Z.C.M.I. Department store in suburban Salt Lake City featured the effective use of 16 in. deep by 48 in. wide double tee’s as attractive wall panels. The structure is precast concrete from the ground up including grade beams. Prestressed double tee’s provide two floors of shopping and the roof.
Precast concrete wall panels are giving architects a new dimension with which to express their most imaginative creations. These panels, designed with unusual patterns, have relieved today's structures of the routine walls whose sole means of identification was height and location.

More and more architects want the structural frame of a building to assert itself. They are no longer merely interested in hiding the bones of a building under a skin of tinsel. This can be basically achieved two ways. The most common way is a non-structural wall panel enclosing the space between the structural columns and beams. More recently the structural frame has also been required to double as the enclosing wall panel. This means that the frame must also provide the exterior architectural treatment. Precast concrete wall panels, both reinforced and prestressed, provide an excellent medium for both types of closures. Concrete wall panels can provide a feeling of texture and strength unmatched in other materials.

**Structural Panels**

Prestressing has brought to wall panels a new concept—the light, architectural, and yet structural wall panel. In the past, wall panels have been only asked to support themselves and to shed the elements. To ask them to do more when they are built of conventional materials results in heavy cumbersome members. But by prestressing them relatively light panels can be built which not only are easier to handle and erect, but are able to double as a part of the structural frame. One of the more well known applications of prestressed decorative wall panels as structural members is the filigree members of the "Century 21 Exposition" shown on page 6.

Another advantage of prestressing a panel is deflection control. Frequently, loads are applied to a panel eccentrically causing the panel to bow in or out. By prestressing a panel, this deflection can be accounted for and a truly vertical panel can be produced even under eccentric load. As an example, the roof members of the Century 21 Exposition were carried on studs on the back of the decorative panels. This eccentric load would have caused the panels to bow out 5/8 in. However, by controlling the location of the prestress force in the panels, they actually were cambered in the required 5/8 in. Therefore, under load they assumed a vertical position.

**Appearance**

There are three basic variables that can be used either separately or together to produce a design pattern in concrete wall panels:

1. High and Low Relief
2. Contrasting textures
3. Color

Taking best advantage of these variables and considering the distance at which the viewer will see the panel is very important to the designer.

**High and Low Relief**

High and low relief are produced by forming techniques. Forms can, and have been made of steel, wood, plastic, sand and even styrofoam, all of which yield special surface effects. One of the most popular forming materials being used for relief work, however, is plastic. There are several reasons for this popularity. First, plastic is inexpensive and easily shaped. The smooth surface it provides needs no parting agent to prevent sticking to the finished concrete. Another important point is that plastic forms reinforced with fiberglass, can be used several times without being repaired or in need of extensive maintenance.

Plastic forms can be made in a variety of ways. By one method liquid plastic is sprayed on a negative pattern with a spray gun. For large members, the forms can be produced in sections and then sealed together with resin and fiberglass to make a seamless mold. A special gel coat is then applied to insure a smooth impervious surface. The molds are fastened to steel pallets and braced securely to prevent any deviation in the completed panel.

Pattern decoration can also be imparted to a thermoplastic sheet either by positive pressure or vacuum forming. These plastic sheets which can be as thin as 1/16 in., are heated to above...
Erecting a precast "Schokbeton" wall panel for the dramatic Police Administration Building in Philadelphia. These panels were also employed as exterior bearing walls supporting one end of the precast wedge shaped floor slabs. The cantilever beam supporting the panels is comprised of a precast segmental beam post-tensioned together.

R. R. Donnelly & Sons office building, Chicago, Illinois, employs precast panels doubling as window frames.

Four inch thick white concrete wall panels contribute to the attractive appearance of the Federal Center Buildings, Hyattsville, Maryland.

Precision precast panels for the College of Education Building at Wayne State University, Detroit, Michigan.
300° F. for molding. A model of wood, metal or plaster of paris is appropriate for making plastic forms by this method. Depth of relief should be considered in relation to valley pattern so that when the plastic sheet is molded over the model, excessive thinning does not take place, producing a fragile form. The relief of the finished form should be such that the molded concrete panel encounters no stripping difficulties.

All precast concrete wall panels are made with a low slump concrete. An air entraining agent is generally added to the mix to insure the panels’ ability to withstand the weather.

In one patented process called “Schokbeton,” the forms are hand crafted of mahogany. These forms are attached to a shocking table which delivers high amplitude, low frequency external vibration. By this method a voidless finish of amazing accuracy is obtained.

Texture

The multiplicity of textures which can so easily be imparted to concrete is one of the qualities that has made it a favorite medium with architects. Contrasting textures are frequently used to define patterns by themselves or they are used to enhance other characteristics to achieve the design.

Casting the panel in a smooth plastic lined form can give it a shiny texture, if desired. A high gloss effect is best realized by curing the concrete under some type of waterproof membrane such as polyethylene film which preserves the original water in the mix without gain or loss of moisture. In this process the membrane should not be removed until curing is completed.

Steel, wooden, and sand forms will produce a velvety or low reflective concrete panel texture. Grainy surfaced plastic and rubber form linings are also used successfully to texture concrete wall panels with a non-gloss finish. If a still more rugged effect is desired, mechanical texturing techniques can be applied. Bush hammering, spawling, sand blasting and coarse grinding are used to develop pleasing rough surfaces.

Color

Pigments are available to produce concrete of virtually every color in the rainbow. Adding color to prestressed concrete has no more adverse effects than adding color to normal reinforced concrete. Inorganic pigments (metallic oxides) are preferred for concrete since they eliminate possible reaction with the cement hydration process. The most successful coloring results have been accomplished by dry preblending the cement and coloring agent to prevent uneven color or streaking. Coloring agents in the order of 1% to 6% by weight of the cement in the mix are normally necessary, although it is an interesting fact that for the more brilliant colors, lesser amounts of pigments are generally added.

Colored Aggregate

All of the previously mentioned effects (relief, texture, and color) can be applied to concrete using exposed colored aggregates. Aggregates of metal, plastic, glass, and a host of natural minerals and rocks have been used to create interesting precast concrete panel designs. Perhaps the most popular decorative aggregates are marble, quartz, and granite. Marble has the widest range of color; quartz is highly reflective and durable; and granite (owing to its composition of quartz and feldspar) lends a softer, mottled appearance and also has excellent weathering resistance qualities.

Decorative aggregates are selected on the basis of color, size and ability to withstand corrosion. It is not unusual for two or more aggregates to be blended to obtain the required color. Contrast is most effectively provided if the dark coloring is offered through the aggregate and not the background. Rounded or square shaped particles will give the best area coverage. Bladed or flat pieces are difficult to hold in the concrete matrix. The size of aggregates popularly used range from fine sands to large cobbles 6 in. - 7 in. in diameter.

The distance of aggregate exposure is termed reveal. Exposed aggregate panels are the most popular of precast panels and depend a great deal upon reveal for their pleasing appearance. The reveal is largely based upon the
size of the aggregate. That is, as the aggregate becomes larger the reveal becomes deeper. There are a number of ways by which the reveal can be varied. A shallow layer of sand can be placed in the bottom of the form and the decorative aggregate set into it. Another method is to spray a retarder either on the surface of the newly cast panel or on the forms when the panels are cast face down. After the concrete takes its set, the exposed aggregate is brushed and washed free of sand and mortar. A muriatic solution is frequently used to bring out the full highlights of the imbedded decoration.

Typical Members

It is also interesting to observe the increasing use of typical prestressed members (tees - channels - cored slabs) as wall panels. This can be basically attributed to several things—the inherent strength of these structural members—their attractive form and shape—the relative flexibility of their use—their wide availability—and economy.

One of the important considerations for wall panel construction is uniformity, and of course a member cast in a fixed form is the best assurance of uniform appearance. The only remaining variable is color which can be controlled by rigid manufacturing specifications or perhaps employing white cement, paint or rubbing the finish.

Perhaps one of the most interesting features of employing stemmed members as wall panels is the excellent shadow patterns they create. Because they are cast on long beds they can be made to any length. Typical prestressed members are made in wide widths (4 ft. - 10 ft.) and therefore a building employing them is rapidly enclosed.

Connections

The means of fastening and connecting precast panels to each other and to the structural frame is important. When designing the connecting device, it is well to allow a reasonable amount of

![Architects: Show-Metz Assoc.; Preacast Concrete: Martin-Marietta Corp. Chicago's McCormick Place. The wall panels employ bas relief to exhibit modernistic designs at the new civic center](image)

![Precast Concrete: Standard Prestressed Structures. Wall panels in the Sandwich West Township Municipal Building, Windsor, Ontario, are filled with thermo-glass panes.](image)

![Architect: John Graham & Co.; Prestressing: Utah Prestressed Concrete Co. A close-up view of the Salt Lake City department store shown on the cover. Note the shadow effect on the double tee wall panels.](image)
field adjustments. The connection are weld-
To function properly,
be careful, keeping in mind erc-
An ample connection ed with sufficient toler-
installation and result erec-
provided in connections . Double headed nuts es in one direction. Over-
bolts and washers pro-
to provide tol-
ed in two directions.

decorative panels, it is to provide a connection sporting until it is com-
also results in important economies be-
ce the glazed are able to operate on a production-line basis on the ground. Since the panels form the facade of the building, pre-glazing enables them to provide a completely finished wall upon erection.

The glass is usually held in place with a neoprene gasket which is wedged into a slot in the panel. The glass is then set into the neoprene gasket and a zipper strip locks the pane in place. Precasting wall panels with provisions for glazing requires close tolerances, but many successful applications back up using them in this way.

The sandwich panel is also growing in popularity. In this type of panel con-
construction, a layer of styrofoam, or other insulation, is placed between two layers of concrete. It is easily cast in the yard and provides a fully insulated panel requiring little additional work on the job site.

The insulating material may be cell-
lar glass, fibrous glass, or foamed polystyrene. The total thickness ranges from 5 to 8 in. The effective insulation provided by a 6 in. sandwich panel including a 1 in. insulating core is a "U" value ranging from 0.16 to 0.21 depending on the insulating material.
Prestressed Concrete: Northeast Concrete Products, Inc.

The Quincy Market, Cold Storage and Warehouse Company's new building in Gloucester, Mass. 8 in. double tee wall panels were used in conjunction with double tee floor members.

The New Hampshire State Office Building showing welded connections of the panels to the columns which will later be enclosed.

Typical Details

Wall panel connection detail providing ample tolerance and a quick simple connection. Connection is also set in a pocket in the structure where it later can be covered up.

Schematic of the post-tensioned connections for the Peter Bent Brigham Hospital. All of the components were precast and then tied together by post-tensioning.

Wall panel connection employing a recessed bolted device.
LYMAN NAMED EL PASO’S ‘ENGINEER OF THE YEAR’

Robert J. Lyman, immediate Past President of the Prestressed Concrete Institute, has been selected El Paso’s “Engineer of the Year.”

Mr. Lyman, who is vice president, general manager and chief engineer of Atlas Structural Concrete, Inc. at El Paso, pioneered and developed the use of prestressed concrete in this west Texas city of a quarter million people. He was selected for the Engineer of the Year Award by the El Paso Chapter of the Texas Society of Professional Engineers. The announcement was made recently at a T.S.P.E. banquet in El Paso’s Hotel Paso del Norte.

PRESTRESSED CONCRETE WINS IN SUIT AGAINST CHICAGO BUILDING COMMISSIONER

Crest Concrete Systems, Chicago area prestressed concrete manufacturer, was awarded the decision in its suit against the Chicago Building Commissioner. The use of prestressed concrete in the city has been restricted by the Building Commissioner by his application of ten “Rules.” The Judge’s decree listed the ten rules as illegal, invalid and inconsistent with the provisions of the City’s Building Code. The suit was heard before a Master in Chancery as appointed by Circuit Court Judge B. Fain Tucker.

The Judge ordered the following in her Decree: “The City of Chicago shall not, on the grounds of alleged inadequate fire resistance, deny the use of the Plaintiff’s products (prestressed concrete) which have been listed by, and have the labeling service of Underwriters’ Laboratories, Inc. in the construction of buildings in said city, regardless of span length, nor shall the City of Chicago require the use or application of any additional fireproofing materials.”

All of the typical prestressed concrete members (double tees, single tees, floor slabs) available in the Chicago area are approved for Underwriters’ Laboratories two-hour Label Service. Prestressed concrete has been used extensively in Chicago suburbs over a period of six years. This case has attracted national prominence because of the general acceptance of prestressed concrete in virtually all other areas of the United States and Canada.

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