 200-ft. long building.

Columns were cast in 3-floor sections with spaces at each floor level for beam entries. The columns were connected at the building's footing, fourth and seventh floors. Extra dowels were used in the connections for handling stresses during erection.

Column and beam connections were cast after the 4-in. thick prestressed flat slabs were placed. Negative steel was used through the connections so the beams could act as continuous members.

The beams, flat slabs, and a 2-in. topping combined to make up a 16-in. by 22-in. composite beam for the interior and sides of building. Along the front sides, the 4-in. thick wall panels were cast to be set into the step of a spandrel beam. At each floor level, the panels were erected with the spandrels.

An elevator shaft consisting of precast columns and wall panels was made continuous by the topping pour. Framing for one stair well at each end of the building was also provided.