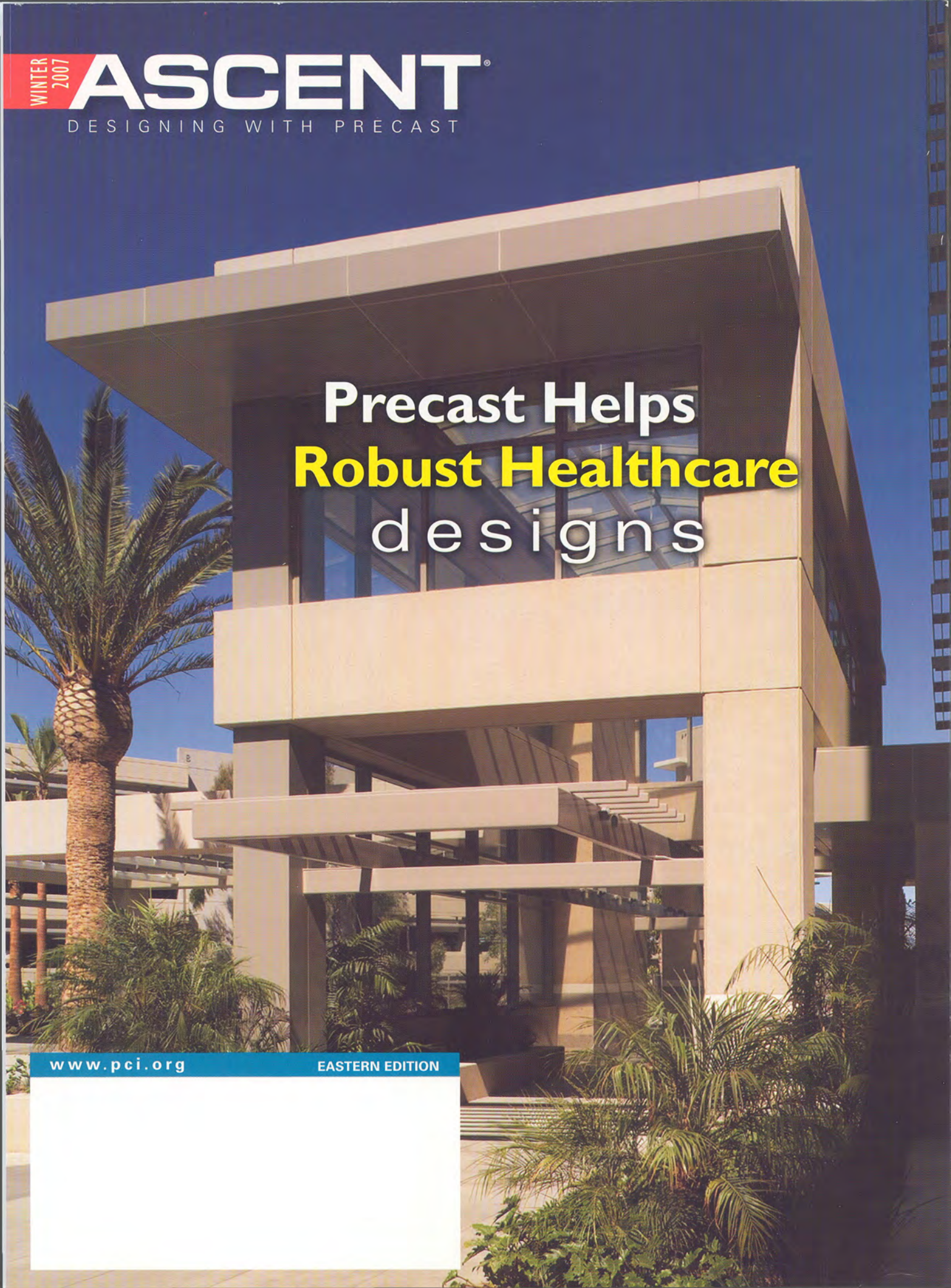
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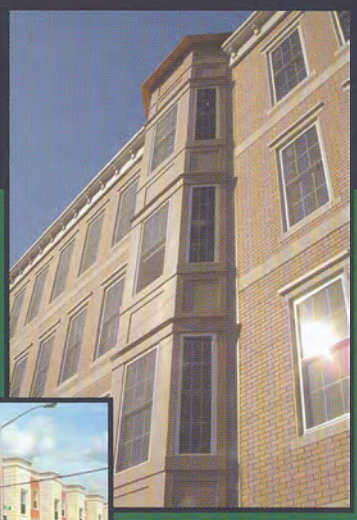
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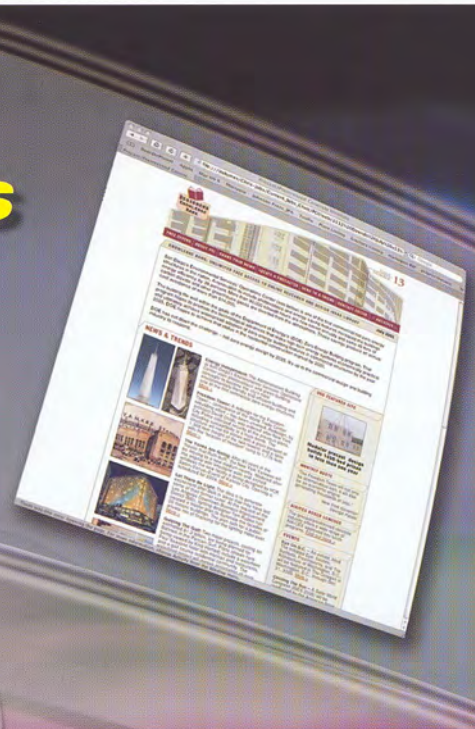
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Features

Breaking The Mold

HOK Sport has become well known for its stadium designs, but continues to find new approaches, aided by precast concrete components.

Precast Helps Robust Healthcare Designs

Speed of construction aesthetic diversity and many other benefits lead to the use of more precast components in healthcare projects of all kinds.



Photo Courtesy of Taylor

Embedded Thin Brick Offers Durability, Versatility

Owners and designers are learning that architectural precast concrete panels featuring embedded thin brick provides significant benefits versus traditional masonry.



Precast Provides Options For Single-Family Housing

Designers find that various precast concrete components can aid the flexibility and marketability of single-family homes.





Precast Blends Parking With Many Project Types

A wide range of projects now include parking, and designers are using precast concrete components to blend the various functions.

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State-by-state directory of PCI-qualified erectors, including a guide to erector classification and a guide specification for reference in projects.

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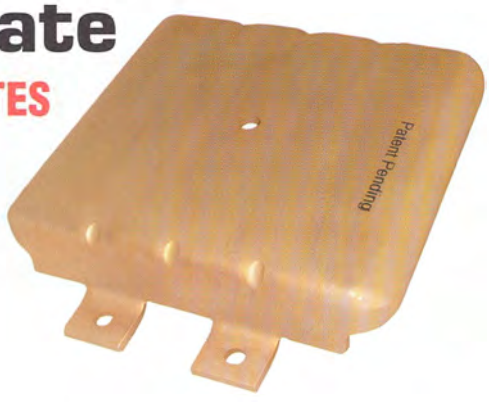
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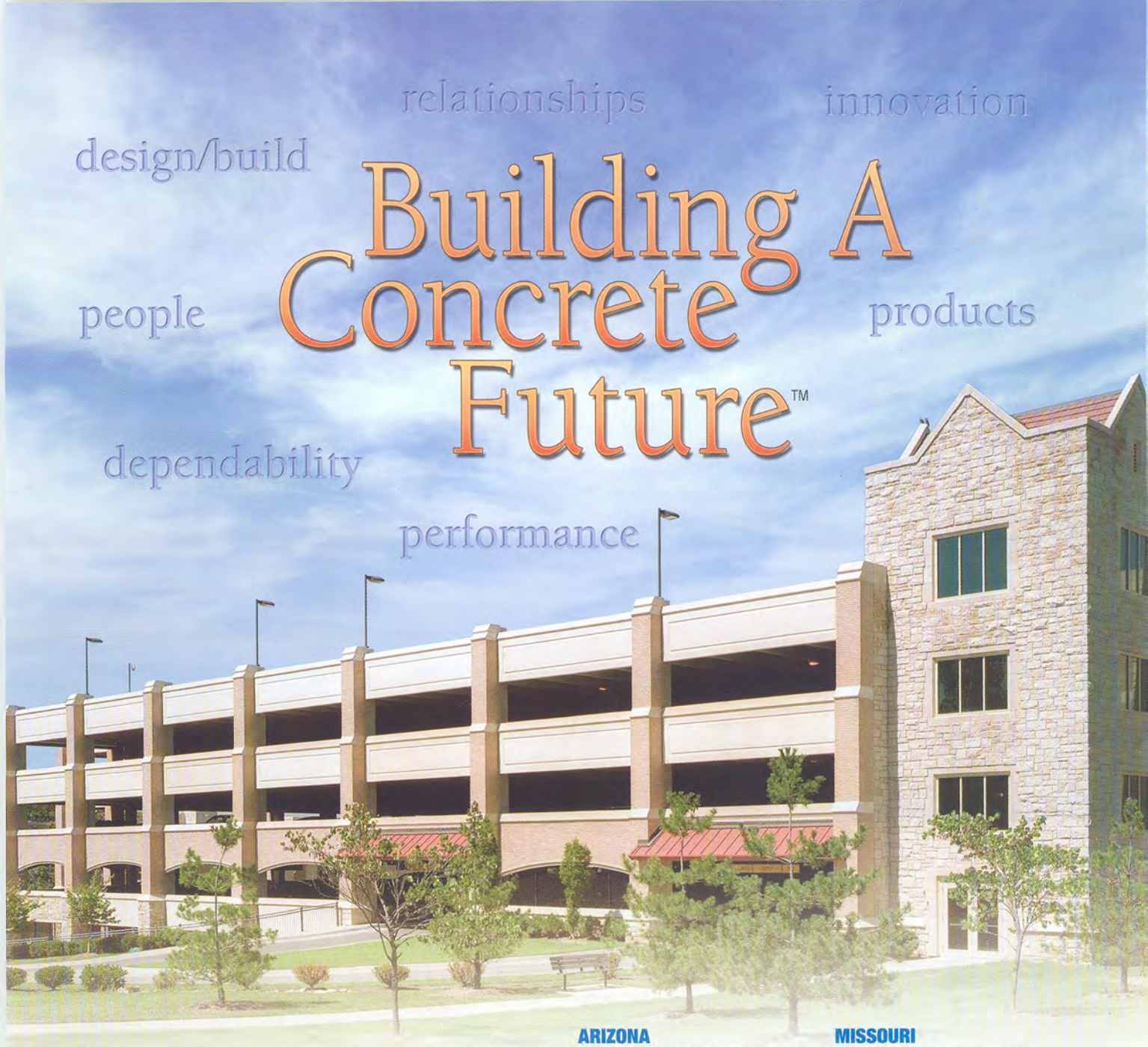
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Taking the LEED



Jim Schneider
Executive Editor

Before settling in glorious Chicago, Illinois, I spent a few years living in Southern California. I moved there just in time to see the state's then-revolutionary smoking ban come into effect. There would be no smoking in restaurants or bars. As a lifelong nonsmoker, this didn't mean a lot to me, but it certainly did to some of my friends. Several even took the hint and set about quitting. Certainly, everyone got very used to the idea of being able to go out and not come home smelling like an ashtray.

At that time, I took the ban to be sort of a "California thing." After all, the weather is nice year-round, so what's the big deal if people have to smoke outside? I couldn't imagine such a ban passing anywhere else. Much to my surprise, it wasn't long before New York and other cities started to pass legislation against smoking, too. Now Chicago has passed the ban, and it appears that even Paris, France, where smoking is a normal part of respiration, will enact a smoking ban. Truly, anything is possible.

Here we see the progression of a movement. First there were voluntary restrictions on smoking, then there were some soft laws passed on a local level, and eventually we began to see citywide and statewide measures being put into effect. Yes, there was certainly resistance, but the benefits to health and general welfare could not be ignored.

I like to think that we may be embarking on a similar path where sustainable design and green building is concerned. LEED standards are a good start, but they are just that: a start. At first it was something to aspire to, but as the idea of green building becomes more pervasive, we have begun to see municipalities and states passing laws that require that public buildings, for example, measure up to a certain minimum LEED standard.

This issue contains part two of our Designer's Notebook on Sustainability, which further discusses some of precast concrete's advantages for sustainable design. Things like the material's thermal mass help to make it a very useful material for designers looking to create an energy-efficient structure. More and more, attitudes toward the real cost of a structure are beginning to change and we are seeing that doing something for the environment doesn't mean doing something against the bottom line.

With growing regulatory incentive combined with a steady stream of new technology, building green can be efficient in both financial and environmental terms. We may soon see LEED become that bare minimum that everyone takes for granted and seeks to exceed. ■

PCI

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The Cover: *Photo–Assasi Productions/Courtesy of Taylor.*
Hoag Hospital Sue and Bill Gross Women's Pavilion Newport Beach, Calif. (see page 18)

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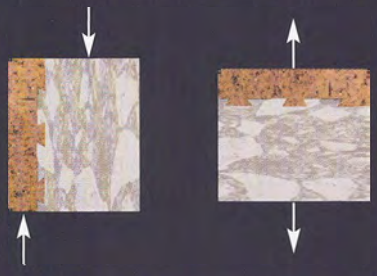
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Concrete Home Showcased For Builders

ORLANDO



Builders, architects and other visitors to the International Builders Show in Orlando toured The New American Home, a real-world laboratory demonstrating concepts, materials, designs and construction techniques that can be used in housing projects of any size and price. The three-story home features several precast concrete components.

The residence, designed by **Bloodgood Sharp Buster Architects & Planners** and built by custom homebuilder Carmen Dominguez, was constructed on an urban in-fill site in downtown Orlando. The "urban loft" design features a roof plaza and 4,707 square feet of living area plus a 576-square-foot suite above the detached garage. The design was planned to suggest history that is complementary with the architecture of Orlando's Lake Eola historic district.



The project features a structural precast concrete wall system and hollow-core flooring, along with other concrete products that include concrete roof tiles, cementitious exterior finishes, retaining walls and decorative concrete in both interior and exterior flatwork applications. The hollow-core flooring was provided by **Gate Precast Co.** in Jacksonville, Fla.

The show also featured a renovated home, called the Renewed American Home, which will include a concrete masonry safe room and additional decorative concrete flatwork. The home was adjacent to the New American Home, providing easy access for attendees at the show, which ran from February 7 to 10.

The **Precast/Prestressed Concrete Institute (PCI)** in Chicago and the **Portland Cement Association (PCA)** in Skokie, Ill., are among the sponsors of the home.

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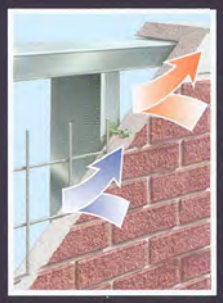
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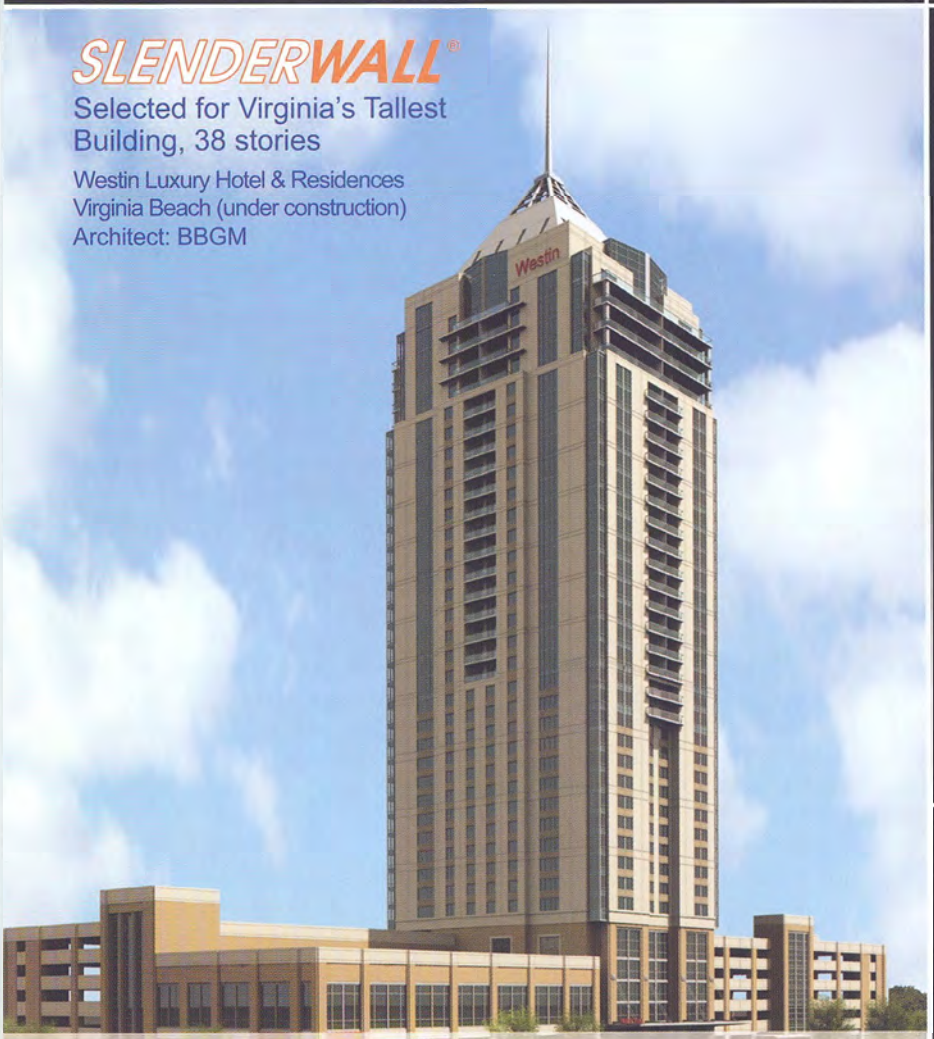
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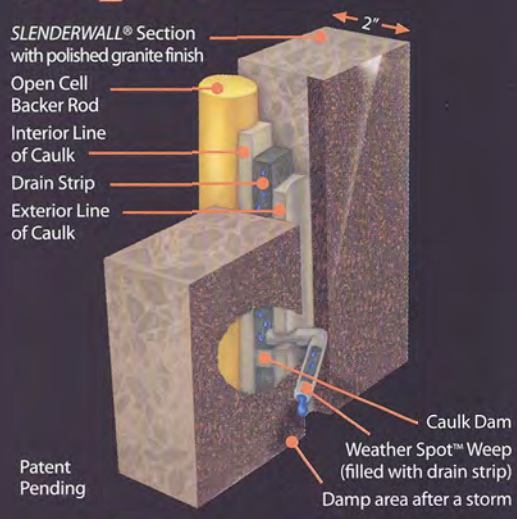
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Corrections

In the Fall issue of *Ascent*, we incorrectly listed the credits on two of our Design Award winning structures. The precasters involved in the **Kenneth P. Lavalle Stadium** at the State University of New York at Stony Brook, N.Y., were: **Newcrete Products,** a division of **New Enterprise Stone & Lime Co. Inc.,** Roaring Spring, Pa.; **Architectural Precast Inc.**, Middleburg, Pa.; and **Oldcastle Precast Building Systems Division**, South Bethlelem, N.Y.

We also incorrectly listed the designer on the **Maryland 216 Sound Barrier** in Howard County, Md. It was designed by **Whitman, Requardt & Associates LLP (WR&A)** in Baltimore. We regret these errors.

Fabcon Supplies Industrial Facilities

SAVAGE, MINN.

Fabcon has been named to supply its VersCore Plus wall panels for three industrial projects in Minnesota and Missouri. In all, the company will be providing more than 250,000 square feet of panels for the projects. They comprise:

- APC Tech Center in O'Fallon, Mo., which will use approximately 57,000 square feet of panels with a steel-form finish.
- Case New Holland in Cameron, Mo, where architectural firm **CSO Schenkel Shultz** has specified 120,000 square feet of panels with a steel-form finish.
- Cybex in Owatonna, Minn., which will use 75,000 square feet of panels with a random-rib finish.

High Acquires N.J. Plant

BUENA, N.J.

High Concrete Innovations LLC in Lebanon, Pa., has acquired the assets of the United Precasting Corp. precast concept plant in Buena, N.J. The 91-acre facility will continue to manufacture components for parking structures, miscellaneous structural products and hollow-core planks. The plant serves a variety of customers in New Jersey, Delaware and the New York City and Philadelphia metropolitan areas. Doug Lorah, vice president of technology and business development for the High Concrete Group, will oversee plant operations.

PCI Certifies Erectors

CHICAGO

The **Precast/Prestressed Concrete Institute** has upgraded its Erector Quality-Assurance Program to provide a certification standard, replacing the qualification standard that has existed since the program began in 1999. The upgraded standard, which already includes three precast concrete erectors, provides a third-party procedure-auditing program of the company's quality standards.

The existing qualification program, which has a membership of 80 erectors, including more than 45 independent erection companies, requires crews to be audited by trained in-house personnel every year, with an independent third-party audit on at least one project each year as well. Three areas of qualification can be achieved: Simple Structural Systems, Complex Structural Systems, including total precast structures, and Architectural Systems.

The new certification program requires those steps as well as a complete documentation program for the quality-assurance procedures used in the erection process throughout the year by all crews. The auditor ensures all crews have undergone a field audit in the past year and evaluates uniformity and consistency in the standards that are being used. The audits are based on two PCI manuals, *Erectors' Manual: Standards & Guidelines for the Erection of Precast Concrete Products*, which offers techniques and details, and *Erection Safety for Precast & Prestressed Concrete*, which provides supplemental information.

The program is designed to ensure that the materials produced in the factory to exacting standards are installed as professionally in the field. This extension of the quality procedures assures the owner and architect that the vision they had for the building and the precast concrete components will be met in the field and throughout the life of the structure.

For more information about the program, contact PCI at 312-786-0353 or *info@pci.org*.

Editor's note: The following letter addresses important points about evaluating hurricane damage based on ground observations and offers some suggestions on issues involving precast concrete fortified housing. ASCENT's editors welcome letters and comments on any topics brought up in the articles or that relate to issues concerning precast, prestressed concrete. They can be addressed to Executive Editor Jim Schneider at jschneider@pci.org.

Dear Editor:

In "Designing For Hurricane Zones" (*ASCENT*, Summer 2006), the discussion about the Federal Courthouse in Gulfport missed some important and expensive damage—far more than was represented by the statement, "the only apparent damage to the building was to a few broken windows, a small area of broken granite and a few missing letters above the building's main entry."

FEMA's Hurricane Katrina Mitigation Assessment Team also evaluated this building, but our findings were quite different than those reported in the article. In addition to the damage that was observable from the ground, there was significant damage at the rooftop level.

When reporting on hurricane damage, reports should not be based solely on ground-based observations. Otherwise, rooftop damage (which frequently occurs) can be easily overlooked.

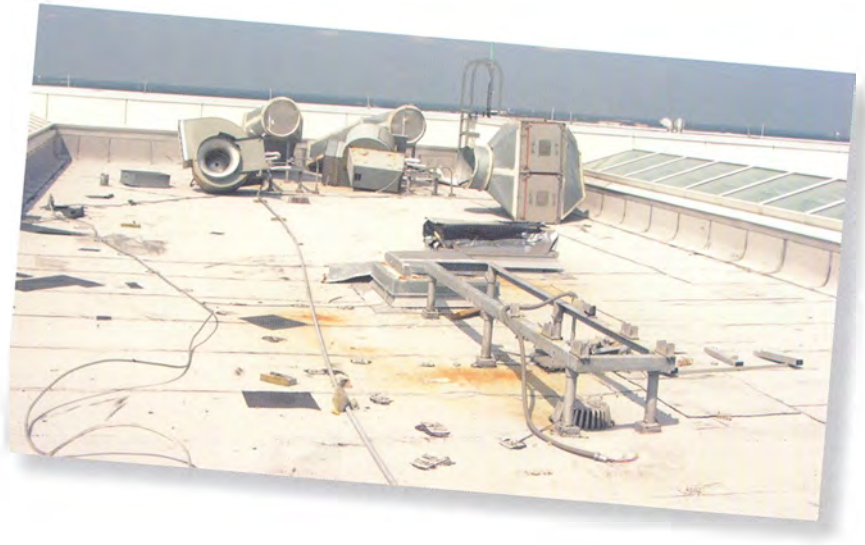
Several pieces of rooftop HVAC equipment were blown off vibration isolators and curbs, which allowed rain to enter the building. Several pieces of parapet coping and portions of the lightning-protection system were blown off, and a few outer panes of a skylight were broken. Also, some of exterior insulation and finish system (EIFS) was blown away.

Although these damages were not nearly as significant as wind-induced damages experienced by many other buildings, the Courthouse damage was not trivial. Because of breaches in the building envelope, water-infiltration damage required temporary relocation of courthouse operations. Most of the court chambers were reoccupied in June 2006, but the building did not open to the public until July (approximately 10 months after Hurricane Katrina). Repairing the wind and water-infiltration damage cost millions of dollars.

At the end of the article there was discussion about "fortified housing." We have the following comments on that portion of the article:

- Where it is desired to provide a shelter to provide occupant protection from tornadoes or hurricanes, FEMA has two design guides: *FEMA 320—Taking Shelter From the Storm: Building a Safe Room Inside Your Home*, and *FEMA 361—Design & Construction Guidance for Community Shelters.* FEMA publications can be obtained at no cost by calling 800-480-2520.
- Impact-resistant roof materials were mentioned. However, most roof systems have limited resistance to windborne debris. To avoid water infiltration due to debris damage, a secondary membrane can be incorporated. For further discussion on this topic, see *FEMA 543—Design Guide for Improving Critical Facility Safety from Flooding & High Winds.*
- It was stated that windows are available with higher water-design pressure ratings. While it is true that water resistance of windows can be tested at various pressures, current test standard pressures are well below the pressures that are often experienced during hurricanes.
- Windborne debris impact of garage doors was mentioned. ASCE 7 criteria regarding debris impact only pertains to glazing, not to solid doors or walls. However, in some instances, such as apparatus bay doors at fire stations, it is prudent to have doors that are resistant to debris. FEMA 543 provides guidance on this issue.

John Ingargiola
Civil Engineer
FEMA Mitigation Assessment Team Program Manager





Breaking The Mold

— Craig A. Shutt

HOK Sport has become well known for its stadium designs, but continues to find new approaches, aided by precast concrete components



– Dennis Wellner, founding partner and leader, HOK Sport's NFL market

"The leadership of our office has been diverse so we developed our niche in various sporting types, but each of us approaches the project differently. And we like that diversity."

Architects like to think that every project they design meets the individual needs of the client, without a reliance on particular signature styles or tricks. But in fact, some building owners select an architectural firm because they've admired certain projects and want something similar. HOK Sport in Kansas City has garnered such a reputation for its work on public-assembly spaces, but its strong design sense ensures clients receive what they really want, which is a unique design for their purposes.

"In the architectural world, some firms are driven by a design philosophy or 'guru,' so that no matter the type of project, the individual's stamp is apparent," says Dennis Wellner, founding partner and leader of the firm's NFL market. "Fortunately for us, the leadership of our office has been diverse, because the founding principals came from different segments of the market. So we developed our niche in various sporting types, but each of us approaches the project differently. And we like that diversity."

Even so, the company's work on key stadiums, specifically Camden Yards at Oriole Park in Baltimore, has been so influential that owners have a vision in mind when they propose their project. "We have heard clients say that they'll listen to what we have to propose to them, but they want Camden Yards," he says. "I was afraid for awhile that all we'd ever get to do again was brick ballparks. It creates a real challenge to break away from that perspective. At the same time, we can respect that style, because the stadium may be part of a historic district, and then the Camden Yards style is appropriate."

Achieving all of the owner's key goals without maintaining one design approach creates a successful design, he says. He points to the immediate follow-up project to Camden Yards, Jacobs Field in Cleveland, as an example of the diversity that can be



Multiple crews helped ensure that precast concrete seating units were installed on time during a compressed schedule after the Cardinals' playoff games delayed construction on the new Busch Stadium in St. Louis.

accomplished. "It represents a much more contemporary interpretation of the key features that people associate with old-time baseball, yet the building itself is rather contemporary."

Today, owners are acknowledging that HOK Sport understands their needs and can replicate the popularity of its Camden Yards design without mass-producing that style. The new stadium being developed for the Nationals baseball team in Washington, D.C., is a strong example. "The owners had a great desire for a brick-faced ballpark," he explains. "But the stadium's siting and overall goals were more forward-looking. So you'll see a very contemporary building when it opens in 2008."

"We see owners relying less and less on that brick-façade appearance that they associate with our past successful projects, unless we're in a market where it's applicable." That happened with the new St. Louis Cardinals' baseball stadium, which is situated in an older part of town and could use a brick façade and other historic-appearing design elements to blend with the project's neighbors.

Tremendous Growth Since 1983

The company has expanded considerably since it opened its doors in 1983. "We always thought back then that if we could grow to employ 24 people, life would be grand," Wellner says. "We've gone a little bit beyond that by now." Indeed, the company now employs about 400 people in five offices worldwide. Those offices grew out of necessity as the firm expanded, he notes, rather than through a desire to spread out. (For more on the company's history and expansion, see sidebar, p. 17).

Today, the firm handles a wide range of public-assembly projects, including HOK's convention-center business and Denver-based special-events design group. "Those disciplines broadened our



PROJECT SPOTLIGHT

The New Busch Stadium

Location: *St. Louis, Mo.*

Project Type: *Major League Baseball stadium*

Area: *47,900 seats, 11,499 club seats, 106 suites*

Designer: *HOK Sport*

Owner: *St. Louis Cardinals*

Contractor: *Hunt Construction in association with Kwame Building Group*

PCI-Certified Precaster: *Metromont Corp., Greenville, S.C.*

Description: *The new home to the Cardinals draws its inspiration from the rich architectural heritage of the surrounding downtown St. Louis neighborhoods. The stadium features precast concrete seating units, as well as architectural precast concrete panels to help achieve efficiency in construction that was needed due to the compressed schedule.*

Seating units include 1,040 double and triple risers and seating tubs, with about 944 additional structural components used, consisting of columns, flat slabs, raker beams and wall panels. In all, about 854 truckloads of material were used. Upper-bowl seating areas were installed first, in the eight months starting in November of 2004, followed by the lower-bowl areas, which began construction in February 2005 and were completed in September of that year.

The footprint of the new stadium encroached on the old structure, requiring it to be removed completely prior to completion of the new facility. That caused the schedule to become compressed when the Cardinals made the playoffs in 2005, delaying some of the construction. Multiple installation crews and close communication allowed the project to keep on track. Precast concrete's ability to continue to factory-cast components through the winter helped ensure the timetables could be met, and the stadium was ready for the first pitch of the 2006 season.



PROJECT SPOTLIGHT

The Grand River Center

Location: *Dubuque, Iowa*

Project Type: *Convention center*

Area: *30,000 square feet of exhibition space, 12,000 square feet of ballroom, 12,000 square feet of meeting rooms and 400-car parking structure*

Designer: *HOK Venue*

Owner: *City of Dubuque*

Contractor: *J.P. Cullen & Sons*

PCI-Certified Precaster: *High Concrete Technology LLC, Paxton, Ill.*

Description: *The facility was designed as a regional destination center for education, conference and convention programs as part of the larger America's River project. Located on a former industrial site on the Fourth Street Peninsula, the site offered an opportunity to provide the facility with dramatic river views while creating a contemporary, forward-looking design.*

The building's façade features precast concrete insulated sandwich wall panels, consisting of 2 inches of insulation between two 3-inch-thick concrete layers. Some of the panels feature window openings, which had glazing units attached in the field after erection. Two types of finishes were used on the panels, an exposed-aggregate wash and a light sandblasting to provide contrasting appearances.

The project was designed to be environmentally conscious in all ways possible, starting with the use of a brownfield site. Glass features low-emissivity insulating glass and is protected by a 10-foot overhang. The precast concrete components also aid this goal by providing energy efficiency, creating a high thermal mass and using local materials in their production.

expertise, but they kept us within the framework of designing facilities that must deal with large numbers of people," he explains.

"Our bread and butter is smaller-scale projects for minor-league baseball and all types of sports facilities for colleges and universities. Over time, even within our specialized area, we've had a broad reach of projects, so we can do small projects that require one or two people, or we can handle large projects that take 25 people to complete them." This year, because of the array of baseball stadiums that have been underway, including projects for the Yankees, Mets and Nationals, most of the office has focused on that work in some way, he notes.

At the same time, Wellner himself is spearheading two football projects: the $200-million renovation of Dolphin Stadium for the Miami Dolphins, and the $300-million expansion of the Kansas City Chiefs' Arrowhead Stadium, the 1972 project that was the first such single-sport facility.

"We give considerable thought to how long a particular project type can last, as there are a limited number of professional stadiums available. But there is quite a lot of collegiate football, arena and convention-center work that arises every year, so over time our commissions are fairly balanced."

Two Key Questions Arise

Within that broad scope of work, two key trends have emerged to shift owners' requirements for projects. "The two major questions that arise with projects today are, what types of premium seating are desired, and what types of associated developments will be created around the stadium?" he says.

Owners are looking for more variety in seating options, as they allow for the generation of significantly more revenues. Those revenues in turn can ensure the

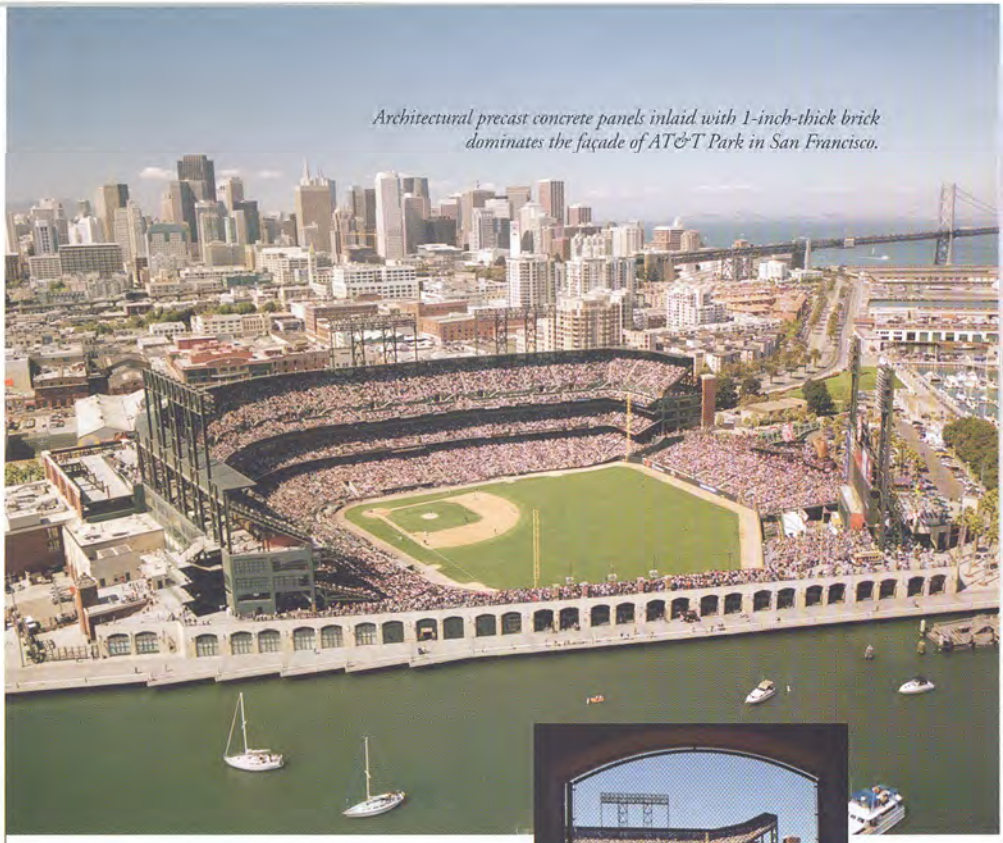


The Grand River Center in Dubuque, Iowa, features architectural precast concrete panels on its façade to enhance the ambiance of the river-focused facility. It also aids the goal of being as environmentally responsible in the construction as possible.

'[Owners] are asking what new energy they can inject for the area to keep crowds staying longer.'

stadium project meets its budget goals and remains successful. The options today, based on work HOK Sport helped develop many years ago, include field suites, field club seats, mini-suites, mega-suites and others. "General fan seating is a constant in the stadiums, and the amount is driven by market location," Wellner explains. "But other types of seating have grown significantly. Premium seating of some type is now included with every type of stadium."

Owners also have learned that because stadiums attract large numbers of people for long



Architectural precast concrete panels inlaid with 1-inch-thick brick dominates the façade of AT&T Park in San Francisco.



PROJECT SPOTLIGHT

AT&T Park

Location: *San Francisco*

Project Type: *Baseball stadium*

Area: *40,791 seats, 8,259 club seats, 67 suites*

Designer: *HOK Sport*

Owner: *China Basin Ballpark Co.*

Contractor: *Huber, Hunt, Nichols Inc. and Kajima Construction Services, a joint venture*

PCI-Certified Precaster: *Willis Construction Co., San Juan Bautista, Calif. (For technical information on these projects, contact the precaster; see the Plant Certification listing.)*

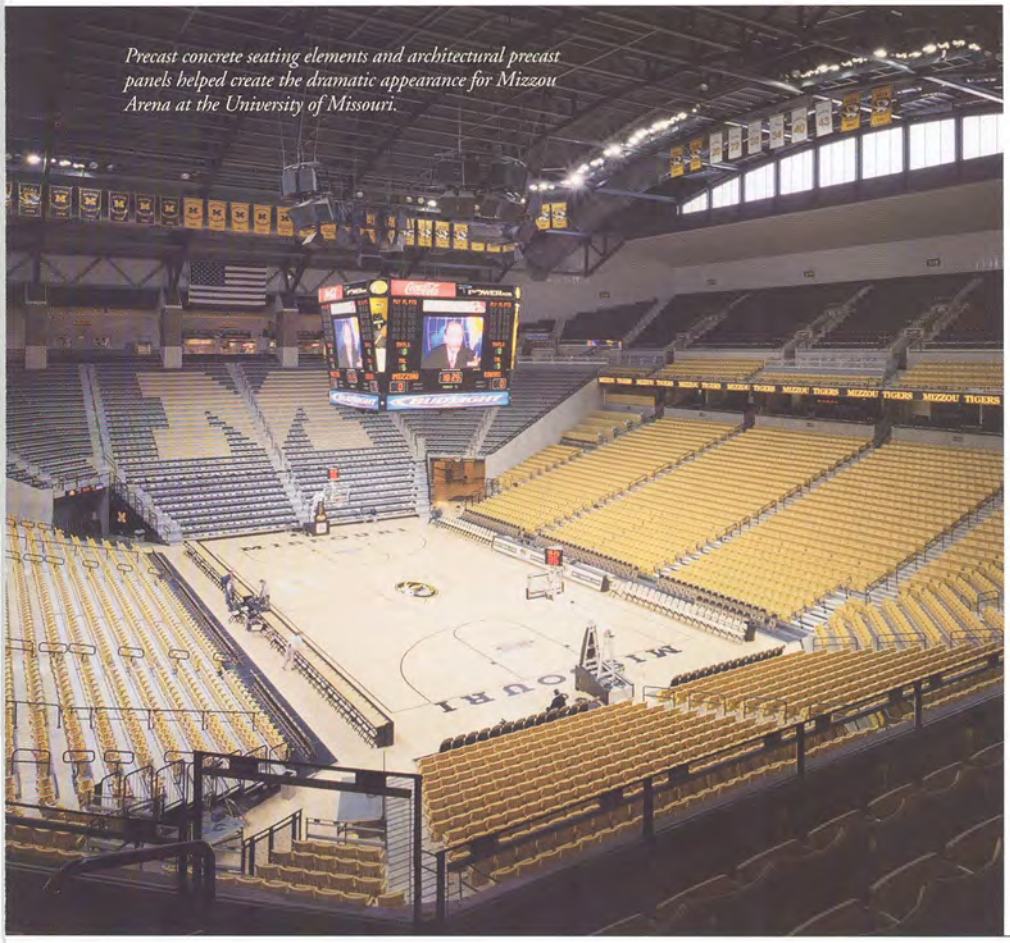
Description: *Home to the San Francisco Giants and formerly known as Pac Bell Park, the stadium has become well known for its dramatic views and right-field wall that fronts the bay. The design for the façade features 1-inch-thick inlaid brick on architectural precast concrete panels to achieve a rugged appearance that recaptures the spirit of old-time baseball and fits into its older neighborhood. Large archways in the panels allow passersby to glimpse the playing field without buying a ticket.*

Several finishes were used on the 860 architectural precast panels used on the project to reflect the surrounding ambience. The embedded thin-set brick panels, including setbacks and industrial sash windows, were featured along King Street to recall the South of Market and Embarcadero environs. Some 120,000 square feet and 690 panels were used for these areas.

Lightly colored precast concrete panels were used along the waterfront side to reflect the pier-building architecture, as well as the hues and tones of the city when seen from the water. About 30,000 square feet, in 170 panels, were cast for this cladding.

Precast concrete raker beams, risers and stair units were used for the seating areas as well, including 2,000 riser units, 100 wall units and 150 stair components.





Precast concrete seating elements and architectural precast panels helped create the dramatic appearance for Mizzou Arena at the University of Missouri.

PROJECT SPOTLIGHT

Mizzou Arena

Location: *Columbia, Mo.*

Project Type: *University basketball arena*

Area: *15,500 seats, 1,000 club seats, 23 suites*

Designer: *HOK Sport and 360 Architecture*

Owner: *University of Missouri*

Contractor: *J.E. Dunn Co.*

PCI-Certified Precaster: *Metromont Corp., La Vergne, Tenn.*

Description: *The design for this arena encourages player development by surrounding student-athletes with such facilities as meeting and study areas, practice and weight rooms, cafeteria and game facilities. The structure features fan-friendly concourses and improved sightlines.*

Precast concrete components were used for the key seating elements, including 565 pieces of risers and raker beams, while 453 architectural precast concrete panels were featured on portions of the façade.

periods of time, more revenue can be generated by finding additional ways to keep them around longer. As a result, stadiums are adding retail, entertainment and even housing options, Wellner says. "They are asking what new energy they can inject for the area to keep crowds staying longer. That's a new level of investigation for [creating] the overall development."

That often requires more input from other design professionals, he notes. "We're experts in stadiums, so we bring in experts on shopping and other activities." Even within retail, ideas are changing as urban settings attract shoppers away from the traditional suburban mall concept. Adding housing elements expands the options further, with combinations and permutations of housing spaces above retail or entertainment and retail over structured parking.

Precast Concrete Options Grow

As these designs change, the company is also finding more options for using precast concrete components in their projects. HOK Sport, as with other stadium designers, has long used precast concrete seating sections in many applications. The combination of raker beams with risers and one-, two- or three-row seating units creates a fast, durable and structurally sound design.

"The use of risers and rakers is the most prevalent approach because of the speed and strength," Wellner says. Ironically, the firm has considered steel treads and risers in a few recent, unique situations, he notes. "It's not because they're economical, but because they can make more noise when people jump on them, and that's what the owner wants to include."

The firm uses a wide range of materials for the other structural components, fitting the material to the owners' needs. "We like bringing in the contractor early on the project, because we want them familiar with the systems that we're planning to use, including the precast concrete structure," he says. "Their early involvement lessens our concerns about their understanding of the project and ensures they know how everything will fit together, which creates more economy."



Architectural precast concrete wall panels also are popular with the designers. "We heavily use architectural precast, because we can do an awful lot with the medium," he says. "We can build a form with a particular shape that has interest, and then we can repeat that shape as often as we need using the same form. That creates a great deal of economy. There are a lot of benefits like that when you design a building using architectural precast concrete."

The economy of the material is such that the designers can have the precast concrete components transported a significant distance from the plant and still create an economical design, he notes. The speed of casting the components, which often can be done as other work progresses at the site, adds to the benefits. "You can mold the material to any shape you want, pull it from the form, and you're done," he says. "It's really a nice material to work with."

'The use of risers and rakers is the most prevalent approach because of the speed and strength.'





Expansion work at Colorado State University's Hughes Stadium features a total-precast concrete structure, allowing it to be self-supporting. The design also allows for easy expansion.

PROJECT SPOTLIGHT

Hughes Stadium Expansion

Location: *Fort Collins, Colo.*

Project Type: *University football stadium*

Area: *5,000 seat expansion*

Designer: *HOK Sport*

Owner: *Colorado State University*

Contractor: *Turner Sports Construction*

PCI-Certified Precaster: *Renaissance Precast Industries, River Rouge, Mich.(structural components) and Winfrey Architectural Concrete Inc., Longmont, Colo.*

Description: *The goal for this project was to enhance spectator amenities in the existing stadium and add premium seating in the form of improved suites and club seating. The project was completed in two phases. The first consisted of adding 5,000 seats, connection hallways and amenities such as restrooms and concessions in the north end zone. Phase two focused on expanding the west sideline with club seats and suites.*

Precast concrete components were used as the primary structural frame for the expansion work. The pieces included hammerhead columns, upper and lower bracing beams, double-tee floor slabs, stair-tower walls and stair sections for the new seating. Producing the hammerhead columns posed the greatest challenge for the precaster, as the pieces had to match the existing structure, which had been built using cast-in-place concrete.

Punched picture-frame windows were included on the west-elevation expansion to create personal views from the suites of the nearby mountains. Exit towers and concrete tubes serve as shafts to run wiring and tubing while also providing lateral structural support. The new precast concrete structure is self-supporting, without relying on the existing stadium for structural stability. The modular design also will allow the stadium to expand easily as needed in the future.

The precast design was chosen due to the cost savings it could provide while offering an aesthetic look that blended with the Rocky Mountain environment.

PROJECT SPOTLIGHT

300 Wyandotte: HOK Sport Venue Event Headquarters

Location: *Kansas City, Mo.*

Project Type: *Corporate headquarters with integrated parking*

Area: *95,000 square feet*

Designer: *HOK Sport Venue Event*

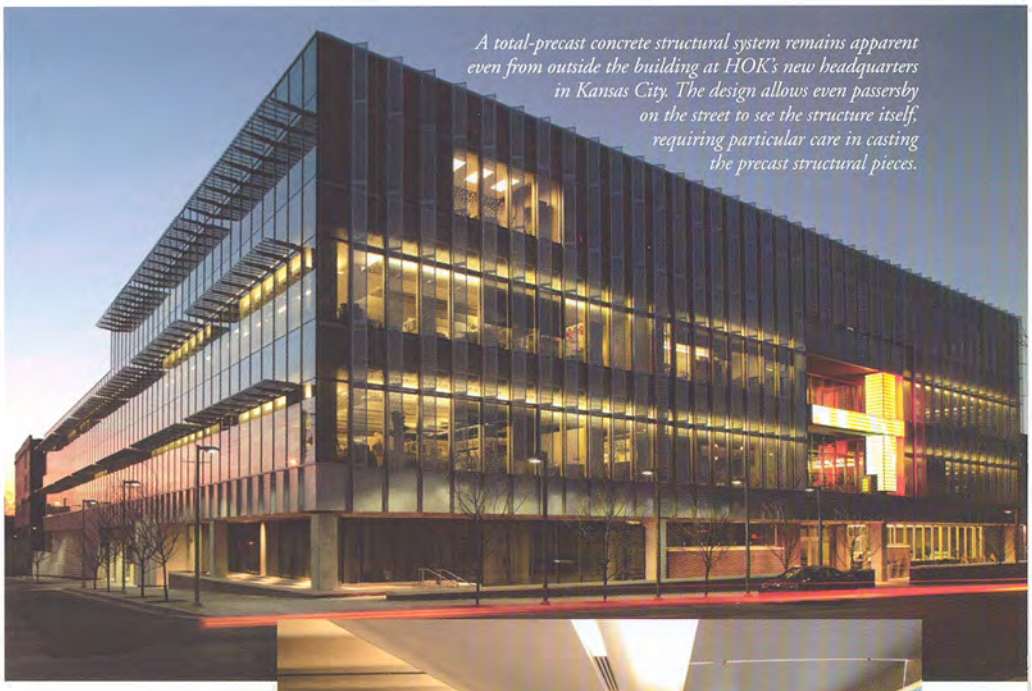
Owner: *Opus Northwest*

Contractor: *Opus Northwest*

PCI-Certified Precaster: *IPC Inc., a subsidiary of the Cretex Cos. Inc., Des Moines, Iowa.*

Description: *The firm's new headquarters offers dramatic views into the office from outside, aided by the use of a total-precast concrete structural system that allows large expanses of glass on the façade. The exterior features three precast balconies used for casual meetings and dining areas. The building's interior centerpiece is a two-story atrium that vertically unites the space and provides a public gathering location. Called "The Grandstand," it consists of tiered seating units.*

The project's precast structural system consists of beams, columns, double tees, hollow-core, solid slabs, stairs, interior spandrels, stair/elevator panels and 12-inch exterior and interior wall panels. The components allowed for the design of 32-foot by 50-foot bays, which created large, open spans for the desired open-plan office designs.



A total-precast concrete structural system remains apparent even from outside the building at HOK's new headquarters in Kansas City. The design allows even passersby on the street to see the structure itself, requiring particular care in casting the precast structural pieces.



It also can help with the brick projects that owners find so appealing. "We like to use precast concrete to show off a concrete finish and play to the strengths of its own aesthetics," he says. "But we also use it with face brick in some cases, particularly urban ballparks. We haven't relied on using it in one certain way, because it offers a lot of flexibility."

Headquarters Features Precast

HOK Sport's appreciation of the material can be seen in its own headquarters building, which opened in October 2005. The 95,000-square-foot facility offers a dramatic appearance, using precast concrete structural framing attached to an all-glass curtain wall. The combination allows passersby to look into the building and see the structure, including HVAC and support columns and beams. The goal was to show off design principles that emphasize collaboration and transparency.

The design features precast concrete columns and beams, which support double tees that are fully exposed throughout the building. "This is our house, so we were trying to accomplish a lot on a limited budget," he explains. "We used precast concrete because we could utilize the repetition that precast provides to create a design that, even if you left it alone as we did here, it would still look good. The design works from the standpoint of both economy and visual cleanliness."

Although it has opened a new headquarters, the firm has little intention of opening other offices. It currently operates five offices, including spaces in Nashville, Denver, London and Brisbane, Australia. The former two developed as new portions of the business arose, while the latter two were created to help serve customers overseas. In fact, HOK Sport prefers to keep its people gathered in the fewest locations possible, Wellner says.

"It's best if we centralize our expertise and send teams to particular locations for projects rather than opening additional offices around the country," he says. Kansas City offers a centralized geographical location to begin with, he points out, making travel to other locations much easier than for a coastal firm. "There's really no reason for us to open more offices, beyond a specific project office as needed. If we did that, we would divide up our expertise and lose our efficiency."

Keeping the offices together allows HOK Sport to pull on the diversity of background and experience that its designers offer through a variety of project types within its specialized field. Such focus ensures that the firm will continue to offer evolutionary and revolutionary designs that provide owners with even more than they expect, especially if they come to the company's doors with a vision of a "signature" work in their minds. ■

For more information on this or other projects visit *www.pci.org/ascent.*

How to do it in Precast...



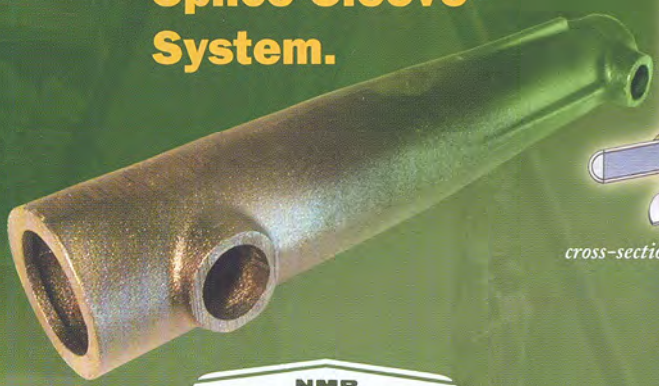
...a moment-resisting frame for a parking structure.

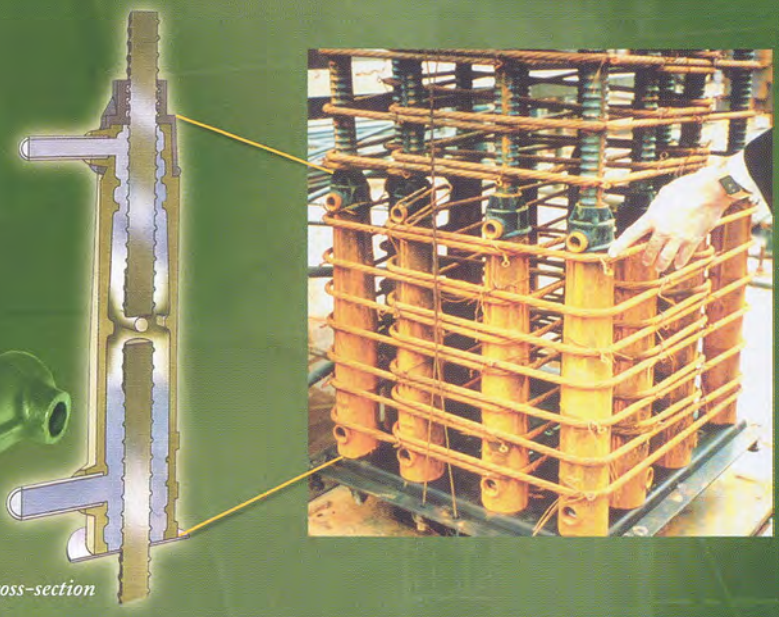
Q How is the moment connection made?

A All you need is an emulative detail, reconnect the concrete and rebar.

Q How do you connect the rebar?

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cross-section

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Precast Helps Robust Healthcare Designs

— Donald P. Merwin



Hoag Hospital Sue and Bill Gross Women's Pavilion
Newport Beach, Calif.
Taylor, Newport Beach, Calif.

Speed of construction, aesthetic diversity and many other benefits lead to the use of more precast components in healthcare projects of all kinds



Outpatient Surgery & Endoscopy Center, Hardin Memorial Hospital
Elizabethtown, Ky.
JRA Architects, Lexington, Ky.



'Once a hospital is funded, the owners want to see the building in place.'

St. Clare's Hospital
Weston, Wis.
Hammel, Green & Abrahamson, Inc., Milwaukee



Photo: Assassi Productions/Courtesy of Taylor.



As the healthcare industry grows, often by leaps and bounds, the cost of building new hospitals and other facilities has become increasingly important in medical budgets. As a result, designers are looking at precast concrete components as a way of containing those costs by getting the buildings up and running in shorter times and achieving aesthetic looks that help minimize costs.

The use of precast concrete in hospital construction is not necessarily new, but the reasons for its use are on the upswing. Although economy remains the overarching benefit that architects and building owners achieve, they also are relying on its speed of construction to help enclose the building more quickly. That speed can offset delays encountered in cold climates with other portions of the construction, particularly site work.

Precast concrete loadbearing wall panels also can eliminate the need for a structural-steel framework, cutting that step from the process. And its ability to provide a strong, institutional look at a more economical cost than stone or granite, while eliminating schedule delays for shipping or the use of masons on the site, adds to its popularity—especially when its ability to offer low maintenance can cut long-term operating costs, too.

"We've been doing hospital projects using precast concrete components for 30 years," says Jack Schroeder, president of Precast Concrete Specialties (IPCS) in Omro, Wis. "It's a popular material, because of its speed, economy and appearance options." PCS supplied the precast for St. Clare's hospital, which opened recently in Weston, Wis.

"Preferences for materials vary from client to client, so we find we use a wide variety of materials on our healthcare projects," says Randy Regier, president of Taylor, a healthcare architectural firm in Newport Beach, Calif. "Precast offers the look of permanence you achieve with cast-in-place concrete." Taylor recently completed architectural work for Hoag Memorial Hospital Presbyterian in Newport Beach, a seven-level acute-care addition to an existing hospital using architectural precast concrete panels for the façade.

Speed is the key drawing card for his healthcare clients, notes Joseph Jones, principal of JRA Architects in Lexington, Ky. "Once a hospital is funded, the owners want to see the building in place." That leads his firm to specify more total-precast concrete structural systems.

"The trend in precast today is in the use of panels that are not just architectural, but loadbearing as well," he says. These panels are 9 to 10 inches thick and often contain insulation and reinforcing steel, so they can support the flooring members, which also are often made of precast concrete slabs. JRA recently specified uninsulated loadbearing panels for an addition to Hardin Memorial Hospital in Elizabethtown, Ky.

Larry Blackburn of Turner Construction in Cincinnati, the general contractor on the Hardin project, agrees that more owners and designers are seeing the benefits. "Three-fourths of the projects we do in hospital construction use precast concrete components," he says. "I'd say there definitely is a trend toward more use of precast in these projects."

'Precast allowed us to build the building faster and saved money in the process.'

Hardin Addition Blends In

The Hardin Memorial addition for outpatient surgery and endoscopy faced the challenge of enclosing the building with a material that was in harmony with the existing hospital and could be rapidly erected to meet a demanding construction schedule. JRA Architects created a design that featured loadbearing precast concrete wall panels to achieve the goals.

Full-height loadbearing panels were considered ideal because they matched the existing building, could be erected quickly and proved to be economically superior, says Jones. The panels consist of reinforced concrete with sand aggregate, etched and lightly sandblasted, giving them a stone appearance that met the architect's design requirements. The panels were formed to provide openings for the windows, which were installed on site. The building shell was completed before winter set it, so Turner Construction of Cincinnati, the general contractor, placed tarpaulins over the window openings to work inside during cold weather.

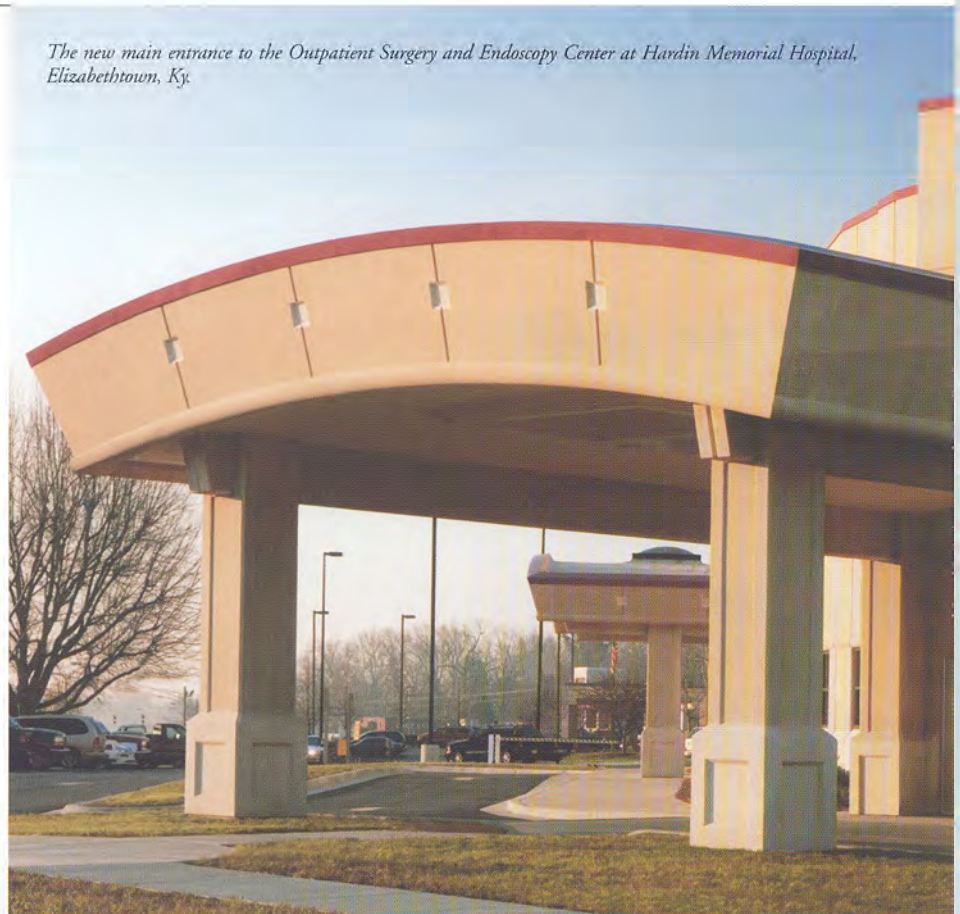
"Precast allowed us to build the building faster and saved money in the process," Jones says. "Constructing a $14-million building in 10 months is pretty demanding, but we did it." The full-height panels, 9 to 10 inches thick and 31 feet tall, "were very heavy," he notes. The panels were manufactured by Gate Precast Co. at its Winchester, Ky., plant and were shipped about 100 miles to Elizabethtown.

The loadbearing panels replaced the large steel columns that would have occupied significant floor space, Jones points out, providing more design flexibility and overall space in the facility. The panels were secured to each other and to the building frame, quickly enclosing the structure. Turner's Blackburn liked the system, he says, because the precast concrete components saved construction time and money while eliminating the need to schedule brick masons and work with them and their scaffolding, etc., on the site.

The 50,000-square-foot, two-story addition also was planned to expand in the future. The architects designed it to accommodate a third floor at a later date, which can be achieved by erecting a one-story panel with doweled connections that fit into inserts in the lower panels.

"Precast concrete components provided us with a lot of attributes on this project," says Jones. "They served as the architectural skin, the structure, the fireproofing, the support for the future floor, the support for the windows, the support for many of the interior materials in the building and an efficient thermal mass. The architectural and structural precast solution used on this building provided 'green' benefits to the owners that will benefit them for many years."

The loadbearing walls used on the project "have been around for a long time, but they're becoming more popular today," says Larry Isenhour, Gate's vice president of operations. "We think there is a trend toward using them more often, as we're seeing a lot more precast panels in hospital projects."



The new main entrance to the Outpatient Surgery and Endoscopy Center at Hardin Memorial Hospital, Elizabethtown, Ky.

Fact Sheet

Project: *Outpatient Surgery & Endoscopy Center, Hardin Memorial Hospital*

Type: *Hospital addition*

Location: *Elizabethtown, Ky.*

Designer: *JRA Architects, Lexington, Ky.*

Engineer: *Slesser Engineer, Louisville, Ky.*

Contractor: *Turner Construction, Cincinnati*

Owner: *Hardin Memorial Hospital, Elizabethtown, Ky.*

Precaster: *Gate Precast, Winchester, Ky.*

Precast components: *57 load-bearing panels of various sizes, six canopy false beams, three column surrounds*

Project cost: *$14,232,693*

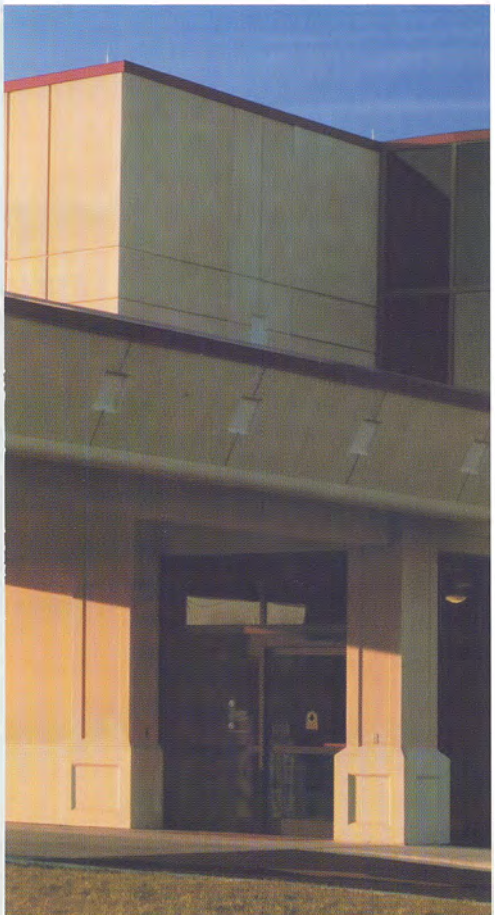
Hoag Project Creates New Entry

The $129-million Hoag Hospital addition in Newport Beach, Calif., named the Sue & Bill Gross Women's Pavilion, is the initial phase of a 25-year master plan for the hospital campus. The 320,000-square-foot building includes three floors for maternity care, 82 private rooms for neonatal intensive care, ambulatory surgery and surgical nursing units. It also serves as the new main entrance to the hospital, creating the welcoming face to visitors for the entire campus.

The building's cladding consists of 551 precast architectural spandrels, column covers and wall panels. The components "offer the permanence and durability required of a building of this type, and harmonize with the established material palette of the hospital's existing west tower," according to Taylor's Regier.

The panels feature a finish that combines light and medium sandblasts adjacent to each other to create an attractive contrast, he says. The largest panel, about 15 by 40 feet, weighed 17 tons. Installation was achieved with a Liebherr 1400 crane operating on a tight construction site.

"Precast concrete offered a durable, low-maintenance material





The seven-story Women's Pavilion at Hoag Memorial Hospital also includes the new main entrance to the facility. Photo: Assasi Productions/Courtesy of Taylor.

Fact Sheet

Project: *Hoag Hospital Sue and Bill Gross Women's Pavilion*

Type: *Hospital addition*

Location: *Newport Beach, Calif.*

Designer: *Taylor, Newport Beach, Calif.*

Engineer: *TMAD Taylor & Gaines, Pasadena, Calif.*

Construction Manager: *Jacobs Facilities Inc., Cypress, Calif.*

Contractor: *McCarthy Building Companies Inc., Newport Beach, Calif.*

Owner: *Hoag Memorial Hospital Presbyterian, Newport Beach*

Precaster: *Coreslab Structures, Perris, Calif.*

Precast components: *551 architectural wall panels of various sizes*

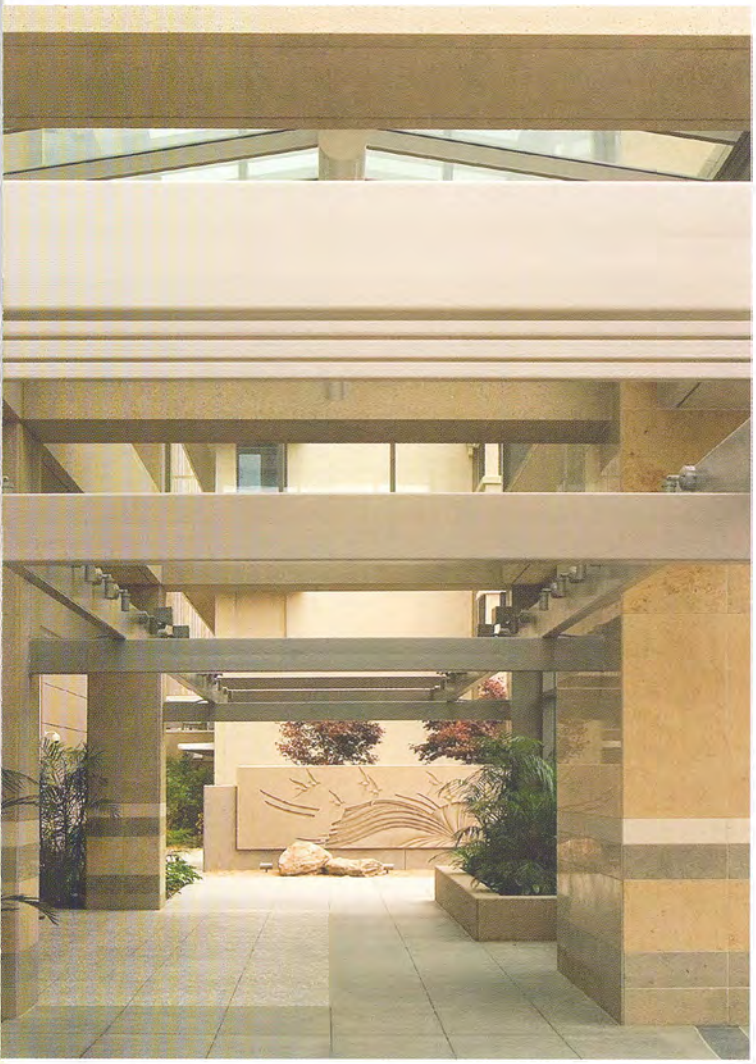
Project cost: *$129 million*

that is timeless in appearance," he says. The designers specified architectural precast because "it created a sense of permanence to the building. The campus' existing buildings were constructed of concrete, so the precast allowed the new tower to fit into the context of the established buildings. Precast is solid and long-lasting."

The speed of erection also benefited the project, he notes. Construction was completed 60 days ahead of schedule and below budget, despite the highly technical nature of the building.

Seismic Needs Addressed

Although the hospital is located atop a bluff with a fine view of the Pacific Ocean, it also sits only about one mile from the Newport-Inglewood fault, which is capable of producing a 6.9 magnitude earthquake. To protect the building from the devastation of such a quake, it is built on base isolators, consisting of layers of rubber and steel sandwiched together. Fifty-four isolators, 44 inches in diameter and 16 inches tall, support the building. The isolators can move as much as 27 inches in any direction, keeping the building in place as the ground—and the isolators—move during a seismic event.



Adding to the beauty at Hoag Memorial Hospital in Newport Beach, Calif., is a precast art wall showing shorebirds and crashing waves. Photo: Assassi Productions/Courtesy of Taylor.

The isolators created the need for what Regier called "a moat wall" that would allow for that potential 27 inches of movement. Built from the sub-basement up to grade, it is covered by precast panels that are attached to the building. "We now have to meet stringent earthquake codes, so it's usually more economical to build new buildings rather than update old ones," he adds.

The hospital also features a precast art wall, consisting of a 60-foot-long scene of shorebirds and crashing waves. It was created using a 4-inch-thick polystyrene design that was placed into the concrete formwork at the Coreslab Structures plant in Perris, Calif. After the concrete cured, the polystyrene was removed from the face of the panel with sandblasting, which revealed the artwork.

The artist, Tom Van Sant, worked at Coreslab's plant for three weeks, laying out his polystyrene designs on the production beds. The finished product now hangs on a poured concrete wall at the hospital. "We've done some work like this before, but this was the first time a hired artist was involved," says Coreslab's plant manager, Jon Clausen. "It was a departure for our guys, to say the least."

> 'The trend in precast today is in the use of panels that are not just architectural, but loadbearing as well.'

It may not be the last time it happens, either. "We're seeing a lot more use of precast concrete here on the West Coast," he adds. "We've been involved in at least six hospital jobs within the past two years in the Los Angeles basin."

Steve Mynsberge, senior vice president-healthcare services for general contractor McCarthy Building Companies Inc., agrees. "There are a lot of precast concrete skins in healthcare buildings. They're fairly common with our clients. One of the benefits is speed of installation—the ability to erect the walls in a single operation. It goes quickly when compared to studs and plaster, which require much longer." Healthcare facilities also are using more glass-fiber reinforced concrete (GFRC), he notes.

St. Clare's Features Inlaid Brick

Inset half-brick panels were used as one of four finishes featured on the new St. Clare's Hospital in Weston, Wis. The design required 704 panels and 200 molds to manufacture all of the required panel options, says PCS's Schroeder. In addition to the brick inlays, other panels feature large locally quarried quartzite inlays. There are also sections of panels with an acid etching that resembles quarried limestone and highly detailed insulated panels that create interesting shadow lines.

About 50 percent of the exterior walls are constructed of precast concrete panels, many of which are either concave or convex (horizontally and vertically), which emphasize the character of the building masses, says the project manager, Michael Torine of Hammel, Green & Abrahamson Inc., the architect/engineering firm.

The precast formwork was extensive, with some forms requiring more than three weeks to build. Some of the



'We've seen a substantial amount of precast being used in hospital construction.'

Convex brick-inlay panels weighing almost 23 tons each grace a wall of the main building at St. Clare's Hospital, Weston, Wis.



Fact Sheet

Project: *St. Clare's Hospital*

Type: *New hospital building*

Location: *Weston, Wis.*

Engineer: *Hammel, Green & Abrahamson Inc., Milwaukee*

Contractor: *M.A. Mortenson, Brookfield, Wis.*

Owner: *Ministry Health Care, St. Clare's Hospital, Weston*

Precaster: *Precast Concrete Specialties, Omro, Wis.*

Precast specialty engineer: *Computerized Structural Design, Milwaukee*

Precast components: *704 wall panels of various sizes with 3 finishes: Brick inlay, quartzite inlay, acid etch*

Project cost: *$90 million*

panels are more than 400 square feet in size and weigh almost 23 tons. In addition to its use for the panels, precast concrete was used for column covers and window units. More than 220 loads of material were trucked about 100 miles from the plant in Omro to the building site in Weston.

To achieve the look of brick masonry, half bricks were placed into mats and then the concrete was poured over them. "The building really has the look of brick masonry," says Schroeder. (For more on the use of embedded brick in panels, see the feature on page 30 in this issue.)

The vertically convex brick-inlay panels were used on the seven-story main hospital building, while the chapel features horizontally concave panels with the quartzite inlays. This differentiation helps distinguish the two facilities. The overall campus design features embedded brick with acid-etched details on the panels of the upper levels and inset-quartzite panels at the base. The power plant features highly detailed insulated panels that reflect the detailing used on the balance of the campus.

Most of the construction work on the $90-million project was done in the winter, notes Kurt Theune, assistant project manager for general contractor M.A. Mortenson of Brookfield, Wis. That scheduling need played to precast's ability to continue construction in harsh weather, allowing the building to be enclosed faster and other tradesmen to continue working through the cold weather.

"Precast gave us the ability to enclose the building quickly," he says. "The wide panels took up envelope real estate real fast. The materials are a customer and designer decision, but I believe precast is selected about half the time. We've seen a substantial amount of precast being used in hospital construction." ■

For more information on this or other projects visit *www.pci.org/ascent.*



A wide range of projects now include parking, and designers are using precast concrete components to blend the various functions

The height of the various parking levels at River Pier Landing was matched to the height of the retail/condominium floors to allow residents to walk directly from the parking lot to their apartments without needing stairs or an elevator. This was accomplished with hollow-core precast planks and other precast components that reduced floor-to-floor heights in the condominium building.

Precast Blends Parking With Many Project Types

— Wayne A. Endicott

An increasing number of infill projects aim to make the most efficient use of city spaces. The result is that architects are finding new ways to mix residential with retail and commercial uses. An important part of the equation is incorporating sufficient parking, sometimes in a constricted footprint. As a result, many designers are looking at precast concrete components to blend these mixed-use projects into a unified entity.

The material's aesthetic versatility and structural durability are two key benefits that designers cite. In addition, limited site access frequently compounds the problem and leads to a desire to create a less-congested site. Add the desire of developers to complete projects as quickly and economically as possible, and more designers are examining the options for precast concrete components.

The solutions are hardly cookie-cutter in nature, however. Four decidedly different projects around the country show how designers are adapting the material to meet owners' needs. Although all four combine parking with residential or commercial space (and sometimes both), each had unique obstacles that precast concrete helped designers overcome. The projects comprise River Pier Landing in Chattanooga, Tenn.; the Jefferson Street Parking Ramp in Wausau, Wis.; the Atlantic Station Parking Structure in Atlanta; and the Lindbergh Retail District, also in Atlanta.

Parking, Housing Connect

The River Pier Landing project, designed by Chattanooga architectural firm Artech, combines retail space on the first floor with five stories containing 16 condominiums. An adjacent six-story parking structure features additional retail space on the first floor and five levels of parking



above. The five parking levels allow condominium residents direct access to their units through a series of bridges between the two structures.

The 190,000-square-foot project features precast concrete cantilevered balconies, exterior wall panels embedded with thin brick and architecturally detailed columns and cornices, all supplied by Metromont from its Nashville area plant. Project architect Justin Dumsday notes that there were several issues that led them to use precast concrete.

"Perhaps the most compelling reason was the need to provide durability and longevity," Dumsday says. "We also were looking at a serious time constraint. The owners wanted the project completed in time for an annual festival."

Owners also wanted to maximize land use. Dumsday points out that floor-to-floor height became a major consideration and that the shallow depth of the precast concrete components, which included double-tees, inverted tee and L-beams, and hollow-core planks, helped minimize floor-to-floor heights. Columns, cornices, elevator shafts and stairwells also were supplied by the precaster.

Of particular importance was the use of 8-inch hollow-core planks for the flooring/ceiling units in the condominiums. The design of the floor system allowed the condo floors to align with the parking levels while permitting ductwork and plumbing to be installed in ceiling spaces through the voids in the hollow-core slabs. The system resulted in the ability to add an additional story to the project, increasing its financial viability.

The precast wall panels feature embedded thin brick to provide a masonry look without needing to have masons and scaffolding on the site. The hollow-core slabs cantilever 3 feet out from the building to create monolithic balconies. The parking structure features double tees supported on concrete columns and spandrel panels with a thin-brick facing that matches the condominium building. Solid



Columns along the base of the River Pier Landing condominium building were designed to reflect the layers of limestone rock along the river that flows nearby.



The River Pier Landing project in Chattanooga, Tenn., consists of retail stores at grade level with 16 condominiums on the five above grade floors. It connects by precast bridges to a companion six-story parking garage. The project features balconies, cast-in thin brick walls, and architecturally detailed precast columns and cornices.

Fact Sheet

Project Name: *River Pier Landing*

Location: *Chattanooga, Tenn.*

Owner: *River Pier Landing LLC, Chattanooga*

Architect: *Artech, Chattanooga*

Engineer of record: *Bennett & Pless, Atlanta*

General contractor: *Morgan Construction Co., Chattanooga*

Precaster/specialty precast engineer: *Metromont Corp., Nashville, Tenn.*

Size: *190,000-square-foot, six-story mixed-use development with retail on ground floor and 16 condominiums above*

Components: *Precast panels with light and heavy sandblasting finish, bushhammered ribs and thin brick inlays, double tees, inverted tee and L-beams, spandrel beams, flat slabs, cantilevered two-way balcony slabs, hollow-core plank and concrete columns*

Project construction cost: *$11.1 million*

The shallow depth of the precast concrete flooring components allowed an extra floor to be added.

precast planks provide bridges from the parking structure to the condos.

The parking structure not only provided a service to condominium owners, it also filled a pressing neighborhood need. Adjacent to the project is the city's aquarium, which attracts more than one million visitors each year. The parking serves those visitors, too. Its proximity helped determine the project's structural system, says Dumsday. "We had a very limited staging area, so the use of concrete components that could be erected as they were delivered turned a staging problem into a scheduling problem."

The project was priced two ways: as a standard steel structure with typical masonry veneer and with a precast concrete structure. The precast version won out on several fronts, including overall cost. Also factored in its selection were its durability, fire rating and its ability to provide fast construction. As a result, the building could be enclosed sooner, allowing interior work to begin earlier.

Parking Includes Retail

The Jefferson Street Parking Ramp in Wausau, Wis., is self-contained, with stores on the first floor and parking on four floors above the retail space. The structure also connects to an adjacent hotel and condominium building by means of a second-story skywalk, providing parking services for those users. Designed by local firm Mudrovich Architects, the project is part of a downtown revitalization effort and replaces a smaller existing parking lot.

Actually divided into connected halves with metered parking on the first level between the two wings, the building features a poured concrete frame enclosed with precast wall panels provided by Precast Concrete Specialties of Omro, Wis.

"We selected precast concrete wall panels for the project due to their strength," says Jeff Crowell, a partner in Mudrovich. Another factor in the selection of precast walls was their speed of construction. The entire structure was completed in just 18 weeks, with erection of the 415 precast panels requiring 13 weeks.

To erect the structure, streets on three sides of the project were closed to provide uninterrupted access that helped speed construction. The accelerated erection schedule minimized traffic disruptions in the area, he points out. Another factor that impacted the decision was that the panels could be erected through the fall and winter months using a single-tower crane.

"We used three different finishes on the exterior panels to meet a city requirement that we match the character of the existing area buildings," he explains. These included embedded thin-brick panels trimmed with an acid-etched finish to resemble limestone trim and formliner mats that resembled old fieldstone blocks. Some panels include all three panels on their face, requiring particular attention to detail in the pour.



Three different finishes were created for the exterior of the Jefferson Street Parking Ramp, including thin brick inlays, an acid-etched finish and formliner mats that resemble old fieldstone blocks. They frequently were all included in a single precast panel.

Fact Sheet

Project Name: *Jefferson Street Parking Ramp*

Type: *Mixed-use structure including parking garage and retail space*

Location: *Wausau, Wis.*

Owner: *City of Wausau*

Architect: *Mudrovich Architects, Wausau*

Engineer of record: *Arnold & O'Sheridan, Madison, Wis.*

General contractor: *The Samuels Group, Wausau*

Precaster: *Precast Concrete Specialties, Omro, Wis.*

Precast specialty engineer: *Computerized Structural Design, Milwaukee, Wis.*

Size: *Five stories with retail on first level and parking above, for a total of 1,012,177 square feet*

Components: *415 precast concrete wall panels totaling 62,000 square feet*

Project construction cost: *$19 million*



Parking Above Retail

The Lindbergh Retail District contains three warehouse anchor stores, as well as several smaller stores. Parking is provided above the largest of the three stores, as well as in front of two second-floor stores, providing customers with direct access adjacent to or above the retail units.

Designed by Robertson, Loia, Roof, PC of Alpharetta, Ga., the project's parking encompasses a 418- by 390-foot footprint. The entire precast structure, including retail space and parking areas, covers seven acres of land. The structure is one of three buildings that are part of a new 26-acre mixed-use development that also contains a Home Depot store and an apartment complex.

"We chose precast for several reasons," says Kevin Kotellos, senior associate. "First, it provided us with the required fire rating at a cost less than a steel frame with fireproofing. It also was cheaper than a cast-in-place system would be. A third consideration was that we were working with a very tight construction schedule and precast would allow us to meet that schedule."

The precast structure is divided into two distinctly different structural framing systems. One of the structures contains the roof of the Target store at ground level. The 362- by 404-foot structure supports the Best Buy and Linens N Things stores on a 270- by 404-foot footprint as well as a 92- by 404-foot parking area.

This portion of the project features two unique new product lines developed by Tindall Corp. in its Conley, Ga., plant. The first is a 12-foot-wide by 18-inch-wide "tri-slab" deck member. It consists of three stems, including two half-stems on either side and a full stem in the middle. When set side by side, the two half stems join to create a full stem that provides a structural system that results in a precast concrete joist 6 feet on center. The sides of the tri-slabs contain a shear key that runs their full length and allows them to be grouted together to eliminate the need for welded connections.

The second new product is a 36-inch-wide by 25-inch-deep "W-beam," which includes a center web and two thinner outside webs that allow the tri-slabs' stems to fit into pocket blockouts in the W-beam and after setting, to be tied together with field-poured concrete.

The second structural system is a traditional simple span for the parking structure in front of the Target store. This features 10-foot-wide and 24-inch-deep double tees, beams that are 36 inches wide and 40 inches deep spanning 45 feet, and precast shear walls. Full-height cast-in-place retaining walls on two sides of the parking areas support the precast tee girders and double tees, providing lateral resistance in three of the four structures.

The project was completed in 11 months with the actual precast erection consuming just 50 days. On-site work proceeded while the various components were cast in Tindall's plant.



A bridge connects the Jefferson Street Parking Ramp in Wausau, Wis., to an adjacent building. The parking structure features retail stores on the lower level with four floors of parking above.

The Target store at the Lindbergh Retail District in Atlanta (inset photo) includes a rooftop parking deck. Parking at ground level serves not only the retailer but also two other warehouse retailers, Best Buy and Linens N Things. The stores, as well as the parking lot, were built using structural, as well as architectural precast components.



Fact Sheet

Project Name: *Lindbergh Retail District*

Location: *Atlanta, Ga.*

Owner: *The Sembler Co., Atlanta.*

Architect: *Robertson, Loia, Roof, PC, Alpharetta, Ga.*

Engineer of record: *Bennett & Pless Inc., Atlanta*

General contractor: *Hardin Construction LLC, Atlanta*

Precaster: *Tindall Corp., Conley, Ga.*

Size: *146,200 square feet of retail and 158,500 square feet of parking*

Components: *1,056 pieces, including flat columns, square columns, W-beams, tri-slabs, wall panels, shear walls, double tees, spandrels with exterior ledges and T-girders*

Project construction cost: *$10 million*



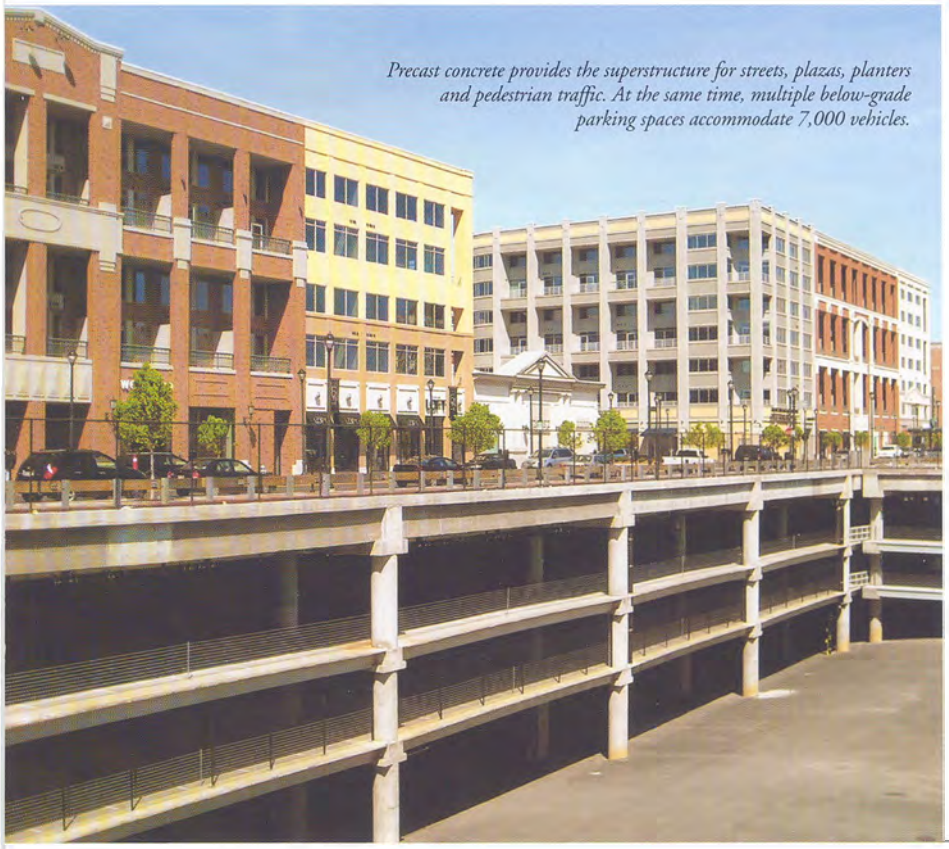
The precast parking deck at the Atlantic Station redevelopment project in Atlanta provides below-grade parking for the huge 15-million-square-foot mixed-use project. The parking system provides 7,000 spaces for the 10 buildings in the development, which includes retail space, residential units, offices and hotel space. It also acts as a platform for the cast-in-place buildings in the project, as well as providing streets, plazas and parks.

Parking Supports Buildings

Perhaps the most intriguing of the projects is the Atlantic Station Parking Structure, built on a 138-acre site formerly occupied by a steel mill. The parking deck, in addition to providing 7,000 parking stalls as well as streets, sidewalks and other spaces, also acts as the base for 10 cast-in-place concrete buildings that rise above street level. The project is the centerpiece for a $2-billion redevelopment project that is turning the once-abandoned site into 15-million square feet of office, retail, residential and hotel space and several acres of public parks.

When completed, the site will include several city blocks of mixed-use urban development. In addition to the parking structure, the project features 6-million square feet of Class A office space, 2-million square feet of retail and entertainment, approximately 4,000 residential units, 1,000 hotel rooms and 11 acres of public parks. Architect and engineer for the massive project is Carl Walker Inc. of Atlanta.

"The precast concrete parking system literally provides a platform for the buildings above it," says Walker Principal Derrick Bridges. The large parking plate provides an underground superstructure and parking system. The innovative system, which won the Precast/Prestressed Concrete Institute's Harry H. Edwards Industry Advancement Award last year, includes approximately 3-million square feet of precast concrete superstructure. In addition to providing the foundation for the buildings in the development, the top level of precast also doubles as streets, sidewalk, retail



Precast concrete provides the superstructure for streets, plazas, planters and pedestrian traffic. At the same time, multiple below-grade parking spaces accommodate 7,000 vehicles.

Fact Sheet

Project Name: *Atlantic Station Parking Structure*

Location: *Atlanta, Ga.*

Owner: *Jacoby Development, Atlanta*

Architect/engineer of record: *Carl Walker Inc, Atlanta*

General contractor: *Vratsinas, Atlanta*

Precaster: *Metromont Corp., Greenville, S.C.*

Precast specialty engineer: *PTAC, Pensacola, Fla.*

Size: *7,000 parking spaces covering approximately 3 million square feet in a two- and three-story parking deck plus streets, plazas and foundations for multistory structures*

Components: *4,592 precast components, including 3,311 double tees, 295 columns, 274 girders, 93 shear walls, 359 wall panels and 257 spandrels*

Project construction cost: *Approximately $2 billion*

'The precast concrete parking system literally provides a platform for the buildings above it.'

space, plazas and planters.

The system combines moment frames with shear walls that support factory-topped double tees, Bridges says. The use of double tees in the roads required approval from the Georgia Department of Transportation and a sign-off by Georgia's governor, as it was a first-time application in the state.

The cast-in-place moment frames support precast double tees. Factory topped 10-foot-wide, 26-inch-deep double tees comprise most of the two- and three-level parking areas. Street-level roadways required 12-foot-wide, 47-inch-deep members blocked out to 10 feet wide with an 8-inch-thick concrete composite slab.

The multilevel parking lot, which stretches over several city blocks, provides a base for 10 cast-in-place concrete buildings that rise a typical four stories above the street. Building footprints were segregated from the parking level and roadway structures. This required the precast structures directly below the buildings to be fashioned using a system of precast columns, shear walls and shear-frame structure to support each building. In all, more than 4,500 precast components comprise the structure.

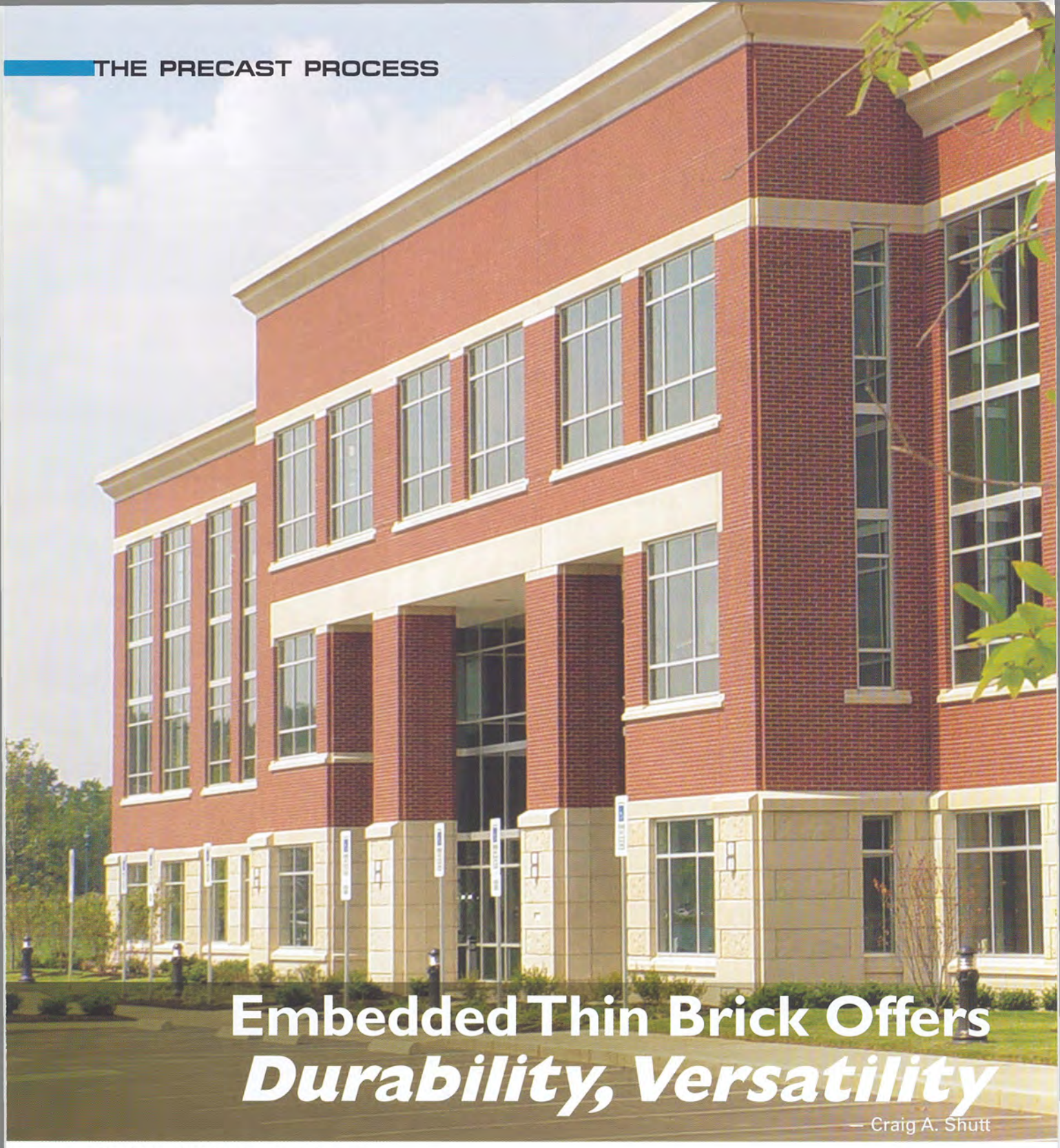
"The project presented a unique design challenge," says Bridges. "The buildings were actually designed after we completed plans for the parking structure. This required that we come up with assumed design loads and lateral loads from the onset of the project." All of the buildings are composed of efficient cast-in-place concrete moment frames with semi-lightweight (120 pcf) cast-in-place concrete. This minimized the mass of the buildings and thus allowed the design approach for the supporting precast structure.

Precast concrete's speed of erection, as well as the cost impact, played major roles in the decision to use the material for the parking structure.

The project is not yet complete, Bridges notes. Plans are now being formulated to add another such parking structure with perhaps as many as 7,000 additional parking spaces to the site north of the Georgia Tech campus. Among the buildings still under the planning stage is a 44-story Atlantis hotel.

Although few projects around the country are quite this extensive in their use of precast concrete parking structures, more such mixed-use designs are looking at precast as a strong option. Whether adding retail into parking, using parking as a complement or building retail and other buildings on top of the parking structure, precast concrete provides a variety of benefits that are making it a strong choice in a wide range of designs. ■

For more information on this or other projects visit *www.pci.org/ascent.*



Embedded Thin Brick Offers *Durability, Versatility*

— Craig A. Shutt

Thin brick embedded into architectural precast concrete panels can create a variety of designs that offer considerable advantages over traditional laid-up masonry. Photo courtesy of Metro Brick.

Owners and designers are learning that architectural precast concrete panels featuring embedded thin brick provides significant benefits versus traditional masonry



Photo courtesy of Smith-Midland.

A growing number of projects around the country are using architectural precast concrete panels with embedded thin bricks to give them the look of laid-up brick. Manufacturers say the process offers significant benefits, but there are some designers with misconceptions about the products, which have kept them from tapping into these advantages.

"We're seeing increased interest because we can provide virtually any type of design an architect can accomplish with traditional brick," says Greg Howard, vice president of Innovative Brick in Broomfield, Colo. "Our goal is to provide any design a mason could offer—arches, corbels, recessed bands, whatever is needed."

A driving force behind the popularity of embedded brick has been project owners, adds H. Moffette Tharpe Jr. of Easi-Set Industries in Midland, Va. "They are particularly drawn to the speed of construction that a panelized approach can provide," he explains. "While the building is being built, the owner isn't receiving revenue from tenant leases, so they are looking for ways to shorten the construction process by doing as much work as possible offsite to speed erection and thereby reduce costs."

Bricks Cast Into Concrete

Inset or embedded brick is integrated into architectural precast concrete wall panels through a process similar to the use of a formliner, manufacturers explain. The bricks, typically $^1/_2$-inch thick with a textured back, are placed face down into a grid made of polystyrene or rubber. The latter can be used several times, but most designs are using the one-time plastic grids today, producers say. The concrete for the panel is poured on top of the back side of the bricks set into the grids, embedding the brick into the concrete matrix.

Once the panel is stripped, the grid is pulled away from the face of the brick. Typically, the face of the thin brick is coated with wax to prevent the concrete from adhering to the brick's face and help the liner release from the panel. The brick-faced panel is cleaned with a high-powered pressure wash, resulting in a panel that appears to have been assembled by masons.

Tight construction schedules, environmental awareness, budget constraints and a range of other benefits are motivating architects to research the benefits of brick-faced precast panel systems, manufacturers agree. The frequent concern that arises is a misconception of the product's dynamics that can be easily explained, they note. "Whenever we talk with architects, the first thing they say is that they're concerned that thin brick will pop out of the concrete," says Randy Wilson, national sales manager for Metro Brick in Canton, Ohio. "We clarify why this simply can't happen."

The misconception is natural, he notes, because traditional full brick tends to expand after construction, due to its porous and water-absorbing nature, while standard ready-mix concrete continues to shrink. That conflict, the thinking goes, could result in pressure on the brick that makes it pop out of the wall. However, these standard attributes of the basic materials don't apply in this case, manufacturers stress. Architectural precast concrete wall panels with embedded thin brick are an engineered product, not a combination of two dissimilar materials.

Typical face brick has a water-absorption rate of 8% to 17%, a loose density that allows the material to expand as it is exposed to moisture after coming out of the kiln. But thin bricks used in precast concrete panels aren't simply a thinner slice of a standard face brick, explains Howard. "Thin brick is an extruded product with a much higher density than face brick. It's 'real' brick, but it's made differently." Thin brick provides a water-absorption rate of less than 3% to 6%, reducing the potential for expansion and preventing water from migrating into the wall system.

The precast concrete also has been engineered to ensure minimal shrinkage, adds Wilson. "Precasters create design mixes with high early-strength concrete and other admixtures to ensure the concrete

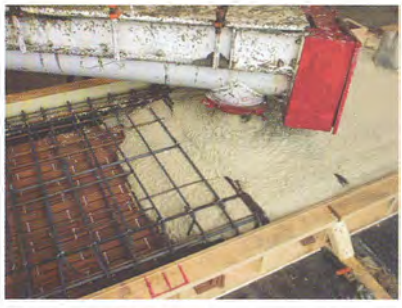
'Our goal is to provide any design a mason could offer—arches, corbels, recessed bands, whatever is needed.'



This side view shows how the thin brick is embedded into the concrete, eliminating grout or adhesive that could allow the brick to loosen.



Embedded-brick precast panels can achieve a variety of creative looks, such as this radiused panel that highlights the entry to a civic center. Photo courtesy of Innovative Brick.



The brick is laid face down into a grid at the bottom of the concrete form, with concrete cast over it. The grid is then pulled away from the face to create the final look.



Arches and other distinctive touches can be created with thin brick embedded in precast panels.

'We often blend colors to create more visual interest.'

panel will not shrink or crack. He points out that a typical panel can be 30 feet long with a 3/4-inch joint between panels.

In addition to the lack of brick expansion or concrete shrinkage, the bricks are secured into the concrete during the casting process and become part of the system. "These bricks aren't stuck against the concrete face or glued on with adhesive, they are embedded into the concrete before it cures," explains Ashley Smith, vice president of sales and marketing for Smith-Midland in Midland, Va. The backs of the bricks also are textured, he notes, to ensure they have a good mechanical bond. "Brick manufacturers do a lot of testing on their products to ensure they work as they should," he says. "I've never heard of a failure with thin bricks."

"The environmental benefits are significant," says Metro Brick's Wilson. One obvious savings comes in the reduction of the number of trucks required to deliver thin brick to the precast plant, he points out. One truck can transport 8,000 square feet of thin brick compared to only 1,300 to 1,500 square feet of full brick. In one recent project, he notes, the thin-brick panels helped the project gain three Innovation points in the US Green Building Council's (USGBC) LEED rating system.

Wilson sees the use of embedded-brick precast panels growing in the coming years. "My distributors are amazed at the architectural interest in thin-brick systems today," he says. "Many architects are not educated about how precast panels work, but they're curious about its environmental attributes and the speed to market. They immediately understand the benefits and begin to use the material on the next project."

Howard agrees that the use will grow. "This isn't a brand new concept, it's accepted and used, with no failures," he says. "It's really catching on as it's better understood by owners and designers." ■

For more information on this or other projects visit *www.pci.org/ascent*.

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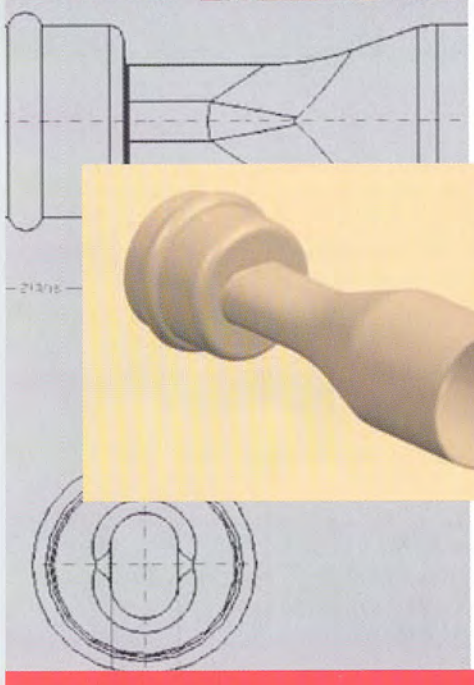
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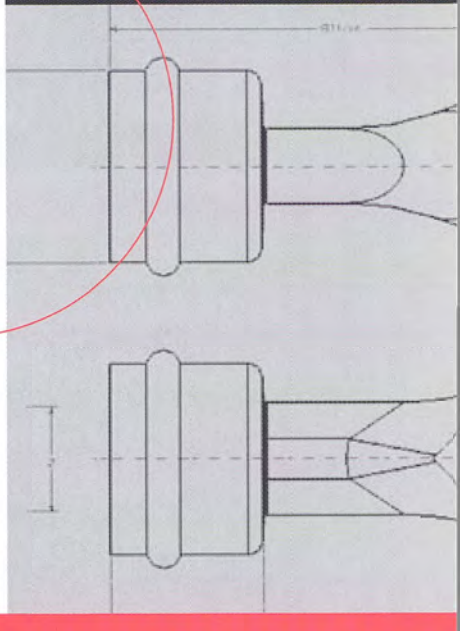


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Precast Provides Options For Single-Family Housing

— Craig A. Shutt



Designers find that various precast concrete components can aid the flexibility and marketability of single-family homes

With the housing boom slowing down, developers and builders are looking for ways to differentiate themselves in a tighter market. A number are finding that precast concrete components can provide benefits to both them and the homeowners that other materials can't match.

An example can be seen in the housing units constructed in Yonkers, N.Y., by Habitat For Humanity of Westchester County. The four duplexes' design follows a plan used earlier by the group in another neighborhood, in which a total-precast concrete system created the homes' shell. The components consisted of precast concrete waffle foundation panels, stem and roof decks, demising wall panels and insulated wall panels.

"As we saw with our recently completed homes on Willow Street, this construction method will allow us to more quickly place families into homes that will last much longer than a wood-frame structure," says Jim Killoran, director of the group. "This could revolutionize the way we build homes for Habitat for Humanity locally and nationwide." The 1,800-square-foot, two-story homes will have an appearance consistent with other residences in the neighborhood, including numerous architectural features. With the shells in place by the fall, the homes are planned for occupancy in 2007.





A variety of home styles, from ranch styles to large, two-story models with soaring ceilings, can be created using precast concrete components, as seen in these examples from Dukane Precast.

multifamily housing. We can use a similar approach to them all, creating a precast concrete shell that goes up fast and then attaching metal studs to create the finished interior."

A number of components can be used in this construction, either together or individually. The key types are:

Solid wall panels. These panels can have insulation attached to the interior side to aid energy efficiency and can be used as foundation walls or as façade panels. Solid concrete slabs also are used to span long distances as flooring units, and this type of component can be used as the foundation wall as well.

Insulated sandwich wall panels. This configuration of panel features a layer of insulation, typically 2 inches of material, "sandwiched" between two layers of precast concrete. The wythes of concrete are secured with connections that can be designed to ensure no thermal breaks occur that conduct heat. The panels can be loadbearing, with an interior wythe that supports flooring units above, eliminating the need for any other structural framework.

Double-wall panels. These panels are similar in their final design to sandwich wall panels but are cast differently, with the two panels cast and then the interior filled with foam insulation afterward. The panels are form-finished on both sides, eliminating the need for drywall on the interior. These panels also can be used as flooring units, with the top surface not requiring a leveling course and the bottom surface offering a drywall-smooth finish.

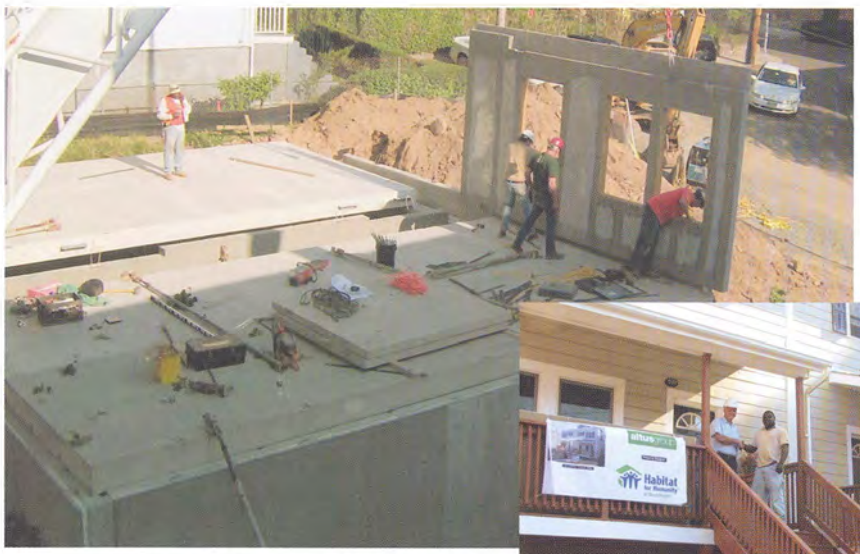
Hollow-core panels. These panels, typically used as flooring panels, feature voids through their lengths to lessen their weight while maintaining their structural integrity. They can span long distances, while the internal voids provide conduits for running mechanical services.

A Multitude of Benefits

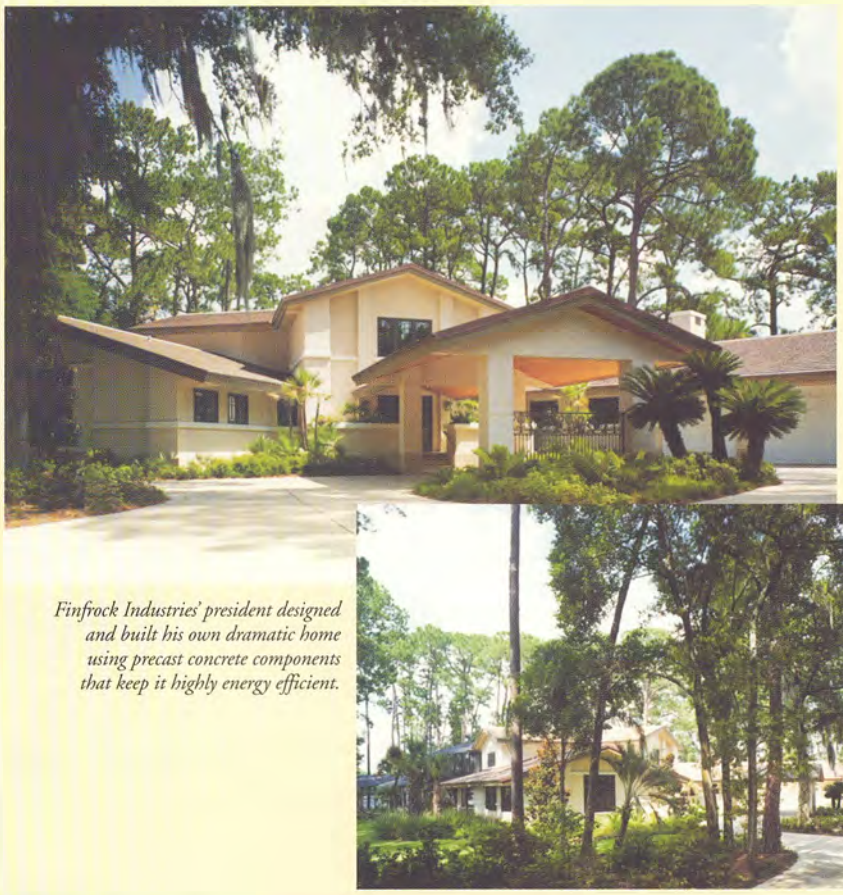
Owners, designers, contractors and homeowners are realizing the benefits that using precast concrete components can offer to a home. Some of these result from the inherent attributes of concrete, while others are derived from the value

The components were produced by Oldcastle Precast in South Bethlehem, N.Y., and were delivered to the jobsite as needed for immediate erection. The panels, called CarbonCast panels, feature carbon-fiber grid reinforcement, which replaces the typical secondary steel reinforcement in the components for more durability and lighter weight.

More designers are seeing the benefits that can be provided, which go beyond speed and aesthetic appeal. "We've done quite a few single-family homes using precast concrete components," says Thad Gleason, principal in Gleason Architects PC in Sugar Grove, Ill. "They work well for single-family projects as well as townhomes and



Habitat for Humanity of Westchester County, N.Y., is using CarbonCast precast concrete panels and components from Oldcastle Precast to create housing quickly and economically.



Finfrock Industries' president designed and built his own dramatic home using precast concrete components that keep it highly energy efficient.

Building on a Grand Scale

The potential for building dramatic homes that can hold their own with other showpieces can be seen in the residence built for Robert Finfrock, owner of Finfrock Industries Inc., a precast concrete manufacturer in Florida. Working with architectural firm Burke, Hogue & Mills & Associates Architects in Lake Mary, Fla., Finfrock designed a 6,644-square-foot home featuring a total-precast concrete shell.

"I built it because of my abilities and desire to have a home made with precast concrete," Finfrock says. The home features architectural and structural pigmented precast concrete exterior walls and structural interior walls with hollow-core and solid-slab concrete floor and roof components.

Some 426 precast components were used to build the home, which includes four bedrooms, 4.5 baths, family room, living room, billiard room, dining room, kitchen, laundry, closets, a large garage with a workshop, a lap pool and sun deck.

The home features a Prairie-style design and follows the shape of the site. The residence was sited to take full advantage of views without overpowering the delicate nature of the location. The structure is nestled among trees, which remained in place thanks to the use of precast concrete components that were cast offsite and delivered as needed each day.

"I love the house," Finfrock says. "It's very low maintenance and highly energy efficient. Because of the mass of the walls, it doesn't change temperature—when the weather changes, it takes three days for the building to know it. It's definitely a one-of-a-kind home, but the principles can be applied to other single-family housing styles."

added by precasting the products under factory-controlled conditions. The advantages include:

Speed of design and construction. Precast concrete components can be fabricated while other work progresses, such as foundation work. Once the site is ready, the panels can be erected quickly. "I can set a house in two days with precast concrete and get them weathertight," says Clifton Crawford, president of Crawford Development Partners in Evanston, Ill. He uses double-wall insulated panels produced by Dukane Precast in Naperville, Ill.

"It takes a lot longer with traditional framing and siding material, and with money the way it is today, that creates a major difference." He estimates that using precast panels reduces the home's overall timetable by 25% to 30%. His process consists of putting in footings, setting the precast concrete double wall on the footings, and laying deck panels across the tops of the panels for flooring and roofing supports. Gable roofs framed in wood complete the shell.

Habitat's Killoran agrees that precast's speed creates a definite benefit. "Precast breaks the traditional mold," he says. "I can do 25 shells collectively, knowing I am getting a great product that will get families in homes quicker."

Energy efficiency. Concrete's inherent thermal mass helps insulate homes and keep interior temperatures more consistent, absorbing heat and releasing it when temperatures cool at night. Insulated panels such as Dukane's double-wall design add R-21 insulating value to a 8-inch panel and up to R-35 for a 10-inch panel. Oldcastle's panels typically are created with an R-15 insulation value, but they can go as high as R-25, according to Harold Messenger, vice president.

Moisture control. Completing the shell quickly prevents other construction materials from becoming wet, creating moisture problems that could encourage mold and mildew. The precast panels, when used for either foundations or façades, create a large, solid expanse with very few joints compared to concrete masonry units or brick. The solidity minimizes the potential for moisture





Precast concrete panels can replicate the look of brick by using thin brick embedded in the panels or by creating a pattern on the face with formliners, as in this example from Prestress Engineering Corp.

'I can set a house every two days with precast concrete and get them weathertight.'

penetration, helping to keep the interior watertight throughout its lifetime.

Long-term durability. Concrete's durability ensures the home will maintain its appearance for generations. If a brick look is achieved, with thin brick embedded into the panels or with formliners to cast a brick appearance into the panels, it won't require tuckpointing, creating a low-maintenance design that saves cost over the home's life. CarbonCast panels, created by members of AltusGroup including Oldcastle, feature C-Grid carbon fiber that can't corrode as other reinforcement might. The concrete also is impervious to termite and rodent infestation.

Wind resistance. Precast concrete homes provide significantly more protection from wind-borne debris than other building materials. Tests sponsored and conducted by the Portland Cement Association (PCA), PCI and Dukane Precast have helped to create examples of fortified homes in Bolingbrook, Ill., where insurance companies offered premium discounts to homes built to the standard. (For more on this program, see "Designing For Hurricane Zones" in the Summer 2006 issue of *Ascent*.)

Design flexibility. Precast flooring units, such as hollow-core slabs, provide the ability to span long distances without interior support columns. This opens up interiors for more flexible layouts. Ben Miller of Streeter Associates in Minnetonka, Minn., has had great success using hollow-core planks to create new space on lower levels, particularly beneath garages, he says.

The components, produced by Molin Concrete Products Co. in Lino Lakes, Minn., are set on the foundation walls to open space below while providing structural



Hollow-core planks can create added column-free space beneath a home, particularly in the garage where loads are lowest, as seen in these homes that [illegible] from Molin Concrete Products.





Piekarz Associates Architects in Chicago has been designing single- and multifamily housing for many years using precast concrete panels. The latest designs feature two finishes: embedded thin brick on top with a rusticated-stone appearance below.

'The long, clear spans offer a key marketing advantage for builders, and the speed of installation is a big plus.'

stability that will support cars. "We've been using this approach for eight years now," Miller says. "Prior to that, we didn't offer this option on homes, because we didn't have a way to achieve it."

Adds Erik Molin, "The long, clear spans offer a key marketing advantage for builders, and the speed of installation is a big plus. You can quickly have a completed deck for a home." Typically, 8-inch panels are used for spans up to 28 feet long, after which the company uses 12-inch-thick panels. Recently, 6-inch hollow-core slabs were used for a project where a garden was being placed overhead.

Fire safety. Precast concrete's inherent noncombustible composition ensures it won't encourage flame, either inside or outside the home. This creates a safer environment that can also help reduce insurance rates.

Acoustical control. Precast's dense composition, coupled with high levels of interior insulation, helps keep noise out and create a quieter home. The precast concrete flooring units can help ensure noise doesn't travel from one floor to another.

Aesthetic versatility. Precast concrete panels can replicate the look of a variety of more expensive and labor-intensive materials. This includes brick and many types of stone. Using precast panels inset with thin brick reduces scheduling conflicts, creates a less congested site and provides an economical way to fit in with the neighborhood.

The market for precast concrete panels will continue to grow as more developers, designers, homebuilders and homebuyers become aware of the possibilities. "Most homeowners have never seen this technology," says Brian Bock of Dukane. "The greatest challenge is just getting people comfortable with the idea of doing something different, while also having the experts in architecture, concrete and insulation explain to their own peers why it makes sense."

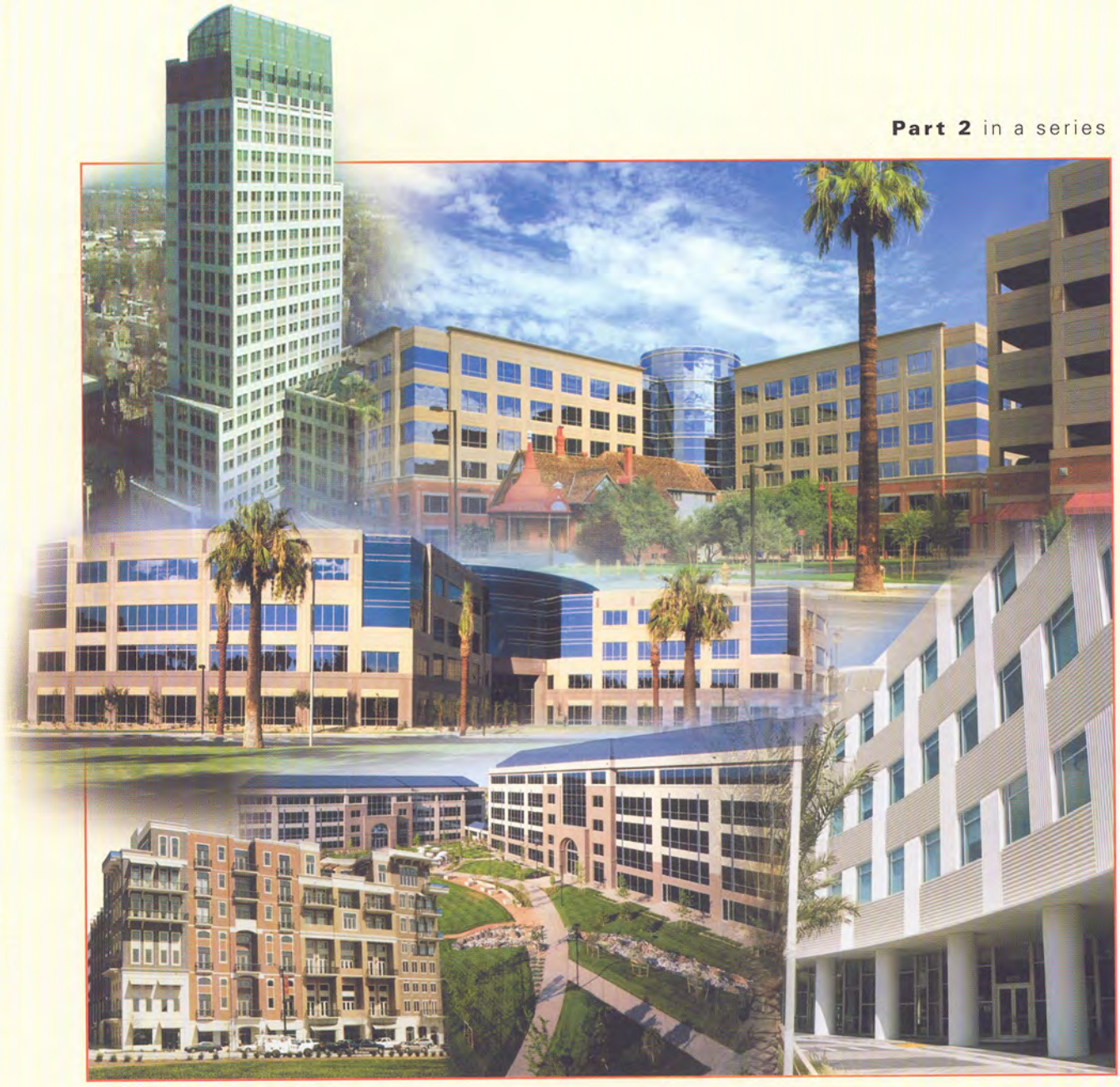
Gleason agrees. "We've been doing these projects for four years, and they work well. They can be constructed any time, they're durable and well insulated. As the initial costs become more cost-competitive as volume rises, I expect we'll see more built." ■

For more information on this or other projects visit *www.pci.org/ascent.*

SUSTAINABILITY

Designer's NOTEBOOK

Part 2 in a series



SUSTAINABILITY

Energy Star

Energy Star is a government/industry partnership designed to help businesses and consumers protect the environment and save money through energy efficiency. Energy Star labeling is available for office equipment such as computers and monitors, appliances such as refrigerators, and residential and commercial buildings. Buildings that meet certain criteria and achieve a rating of 75 or better in the Energy Star program are eligible to apply for the Energy Star (see www.energystar.gov).

The rating consists of a score on a scale of 1 to 100. The score represents a benchmark energy performance. For example, buildings that score 75 or greater are among the United States' top 25%. In addition, buildings must maintain a healthy and productive indoor environment.

At the present time, five commercial-building types are eligible for the Energy Star certification: offices, K–12 schools, supermarket/grocery stores, hotel/motels, and acute care/children's hospitals. These building types are broken down further into a number of specific occupancies. For example, office buildings include general office, bank branch, courthouse, and financial center.

Demonstrating conformance is accomplished through a Web-based software tool called Portfolio Manager. The program hinges on the unbiased opinions of a professional engineer who must visit the building and verify that data entered about the building are correct.

Through the Portfolio Manager, the engineer inputs the building location and energy consumption and describes its physical and operating characteristics. Operating characteristics include such things as average weekly occupancy hours, number of occupants, and number and types of equipment such as personal computers, refrigeration cases, cooking facilities, and laundry facilities. Energy consumption is based on all sources of energy used per month. In addition to energy performance, the engineer is responsible for demonstrating compliance with industry standards on thermal comfort, indoor air quality, and illumination.

The professional engineer assessing the building is expected to give an opinion about the capability of the building to provide acceptable thermal environmental conditions per ASHRAE Standard 55 and its capability to supply acceptable outdoor air per ASHRAE Standard 62 (see www.ashrae.org). The engineer is also expected to give an opinion about the capability of the building to provide minimum illumination levels per the Illuminance Selection Procedure in the *IESNA Lighting Handbook* (see www.iesna.org).

In addition, Portfolio Manager has the capability to manage energy data, analyze trends in energy performance (to make budget and management decisions regarding investments in energy-related projects), verify building performance, and track the progress of building improvements.

Green Globes

Green Globes is an online, point-based green building rating system administered by the Green Building Initiative (www.thegbi.org). Many of the points are similar to those in LEED, though the point structure differs; Green Globes has 1,000 total points compared with the 69 for LEED-NC. Certification for Green Globes is available at 35% achievement of the total applicable points compared with LEED at 38% (26 points). It is easier to obtain certification in Green Globes, however, because points that are not applicable to the building are subtracted from the total number of applicable points, so a higher percentage is obtained for those criteria that are met.

Durability

A key factor in building reuse is the durability of the original structure. Precast concrete panels provide a long service life due to their durable and low-maintenance concrete surfaces. A precast concrete shell can be left in place when the building interior is renovated. Annual maintenance should include inspection and, if necessary, repair of sealant material.

Modular and sandwich panel construction with concrete exterior and interior walls provides long-term durability inside and out. Precast concrete construction provides the opportunity to refurbish the building should the building use or function change, rather than tear it down and start anew. These characteristics of precast concrete make it sustainable in two ways: it avoids contributing solid waste to landfills and it reduces the depletion of natural resources and production of air and water pollution caused by new construction.

LEED Materials Credit 1 in Building Reuse. *The purpose of this credit is to leave the main portion of the building structure and shell in place when renovating, thereby conserving resources and reducing wastes and environmental effects of new construction. The building shell includes the exterior skin and framing but excludes window assemblies, interior partition walls, floor coverings, and ceiling systems. This credit should be obtainable when renovating buildings with a precast concrete façade, because concrete generally has a long life. This is worth 1 point if 75% of the existing building structure/shell is left in place and 2 points if 100% is left in place.*

Corrosion Resistance

The inherent alkalinity of concrete results in a system of concrete and reinforcing steel that does not corrode in most environments. The most common reason for surface spalling of concrete in buildings is corrosion of reinforcing steel due to inadequate concrete cover. Precast concrete offers increased resistance to this type of spalling because reinforcement and concrete are placed in a plant, with more quality control than cast-in-place construction. This reduces variations in concrete cover over reinforcing steel and reduces the likelihood of inadequate cover.

Inedible

Vermin and insects cannot destroy concrete because it is inedible. Some softer construction materials are inedible but still provide pathways for insects. Due to its hardness, vermin and insects will not bore through concrete.

Resistant to Natural Disasters

Concrete is resistant to wind, hurricanes, floods, and fire. Properly designed precast concrete is resistant to earthquakes and provides blast protection for occupants.

Fire Resistance

Precast concrete offers noncombustible construction that helps contain a fire within boundaries. As a separation wall, precast concrete helps to prevent a fire from spreading throughout a building or jumping from building to building. During wild fires, precast concrete walls help provide protection to human life and the occupant's possessions. As an exterior wall, concrete that endures a fire can often be reused when the building is rebuilt.

The fire endurance of concrete can be determined based on its thickness and type of aggregate. Procedures for determining fire endurance of building materials are prescribed by ASTM E119. Concrete element fire endurance

is generally controlled by heat transmission long before structural failure, whereas other construction materials fail by heat transmission when collapse is imminent. So, a two-hour fire endurance for a precast concrete wall will most likely mean the wall gets hot (experiences an average temperature rise of 250 °F [140 °C] or 325°F [180°C] at any one point) whereas a two-hour fire endurance of a frame wall means the wall is likely near collapse. Concrete helps contain a fire even if no water supply is available, whereas sprinklers rely on a problematic water source.

Tornado, Hurricane, and Wind Resistance

Precast concrete can be economically designed to resist tornadoes, hurricanes, and wind. Hurricanes are prevalent in coastal regions. Tornadoes are particularly prevalent in the path of hurricanes and in the central plains of the U.S.

Case Study: In 1967, a series of deadly tornadoes hit northern Illinois. Damages at the time were estimated at $50 million, with 57 people killed and 484 homes destroyed. Two precast/prestressed concrete structures, a grocery store and a high school, were in the direct path of two of the tornadoes, which struck almost simultaneously. Repairs to the structural system of the grocery store (limited to a single crack in the flanges and stem of a beam subjected to uplift) were less than $200. In the high school, structural damage was limited to the flange of one double-tee member (24 ft [7.5 m] of which was broken off by flying debris) and damaged concrete diaphragm end closures.

Flood Resistance

Concrete is not damaged by water; concrete that does not dry out continues to gain strength in the presence of moisture. Concrete submerged in water absorbs very small amounts of water even over long periods of time, and this water does not damage the concrete. Conversely, building materials such as wood and gypsum wallboard can absorb large quantities of water and cause moisture related problems. In flood-damaged areas, the concrete buildings are often salvageable.

Concrete will only contribute to moisture problems in buildings if it is enclosed in a building system that does not let it dry out, trapping moisture between the concrete and other building materials. For instance, impermeable vinyl wall coverings in hot and humid climates will act as a vapor retarder and moisture can get trapped between the concrete and wall covering. For this reason, impermeable wall coverings (such as vinyl wallpaper) should not be used in hot and humid climates.

Earthquake Resistance

Precast concrete can be designed to be resistant to earthquakes. Earthquakes in Guam, United States (Richter Scale 8.1), Manila, Philippines (Richter Scale 7.2) and Kobe, Japan (Richter Scale 6.9), have subjected precast concrete buildings to some of nature's deadliest forces. Appropriately designed precast concrete framing systems have a proven capacity to withstand these major earthquakes.

Case study: The 1994 earthquake in Northridge, California (Richter Scale 6.8), was one of the costliest natural disasters in U.S. history. Total damage was estimated at $20 billion. Most engineered structures within the affected region performed well, including structures with precast concrete components. In particular, no damage was observed in precast concrete cladding due to either inadequacies of those components, or inadequacies of their connections to the building's structural systems, and no damage was observed in the precast concrete components used for the first floor or first-floor support of residential housing. It should be noted that parking structures with large plan areas—regardless of structural system—did not perform as well as other types of buildings.

Weather Resistance

High Humidity and Wind-Driven Rain

Precast concrete is resistant to wind-driven rain and moist, outdoor air in hot and humid climates. Concrete is impermeable to air infiltration and wind-driven rain. Moisture that enters a precast concrete building must come through joints between precast concrete elements. Annual inspection and repair of joints will minimize this potential. More importantly, if moisture does enter through joints, it will not damage the concrete.

Good practice for all types of wall construction is to have permeable materials that breathe (are allowed to dry) on at least one surface and not encapsulate concrete between two impermeable surfaces. Concrete breathes and will dry out. Therefore, as long as a precast concrete wall is allowed to breathe on at least one side and is not covered by an impermeable material on both wall surfaces, the potential for moisture problems within the wall system is minimal.

More information on condensation potential and moisture control in precast concrete walls is covered in Designers Notebook *Energy Conservation and Condensation Control*, DN-15.

Ultraviolet Resistance

The ultraviolet (UV) range of solar radiation does not harm concrete. Using nonfading colored pigments in concrete retains the color in concrete long after paints have faded due to the sun's effects. Precast concrete is ideal for using pigments because the controlled production allows for replication of color for all panels for a project (See Figs. 3 and 4 in *Designer's Notebook, Ascent Summer 2006*).

Mitigating the Urban Heat Island Effect

Precast concrete provides reflective surfaces that minimize the urban heat island effect. Cities and urban areas are 3 to 8 °F (2 to 4 °C) warmer than surrounding areas due to the *urban heat island effect*. This difference is attributed to heat absorption of buildings and pavements that have taken the place of vegetation. Trees provide shade that reduces temperatures at the surface. Trees and plants provide transpiration and evaporation that cool the surfaces and air surrounding them. Research has shown the average temperature of Los Angeles has risen steadily over the past half century, and is now 6 to 7 °F (3 to 4 °C) warmer than 50 years ago.

Warmer Surface Temperatures

Urban heat islands are primarily attributed to horizontal surfaces, such as roofs and pavements, that absorb solar radiation. In this context, pavements include roads, streets, parking lots, driveways, and walkways. Vertical surfaces, such as the sides of buildings, also contribute to this effect. Using materials with higher albedos, such as concrete, will reduce the heat island effect, save energy by reducing the demand for air conditioning, and improve air quality (Fig. 7).

Studies indicate people will avoid using air-conditioning at night if temperatures are less than 75 °F (24 °C). Mitigating the urban heat island effect to keep summer temperatures in cities less than that temperature at night has the potential to save large amounts of energy by avoiding air-conditioning use.

Smog

Smog levels have also been correlated to temperature rise. Thus, as the temperature of



Fig. 7
High-reflecting (usuallly light-colored) surfaces help mitigate urban heat islands.

Cape Coral City Hall
Cape Coral, Florida
Architect: Spillis Candela/DMJM

urban areas increases, so does the probability of smog and pollution. In Los Angeles, the probability of smog increases by 3% with every degree Fahrenheit of temperature rise. Studies for Los Angeles and 13 cities in Texas have found that there are almost never any smog episodes when the temperature is below 70 °F (21 °C). The probability of episodes begins at about 73 °F (23 °C) and, for Los Angeles, exceeds 50% by 90 °F (32 °C). Reducing the daily high in Los Angeles by 7 °F (4 °C) is estimated to eliminate two-thirds of the smog episodes.

Smog and air pollution are the main reasons EPA mandates expensive, clean fuels for vehicles and reduced particulate emissions from industrial facilities such as cement and asphalt production plants. The EPA now recognizes that air temperature is as much a contributor to smog as nitrogen oxide (NOx) and volatile organic compounds (VOCs). The effort to reduce particulates in the industrial sector alone costs billions of dollars per year, whereas reduction in smog may be directly related to the reflectance and colors of the infrastructure that surround us. Installing low-albedo roofs, walls, and pavements is a cost-effective way to reduce smog.

Albedo (Solar Reflectance)

Albedo, which in this case is synonymous with solar reflectance, is the ratio of the amount of solar radiation reflected from a material surface to the amount shining on the surface. Solar radiation includes the ultraviolet, as well as the visible spectrum. Albedo is measured on a scale not reflective (0.0) to 100% reflective (1.0). Generally, materials that appear to be light-colored in the visible spectrum have high albedo and those that appear dark-colored have low albedo. Because reflectivity in the solar radiation spectrum determines albedo, color in the visible spectrum is not always a true indicator of albedo.

Surfaces with lower albedos absorb more solar radiation. The ability to reflect infrared light is of great importance because infrared light is most responsible for heating. On a sunny day when the air temperature is 55 °F (13 °C), surfaces with dark acrylic paint will heat up to 90 °F (32 °C) more than air temperatures, to 145 °F (63 °C). Light surfaces, such as white acrylic, will heat up to 20 °F (11 °C) more, to a temperature of 75 °F (24 °C). The color and composition of the materials greatly affect the surface temperature and the amount of absorbed solar radiation. The effect of albedo and solar radiation on surface temperatures is referred to as the sol-air temperature and can be calculated.

Traditional portland cement concrete generally has an albedo or solar reflectance of approximately 0.4, although values can vary; measured values are reported in the range of 0.4 to 0.5. The solar reflectance of new concrete is greater when the surface reflectance of the sand and cementitious materials in the concrete are greater. Surface finishing techniques also have an effect, with smoother surfaces generally having a higher albedo. For concrete elements with "white" portland cement, values are reported in the range of 0.7 to 0.8. Albedo is most commonly measured using a solar-spectrum reflectometer (ASTM C 1549) or a pyranometer (ASTM E 1918).

Emittance

In addition to albedo, the material's surface emittance affects surface temperature. While albedo is a measure of the solar radiation reflected away from the surface, surface emittance is the ability of the material to emit, or "let go of" heat. A white surface exposed to the sun is relatively cool because it has a high reflectivity and a high emittance. A shiny metal surface is relatively warm because it has a low emittance, even though it has a high albedo. The emittance of most nonreflecting (nonmetal) building surfaces such as concrete is in the range of 0.85 to 0.95. The emittances of aluminum foil, aluminum sheet, and galvanized steel, all dry and bright, are 0.05, 0.12, and 0.25, respectively.

Moisture

Moisture in concrete helps to cool the surface by evaporation. Concrete when placed has a moisture content of 100% relative humidity. The concrete surface gradually dries over a period of one to two years to reach equilibrium with its surroundings. Concrete surfaces exposed to rain and snow will continue to be wetted and dried. This moisture in the concrete surface will help to cool the concrete by evaporation whenever the vapor pressure of the moisture in the surface is greater than that of the air. In simpler terms, when the temperature and relative humidity of the air are greater than that just beneath the concrete surface, the concrete will dry and cool somewhat by evaporation.

The albedo of concrete decreases when the surface is wet. Consequently, albedo is lower when concrete is relatively new and the surface has not yet dried, and when the concrete becomes wet. The albedo of new concrete generally stabilizes within two to three months.

LEED Sustainable Sites Credit 7.1 on Heat Island Effect, Non-Roof. *The intent of this credit is to reduce heat islands. The requirements are met by placing a minimum of 50% of parking places underground or covered by a parking structure. Precast concrete parking structures can be used to help obtain this point. Any roof used to shade or cover parking must meet specified criteria. This credit is worth 1 point.*

Mitigation Approaches

One method to reduce the urban heat island effect is to change the albedo of the urban area. This is accomplished by replacing low albedo surfaces with materials of higher albedo. This change is most cost effective when done in the initial design or during renovation or replacement due to other needs. Planting trees for shade near buildings also helps mitigate the urban heat island effect. Shade also directly reduces the air-conditioning load on buildings. Using deciduous trees shades the buildings in the summer and allows the sun to reach the buildings in the winter.

Thermal Mass and Nocturnal Effects

The thermal mass of concrete delays the time it takes for a surface to heat up but also delays the time to cool off. For example, a white nonconcrete roof will get warm faster than concrete during the day, but will also cool off faster at night. Concrete surfaces are often warmer than air temperatures in the evening hours. Concrete's albedo and thermal mass will help mitigate heat island effects during the day but may contribute to the nocturnal heat island effect. The moisture absorbed by concrete during rain events helps reduce the daytime and nocturnal heat island effect when it evaporates. The challenge is to use concrete to mitigate heat islands while keeping evening temperatures as cool as possible.

Environmental Protection

Radiation and Toxicity

One goal of sustainability is to reduce radiation and toxic materials; concrete provides an effective barrier against radiation and can be used to isolate toxic chemicals and waste materials. Concrete protects against the harmful effects of X-rays, gamma rays, and neutron radiation.

Concrete is resistant to most natural environments; it is sometimes exposed to substances that can attack and cause deterioration. Concrete in some chemical manufacturing and storage facilities must be specifically designed to avoid chemical attack. The resistance of concrete to chlorides is good, and using less permeable concrete can increase the resistance even more. This is achieved by using a low water-to-cementitious materials ratio (around 0.40), adequate curing, and supplementary cementitious materials such as slag cement or silica fume. The best defenses against sulfate attack, where this is an issue, are the measures suggested previously, in addition to using cement specially formulated for sulfate environments.

Resistance to Noise

Precast concrete walls provide a buffer between outdoor noise and the indoor environment. Because land is becoming scarcer, buildings are being constructed closer together and near noise sources such as highways, railways, and airports. The greater mass of concrete walls can reduce sound penetrating through a wall by over 80% compared to wood or steel frame construction (Section 5.5). Although some sound will penetrate the windows, a concrete building is often two-thirds quieter than a wood or steel frame building.

Precast concrete panels also provide effective sound barriers separating buildings from highways or industrial areas from residential areas.

Security and Impact Resistance

Concrete is often used as a first line of defense against explosions or blasts. Rows of concrete planters or ballards are now positioned in front of most federal buildings such as court houses, office buildings and other high-security areas. Decorative concrete walls are also used as a primary line of defense to prevent vehicles from coming close to buildings. From a holistic perspective, the barriers may also provide benches and a visual separation between the street and plaza.

Precast Concrete Production

The production of precast concrete has many environmental benefits, including:

1. Less materials are required because precise mixture proportions and tighter tolerances are achievable.
2. Optimal insulation levels can be incorporated into precast concrete sandwich panel walls.
3. Less concrete waste is created because of tight control of quantities of constituent materials.
4. Waste materials are more likely to be recycled because concrete production is in one location.
   a. Gray water often recycled into future mixtures.
   b. Hardened concrete recycled (presently about 5 to 20% of aggregate in precast concrete can be recycled concrete; in the future this could be higher).
   c. Steel forms and other materials are reused.
5. Less dust and waste is created at the construction site because only needed precast concrete elements are delivered and there is no debris from formwork and associated fasteners—construction sites are cleaner and neater.
6. Fewer trucks and less time are required for construction because concrete is made offsite; this is particularly beneficial in urban areas where minimal traffic disruption is critical.
7. Precast concrete units are normally large components, so greater portions of the building are completed with each activity.
8. Less noise is found at the construction site because concrete is made offsite.

LEED Sustainable Sites Credit 5.1 on Site Development, Protect, or Restore Habitat. *The intent of this credit is to encourage the conservation of natural areas on the site and restore damaged areas. The requirements are met by limiting site disturbance to prescribed distances. Tuck-under parking, such as precast concrete parking structures, can be used to help obtain this credit worth 1 point. Also precast concrete requires minimal site disturbance for erection of panels.*

LEED Sustainable Sites Credit 5.2 on Site Development, Maximize Open Space. *The intent of this credit is to provide a high ratio of open space to development footprint. The requirements are met by limiting the size of the development footprint; specifically, by exceeding the local zoning's open space requirement for the site by 25%. Tuck-under parking, such as precast concrete parking structures, can be used to help obtain this credit worth 1 point.*

Less concrete is generally used in precast concrete buildings than in other concrete buildings because of the optimization of materials. A properly designed precast concrete system will result in smaller structural members, longer spans, and less material used on-site. This translates directly into economic savings, which can also result in environmental savings. Using less materials means using fewer natural resources and less manufacturing and transportation energy—not to mention the avoided emissions from mining, processing, and transporting raw and finished material.

Concrete products can provide both the building structure, and the interior and exterior finishes. Structurally efficient columns, beams, and slabs can be left exposed with natural finishes. Interior and exterior concrete walls offer a wide range of profile, texture, and color options that require little or no additional treatment to achieve aesthetically pleasing results. Exposed ceiling slabs and architectural precast concrete panels are some examples of this environmentally efficient approach. This structure/finish combination reduces the need for the production, installation, maintenance, repair, and replacement of additional finish materials. It also eliminates products that could otherwise degrade indoor air quality. This approach provides durable finishes that are not prone to damage or fire. Exposing the mass of the structure moderates heating and cooling loads.

Constituent Materials

Concrete. Concrete is basically a mixture of two components: aggregates and paste. The paste, comprised of portland cement and water, binds the aggregates (usually sand and gravel or crushed stone) into a rocklike mass. The paste hardens because of the chemical reaction of the cement and water. Supplementary cementitious materials and chemical admixtures may also be included in the paste. The absolute volume of cement is usually between 7% and 15% and the water between 14% and 21%.

Portland Cement. Portland cement (hereafter called cement) is made by heating common minerals, primarily crushed limestone, clay, iron ore, and sand, to a white-hot mixture to form clinker. This intermediate product is ground, with a small amount of gypsum, to form a fine gray powder called cement. To trigger the necessary chemical reactions in the kiln, these raw materials must reach about



Fig. 8 [a] Fly ash



Fig. 8 [b] Slag cement



Fig. 8 [c] Silica fume (top) and white silica fume (bottom)

2,700 °F (1,482 °C)—the temperature of molten iron. Although the portland cement industry is energy intensive, the U.S. cement industry has reduced energy usage per ton of cement by 35% since 1972.

Carbon dioxide emissions from a cement plant are divided into two source categories: combustion and calcination. Combustion accounts for approximately 35% and calcination 65% of the total CO_2 emissions from a cement manufacturing facility. The combustion-generated CO_2 emissions are related to fuel use. The calcination CO_2 emissions are formed when the raw material is heated and CO_2 is liberated from the calcium carbonate. As concrete is exposed to the air and carbonates, it reabsorbs some of the CO_2 released during calcination. Calcination is a necessary key to cement production. Therefore, the focus of reductions in CO_2 emissions during cement manufacturing is on reducing fuel and energy use.

White portland cement is a true portland cement that differs from gray cement chiefly in color. The manufacturing process is controlled so that the finished product will be white. White portland cement is made of selected raw materials containing negligible amounts of iron and magnesium oxides—the substances that give cement its gray color. White cement is used primarily for architectural purposes in structural walls, precast concrete, and glass-fiber reinforced concrete (GFRC) facing panels. Its use is recommended wherever white or colored concrete, grout, or mortar is desired. White portland cement should be specified as white portland cement meeting the specifications of ASTM C 150, IType I, II, III, or V.

Abundant Materials. Concrete is used in almost every country of the world as a basic building material. Aggregates, about 85% of concrete, are generally low-energy, local, naturally occurring sand and stone. Limestone and clay needed to manufacture cement are prevalent in most countries. Concrete contributes to a sustainable environment because it does not use scarce resources. Limestone and aggregate quarries are easily reused. While quarrying is intense, it is closely contained and temporary. When closed, aggregate quarries are generally converted to their natural state or into recreational areas or agricultural uses. In contrast, other material mining operations can be extensive and involve deep pits that are rarely restored, and deforestation can have negative environmental effects.

Fly Ash, Slag Cement, and Silica Fume. Fly ash, slag cement, and silica fume are industrial by-products; their use as a replacement for portland cement does not contribute to the energy and CO_2 effects of cement in concrete. If not used in concrete, these supplementary cementitious materials (SCMs) would use valuable landfill space. Fly ash (Fig. 8 [a]) is a by-product of the combustion of pulverized coal in electric power generating plants. Slag cement (Fig. 8 [b]) is made from iron blast-furnace slag. Silica fume (Fig. 8 [c]) is a by-product from the electric arc furnace used in the production of silicon or ferrosilicon alloy. These types of industrial by-products are considered post-industrial or pre-consumer recycled materials. Fly ash is commonly used at cement replacement levels up to 25%, slag cement up to 60%, and silica fume up to 5% to 7%. When slag cement replaces 50% of the portland cement in a 7,500 psi (50 MPa) concrete mixture, greenhouse gas emissions per cu yd of concrete are reduced by 45%. Because the cementitious content of concrete is about 15%, these pozzolans typically account for only 2% to 5% of the overall concrete material in buildings.

SCMs may slightly alter the color of hardened concrete. Color effects are related to the color and amount of the material used in concrete. Many SCMs resemble the color of portland cement and therefore have little affect on color of the hardened concrete. Some silica fumes may give concrete a slightly bluish or dark gray tint and tan fly ash may impart a tan color to concrete when used in large quantities. Slag cement and metakaolin (a clay SCM without recycled content) can make concrete lighter. Slag cement can initially impart a bluish or greenish undertone that disappears over time as concrete is allowed to dry.

The optimum amounts of supplementary cementing materials used with portland or blended cement are determined by testing, the relative cost and availability of the materials, and the specified properties of the concrete. When supplementary cementitious materials are used, the proportioned concrete mixture (using the project materials) should be tested to demonstrate that it meets the required concrete properties for the project. Some pozzolans increase curing times, but this is not as great a concern for precast concrete manufacturing as it is in cast-in-place applications where construction schedule has a greater impact.

The durability of products with recycled content materials should be carefully researched during the design process to ensure comparable life cycle performance. There would obviously be a net negative impact if a product offering a 20% to 30% recycled content had only half the expected service life of a product with a lower or no recycled content.

Recycled Aggregates. The environmental attributes of concrete can be improved by using aggregates derived from industrial waste or using recycled concrete as aggregates. Blast furnace slag is a lightweight aggregate with a long history of use in the concrete industry.

Recycled concrete can be used as aggregate in new concrete, particularly the coarse portion. When using the recycled concrete as aggregate, the following should be taken into consideration:

1. Recycled concrete as aggregate will typically have higher absorption and lower specific gravity than natural aggregate and will produce concrete with slightly higher drying shrinkage and creep. These differences become greater with increasing amounts of recycled fine aggregates.
2. Too many recycled fines can also produce a harsh and unworkable mixture. Many transportation departments have found that using 100% coarse recycled aggregate, but only about 10% to 20% recycled fines, works well. The remaining percentage of fines is natural sand.
3. When crushing the concrete (Fig. 5.4.9), it is difficult to control particle size distribution, meaning that the "aggregate" may fail to meet grading requirements of ASTM C33.



Fig. 9 Crushed concrete from other sources can serve as recycled aggregate.

4. The chloride content of recycled aggregates is of concern if the material will be used in reinforced concrete. This is particularly an issue if the recycled concrete is from pavements in northern climates where road salt is freely spread in the winter.

5. The alkali content and type of aggregate in the system is probably unknown, and therefore if mixed with unsuitable materials, a risk of alkali-silica reaction (ASR) is possible.

LEED Materials Credit 4 on Recycled Content. *The requirements of this credit state: "Use materials with recycled content such that post-consumer recycled content plus one-half of the preconsumer content constitutes at least 10% (based on cost) of the total value of the materials in the project." The percentage is determined by multiplying the price of an item by the percent of recycled materials—on a mass basis—that make up that item. To earn this credit, the project must meet the threshold percentages based on the total of all permanently installed building materials used on the project. Supplementary cementitious materials, such as fly ash, silica fume, and slag cement, are considered preconsumer. Since the cementitious content of concrete is about 15%, these pozzolans typically account for only 2% to 5% of the overall concrete material in buildings. For this reason, LEED-NC v2.2 allows the recycled content of concrete to be based on the recycled content of the cementitious materials. Using recycled concrete or slag as aggregate instead of extracted aggregates qualifies as post-consumer. Although most reinforcing bars are manufactured from recycled steel, in LEED, reinforcement is not considered part of concrete. Reinforcing material should be considered as a separate item. This credit is worth 1 point for the quantities quoted above and 2 points for double the amount.*

LEED Innovation Credit on Reducing Cement Content. *LEED has an innovation credit that allows 1 point for a 40% reduction of cement content compared to common practice. This can be met by using at least 40% less portland cement or replacing at least 40% of the cement in concrete with fly ash, slag cement, silica fume, or a combination of the three. Slag cement is commonly used at replacement levels up to 60%. However, fly ash replacement levels for portland cement greater than 25% are not common, as the fly ash and portland cement need to be chemically and physically compatible to ensure durable quality concrete that sets properly. For quality concrete, mixtures with fly ash at replacement levels greater than 25% should not be used without proven field experience or laboratory testing. Certain aesthetic (color) and stripping time restrictions will apply when using supplementary cementitious materials.*

Admixtures. The freshly mixed (plastic) and hardened properties of concrete may be changed by adding chemical admixtures to the concrete, usually in liquid form, during batching. Chemical admixtures are commonly used to (1) adjust setting time or hardening, (2) reduce water demand, (3) increase workability, (4) intentionally entrain air, and (5) adjust other fresh or hardened concrete properties. Admixtures provide enhancing qualities in concrete but are used in such small quantities that they do not adversely affect the environment. Their dosages are usually in the range of 0.005% to 0.2% of the concrete mass.

Color Pigments. Non-fading color pigments are used to provide the decorative colors in precast concrete. They are insoluble and generally non-toxic, although some may contain trace amounts of heavy metals. Many iron oxide pigments are primarily the by-product of material recycling (manufactured by precipitating scrap steel.)

Local Materials. Using local materials reduces the transportation required to ship heavy building materials, and the associated energy and emissions. Most precast concrete plants are within 200 miles (300 km) of a building site. The cement, aggregates, and reinforcing steel used to make the concrete and the raw materials to manufacture cement are usually obtained or extracted from sources within 200 miles of the precast concrete plant. The primary raw materials used to make cement and concrete are abundant in all areas of the world.

Precast concrete elements are usually shipped efficiently because of their large, often repetitive sizes and the ability to plan their shipment during the normal course of the project.

LEED Materials Credit 5 on Regional Materials. *The requirements of this credit state: "Use building materials or products that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of the project site for a minimum of 10% (based on cost) of the total materials value." This means that a precast concrete plant within 500 miles of the building would qualify if the materials to make the concrete were extracted within 500 miles. Calculations can also include concrete either manufactured or extracted locally.*

Precast concrete will usually qualify because precast concrete plants are generally within 200 to 500 miles (300 to 800 km) of a project. Precast concrete plants generally use aggregates that are extracted within 50 miles (80 km) of the plant and within 200 to 500 miles of the project. Cement and supplementary cementitious materials used for buildings are also primarily manufactured within 500 miles of a project. Reinforcing steel is also usually manufactured within 500 miles of a project and is typically made from recycled materials from the same region.

Using materials that are extracted or manufactured locally supports the regional economy. In addition, reducing shipping distances for material and products to the project minimizes fuel requirements for transportation and handling. This credit is worth 1 point for the quantities quoted above and 2 points for double the amount, or 20% of the materials.

— Martha G. VanGeem, P.E.
Manager Building Science & Sustainability,
LEED™ Accredited Professional, CTL Group, Illinois

Part 3 in the series will be continued in the Spring 2007 issue.

PCI-Certified Plants

When it comes to quality, why take chances? When you need precast or precast, prestressed concrete products, choose a PCI-Certified plant. You'll get confirmed capability — a proven plant with a quality assurance program you can count on.

Whatever your needs, working with a PCI plant that is certified in the product groups it produces will benefit you and your project:

- You'll find easier identification of plants prepared to fulfill special needs.
- You'll deal with established producers — many certified for more than 30 years.
- Using quality products, construction crews can get the job done right the first time, keeping labor costs down.
- Quality products help construction proceed smoothly, expediting project completion.

Guide Specification

To be sure that you are getting the full benefit of the PCI Plant Certification Program, use the following guide specification for your next project:

"*Manufacturer Qualification:* The precast concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute Plant Certification Program. Manufacturer shall be certified at time of bidding. Certification shall be in the following product group(s) and category(ies): [Select appropriate groups and categories (AT or A1), (B1,2,3, or 4), (C1,2,3, or 4), (G)]."

**Please note: Some precast products such as highway median barriers, box culverts and three-sided arches are not automatically included in routine plant audits. They may be included at the request of the precaster or if required by the project specifications.*

Product Groups And Categories

The PCI Plant Certification Program is focused around four groups of products designated A, B, C and G. Products in Group A are audited to the standards in MNL-117. Products in Groups B and C are audited to the standards in MNL-116. Products in Group G are audited according to the standards in MNL-130. The standards referenced above are found in the following manuals:

MNL-116 *Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products*

MNL-117 *Manual for Quality Control for Plants and Production of Architectural Precast Concrete*

MNL-130 *Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Product*

Within Groups A, B and C are categories that identify product types and the product capability of the individual plant. The categories reflect similarities in the ways in which the products are produced. In addition, categories in Groups A, B and C are listed in ascending order. In other words, a plant certified to produce products in category C4 is automatically certified for products in the preceding categories C1, C2 and C3. A plant certified to produce products in category B2 is automatically qualified for category B1 but not categories B3 or B4.

GROUPS

GROUP A – Architectural Products

Category AT – Architectural Trim Units
Wet-cast, nonprestressed products with a high standard of finish quality and of relatively small size that can be installed with equipment of limited capacity such as sills, lintels, coping, cornices, quoins, medallions, bollards, benches, planters, and pavers.

Category A1 – Architectural Cladding and Load Bearing Units
Precast or precast, prestressed concrete building elements such as exterior cladding, load-bearing and non-load-bearing wall panels, spandrels, beams, mullions, columns, column covers and miscellaneous shapes. This category includes category AT.

GROUP B – Bridges

Category B1 – Precast Bridge Products
Mild steel-reinforced precast concrete elements that include some types of bridge beams or slabs, sheet piling, pile caps, retaining wall elements, parapet walls, sound barriers and box culverts.*

Category B2 – Prestressed Miscellaneous Bridge Products
Any precast, prestressed element excluding super-structure beams. Includes piling, sheet piling, retaining wall elements, stay-in-place bridge deck panels and products in Category B1.

Category B3 – Prestressed Straight Strand Bridge Members
Includes all superstructure elements such as box beams, I-beams, bulb tees, stemmed members, solid slabs, full-depth bridge deck slabs and products in Categories B1 and B2.

Category B4 – Prestressed Deflected Strand Bridge Members
Includes all products covered in Categories B1, B2 and B3.

GROUP BA – Bridge Products With An Architectural Finish

These products are the same as those in the categories within Group B, but they are produced with an architectural finish. They will have a form, machine or special finish. Certification for Group BA production supercedes Group B in the same category. For instance, a plant certified to produce products in category B2A also is certified to produce products in categories B1, B1A and B2 (while it is not certified to produce any products in B3A or B4A).

GROUP C -Commercial (Structural)

Category C1 – Precast Concrete Products
Mild steel-reinforced precast concrete elements including sheet piling, pile caps, piling, retaining wall elements, floor and roof slabs, joists, stairs, seating members, columns, beams, walls, spandrels, etc.

Category C2 – Prestressed Hollowcore and Repetitive Products
Standard shapes made in a repetitive process pre-stressed with straight strands. Included are Hollowcore slabs, railroad ties, flat slabs, poles, wall panels and products in Category C1.

Category C3 – Prestressed Straight Strand Structural Members
Includes stemmed members, beams, columns, joists, seating members and products in Categories C1 and C2.

Category C4 – Prestressed Deflected Strand Structural Members
Includes stemmed members, beams, joists and products in Categories C1, C2 and C3.

GROUP CA – Commercial Products with an Architectural Finish

These products are the same as those in the categories within Group C, but they are produced with an architectural finish. They will have a form, machine or special finish. Certification for Group CA production supercedes Group C in the same category. For instance, a plant certified to produce products in category C2A also is certified to produce products in C1, C1A and C2 (while it is not certified to produce any products in Groups C3 or C4A).

Group G – Glass Fiber Reinforced Concrete (GFRC)

These products are reinforced with glass fibers that are randomly dispersed throughout the product and are made by spraying a cement/sand slurry onto molds. This produces thin-walled, lightweight cladding panels.

Visit *www.pci.org* for the most up-to-date listing of PCI-Certified plants.

(as of January 2007)

ALABAMA

Gate Precast Company, Monroeville (251) 575-2803 — A1, C1A
Hanson Pipe and Precast Southeast / Pelham Prestress, Birmingham (205) 663-4681 — B4, C4

ARIZONA

Coreslab Structures (ARIZ) Inc., Phoenix (602) 237-3875 — A1, C4A
TPAC / A Div. of Kiewit Western Co., Phoenix (602) 262-1360 — A1, B4, C4A

ARKANSAS

Coreslab Structures (ARK) Inc., Conway (501) 329-3763 — C4A

CALIFORNIA

Bethlehem Construction, Inc., Shafter (661) 391-9704 — C2
Clark Pacific, Fontana (909) 823-1433 — A1, C3, G
Clark Pacific, West Sacramento (916) 371-0305 — A1, C3
Con-Fab California Corporation, Lathrop (209) 249-4700 — B4, C4
Conrad Constructors, Inc., Rialto (909) 350-8283 — B4
Coreslab Structures (L.A.) Inc., Perris (951) 943-9119 — A1, B4, C4A
Fintech Precast, Inc., Redding (530) 241-8397 — C2
Hanson Structural Precast, Irwindale (626) 962-8751 — C4
Hanson Structural Precast, San Diego (619) 423-9030 — C4
Pomeroy Corporation, Perris (951) 657-6093 — B4, C2
Walters & Wolf Precast, Fremont (510) 226-5162 — A1, G
Willis Construction Co., Inc., San Juan Bautista (831) 623-2900 — A1, C1, G
Willis De Mexico S.A. de C.V., Tecate (011) 52-665-665-2222 — A1, C1

COLORADO

EnCon Bridge Company, LLC, Denver (303) 287-4312 — B4
Plum Creek Structures, Littleton (303) 471-1569 — B4, C3
Rocky Mountain Prestress, Inc. / Architectural Concrete Plant, Denver (303) 480-1111 — A1, C3A
Rocky Mountain Prestress, Inc. / Structural Plant, Denver (303) 480-1111 — B4, C4
Rocla Concrete Tie, Inc., Denver (303) 296-3505 — C2
Stresscon Corporation, Colorado Springs (719) 390-5041 — A1, B4, C4A
Stresscon Corporation / Denver-Metro Division, Dacono (303) 659-6661 — C4

CONNECTICUT

Blakeslee Prestress Inc., Branford (203) 481-5306 — A1, B4, C4A
Coreslab Structures (CONN) Inc., Thomaston (860) 283-8281 — A1
Oldcastle Precast, Inc./dba Rotondo Precast, Avon (860) 673-3291 — B1, C1A

DELAWARE

Concrete Building Systems, Inc., Delmar (302) 846-3645 — B3, C4
Rocla Concrete Tie, Inc., Bear (302) 836-5304 — C2

FLORIDA

Cement Industries, Inc., Fort Myers (239) 332-1440 — B3, C3
Coreslab Structures (MIAMI) Inc., Medley (305) 823-8950 — A1, C4
Coreslab Structures (ORLANDO) Inc., Orlando (407) 855-3191 — C2
Coreslab Structures (TAMPA) Inc., Tampa (813) 626-1141 — B3, C3A
Dura-Stress, Inc., Leesburg (800) 342-9239 — A1, B4A, C3A
Finfrock Industries, Inc., Orlando (407) 293-4000 — C4
Florida Rock and Sand Prestress Precast Co., Inc., Florida City (305) 247-9611 — B2, C3
Gate Concrete Products Company, Jacksonville (904) 757-0860 — B4, C4
Gate Precast Company, Kissimmee (407) 847-5285 — A1
Gate Precast Company, Sarasota (941) 957-0270 — A1
South Eastern Prestressed Concrete, Inc. / JAMCO, West Palm Beach (561) 793-1177 — B3, C3
Southern Prestressed Concrete, Inc., Pensacola (850) 476-6120 — C4
Standard Concrete Products, Inc., Tampa (813) 831-9520 — B4, C3

GEORGIA

Atlanta Structural Concrete Co., Buchanan (770) 646-1888 — C4A
ConArt, Inc., Cobb (229) 853-5000 — A1, AT, C3
Coreslab Structures (ATLANTA) Inc., Jonesboro (770) 471-1150 — C2A
Metromont Corporation, Hiram (770) 943-8688 — A1, C4A
Standard Concrete Products, Inc., Atlanta (404) 792-1600 — B4
Standard Concrete Products, Inc., Savannah (912) 233-8263 — B4, C4
Tindall Corporation / Prestress Division, Conley (800) 849-6383 — C4A
Tindall Corporation / Corrections Division, Conley (800) 849-6383 — C2

HAWAII

Grace Pacific Rocky Mountain Prestress (East), Kapolei (808) 682-5761 — B3, C3
Grace Pacific Rocky Mountain Prestress (West), Kapolei (808) 682-6000 — A1, B4, C4

IDAHO

Eagle Precast Company, Caldwell (208) 454-8116 — A1, B4, C1
Teton Prestress Concrete, LLC., Idaho Falls (208) 523-6410 — B4, C3

ILLINOIS

ATMI Dynacore, Lockport (815) 838-9492 — C2
ATMI Precast, Aurora (630) 896-4679 — C3A
County Materials Corporation, Champaign (217) 352-4181 — B3
Dukane Precast, Inc., Naperville (630) 355-8118 — A1, C3
Egyptian Concrete Company, Salem (618) 548-1190 — A1, B4, C4
High Concrete Technology, LLC, Paxton (217) 379-9790 — A1, C3A
J.W. Peters, Inc. / Subsidiary of The Cretex Companies, Inc., Rochelle (815) 562-4136 — A1, B4, C4A
Lombard Architectural Precast Products Co., Alsip (708) 389-1060 — A1
Mid-States Concrete Products Co., South Beloit (608) 364-1072 — C2
Prestress Engineering Corporation, Blackstone (815) 586-4239 — B4, C4
Spancrete of Illinois, Inc., Crystal Lake (815) 459-5580 — C2
St. Louis Prestress, Inc., Glen Carbon (618) 656-8934 — B3, C3

INDIANA

ATMI Indy, LLC / ATMI Precast, Greenfield (317) 891-6280 — C2
Coreslab Structures (INDIANAPOLIS) Inc., Indianapolis (317) 353-2118 — A1, C4A
Fabcon LLC, Westfield (317) 896-2556 — C2A
Hoosier Precast LLC / Prestress Engineering Corporation, Salem (812) 883-4665 — B3, C1A
Precast Specialties, Inc., Monroeville (260) 623-6131 — A1
Prestress Services Industries LLC / Decatur Division, Decatur (260) 724-7117 — B4, C4
StresCore, Inc., South Bend (574) 233-1117 — C2

IOWA

Andrews Prestressed Concrete, Inc., Clear Lake (641) 357-5217 — B4, C4
IPC, Inc. / Subsidiary of The Cretex Companies, Inc., Des Moines (800) 826-0464 — C4
IPC, Inc. / Subsidiary of The Cretex Companies, Inc., Iowa Falls (641) 648-2579 — B4, C4A
IPC, Inc. / Subsidiary of the Cretex Companies, Inc., West Burlington (319) 754-0477 — A1, B4, C3A

KANSAS

Coreslab Structures (KANSAS) Inc., Kansas City (913) 287-5725 — B4, C4
Prestressed Concrete, Inc., Newton (316) 283-2277 — A1, B4, C4
Stress-Cast, Inc., Assaria (785) 667-3905 — C3A
Waffle-Crete International, Inc., Hays (785) 625-3486 — C2

KENTUCKY

de AM - RON Building Systems LLC, Owensboro (270) 684-6226 — A1, C4
Gate Precast Company, Winchester (859) 744-9481 — A1
Prestress Services Industries LLC / Henderson Division, Henderson (270) 826-6244 — B4, C3
Prestress Services Industries LLC / Lexington Division, Lexington (859) 299-0461 — A1, B4, C4
Prestress Services Industries LLC / Melbourne Division, Melbourne (859) 441-0068 — B4, C3

LOUISIANA

Boykin Brothers, Inc./Louisiana Concrete Products, Baton Rouge (225) 753-8722 — A1, B3, C3A
F-S Prestress, LLC, Princeton (318) 949-2444 — B4, C3
Rotondo Weirich, Pollock (215) 776-1074 — C1

MARYLAND

Atlantic Metrocast, Inc., LaPlata (301) 870-3289 — B3, C1
Larry E. Knight, Inc., Glyndon (410) 833-7800 — C2
Oldcastle Precast Building Systems, Edgewood (410) 612-1213 — C3A

MASSACHUSETTS

Oldcastle Precast, Inc./dba Chase Precast, North Brookfield (508) 867-8312 — B2, C2A
Oldcastle Precast, Inc./dba Rotondo Precast, Rehoboth (508) 336-7600 — B4, C3
Unistress Corporation, Pittsfield (413) 499-1441 — A1, B4, C4A
Vynorius Prestress, Inc., Salisbury (978) 462-7765 — C2

MICHIGAN

Gerace Construction Company, Inc., Midland (989) 496-2440 — A1, B3, C3
Grand River Infrastructure, Inc. / The Premarc Corporation, Grand Rapids (616) 534-9645 — B4, C1
Kerkstra/Spancrete Great Lakes, Grandville (800) 434-5830 — C3A
National Precast Structural, Inc., Shelby (586) 247-1201 — C3
National Precast, Inc., Roseville (586) 294-6430 — A1, C3
Nucon Schokbeton / Stress-Con Industries, Inc., Kalamazoo (269) 381-1550 — A1, B4, C3A
Renaissance Precast Industries, Inc., River Rouge (313) 297-7700 — A1, B4, C3A
Stress Con Industries, Inc., Detroit (313) 873-4711 — B2, C3
Stress Con Industries, Inc. / Spancast of Michigan, Saginaw (989) 239-2447 — B4, C3

MINNESOTA

Cretex Concrete Products North, Inc. / Subsidiary of The Cretex Companies, Inc., Maple Grove (763) 545-7473 — B4, C2
Fabcon / Manufacturing and Sales, Savage (952) 890-4444 — C2A
Hanson Structural Precast Midwest, Inc., Maple Grove (763) 425-5555 — A1, C4A
Molin Concrete Products Co., Lino Lakes (651) 786-7722 — C3A
Wells Concrete Products Co., Wells (507) 553-3138 — A1, C4A

MISSISSIPPI

F-S Prestress, LLC, Hattiesburg (601) 268-2006 — A1, B4, C4
Gulf Coast Pre-Stress, Inc., Pass Christian (228) 452-9486 — B4, C4
J.J. Ferguson Prestress-Precast Company, Inc., Greenwood (662) 453-5451 — B4
Jackson Precast, Inc. / A Div. of GFRC Cladding, Jackson (601) 321-8787 — A1, C2A
Madison Materials Company, Ridgeland (601) 856-4135 — B4
Tindall Corporation / Mississippi Division, Biloxi (228) 435-0160 — C4

MISSOURI

Coreslab Structures (MISSOURI) Inc., Marshall (660) 886-3306 — A1, B4, C4A
Egyptian Concrete Company, Bonne Terre (573) 358-2773 — B4
Mid America Precast, Inc., Fulton (573) 642-6400 — A1, B1, C1
Mid West Prestress, LLC / Mid South Prestress, LLC, Wright City (636) 745-7480 — C3
Prestressed Casting Company, Ozark (417) 581-7009 — C4
Prestressed Casting Company, Springfield (417) 869-1263 — A1, C3A

MONTANA

Missoula Concrete Construction, Missoula (406) 549-9682 — A1, B3, C3
Montana Prestressed Concrete, Billings (406) 656-4310 — B4, C3

NEBRASKA

Concrete Industries, Inc., Lincoln (402) 434-1800 — B4, C4
Coreslab Structures (OMAHA) Inc., LaPlatte (402) 291-0733 — A1, B4, C4A
CXT, Inc., Grand Island (308) 382-5400 — C2
Enterprise Precast Concrete, Inc. / Enterprise Properties, Inc., Omaha (402) 895-3848 — A1
GFRC, Inc., Lincoln (402) 466-3200 — G
Stonco, Inc. / Enterprise Properties, Inc., Omaha (402) 556-5544 — A1

NEW HAMPSHIRE

Architectural Cladding Systems, Inc., Hollis (603) 889-6310 — G
Newstress International, Inc., Epsom (603) 736-9348 — B3, C3

NEW JERSEY

DiSanti Concrete Products, Inc., Howell (732) 751-0900 — A1, C2A
High Concrete Innovations, LLC (Buena Plant), Buena (856) 697-3600 — C3
Jersey Precast Corp., North Brunswick (732) 249-8973 — B4, C3
Precast Systems, Inc., Allentown (609) 208-1987 — B4, C4
Universal Concrete Products of NJ, Inc., Folsom (609) 704-9400 — A1, C1

NEW MEXICO

Coreslab Structures (ALBUQUERQUE) Inc., Albuquerque (505) 247-3725 — A1, B4, C4
Ferreri Concrete Structures, Inc., Albuquerque (505) 344-8823 — A1, C4

NEW YORK

David Kucera Inc., Gardiner (845) 255-1044 — A1, G
Lakelands Concrete Products, Inc., Lima (585) 624-1990 — A1, B3A, C3A
Oldcastle Precast Building Systems, Manchester (585) 289-3530 — C3
Oldcastle Precast Building Systems, South Bethlehem (518) 767-2269 — B3, C3
The L.C. Whitford Materials Co., Inc., Wellsville (585) 593-2741 — B3, C3

NORTH CAROLINA

Gate Precast Company, Oxford (919) 603-1633 — A1, C2
Metromont Corporation, Charlotte (704) 372-1080 — A1, C3
Oldcastle Precast, Inc / dba NC Products, Raleigh (919) 772-6301 — C1
Prestress of the Carolinas, LLC, Charlotte (704) 587-4273 — B4
S & G Prestress Company, Wilmington (910) 397-6255 — B4
S & G Prestress Company, Wilmington (910) 763-7702 — B4, C3
Utility Precast, Inc., Charlotte (704) 596-6283 — B3A

NORTH DAKOTA

Concrete Inc. / Subsidiary of Wells Concrete Products Co., Grand Forks (701) 772-6687 — C4A

OHIO

Fabcon LLC, Grove City (614) 875-8601 — C2A
High Concrete Technology, LLC, Springboro (937) 748-2412 — A1, C3
Hollowcore Midwest, LLC, Fairfield (513) 829-1555 — C2
KSA, Sciotoville (740) 776-3238 — C2
Prestress Services Industries LLC / Grove City Division, Grove City (614) 871-2900 — B4
Sidley Precast / Division of R.W. Sidley, Inc., Thompson (440) 298-3232 — A1, C4A
United Precast, Inc. / I-Beam Production Area, Mt.Vernon (800) 366-8740 — B4
United Precast, Inc. / Box-Beam Production Area, Mt.Vernon (740) 393-1121 — B4, C2

OKLAHOMA

Coreslab Structures (OKLA) Inc. (Plant No.1), Oklahoma City (405) 632-4944 — A1, C4A
Coreslab Structures (OKLA) Inc. (Plant No.2), Oklahoma City (405) 672-2325 — B4
Coreslab Structures (TULSA) Inc., Tulsa (918) 438-0230 — B4, C4

OREGON

Morse Brothers, Inc. / Prestress Concrete Group, Harrisburg (541) 995-6327 — A1, B4, C4
R.B. Johnson Co., McMinnville (503) 472-2430 — B4

PENNSYLVANIA

Architectural Precast LLC, Middleburg (570) 837-1774 — A1, C2A
Concrete Safety Systems, Bethel (570) 933-4107 — B1, C1
Conewago Precast Building Systems / Conewago Enterprises, Inc., Hanover (717) 632-7722 — C2A
Fabcon / Manufacturing, Mahanoy City (570) 773-2480 — C2A
Hanson Pipe & Products, Inc., Pottstown (610) 970-2216 — B1A, C1A
High Concrete Structures, Inc., Denver (717) 336-9300 — A1, C3
High Concrete Structures, Inc., Lebanon (717) 682-1001 — A1
High Concrete Structures, Inc., Williamsport (570) 329-4228 — C3
J & R Slaw, Inc., Lehighton (610) 852-2020 — A1, B3, C3
Newcrete Products / Div. of New Enterprise Stone & Lime Co., Inc., Roaring Spring (814) 224-2121 — B4, C4
Nitterhouse Concrete Products, Inc., Chambersburg (717) 267-4505 — A1, C4A
Oldcastle Precast Building Systems, Morrisville (215) 736-9576 — C3
Pittsburgh Flexicore Company, Inc., Monongahela (724) 258-4450 — C2
Say-Core, Inc., Portage (814) 736-8018 — C2
Schuylkill Products, Inc., Cressona (570) 385-2352 — B4, C3
Sidley Precast / Division of R.W. Sidley, Inc., Youngwood (724) 755-0205 — C3
Top Roc Newcrete Products Company / A Div. of New Enterprise Stone & Lime Co., Inc., Erie (814) 838-2011 — B4, C1
Universal Concrete Products Corporation / Bodon Industries, Douglassville (610) 323-0700 — A1, C3A

RHODE ISLAND

Symmetry Products Group / SPG / Div. of Lance Industries International, Inc., Lincoln (401) 365-6272 — G

SOUTH CAROLINA

Coreslab Structures (COLUMBIA) Inc., Hopkins (803) 783-5460 — A1
Florence Concrete Products, Inc., Sumter (803) 775-4372 — B4, C3A
Metromont Corporation, Greenville (864) 295-0295 — A1, C4A
Tekna Corporation / Tekna Investments, Inc., Charleston (843) 853-9118 — B4, C2
Tindall Corporation / Spartanburg Prestress Division, Fairforest (864) 576-3230 — A1, C4A

SOUTH DAKOTA

Gage Brothers Concrete Products Inc., Sioux Falls (605) 336-1180 — A1, B4, C4

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Construction Products, Inc. of Tennessee, Jackson (731) 668-7305 — B4, C4
CPI Concrete Products, Inc., Memphis (901) 775-9880 — B4, C3
Gate Precast Company, Ashland City (615) 792-4871 — A1
Metromont Corporation, LaVergne (615) 793-3393 — C4A
Mid South Prestress, LLC, Pleasant View (615) 746-6606 — C3
Ross Prestressed Concrete, Inc., Bristol (423) 323-1777 — B4, C3
Ross Prestressed Concrete, Inc., Knoxville (865) 524-1485 — B4, C4
Sequatchie Concrete Service, Inc., Knoxville (423) 867-4510 — C2
Southeast Precast Corporation, Knoxville (865) 524-3615 — A1

TEXAS

Coreslab Structures (TEXAS) Inc., Cedar Park (512) 250-0755 — A1, C4A
CXT Inc. / L. B. Foster, Hillsboro (254) 580-9100 — B1, C1
Enterprise Concrete Products, LLC / Enterprise Properties, Inc., Dallas (214) 631-7006 — B3, C3
Gate Concrete Products Company, Pearland (281) 485-3273 — C2
GFRC Cladding Systems, Inc., Garland (972) 494-9000 — G
Heldenfels Enterprises, Inc., Corpus Christi (361) 883-9334 — B4, C4
Heldenfels Enterprises, Inc., San Marcos (512) 396-2376 — B4, C4
Manco Structures, Ltd., Schertz (210) 690-1705 — B4, C4A
Meridian Precast & Granite, Inc., Waco (254) 776-9690 — A1, C3A
North American Precast Company, San Antonio (210) 509-9100 — A1, C4A
Precast Concrete Services, Groveton (214) 348-1251 — AT
Rocla Concrete Tie, Inc., Amarillo (806) 383-7071 — C2
Rotondo Weirich Enterprises, Inc., Lubbock (215) 256-7940 — C1

UTAH

Eagle Precast Company, Salt Lake City (801) 966-1060 — A1, B4, C4A, G
EnCon Utah, LLC / Euro Partners, Inc. / EnCon United, Tooele (435) 843-4230 — B4, C3A

VERMONT

J. P. Carrara & Sons, Inc., Middlebury (802) 388-6363 — A1, B4A, C3A
William E. Dailey Precast, LLC, Shaftsbury (802) 442-4418 — A1, B2A, C3A

VIRGINIA

Atlantic Metrocast, Inc., Portsmouth (757) 397-2317 — B4, C3
Bayshore Concrete Products Corporation, Cape Charles (757) 331-2300 — B4, C4
Bayshore Concrete Products/Chesapeake, Inc., Chesapeake (757) 549-1630 — B4, C2
Concrete Precast Systems, Inc., Chesapeake (757) 545-5215 — B4, C3
Rockingham Precast, Inc., Harrisonburg (540) 433-8282 — B4
Smith-Midland Corporation, Midland (540) 439-3266 — A1, B1, C3
Structural Concrete Products, LLC, Richmond (804) 222-8111 — C4A
The Shockey Precast Group, Fredericksburg (540) 898-1221 — A1, C3A
The Shockey Precast Group, Winchester (540) 667-7700 — A1, C4A
Tindall Corporation / Virginia Division, Petersburg (804) 861-8447 — C4A

WASHINGTON

Bellingham Marine Industries, Inc., Ferndale (360) 676-2800 — B4, C2
Bethlehem Construction, Inc., Cashmere (509) 782-1001 — B1, C3A
Central Pre-Mix Prestress Co., Spokane (509) 533-0267 — A1, B4, C4
Central Pre-Mix Prestress Co.-Pasco, Spokane (509) 998-6111 — B4, C1
Concrete Technology Corporation, Tacoma (253) 383-3545 — B4, C4
CXT, Inc. / Rail Division, Spokane (509) 921-7878 — C2
CXT, Inc. / Precast Division, Spokane (509) 921-8716 — B1
EnCon Washington, LLC, Puyallup (253) 846-2774 — B1, C2
Wilbert Precast, Inc., Yakima (509) 248-1984 — B4, C3

WEST VIRGINIA

Carr Concrete Corporation, Waverly (304) 464-4441 — B4, C3
Eastern Vault Company, Inc., Princeton (304) 425-8955 — B3, C3

WISCONSIN

County Materials Corporation / Prestress Division, Eau Claire (800) 729-7701 — B4
County Materials Corporation, Roberts (800) 426-1126 — B4, C3
International Concrete Products, Inc., Germantown (262) 242-7840 — A1, C1
J.W. Peters, Inc. / Subsidiary of The Cretex Companies, Inc., Burlington (800) 877-9040 — C3A
MidCon Products, Inc., Hortonville (920) 779-4032 — AT, C1
Precast Concrete Specialties, Inc., Omro (920) 685-2727 — A1
Spancrete Industries, Inc. / Precast Operations, Waukesha (414) 290-9000 — A1, B2A, C3A
Spancrete, Inc., Green Bay (920) 494-0274 — B4, C4
Spancrete, Inc., Valders (920) 775-4121 — A1, C3A

CANADA

ALBERTA

Con-Force Structures Limited / Alberta Region, Calgary (403) 248-3171 — A1, B4, C4
Lafarge Canada Inc. / Construction Materials Group, Edmonton (780) 468-5910 — A1, C1
P. Kruger Concrete Products, Ltd., Edmonton (780) 438-2072 — A1, C1

BRITISH COLUMBIA

Con-Force Structures Limited / Pacific Region, Richomnd (604) 278-9766 — A1, B4, C3
Surespan Structures LTD., Duncan (250) 748-8888 — B4, C3

MANITOBA

Con-Force Structures Limited / Manitoba Region, Winnipeg (204) 338-9311 — C3A
Lafarge Canada Inc. / Lafarge North America, Winnipeg (204) 958-6381 — C2

NEW BRUNSWICK

Strescon Limited, Saint John (506) 633-8877 — A1, B4, C4

ONTARIO

Artex Systems Inc., Concord (905) 669-1425 — A1
Global Precast, Maple (905) 832-4307 — A1
Prestressed Systems, Inc., Windsor (519) 737-1216 — B4, C4

QUEBEC

Betons Prefabriques du Lac Inc. / Papeterie Plant, Alma (418) 668-6161 — A1, G
Betons Prefabriques du Lac, Inc. / Bombardier Plant, Alma (418) 668-6161 — A1, C1
Betons Prefabriques Trans. Canada Inc. / Trans-Canada, St. Eugene De Grantham (819) 396-2624 — A1, B4, C2A
Saramac Inc., Lachenaie (450) 966-1000 — A1
Schokbeton Quebec, Inc., St. Eustache (450) 473-6831 — A1, B4A, C3

MEXICO

PRETECSA, S.A. DE C.V., Atizapan De Zaragoza (011) 52-10360777 — A1, G

PCI-Qualified & Certified Erectors

(as of January 2007)

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- You'll deal with established erectors.
- Using a Qualified/Certified Erector is the first step toward getting the job done right the first time, thus keeping labor costs down.
- Qualified/Certified erectors help construction proceed smoothly, expediting project completion.

Guide Specification

To be sure that you are getting an erector from the PCI Field Certification Program use the following guide specification for your next project:

"Erector Qualification: The precast concrete erector shall be fully qualified or certified by the Precast/Prestressed Concrete Institute (PCI) prior to the beginning of any work at the jobsite. The precast concrete-erector shall be qualified or certified in Structure Category(ies): [Select appropriate groups and categories S1 or S2 and/or A1]."

Erector Classifications

The PCI Field Certification Program is focused around three erector classifications. The standards referenced to the right are found in the following manuals:

MNL-127-99 *Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products*

MNL-132-95 *Erection Safety Manual for Precast and Prestressed Concrete*

GROUPS

Category S1 - Simple Structural Systems
This category includes horizontal decking members (e.g., hollowcore slabs on masonry walls), bridge beams placed on cast-in-place abutments or piers, and single-lift wall panels.

Category S2 - Complex Structural Systems
This category includes everything outlined in Category S1 as well as total precast, multi-product structures (vertical and horizontal members combined) and single or multistory load-bearing members (including those with architectural finishes)

Category A - Architectural Systems
This category includes non-load-bearing cladding and GFRC products, which may be attached to a supporting structure. architectural finishes)

* Certified Erectors

ARKANSAS

Coreslab Structures (ARK) Inc., Conway (501) 329-3763 — S2

ARIZONA

Coreslab Structures (ARIZ), Inc., Phoenix (602) 237-3875 — S2, A
TPAC, Phoenix (602) 262-1360 — S2

CALIFORNIA

Coreslab Structures (L.A.), Inc., Perris (951) 943-9119 — S2, A
Walters & Wolf Precast, Fremont (510) 226-9800 — A

COLORADO

Colorado Fabricators & Constructors, Inc., Highlands Ranch (303) 471-9902 — S2
Gibbons Erectors Inc., Parker (303) 841-0457 — S2
Mehring Welding & Erection, Penrose (719) 372-6607 — S2
Rocky Mountain Prestress, Denver (303) 480-1111 — S2
S. F. Erectors Inc., Elizabeth (303) 646-6411 — S2

CONNECTICUT

Echelon Erectors, LLC, New Haven (203) 562-1000 — S2, A
Marikina Construction Corp., West Haven (203) 799-1013 — S1

FLORIDA

All Florida Erectors and Welding, Inc., Apopka (407) 880-3717 — S2, A
Cement Industries, Inc., Fort Myers (239) 332-1440 — S1
Concrete Erectors Inc., Altamonte Springs (407) 862-7100 — S2
Coreslab Structures (ORLANDO) Inc., Orlando (407) 855-3191 — S1
Finfrock Industries, Inc., Orlando (407) 293-4000 — S2
Gate Precast Erection Co., Jacksonville (904) 757-0860 — S2
James Toffoli Construction Company, Inc., Fort Myers (239) 267-7850 — S2
Pre-Con Construction of Tampa Inc., Tampa (813) 626-2545 — S2, A
Solar Erectors, Inc., Medley (305) 825-2514 — S2
Specialty Concrete Services, Inc., Altoona (352) 669-8888 — S2, A
Summit Erectors, Inc., Jacksonville (904) 783-6002 — S2, A

GEORGIA

ConArt, Inc., Cobb (229) 853-5000 — S1, A
Rutledge & Son's, Woodstock (770) 592-0380 — S2

ILLINOIS

Egyptian Concrete Co., Salem (618) 548-1190 — S1
Mid-States Concrete Products Company, South Beloit (800) 236-1072 — S2
Spancrete of Illinois, Inc., Crystal Lake (815) 459-5580 — S2

INDIANA

Sofco Erectors, Inc., Indianapolis (317) 352-9680 — S2, A
Stres Core Inc., South Bend (574) 233-1117 — S1

IOWA

Cedar Valley Steel, Inc., Cedar Rapids (319) 373-0291 — S2

KANSAS

Building Erection Services Company, Inc., Olathe (913) 764-5560 — S2, A
Carl Harris Co., Inc., Wichita (316) 267-8700 — S2

MAINE

Reed & Reed, Inc., Woolwich (207) 443-9747 — S2

MARYLAND

E & B Erectors, Inc., Pasadena (410) 360-7800 — S2, A
E.E. Marr Erectors, Inc., Baltimore (410) 837-1641 — S2, A
EDI, Inc., Upper Marlboro (301) 568-4585 — S1, A
L.R. Willson & Sons, Inc., Gambrills (410) 987-5414 — S2, A
Mid Atlantic Precast Erectors, Inc., Baltimore (410) 837-1641 — A
Oldcastle Building Systems Divison, Edgewood (410) 612-1213 — S1, A
The Whiting - Turner Contracting Company, Baltimore (410) 821-1100 — A

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Concrete Structures, Inc., Marshfield (781) 837-1931	S2, A
Prime Steel Erecting, Inc., N Billerica (978) 671-0111	S2

MICHIGAN

American Erectors Inc., Waterford (248) 674-0060	S2
Assemblers Precast & Steel Services, Inc., Saline (734) 429-1358	S2, A
Kerkstra Precast, Inc./Spancrete Great Lakes, Jenison (616) 224-6176	S2
Moyle Construction, Houghton (906) 482-3000	S1
Whaley Steel Corporation, Hudson (248) 446-0149	S2, A

MINNESOTA

Amerect, Inc., Newport (651) 459-9909	S1, A
Hanson Structural Precast Midwest, Inc., Maple Grove (763) 425-5555	S2
Molin Concrete Products Company, Lino Lakes (651) 786-7722	S2
Wells Concrete Products Co., Wells (507) 553-3138	S2, A

MISSOURI

J. E. Dunn Construction Company, Kansas City (816) 474-8600	S2, A
Prestressed Casting Co., Springfield (417) 869-7350	S2, A

NEBRASKA

Concrete Industries, Inc., Lincoln (402) 434-1800	S2

NEW HAMPSHIRE

American Steel & Precast Erectors, Inc., Greenfield (603) 547-6311	S2

NEW JERSEY

Car-Win Construction, Eastampton (800) 352-1523	S2
J. L. Erectors, Blackwood (856) 232-9400	S2, A
JEM-Erectors, Inc., Shamong (609) 268-0332	S2, A
Jonasz Precast, Inc., Westville (856) 456-7788	S2

NEW MEXICO

Ferreri Concrete Structures, Inc., Albuquerque (505) 344-8823	S2

NEW YORK

All Systems Precast, Inc., Farmingdale (631) 694-4720	S2
Arben Group LLC, Pleasantville (914) 741-5459	S1
Oldcastle Building Systems Divison, Manchester (716) 289-3530	S2, A
Oldcastle Building Systems Divison, South Bethlehem (518) 767-2042	S2, A

NORTH CAROLINA

Buckner Steel Erection Inc., Graham (336) 376-8888	S2
Carolina Precast Erectors Inc., Taylorsville (828) 635-1721	S2
T & M Concrete, Inc., Waxhaw (704) 843-3292	S2
Tri State Erectors, Inc., Oxford (919) 603-0922	A

NORTH DAKOTA

Concrete, Inc., Grand Forks (701) 772-6687	S2

OHIO

Capital City Group, Inc., Columbus (614) 278-2120	S2, A
Precast Services, Inc., Twinsburg (330) 425-2880	S2, A
Sidley Precast Group, Thompson (440) 298-3232	S2
Sofco Erectors, Inc., Cincinnati (513) 771-1600	S2, A

OKLAHOMA

Coreslab Structures (OKLA), Inc., Oklahoma City (405) 632-4944	S2, A

PENNSYLVANIA

Century Steel Erectors, Kittanning (724) 545-3444	S2
Conewago Enterprises Inc., Hanover (717) 632-7722	S2
High Concrete Structures, Inc., Denver (717) 336-9300	S2
Nitterhouse Concrete Products, Inc., Chambersburg (717) 267-4505	S2

SOUTH CAROLINA

Davis Erecting & Finishing, Inc., Greenville (864) 220-0490	S2, A
Florence Concrete Products Inc., Florence (843) 662-2549	S2
Tindall Corporation, Fairforest (864) 576-3230	S2

TENNESSEE

Hoosier Prestress, Inc., Brentwood (615) 661-5198	S2

TEXAS

Gate Concrete Products Company, Pearland (281) 485-3273	S1
Precast Erectors, Inc., Hurst (817) 684-9080	S2, A

UTAH

Eagle Precast Company, Salt Lake City (801) 966-1060	S2, A

VIRGINIA

The Shockey Precast Group, Winchester (540) 665-3253	S2, A
W. O. Grubb Steel Erection, Inc., Richmond (804) 271-9471	A
W. R. Dean Erectors, Inc., Fredericksburg (540) 371-4376	S2

WISCONSIN

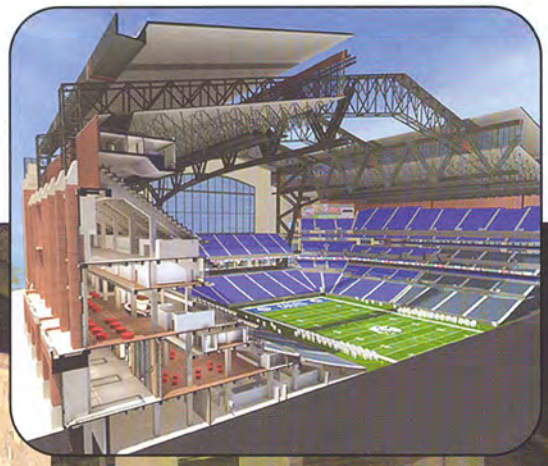
County Materials Corp., Roberts (715) 749-3927	S2
Spancrete Industries, Inc., Waukesha (414) 290-9000	S2
Spancrete, Inc., Valders (920) 775-4121	S2, A
The Boldt Company, Appleton (920) 225-6127	S2, A

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INDIANAPOLIS COLTS STADIUM



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Matt Ballain
VP and General Manager
Coreslab Structures (Indianapolis), Inc.

The Challenge:

Coreslab Structures (Indianapolis), Inc. was awarded the contract to supply the precast concrete for the new Indianapolis Colts Stadium; the schedule was aggressive, the design was unique.

The Solution:

Working with the stadium plans, Hamilton Form and Coreslab collaborated to develop a package of forms, many of which cast several different products and could be easily and quickly adjusted.

The Results:

We invite you to see the results for yourself when the Colts kick-off their 2008 season!

To learn more about Hamilton Form visit www.hamiltonform.com

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WHO DOES THAT ?

We do! We're Tindall, and that's precast.

A tight site in historic downtown Charleston created unusual architectural and structural constraints for the Medical University of South Carolina's new mixed-used structure. The solution? Precast wall panels with sandblast finish and inlay brick coordinate with the historic district, while black shutters and balcony grilles blend with the modern hospital. Plus, the structure's 2-ft-thick shear walls meet the high seismic design requirements for the heavily loaded structure.

With precast design flexibility, why let the high costs of conventional construction exhaust your budget? For creative design solutions and engineered structural integrity, call Tindall Corporation today!

Project: MUSC Parking/Retail/Offices
Owner: Medical University of South Carolina
Architect: Jenkins Hancock & Sides
Engineer: Mabry Engineering
General Contractor: Mashburn Construction
Highlights: 700 parking spaces, blend of historic and modern architecture, meets high seismic design requirements

Check out the entire list of creative precast solutions employed on this project at www.tindallcorp.com/mixeduse/muschome.

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Tindall

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