



Designer's

NOTEBOOK

BENEFITS AND ADVANTAGES

PCI's Architectural Precast Concrete Services Committee explains key benefits to be gained by owners, designers and contractors by specifying architectural precast panels

Designer's Notebook: Benefits and Advantages – Article XIII

Design considerations must balance a variety of needs, including aesthetics, function and financing. Each plays a role in achieving success with the finished project. Architectural precast concrete not only can ensure these general goals are met, but it provides a myriad of life-cycle and ancillary benefits that are difficult to match with other materials.

Durability

Architectural precast concrete offers the building owner peace of mind that results from the certain knowledge that the building's walls have long-term durability and require little or no maintenance to preserve their original look. Economical precasting is based on achieving high strength to allow units to be stripped from the mold at an early age.

This requires high cement contents and low water-cement ratios. Combined with good compaction and curing in a controlled factory environment, these factors ensure a dense, highly durable concrete. A low water-cement ratio has been proven to increase resistance to weathering and corrosion. Entrained air may be used to improve freeze-thaw resistance in particularly severe environments.

Aesthetics

Architectural precast concrete panels provide the designer with an unlimited architectural vocabulary of expression. Whether the project's aesthetic intent is traditional or contemporary, precast concrete can be shaped in a cost effective manner. The material is incredibly responsive to the designer's needs. The only limits are imagination and creativity.

Visual interest in the building's façade can be enhanced with architectural devices such as ribs, bullnoses, reveals, chamfers or casting against various types of formliners. Precast may be designed with a combination of concave, convex and flat sectional shapes.

Taking advantage of precast's initial plasticity can economically create these shapes, adding considerable aesthetic appeal to a project. Design flexibility is possible in both color and texture by varying aggregate and matrix colors, size of aggregates, finishing processes and depth of exposure. Combining different finishes using the same or different concrete mixes within a single precast concrete unit can provide additional flexibility. A highly articulated pattern of color and texture develops a richness of architectural expression.

Commitment to Quality

Architectural precast concrete units produced by PCI-certified plants are produced under strict, factory-controlled conditions to ensure a high quality façade in the desired shapes, colors and textures along with close tolerances. Every PCI member must undergo two stringent unannounced inspections each year by independent auditors to maintain PCI certification. The inspections focus on the process by which the unit is produced, as well as the plant's general operation.

Certification pays off for owners and designers because it produces fewer worries about on-site discovery of units out of tolerance, connection details that aren't cast precisely or finishes that aren't matched from panel to panel. It also minimizes the need for continuous inspections.

Life Cycle Cost

When comparing the cost of alternative façade systems, the cost throughout the design life of the building needs to be evaluated. A precast façade can be designed to match the intended life of a building with minimal maintenance, providing substantial long-term savings. Precast concrete panels present a durable aesthetically pleasing exterior surface that is virtually air- and watertight and does not require painting. This helps the building remain in first class condition long after the mortgage is repaid, ensuring its desirability to future tenants or owners. It also means attractive refinancing can be accomplished more advantageously, too.

Initial Cost

Precast’s speed of erection and its ability to be cast and erected in all kinds of weather aid the entire construction team. Since the casting process does not rely on other critical-path activities to begin, units can be produced as soon as drawings are approved, ensuring units are ready for erection as soon as foundation work and other site preparation is completed (see Fig. 1). These advantages allow the building’s shell, whether load-bearing or cladding, to be enclosed quickly. This, in turn, lets interior trades begin work earlier and reduces overall construction time.

Faster completion reduces interim financing costs, results in earlier cash flows, and produces other economic benefits. This ultimately lowers the building’s long-term overall cost and can make the use of precast concrete more economical than other façade materials.

Load-bearing panels can reduce framing costs by providing a column-free perimeter. Depending on the floor plan, there also is potential for reducing the number and/or size of interior columns, adding layout flexibility. This results in a more efficient and less costly construction. Cost savings are greatest for low-to mid-rise structures of three to 10 stories with a large ratio of wall-to-floor area.

Energy Efficiency

Precast concrete panels can be designed to provide a high degree of energy efficiency for the buildings they enclose. Recessed window walls, vertical fins and various other sculptured shapes facilitate the design of many types of shading devices for window areas to reduce glare and solar gain. This provides economies in the cost of the air-conditioning system by reducing thermal load. Specific wall thermal characteristics can be designed for each face of the structure to suit its sun orientation.

To obtain a range of R values, precast concrete walls may have insulation applied to the back, or the insulation may be incorporated into a sandwich wall panel to reduce heating and cooling costs. The thermal mass inertia of concrete, which is recognized in ASHRAE standards, also reduces peak heating and cooling loads, thus saving energy year-round by reducing large daily temperature swings.

Other Inherent Benefits

Architectural precast concrete is non-combustible with inherent fire-resistant capability, creating a safe envelope that helps protect personnel, equipment and the building itself. That in turn reduces insurance rates. It also eliminates the need and cost of additional fireproofing measures, except on structural-steel frames.

Environmental Impact

In addition, the inherent sound attenuation properties due to precast concrete's mass provide an economical acoustical barrier to exterior or interior noise penetration. These attributes enhance the cost effectiveness of precast panels. The life-safety and tenant benefits provide a potent marketing asset when attracting long-term occupants.

Precast concrete is an environmentally sound material. It is produced from natural materials. No toxic substances are produced in its production or use. Also, the production energy consumption of the concrete is quite small. The thermal mass of concrete saves energy year-round by reducing temperature swings.

Concrete's high albedo (or ratio of light reflected) has the added quality of reflecting heat as well as light, thus reducing the "heat island" effect and higher temperatures endemic to urban areas. The resulting lower overall temperatures can make a difference in the amount of electricity consumed in air conditioning and can reduce smog formation, potentially improving air quality in urban areas.

Precast wall panels can be reused when buildings are expanded. Nonload-bearing panels on the end simply are disconnected from the framing and additional panels and framing are added on each side. With the new addition in place, the end panels can be replaced. Concrete measures up well in regards to sustainability. It strikes a perfect balance between meeting today's needs and natural resources for tomorrow.

Single-Source Provider

As a single unit, precast panels provide one source for supplying the entire exterior wall system. When load-bearing precast structural floors along with panels are specified, it concentrates the complete shell with one certified and reliable producer.

This approach ensures complete responsibility and accuracy for meeting design specifications rests with only one supplier. The precaster is responsible for all manufacturing and constructability issues. This reduces the number of subcontractors and minimizes trade coordination. Also, the producer's competent staff of plant engineers is available to assist the design team.

Supplier Assistance

PCI member precasters can offer detailed expertise that allows the development of design techniques, engineering innovations and scheduling improvements that save time and money from conceptual design to project completion. To maximize these benefits, the design team should interact with the precaster early in the project's development stage. This ensures each element is as cost effective as possible and will take full advantage of precast's inherent performance characteristics. The result will be a functionally efficient, aesthetically pleasing structure produced on time and on budget that meets all programmatic needs.

Jim Van Duys, associate with Smallwood, Reynolds, Stewart, Stewart & Associates Inc., in Atlanta explains how the architectural firm uses precast

How SRSS&A Uses Architectural Precast Concrete

For the past 22 years, Smallwood, Reynolds, Stewart, Stewart & Associates Inc. has used architectural precast concrete as a cladding material and as a structural component in millions of square feet of commercial, institutional and hospitality buildings. We consistently rely on architectural precast to execute our design ideas in a cost-effective manner while maintaining high quality standards.

Design Flexibility

For the designer, the first and most significant advantage of architectural precast concrete is its tremendous flexibility. The material offers limitless potential for the development and manipulation of massing, form, color, texture and detail. The material can be used to execute design ideas in a broad range of architectural styles.

Current fabrication techniques allow the designer to realize virtually any shape. Numerous finishing techniques, combined with a wide variety of aggregates and matrix coloring agents, give the designer an enormous palette of colors and textures with which to work. As a backing material for tile, masonry and stone veneers, precast also provides a cost-effective vehicle for realizing architectural visions using those materials.

The ability to manipulate color, texture and form make precast concrete an excellent material to consider in situations where the relationship of a building to its existing context is an important design consideration. Precast finishing techniques allow the designer to replicate the color and finish of existing stone, masonry or terra cotta. Precast mold-building techniques allow the designer to economically incorporate details such as cornices, quoins, arches and decorative relief panels, to create buildings incorporating classical architectural detailing, or to otherwise coordinate the design of a new building with adjacent structures.

In our design for an addition to the Jefferson-Pilot Corporate Headquarters in Greensboro, N.C., we used heavily molded, sandblasted precast concrete panels to integrate the finish and detailing of the new building with an existing terra cotta clad structure dating from 1924. Details such as bas-relief molded spandrel panels, arch sections, dentil moldings and deep cornice sections were developed from measured drawings to coordinate with the detailing of the original building. Deep



Fig. 1: At the Jefferson Pilot Corporate Headquarters addition in Greensboro, N.C., sandblasted precast panels were used in the design of the new structure to reflect the scale and character of the terra cotta cladding of the original building.



reveals in the vertical panels helped to modulate the precast panels to the scale of the original terra cotta blocks. (See Fig. 1 and 2.)

The Peachtree Office Condominium in Atlanta features buff-colored precast panels in conjunction with hand set brick to

Fig. 2: Molding profiles for the Jefferson Pilot Corporate Headquarters were developed from field measurements and original drawings of the existing building. Deep reveals in the precast panels reflect the scale and detailing of the original structure. Careful layout of panels and reuse of formwork profiles allowed the design of the new building to match the level of detailing of the existing structure while meeting the owner's budget requirements.



Fig. 3: Buff-colored precast was used for cornices, trim members, sills and belt courses in conjunction with hand set brick to compose the classically proportioned façade of the Peachtree Office Condominium in Atlanta.

emulate the detailing and color of limestone accent trim on an adjacent historic apartment building that was designed by Atlanta architect Neal Reed. (See Fig. 3 and 4.)

Precast is a natural choice for projects incorporating curved profiles, such as radial walls and spandrel panels or bullnosed trim sections. At the Chick-fil-A corporate headquarters building in Atlanta, (see Fig. 5), vertically ribbed and bush-hammered precast panels were used to clad the radial end of the structure and to provide the interior spandrel trim for this atrium building.



Fig. 4: Color and detailing of the precast members at the Peachtree Office Condominium were developed to complement adjacent historical structures constructed of brick and limestone.

Economy

A second important advantage of precast concrete is the manufacturing process itself, and the high level of expertise and craftsmanship available in the industry. The southeast region is well supplied with qualified precast manufacturers, and SRSS&A has developed long-standing relationships with many of them. We work closely with the manufacturers, particularly in the early stages of the design process, to coordinate the architectural design with the supplier's resources and abilities.

Involving the precaster early in the process allows us to take advantage of the inherent



economies available to the precaster's production methods, which can vary significantly among manufacturers and regions of the country. By using this technique, we have been able to realize bold design concepts and complex details at favorable cost to our clients. In addition, highly developed engineering, management

and factory production techniques within the precast industry help to ensure a high-quality finished product, which meets the project's requirements for cost and schedule.

Repetition Helps

There are a number of factors that make precast concrete an excellent choice for cladding high-rise structures. The economic benefits of the precasting process are greatest on large repetitive projects, where cost premiums such as special mold construction and shipping of special aggregates can be spread over a large quantity of material.

Compared with other cladding systems, precast concrete can often shorten the overall

Fig. 5: The Chick-fil-A corporate headquarters in Atlanta has added an annex, constructed 15 years after the original, that is clad with the same precast mix design and panel detailing, seamlessly blending the two structures into a corporate campus.



Fig. 6: The IJL Corporate Headquarters in downtown Charlotte, N.C., features two colors of sandblasted precast concrete along with granite clad precast panels.

construction schedule on high-rise projects. Engineering and construction of the cladding panels can begin during site excavation and construction of the building's foundations. With proper planning, panels can be produced and stored in sequence so their installation closely follows construction of the superstructure.

In many cases, the relatively large size of most precast panels allows the building to be enclosed faster than is possible with other materials, so interior construction can begin earlier. These factors can significantly impact overall project cost, since shortening the project schedule will reduce overhead expenses and interim financing costs and can move the project's revenue stream forward.

In designing the IJL Financial Center, a 30-story office tower across the street from the 60-story Bank of America Corporate Headquarters in Charlotte, NC., the project designers specified two colors of sandblasted precast concrete along with granite clad precast panels to coordinate the tower palate with its granite curtain wall-clad neighbor, and to maintain an aggressive construction schedule on a tight urban site (See Fig. 6).

Durability

Durability, strength and inherent weather resistance represent additional advantages of precast concrete. The material stands up well to most environmental conditions, retains its appearance over time, and is relatively easy to maintain. Because precast concrete panels are normally large, the quantity of joints in the building cladding is reduced. The fewer number of joints produces fewer locations for leaks to develop due to joint failure. Fewer joints also reduce the life-cycle cost of replacing joint sealants and add value to the project for the client.



Fig. 7: Designed to withstand extreme wind and seismic loads without resembling a bunker, this data-processing center uses load-bearing precast concrete wall panels and structural precast floor and roof slabs.

In some cases, durability and strength are significant factors in a client's program. In designing a data-processing center for a major financial institution in North Carolina, we decided on an all-precast concrete structure, using 14-inch-thick, load-bearing precast concrete wall panels to meet the owner's aggressive construction schedule and stringent performance criteria (see Fig. 7). Due to the sensitive nature of the building's operations, the owner's criteria required the building to withstand high wind loads as well as enhanced seismic loads.

Flexibility, economy and durability are three of the most important qualities a designer looks for in selecting any building material. Architectural precast concrete embodies these characteristics better than any other material we have found. For this reason, we will continue to make precast concrete a major part of our designs for years to come.

Jim Van Duys, associate, Smallwood, Reynolds, Stewart, Stewart & Associates Inc.