Precast Concrete Offers Aesthetic Versatility

Designers turn to precast concrete to meet owners' demands for signature designs or to blend in with a community, and precasters respond

— Craig A. Shutt

Aesthetic requirements for buildings are expanding, as owners battle to attract tenants and create a distinctive appearance. That encompasses every aesthetic option—from making a signature statement with a contemporary, dramatic look to blending seamlessly into a campus environment or historic neighborhood. A desire for more detailing also has grown, as designers look to add visual interest and depth to façades.

In many cases, designers are turning to precast concrete to meet these needs. Precast concrete is a high performance building material and system. Its excellent aesthetic versatility allows for finishes from one end of the spectrum to the other. Its plasticity provides depth and geometric shapes that create an arresting style. It also can replicate the look of brick, stone, metal panels, and other materials, or incorporate these materials into precast panels, in faster, more economical and more sustainable ways. Precast concrete can also incorporate multiple finishes, shapes, and colors in one component, or panel. This facilitates faster construction, eliminating trades, reducing joints, detailing, and risks, and makes for a more efficient schedule while improving building performance. These attributes combine to help designers deliver economical, quickly constructed, and aesthetically pleasing projects.

The following projects highlight some of the techniques being used throughout North America by precasters to meet the growing needs of owners, designers, and building users.

Thin Brick Helps Campus Housing Blend In

Following an extensive assessment of its Newing College residential community, administrators at Binghamton University in Vestal, N.Y., decided to build eight new residential halls to replace and expand the existing facilities. The project, for which four dormitories are still under construction, took a phased approach to create space for the new facilities and shift students from old to new dormitories in a smooth and controlled pace.

'Precast concrete panels provided the right blend of speed, structural shear capacity, and versatile interior space.'

The design and construction of these facilities, which expand bed spaces overall by 50% to 3,000 beds, took careful consideration of the complex's impact. The university also wanted the projects to set the tone for future construction on the campus by achieving Silver LEED certification. Architectural precast concrete panels, many embedded with thin brick, helped to achieve the university's goals.

The eight facilities, at an average of 120,000 square feet apiece, posed key challenges just in terms of their scale, says Christopher Miller, project manager at architectural firm Stantec. "The owners wanted a residential feel for these buildings, despite their massive size. They also wanted them to fit into the scale of other campus architecture, especially with so many buildings in the group." With five above-ground stories, the buildings were about twice the size of most other campus structures, requiring an aesthetic approach that could reduce their formidable appearance.

Speed also was a critical factor in determining an aesthetic approach to the façades, he notes. "We needed to keep as many beds on line as possible as new dormitories were built." The owners also wanted to avoid inevitable escalations in cost that would occur as time went by before later projects could be completed.

An initial dormitory was built, with students shifted into it, after which two dorms were demolished to make room for three new facilities. Once those were completed, two remaining halls were demolished to accommodate the final four buildings. Some of the remaining residential halls will remain and may be converted to administration offices and other uses.

Designers chose architectural precast concrete wall panels to clad all of the buildings. Precast concrete was chosen over a range of other systems, including cast-in-place concrete, steel with hand-laid brick cavity wall, light-gauge metal, and plank on grout-filled masonry.

"We decided that the precast concrete panels would provide the right blend of speed, structural shear capacity, and versatile interior space," says

Photos courtesy of High Concrete Group LLC

Minimizing scale and projecting a residential image were key reasons that architectural precast concrete panels with embedded thin brick were chosen to clad eight new dormitories at Newing College at Binghamton University in Vestal, N.Y. Precast concrete's speed of erection also was a key factor, as the dorms had to come on line quickly to accommodate student needs.

PROJECT SPOTLIGHT

Newing College Residence Halls at Binghamton University

Location: *Vestal, N.Y.*

Project Type: *Dormitories*

Size: *1.05 million square feet in three dorms*

Cost: *$300 million*

Designer: *Stantec Architecture Inc., Philadelphia*

Owner: *Binghamton University, Vestal, N.Y.*

Engineer: *David Chou & Associates, Blue Bell, Pa.*

Contractor: *LeChase Construction Services Inc., Binghamton, N.Y.*

PCI-Certified Precaster: *High Concrete Group LLC, Denver, Pa.*

Precast Components: *922 pieces, including spandrels, wall panels, insulated wall panels, column covers, solid slabs, and stairs with landings*

Miller. "Architectural precast concrete allowed a more flexible footprint, minimized structure, and could be constructed during cold weather so we could meet an aggressive timeline."

Thin Brick Speeds Construction

Administrators wanted the brick appearance to blend with surrounding academic buildings, Miller notes. One of the reasons the thin-brick design was chosen was due to the long New York winters, which would have minimized the time in which brick could be laid. It also would have required renting temporary heating units for long periods, raising costs. Miller estimates that the precast panels went up about six times faster than hand-laid brick, in 30 working days versus about six months for masonry. "Precast was definitely the best bet to meet the schedule."

Choosing the proper brick color also posed challenges, to ensure the mix met administrators' goals. "The campus has a mixture of brick colors, due to the various time periods in which they were built, and many are fairly dark," Miller says. "We wanted a redder, brighter color than most others had."

A main field of red brick with bands of dark-brown accent bricks was specified. Buff-colored brick at the top floor further reduces the scale. The custom-colored precast is similar to the buff bricks and provides a solid base to the building's hierarchy. High Concrete Group LLC in Denver, Pa., provided the precast concrete components for this second phase of the project, which included three buildings.

Fireproof steel provides the primary building structure, with cast-in-place concrete supporting the architectural precast concrete panels. The panels consist of horizontal load-bearing panels that span column-to-column, providing shear resistance and minimizing the need for interior cross bracing. Flooring consists of 12-inch-thick precast concrete hollowcore planks with a nonstructural topping.

"The design provided the most efficient use of materials," says Miller. "Load-bearing masonry and cast-in-place concrete would have required more material. We could eliminate the spandrel beams between the column lines, allowing the hollowcore planks to carry the load and the needed dia-

phragm action."

The panels were furred out on the interior with $3^5/_8$ -inch studs over $2^1/_2$ inches of semi-rigid mineral-wool insulation. Including R-13 batt insulation and gypsum board, the assembly delivers a composite R-25 for the walls.

Stair towers feature freestanding insulated wall panels with a steel-trowel finish inside. With a 3-inch thickness of XPS insulation sandwiched between the two concrete wythes, the stairwell panels offer an R-16 rating. Hip roofs on the stair towers and gables along the sides further help reduce the scale and create a relatable feel.

The site posed significant challenges for this second phase of the three-phase project. The tight space afforded by the surrounding buildings made locating cranes difficult and left no room for staging precast concrete components nearby. A staging area was created about one mile away and pieces were trucked to the site as they were needed in sequence.

Cranes were located in several secure locations and often had to reach across the building to set panels, requiring the operator to be working blind. Walkie-talkie communication and careful handling ensured the panels were set smoothly. Miller says the operation moved so efficiently that he made a video that he uses in presentations to show how quickly precast concrete panels can be erected.

The use of hollowcore plank and cross-bracing frame allowed open interiors that will provide great flexibility for future changes, Miller notes. "The existing dorms will be challenging to convert to other uses due to the structural layouts. But these new ones that utilized precast concrete have open floor plans that can accommodate any changes in the future. They provide a flexible design that will keep up with the university's needs."

GFRC Raises the Bar for Citrus Tower

A variety of complications arose for the design of Citrus Tower Corporate Plaza in Riverside, Calif. The large office building stands on a high-profile corner location near a major highway. As a result, the owner's goal for the aesthetic design was to "create a memorable architectural statement that was a friendly neighbor to the community, with 'traditional' quality architecture to which no one would be

PROJECT SPOTLIGHT

Citrus Tower Corporate Plaza

Location: *Riverside, Calif.*

Project Type: *Mixed-use building (retail, office, parking)*

Size: *140,000 square feet (plus 153,360 square feet of parking on four subterranean levels)*

Cost: *$36 million*

Designer: *Nadel Architects Inc., Los Angeles*

Owner: *Regional Properties Inc., Riverside, Calif.*

Engineer (Below-Grade Parking): *Seneca Structural Engineering, Laguna Hills, Calif.*

Engineer (Above-Grade Building): *BP Consulting Engineers, Los Angeles*

Contractor: *McCormick Construction Co., Burbank, Calif.*

PCI-Certified Precaster: *Willis Construction Co. Inc., San Juan Bautista, Calif.*

Precast Components: *525 pieces of GRFC spandrels, crowns, arches, and granite-covered column covers*

Citrus Tower Corporate Plaza sets a new standard for aesthetic design in Riverside, Calif. It features GFRC panels on its façade in three colors. GFRC was chosen because of its ability to create the complex appearance desired, including multiple colors in one panel. Its light weight saved on framing costs and made the pieces easier to handle.

Photos courtesy of Willis Construction Inc.

GFRC was chosen due to its capabilities in achieving multiple colors and its light weight.

indifferent," says Herb Nadel, principal at Nadel Architects.

The architectural design expressed a rich and grand visual for the entire building, which was clad with glass-fiber reinforced concrete (GFRC) panels, some of which were embedded with granite veneers. Each bay opening features a two-colored arched spandrel with multifaceted granite-clad GFRC column covers at each structure column.

GFRC consists of portland cement, fine aggregates, acrylic co-polymers, and glass fibers that provide reinforcement similar to the steel reinforcement in concrete. The small fibers provide flexibility and versatility in creating components, allowing the mixture to be sprayed onto forms to create unusual shapes. The light weight and consistency of the glass fibers reduce the weight of the components, making them considerably lighter than traditional precast concrete components with much the same durability and appearance.

Along its base, the building features tall arched windows and a larger arched entry, which draws the eye up and breaks the procession of square windows one story up. Above this are vertical expanses of glass surrounded by precast concrete columns in two tones, a rose hue and a buff color. They lead to a setback penthouse level that serves as a roof crown, which also was clad in GFRC.

GFRC was chosen for the project due to its capabilities in achieving the multi-hued look that was desired and its light weight. The building's foundations are set above a four-story subterranean parking structure on a post-tensioned slab, which required the above-ground structure to be as light as possible. But the designers also wanted to use precast concrete materials to maximize longevity and durability.

Several other options were considered, including stone, 4-inch-thick precast concrete panels, and exterior cement plaster. All were intended to provide a stone-like appearance to meet the owner's requirements, Nadel explains. Evaluations showed that GFRC would meet all of the needs, providing a similar appearance to what precast concrete could provide while eliminating some of the weight. The GFRC's light weight also allowed a reduction in some of the structural steel framing, saving costs.

The ability for the GFRC components to cast multiple colors in one panel also provided budget savings. Using the various colors required close pre-planning with the precaster to ensure clear transitions between colors. The first mix design was sprayed with the form being masked. The masking then was removed, and the mix was allowed to stiffen but not completely set up. That allowed the first pour to be secure when the second mix-design color was sprayed in.

In all, three mix designs were created, with some panels including all three. Two finishes, light and heavy sandblasting, provided textural variety. Attaching the granite to the panels was achieved by spraying a thickened GFRC back-up skin to the back side of each granite piece. Additional GFRC was consolidated to cover metal clips attached to the granite. Willis Construction Co. Inc. created the GFRC components.

The building's most dramatic feature is the rounded tower on the corner, which extends past the roofline. Its canopy consists of compound-radius GFRC panels, with granite cladding the topmost band.

The design reflects a similar project that was to be designed by Nadel in Riverside. "We showed this idea to the client, and we thought the city might be receptive to this idiom of architecture because it blended so well with other structures throughout the city," Nadel says. "The curved corner becomes a beacon and a very identifiable form, giving the building distinctive characteristics along with natural colors that reflect the general built environment."

The designers worked closely with the precaster to find the proper mix of colors and textures. Full-size mockups of the panels were created to confirm the choices. "Those crystallized our selections, and the process of creating them was very successful," he says.

Working with the GFRC panels was seamless, he notes. "Its flexibility created forms and shapes as needed and worked well with the window system. The needed shapes were easily achieved. Detailing the panels also was a simple process, since the material can be configured in virtually any shape or form because of its plasticity."

The design process for the dome required complex calculations, he adds, due to the costs, weight, and the limited resources available to build such a complicated structure. "The cost factor played a major role in how it was ultimately constructed," he says. "There are virtually no straight pieces, since the entire dome and all of its supports are curvilinear."

Cranes were set into one lane of traffic to allow erection, and the process moved smoothly. "Delivering and erecting the GFRC components was a straight-forward and simple process," he says. "There were no complications."

The GFRC offered a great option for this project, he says. "As far as I'm concerned, working with GFRC, or precast concrete, is a fairly simple design process. We have used it innumerable times. I would highly recommend the use of this material because of the design excellence that can be achieved at a very economical price."

The community agrees that the project fits well into the neighborhood and provides a dramatic, signature style. "We have been repeatedly told that the building is a beautiful addition to the city," he says. "It is compatible, memorable, and has an excellent standard of quality. It has raised the bar for architectural excellence within this community."

Precast Mimics Metal Panel Façade at Place de l'Escarpement

The first phase of the Place de l'Escarpement project features a seven-story commercial building at the intersection of two major streets in Quebec. The 142,000-square-foot facility serves as the home to several major corporations. To project the proper image for the tenants, owners wanted to create a bold, contemporary look that was economical and quick to construct. To achieve this, designers selected architectural precast concrete panels in complex shapes.

To provide a dramatic contrast, some façades of the building feature

architectural precast concrete panels cast with an undulating wave pattern across their face. The waves were created with formliners and follow a similar pattern due to repetition in the forms, producing a rhythmic style. The architect worked closely with an artist to create the design that best reflected the wave he was seeking.

Gray concrete with black pigment and a light sandblast was used to emphasize the pattern and draw attention to these faces. Large joints were designed to add a vertical element that is complemented by columns of windows rising up with only thin mullions separating them at each level.

These façades contrast with more traditional architectural panels with a buff-colored finish and multiple reveals that butt against the wavy facings. These faces feature groups of horizontally placed punched windows that are emphasized by the reveal patterns. All of the panels were connected to the cast-in-place frame using hot-dip galvanized anchors.

The gray, wavy panels clad two parallel faces with a large expanse of glass covering the perpendicular fa-

The Place de L'Escarpement commercial building in Quebec provides a bold, contemporary look that was economical and quick to construct thanks to the use of architectural precast concrete panels. Waves in the panels, designed by an artist working with the architect and precasters, were created with formliners, and a gray concrete created with black pigment.

PROJECT SPOTLIGHT

Place de l'Escarpement

Location: *Quebec, QC, Canada*
Project Type: *Office building*
Size: *295,600 square feet*
Cost: *$35 million*
Owner: *Immostar, Quebec, QC, Canada*
Architect: *Pierre Martin Architecte, Quebec, QC, Canada*
Engineer: *Cime Consultants, Quebec, QC, Canada*
Contractor: *Ogesco Construction, Quebec, QC, Canada*
Artist: *Florent Cousineau, Quebec, QC, Canada*
PCI-Certified Precaster: *Bétons Préfabriqués du Lac, Alma, QC, Canada*
Precast Components: *90 flat or L-shaped panels*

Photos courtesy of BPDL

çade between them. The buff-colored panels clad a six-story perpendicular rectangular. The seven-story section seems to wrap over and around the other portion, with the gray panels seemingly overlapping the buff panels on the far side.

"The project presents a modern aesthetic and complex shapes with repetition," says Pierre Martin, president of Pierre Martin Architecte. "The use of gray concrete with black pigments and light sandblasting prove that traditional gray concrete can translate into something modern and unusual. A total of 94 precast concrete panels were supplied by Bétons Préfabriqués Du Lac.

Gold LEED Certification

Complicating the design was the owner's desire to achieve LEED Gold certification. Geothermic technology was used for the heating system, and a green roof was also used. Precast concrete added to achieving certification in a variety of ways, including local manufacturing, use of recycled materials, energy efficiency, and elimination of construction wastes. About 85% of all construction waste was recycled, representing 440 metric tons.

Design and production of the precast concrete panels took about $2^1/_2$ months, after which the erection was accomplished in less than three weeks.

The building also was designed to enhance the productivity of users by including large expanses of windows and providing such amenities as a daycare center, fitness gym, and restaurant. "The design should bring more productivity, less absenteeism, and more personnel retention," Martin says.

The project won the ENERGIA award from the Institute of Urban Development and was the first commercial building to qualify as LEED Gold in Quebec City. The first energy-consumption reports indicated the building uses about half of the energy of a conventional building.

"The building's final impact wouldn't have been the same without the precast concrete panels," says Martin. "We would not have been able to replicate this appearance any other way. Precast concrete also helped obtain the LEED credits. The project ran easily and without problems thanks to good teamwork and close coordination between architect, contractor, and precaster. The final result is just stunning."

'The project presents a modern aesthetic and complex shapes with repetition.'

Paseo Altozano – Precast Replicates Stone

The massive Paseo Altozano (Altozano Walkway) shopping center in Morelia, Michoacan, Mexico, was designed to showcase the blend of traditional Mexican construction techniques in a modern environment. Designers worked with the precast fabricator to create stone-like architectural precast concrete panels, using natural stone as models. The panels replicate stone in a variety of colors and finishes, including simulated slate, to create an eye-catching design.

The project covers 33.3 acres and hosts 21 acres of commercial and entertainment facilities. A variety of approaches were considered for the project, says Fidel Lopez, engineering and erection director at precaster PRETECSA. The company worked with a team of designers at architectural firm Taller Único de Arquitectos, headed by Alonso Ruiz de Velasco, owner and director.

"The project owner's first choice was to clad the building in natural sandstone imported from Costa Rica in different colors, from black to polychromatic, including black, gray, red, yellow, and brown," Lopez explains. But after mockups were made and sites were investigated, it was determined that it would take three years to ship the needed amounts of stone and install it.

"With architectural precast concrete panels, the façade was completed in 13 months, including design, drafting, molding, production, shipping, and erection," says Lopez.

The owner and architect worked with the precaster to choose stones that would serve as the model for the styles to be replicated by the precast concrete. "These pieces were chosen individually based on color and texture to serve as samples for each elevation," explains de Velasco. "The contrasts of the various ready-made textures give the building a distinctive image, meeting the essential interests of the project."

To achieve the proper appearance for each type of material, the precaster used a variety of formliners, finishes and colors. Rubber molds were made of specific stones, with molds varying due to the uniqueness of the stone pieces selected. Additional stone-like pieces were cast from molds made from old and damaged concrete flowing at the precaster's plant.

"Those created a very interesting texture," says Gervacio Kim, operations director at PRETECSA. "A large number of unique molds had to be made to achieve the special shapes needed to get the final real-stone look."

Among the finishes used on the panels were acid etching, chiseled-hammering and polishing. Panels were hand-stained with any of five oxide stains and a penetrating acid stain that helped create the proper patina for the stone colors.

The panels were cast in 350-block patterns that were alternated and shifted to avoid creating a repetitious pattern, so as to better generate a nature stone look. More than 2500 precast concrete pieces, ranging in size from 86 to 140 square feet, were created for the project, totaling 376,736 square feet.

With architectural precast concrete panels, the façade was completed in 13 months.

"The desired slate finishes were achieved with an impressive degree of accuracy and a natural look," Kim says. "The use of precast concrete panels represented considerable savings in terms of substitution of natural materials in the required size, variety, volume, and time."

Large Joints Eliminated

Designers worked with the precaster to create panels in different sizes and shape to eliminate conspicuous joint lines. "It was like working a puzzle to fit the panels together to avoid vertical joints," he says. "That helped us achieve the look of natural stones that had been installed one by one."

A multitude of stone appearances were created from architectural precast concrete to add a distinctive style to the massive Paseo Altozano (Altozano Walkway) shopping center in Morelia, Michoacan, Mexico. Rubber molds made from actual stones, including slate, ensured the accuracy of the precast concrete appearances. A variety of finishes added texture.

PROJECT SPOTLIGHT

Paseo Altozano

Location: *Morelia, Michoacán, Mexico*

Project type: *Retail facility*

Size: *1.45 million square feet*

Cost: *$150 million*

Owner: *Grupo FAME, Morelia, Michoacán, Mexico*

Architect: *Taller Único de Arquitectos, Mexico City, Mexico*

Engineer: *Postensados y Diseños Estructuras, Álvaro Obregón, Mexico City, Mexico*

Contractor: *Grupo Altozano, Morelia, Michoacán, Mexico*

PCI-Certified Precaster: *PRETECSA, Atizapán de Zaragoza, Estado de México*

Precast Components: *2,500 panels.*

Photos courtesy of Fotosenconcreto.com

The stone appearance is convincing, he notes. "In large extended surfaces, the installed precast concrete façade elements create different architectural styles, which were achieved by alternating several finishes and geometries. We were able to take advantage of the architectural properties of the concrete to create visually attractive and original appearances within the complex."

A key challenge was to ship the correct panels to the site in sequence, ensuring the panels fit together as designed, while working on seven elevations simultaneously, Lopez says. The precaster ensured the project was supplied with a continuous inventory of 60 panels per day, with the proper sequence of lifts orchestrated. The textures on the panels' faces were protected with plastic pads and foam during transport.

Six continuous months of intensive work, allowing 210 panels to be erected each week, were required to erect the panels onto the steel framing. The main erection challenge came when the steel installation fell behind and became a bottleneck. To make up that time, eight three-member crews worked to install the panels once the framing was completed, working through the weekends to keep the project on schedule.

"Cement consumption by developers in this area is very low because of a widely held idea that concrete is a gray and dull element," Lopez says. "By combining a wide variety of manufacturing techniques, several architectural styles were magnificently achieved in different buildings within the complex. It showed that concrete can work as a high-quality, multicolored architectural finish that gives life to this massive construction."

Visitors to the center have been impressed. "Initially, people think that it is real stone glued to a steel frame," he says. "On opening day, people were touching the panels trying to figure out if it was real or fake stone because it was constructed so quickly."

These projects give a sampling of the innovative approaches designers are using to make a dramatic statement for their buildings. Precast concrete is the only high-performance building material that offers this expansive aesthetic versatility. Precast concrete and precasters continue to help designers raise the bar to achieve even more distinctive and aesthetically pleasing designs. ■

For more information on these or other projects, visit www.pci.org/ascent.