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Religious Structures

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Precast prestressed concrete opens new vistas in religious building design

As in most areas in architectural and engineering design today, religious building design and construction is undergoing radical changes.

In the past, churches, temples, and ancillary facilities have been designed to reflect the long tradition of the churches of mankind and have literally been monuments to man's love of God.

Ecclesiastical design was in some ways the most difficult challenge facing an architect. Most religious structures were, and often still are, straightforward rectangular shapes. They were cavernous inside, and highly ornate in decor. The physical distance between the altar and the congregation was sufficient to "remove" the service from the worshippers.

For a designer of religious facilities to design a church which would stand apart from others and still incorporate these characteristics was indeed a challenge.

But with the ecumenical movements in the Christian church in recent years and the freedom of design in Jewish synagogues, many of the old restraints on architects are crumbling.

Today, a "church-in-the-round" is possible and examples of this radical shape for religious worship exist. Other geometric shapes, combined with hyperbolic paraboloids, catenary curves, and other structural engineering devices have opened new vistas for the design of houses of worship.

Naturally, precast prestressed concrete is in the forefront of this movement to liberalize church design. The material offers tremendous advantages to the architect who wants to design a church that is different, and it offers these advantages at low cost.

Precast concrete can be molded to any shaped desired. It is strong. It is fire resistant. It features little or no maintenance, especially important for a church. It can be erected quickly, thereby cutting construction cost.

There are fewer parts to erect, thereby simplifying construction and again cutting costs. Finally, it can be cast indoors during bad weather under very strictly controlled conditions, thereby assuring quality.

The Cover

The Bukowinian Greek Orthodox Church, Ottawa, Ontario, Canada is built with 36-ft. tall precast single tee wall panels and a single tee roof combined with precast framing beams and hollow core slabs.

Precast concrete was chosen primarily because a cost comparison study with other materials indicated it was the least expensive and fastest method of construction. The difficulty of access to the site required speed of erection to keep encroachment on the road to a minimum. It took only four days to erect the precast walls and roof.

Arch. & Eng.: Miska & Gale; precast concrete by Francon Limitee.

Sardis Presbyterian Church Education and Fellowship Building Charlotte, North Carolina

Precast prestressed concrete double tees, hollow core plank units, and column and beam frame provided rapid erection and earlier enclosure of the Education and Fellowship Building for Sardis Presbyterian Church, Charlotte, N. C.

Durability of precast concrete and the lack of maintenance to exposed members were additional factors in choosing the material. Also, design considerations influenced the choice of precast, prestressed concrete.

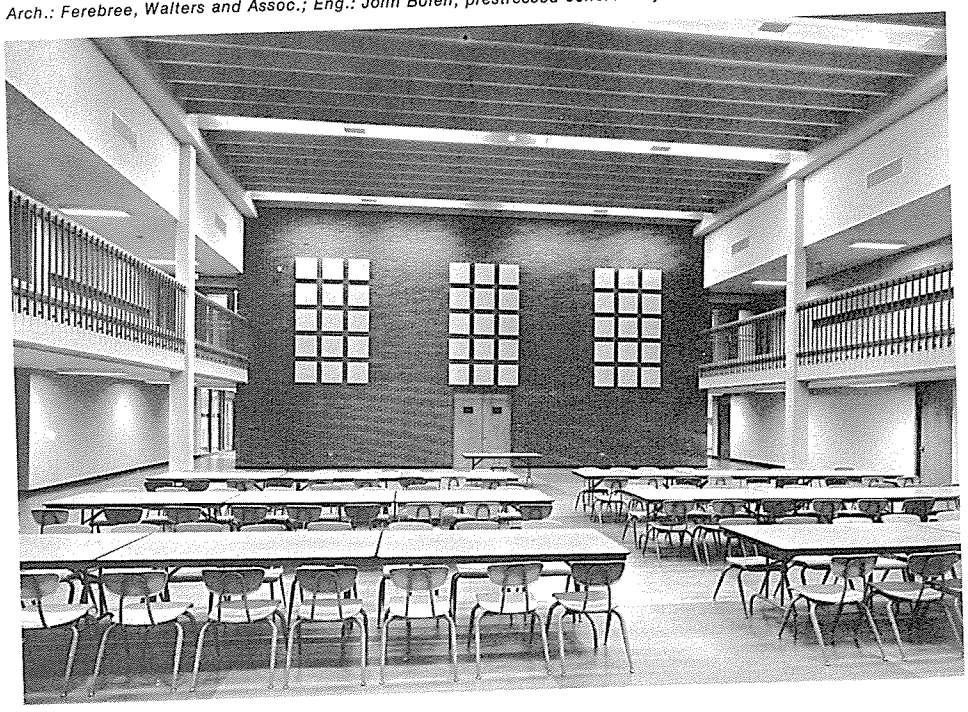
Exposed structural elements provide suitable ceiling finish conditions. The hollow core slabs are used in classroom ceilings where acoustical properties are important. They were cast with a bottom layer of dry concrete mix to provide a sound absorbent surface. The double tees in the fellowship hall ceiling give added interest to the large space and high ceiling.

The structural elements also provide the necessary fire protection. A 4-hr. rating was earned by the prestressed concrete frame, while a 2-hr. rating was earned by the building shell and roof.

A total of 26 double tees 48-ft. long and 14-in. deep were used. The 96 hollow core slab units were used in lengths of 33 and 55 ft. to span over classrooms and corridors. They are 4-ft. wide and 12-in. deep.

The four prestressed columns are 12-in. by 16-in. and 24-ft. high.

Arch.: Ferebree, Walters and Assoc.; Eng.: John Bolen; prestressed concrete by Concrete Materials Inc.



Immanuel Baptist Church, Denver, Colorado

Precast prestressed concrete flared tee wall panels dominate the exterior of the all precast prestressed concrete Immanuel Baptist Church, Denver, Colo.

The tees' flanges flare at a 15° angle to form a flattened Y shape. Thirteen panels, each 41-ft. tall, 10-ft. wide, and 18-in. deep, form the two side walls of the sanctuary. The end walls are made of four prestressed single tee wall panels each in 41-ft. heights.

Inside, the stems of the flared tees and of the single tees in the roof "lend themselves to the serene and calm surroundings of worship, and to the strength and power of support for which a church is representative," says Roland A. Wilson, the architect.

The 13 roof single tees are 45-ft. long, 8½-ft. wide, and 18-in. deep. In addition, the floor is constructed of prestressed double tees 8-ft. wide and 12-in. and 18-in. deep. Lengths vary from 41 ft. 8 in. to 61 ft.

"Prestressed concrete was the most economical means of achieving the construction speed required," says Wilson. At the same time, he adds, it created the esthetic appearance desired.

The architect was not only able to achieve the clean and simple lines of the exterior, but also an unusual and effective interior.

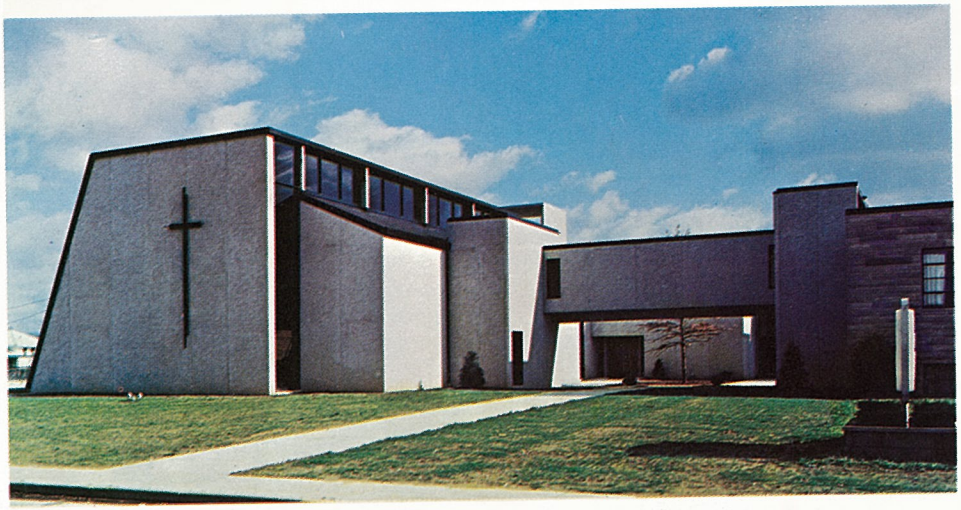
"The use of prestress in this structure is indicative of the versatility and adaptation available in the construction industry with prestressed concrete," Wilson states. The design was completed with standard products (existing casting beds were modified) fabricated easily and swiftly to achieve the maximum in beauty and grace.

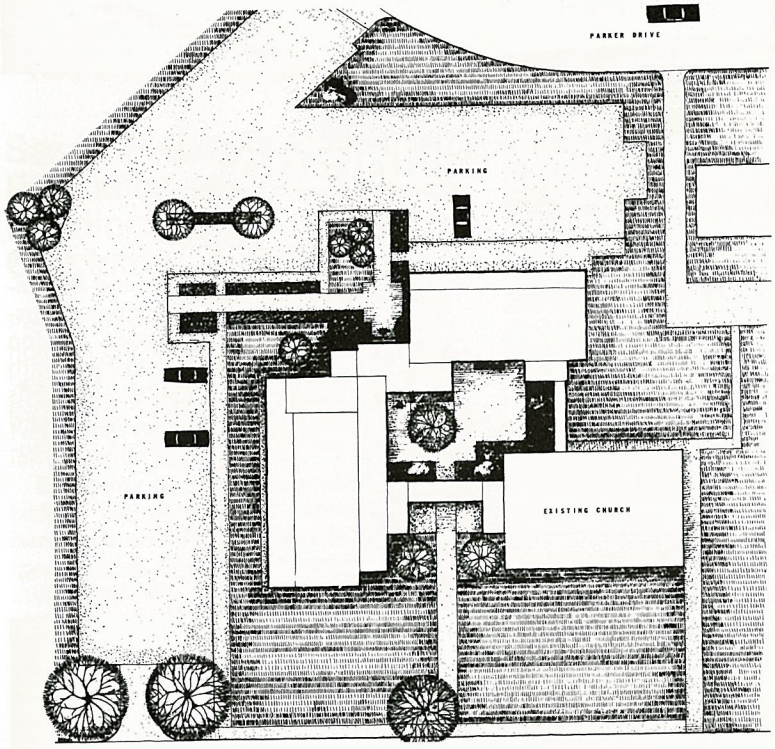
Arch.: James W. Woodworth for Roland A. Wilson, Architect; Eng.: Sallada & Hanson; prestressed concrete by Rocky Mountain Prestress, Inc.

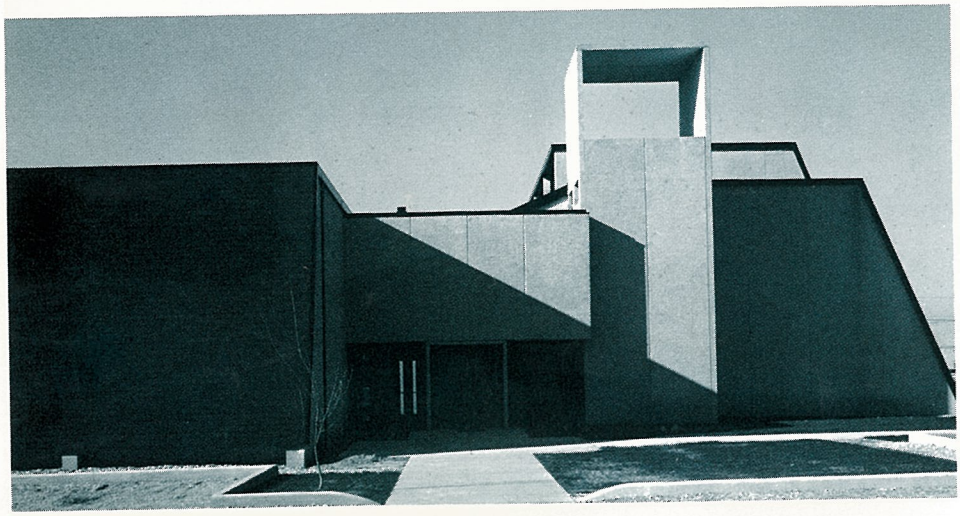
Correction

Empire Prestress, Inc., Portland, Ore., supplied the prestressed concrete for Portland Community College featured in the November, 1969 PCItems, and not Ross Island Sand & Gravel Co. as was credited.

Fairlawn United Methodist







Precast prestressed concrete was chosen to provide Fairlawn United Methodist Church, Evansville, Ind., with a sanctuary and additional classrooms.

An effective, simple and esthetic structure was erected through the use of precast prestressed concrete wall panels, precast concrete for the roof frame, and prestressed double tees and beams, girders, and flat slabs for the floors.

An elevated walkway connects the existing structure and the sanctuary. It is built with prestressed single tees for the roof and floor and 4-in. thick prestressed exposed aggregate wall panels.

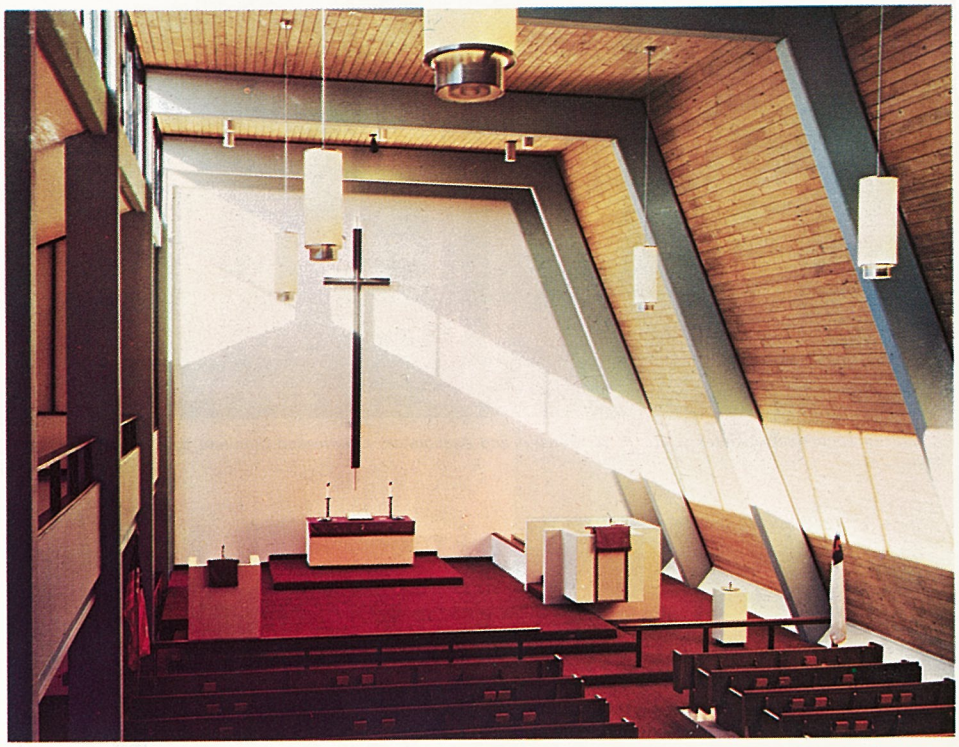
According to the architects, Condict and Fosse, the precast prestressed concrete was used in the church for the following reasons:

1. A pleasing, maintenance-free exterior was attained at a more economical cost than the existing building wall construction.
2. It offered simplicity of framing.
3. Exposed structural components as finished surfaces for both the interior and exterior were available.
4. It allowed a reduction in fire insurance premiums.

Exterior walls consist of 6-in. thick,

Church, Evansville, Indiana

Arch. & Eng.: Condict and Fosse; prestressed concrete by Precision Prestressed Products, Inc.



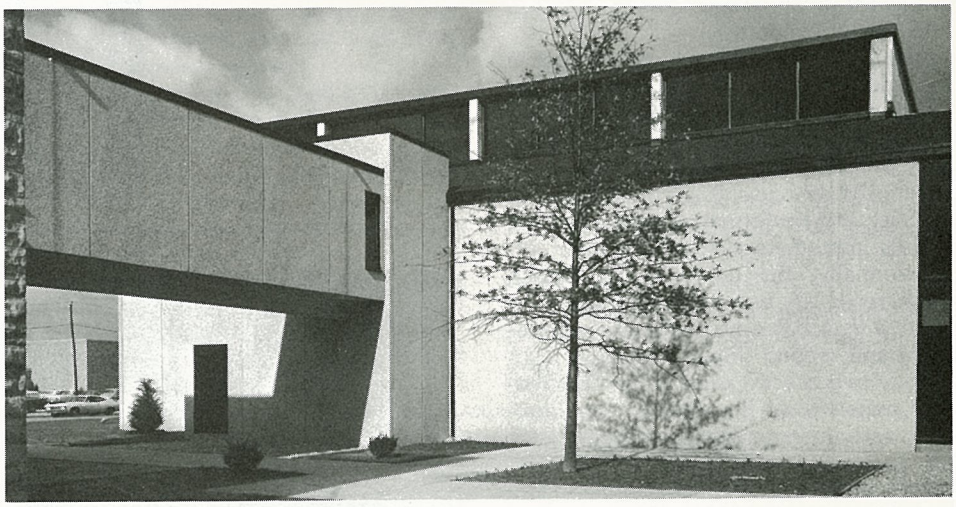
6-ft. wide, load-bearing prestressed concrete panels. Maximum length of the panels is 35 ft. 5 in. An exposed aggregate finish is produced by a gap-graded concrete mix with crushed limestone which is then sandblasted.

The sanctuary roof construction is laminated wood decking spanning between precast concrete rigid frames. Rigid frame components were job-site assembled and welded.

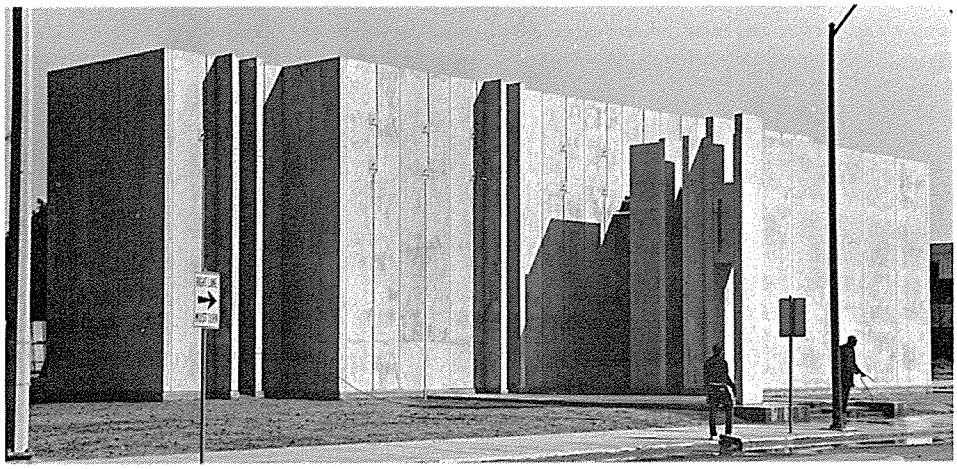
The upper floor framing consists of precast prestressed double tees for the long spans, and a system of precast prestressed beams, girders, and flat slabs on the short spans.

Clerestory windows above the side balcony of the sanctuary and a large chancel window permit early morning natural light to enter. A stair tower leads from the elevated passageway to the sanctuary .

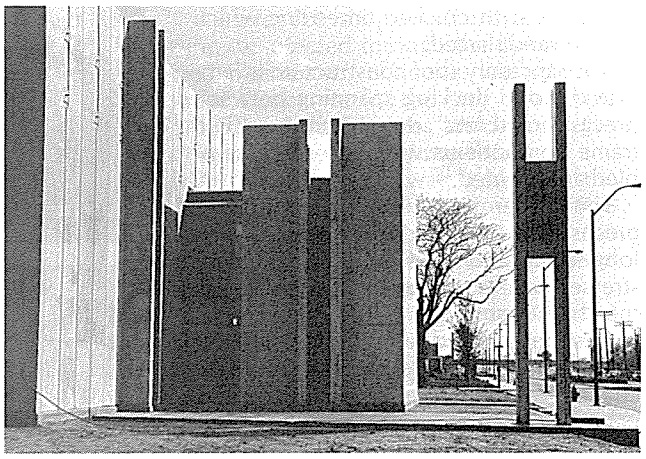
The additional classrooms and a multipurpose church lounge overlook the semi-enclosed courtyard. These areas, too, are enclosed in prestressed concrete wall panels with exposed aggregate finish. In all, approximately 250 precast prestressed concrete components are used in the project.



Church of St. Philip the Evangelist, Cleveland, Ohio



Arch.: Fred Toguchi Associates; Eng.: R. M. Gensert and Associates; prestressed concrete by Concrete Masonry Corp.



To build an inner city church in a substandard area economically and which would meet the needs of the people living in such an area, architect Fred Toguchi designed the Church of St. Philip the Evangelist in Cleveland, Ohio, of precast prestressed concrete.

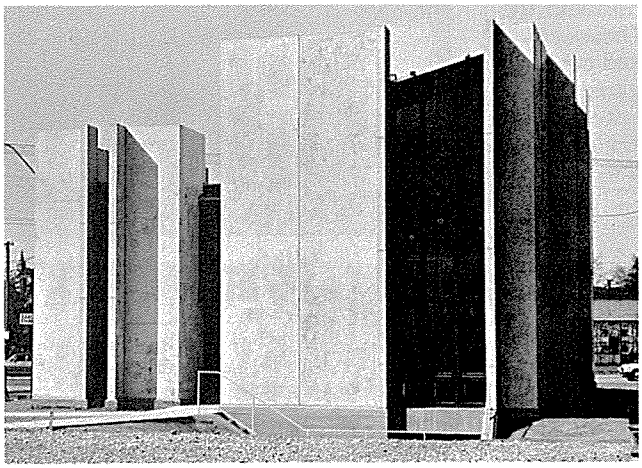
"Economics played a dominent role in the selection of precast concrete as a finished interior and exterior material," says the architect. In addition to its lower cost, precast prestressed concrete was also chosen because it gives a sense of stability and performance to the project and its immediate vicinity.

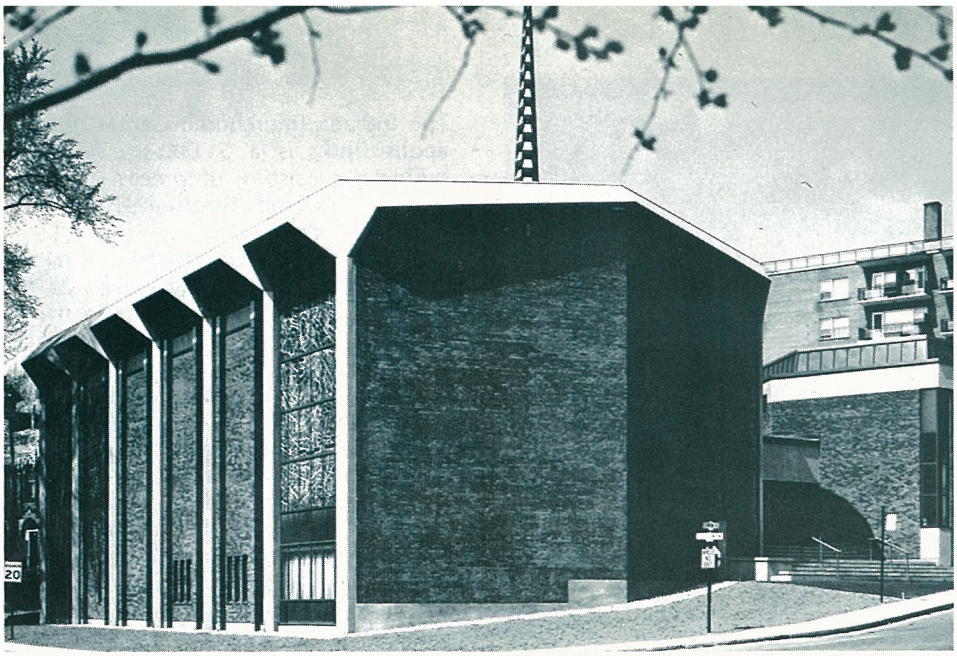
Essentially, the 4,700-sq. ft. church consists of an entrance vestibule and nave with a balcony. There are a basement and second floor however.

Sixty two precast prestressed concrete wall panels form the sides of the structure, and are exposed both on the interior and exterior. Each panel has horizontal mild-steel reinforcing with vertical strands prestressed to 175,000 psi for deflection control and handling stresses.

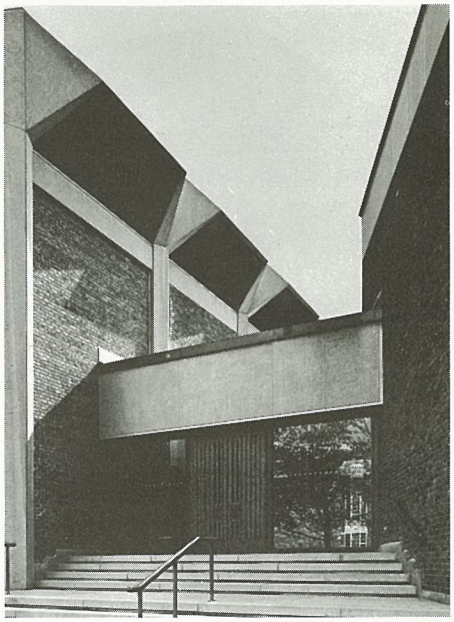
The taller panels around the nave are 27-ft. tall, 6-ft. wide, and 8-in. thick. Those in the vestibule have the same width and thickness, but are only 22-ft. tall.

Some units are 1-ft. 6-in. wide and are set in place at a 90° angle to the others to frame window openings. All connections are welded, except those connecting the wooden roof trusses and precast panels, which are through-bolts.





St. Andrew's United Church Westmount, Quebec, Canada



The new St. Andrews United Church, Westmount, Quebec, Canada, replaced an earlier one on a prominent urban site. This required a building design which would befit the congregation's long history, reflect an ecclesiastical character, and have superior esthetics.

The main building material chosen by the architect to meet these and other, lesser, design requirements was precast prestressed concrete. Exposed precast prestressed columns and beams, floor elements, and precast roof slabs and hoods form the basic structure and give the building its character.

Of considerable importance is the quality of finish of the precast concrete elements, not only in surface color and texture, but in the consistency of joint sizes and in the accurate dimensioning of components meeting at other than right angles.

"The three-dimensional geometry of the concrete work was quite complicated, and the accuracy with which the components fitted together at the side reflects considerable credit on the manufacturer," says Richard E. Bolton, of Bolton, Ellwood & Aimers, architects for the church.

Fourteen precast prestressed concrete columns 41-ft. high support diagonal precast prestressed roof beams covered with precast triangular or trapezoidal shaped slabs.

Precast spandrel beams run between the columns, and precast hoods cantilever from the tops of the columns on the exterior. Prestressed hollow core floor slabs account for the remainder of the precast concrete in the church.

The interior of the church is an exposed masonry structure with brick infilling between columns; diagonal concrete roof beams, are exposed.

The beams are directly supported and bolted to the columns. The criss-cross pattern is accomplished with a prestressed diagonal beam spanning the full width of the church and cast with seats for two beam half sections.

The same pattern was used to support the choir gallery at the back of the worship area. It was necessary, however, to post-tension the beams and erect both as a complete assembly. This was required because the loft called for the support of an additional 80 tons.

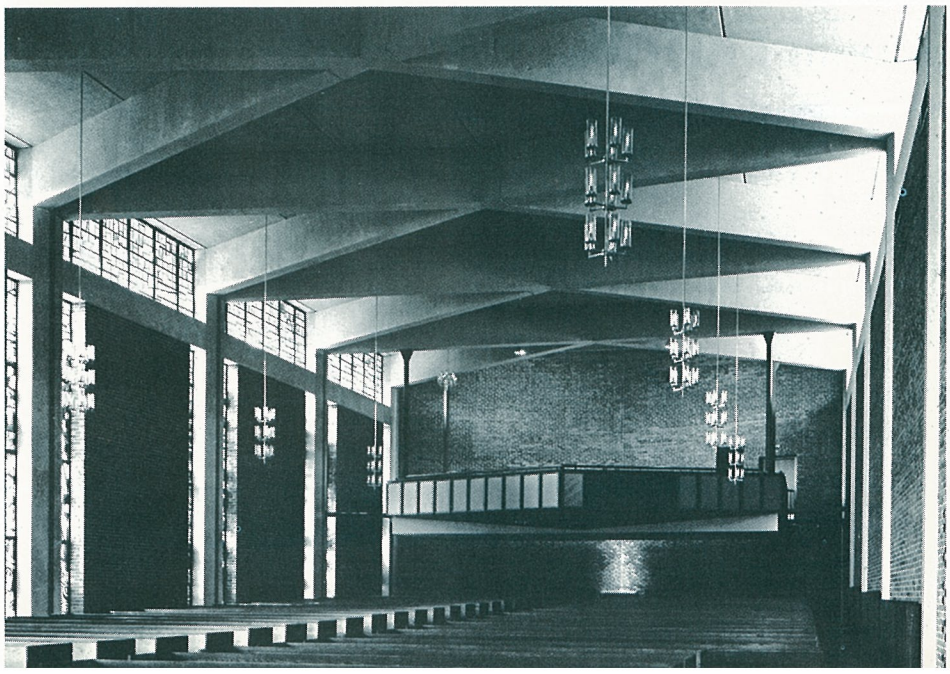
Each beam has a clear span of 54 ft., and a cross-section of 12 in. by 42 in. Each has a 2-in. slope from ridge to eaves.

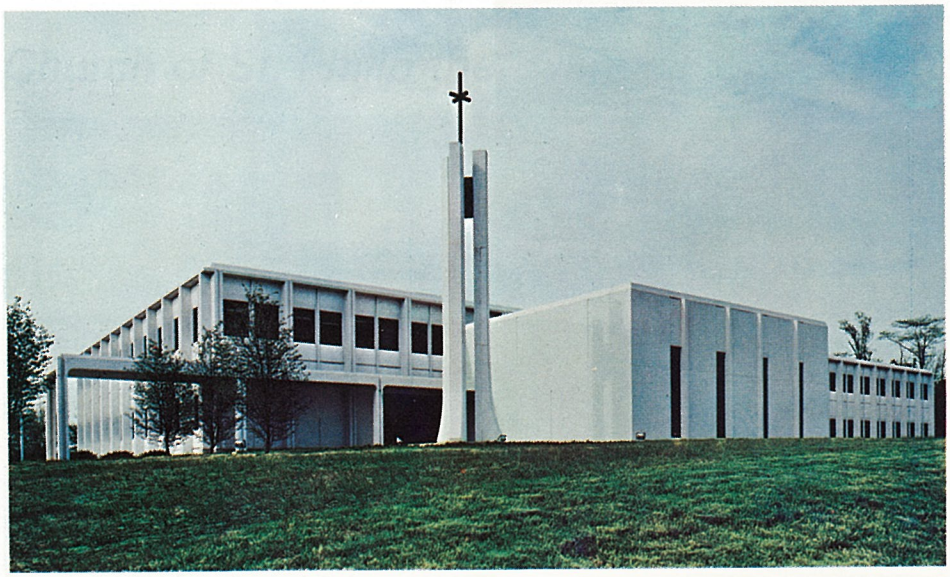
The spandrel beams were cast with integral insulation and installed at the level of the base of the hoods. The hoods are 16-ft. 8-in. wide, 6-ft. high, and project 4-ft. past the wall.

The prestressed hollow core floor slabs are 8-in. thick and span 27 ft. from outside wall to a longitudinal beam on the center line of the building.

All exposed concrete was finished with a light-to-medium sandblasting to expose the aggregate.

Arch.: Bolton, Ellwood and Aimers; Eng.: Kursbatt and Associates; prestressed concrete by Francon Limitee.





Indiana Interchurch Center
Indianapolis, Indiana

Arch. & Eng.: Wright, Porteous & Lowe, Inc.; prestressed concrete by American Precast Concrete, Inc.

The Indiana Interchurch Center, Indianapolis, Ind., is a 51,000-sq. ft. office building consisting of precast concrete wall panels and prestressed concrete double tee floors.

A total of 270 architectural wall panels 10-ft. wide and 26-ft. high make up the exterior walls of the center. The panels were cast with a white quartz aggregate and white cement.

The panels are load-bearing and support the double tee floors with ledges cast into the panels. This provides a more rigid structural system.

Fourteen inch and 8-in. thick prestressed concrete double tees were used in the floors. The tees are 5-ft. wide.

"The use of precast components had advantages we couldn't resist," says Dick Roettger, project architect for Wright, Porteous & Lowe, Inc., architects.

"We were able to combine the usual outside finish, masonry backup, window openings, ventilator openings, and structural elements into one large precast concrete component manufactured under controlled conditions and erected at the site under the control of one supplier."

He adds that the 5-ft. widths of the double tees fit the 5-ft. module used in the building "or any other module."

"This was reassuring in an age when manufactured items impose so many dimensional limitations."

Other advantages of this precast wall panel and prestressed double tee system were also significant:

—The wall panels and double tees could be fabricated and installed by one supplier.

—Their combined used assured low fire insurance rates.

—Since precasting was done in a temperature-controlled plant, work was able to proceed to enclose the building during cold weather.

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