WINTER 2009

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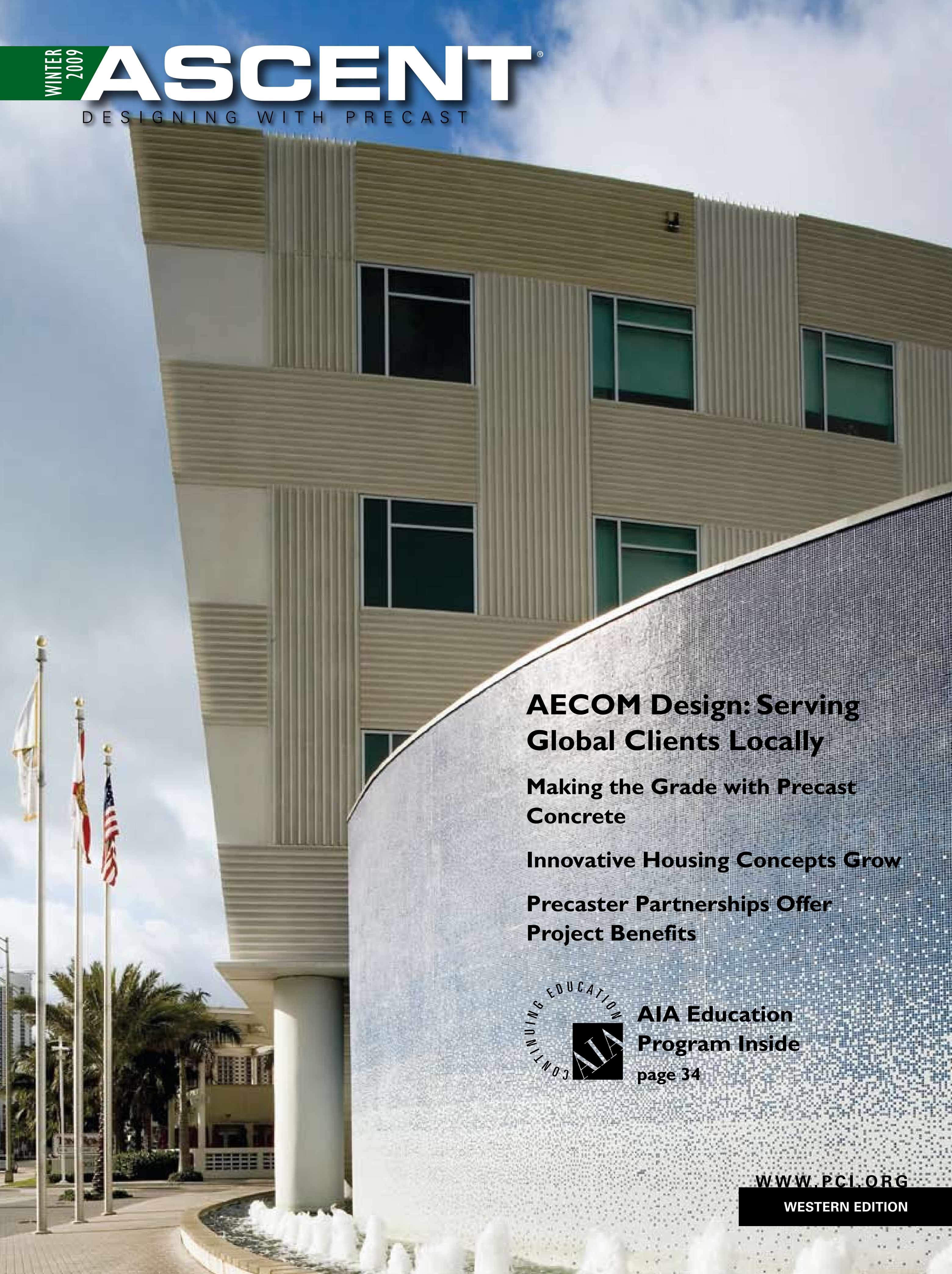
DESIGNING WITH PRECAST



AECOM Design: Serving Global Clients Locally

Making the Grade with Precast Concrete

Innovative Housing Concepts Grow

Precaster Partnerships Offer Project Benefits

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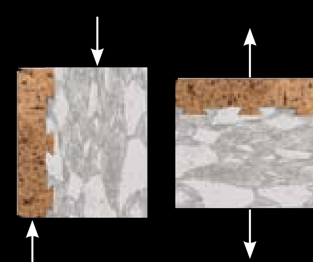
1st Mariner Bank – Canton Crossing, Baltimore, MD

Endicott's unique "keyback" design mechanically locks Thin Brick into the concrete for maximum durability and permanence.



The "keyback" design also provides advantages of increased shear values and pull-out strengths.

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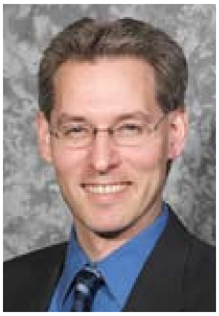

Brian Miller
Executive Editor

I am honored to introduce myself as the new Executive Editor of *Ascent* magazine. Over the past 18 years, *Ascent* has inspired designers by showcasing many of the possibilities and applications of precast concrete. In this issue, some of the great articles you will read address the benefits of using precast concrete in housing and school projects as well as demonstrate the advantages of partnering with multiple precasters to create a successful project.

To continue its success, *Ascent* will undergo a redesign over the next six months. Due to the changing times and expectations for the built environment, it is important that this resource, *Ascent*, changes as well. In this way, *Ascent* will continue to provide even more value to its many faithful readers.

In order to accomplish this overhaul, *Ascent* will be suspended for the next two issues, with the new *Ascent* rolling out this fall. We are excited to take this great publication to the next level. To continue your **FREE** subscription, you **MUST REGISTER** online at www.pci.org. This will only take a few moments.

Also, while you are registering, please take a moment to fill out a short survey to provide us with feedback. Feel free to tell us what you like, and don't like, about *Ascent* and especially what you would like to see in the redesigned version. You can also email me your comments directly—my address is listed at the bottom of this message.

The new design of *Ascent* will be launched in September at the 2009 Annual PCI Convention and Exhibition in San Antonio, Tex. It would be great if all of you could join us in San Antonio for the celebration. Please visit www.pci.org for more details.

I look forward to talking to you in the fall.

Sincerely,

Brian Miller, P.E., LEED AP
Executive Editor
bmiller@pci.org

PCI

Ascent is a publication of PCI
(Precast/Prestressed Concrete Institute)

ASCENT

On the cover: Sunny Isles Beach Government Center, Sunny Isles Beach, FL (see page 10)

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- If you have a project to be considered, send information to Brian Miller, *Ascent* Executive Editor, 209 W. Jackson Blvd., Suite 500, Chicago, IL 60606, Phone: (312) 360-3216, www.pci.org email: bmiller@pci.org


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Fort Leavenworth Prison Expands

FORT LEAVENWORTH, KANS.

Oldcastle Precast Modular in Telford, Pa., is working with J. E. Dunn Construction of Kansas City, Mo., to provide 248 precast concrete cells to the Fort Leavenworth Regional Correctional Facility as part of the Base Realignment & Closure Program for the U.S. Army Corps of Engineers. The project is being designed by HSMM/AECOM of Virginia.

The new $150 million, two-story correctional facility will contain 483 beds and include a warehouse, an engineering and maintenance building, and a covered vehicle-storage area. A new access road will lead to the prison's 40-acre site.

The prison will be divided into two sections. A medium-security general housing unit will contain 200 cells, while the maximum-security single housing units will contain 48 cells. Both units will include first floors with balconies, second floors without balconies, an uninsulated back wall, and accessible cells for the disabled. The single housing units will feature a special formliner finish.

Oldcastle Precast Modular will supply and install the furniture for the cells, including combination units. Production began in late October and was to finish in February. Erection will be completed in March.

Parking Structure Erected in Three Months

TAMPA, FLA.

A 410-car parking structure connected to the $65 million TriPointe Plaza mixed-use development was erected this summer in three months after being value engineered from a cast-in-place design to a total-precast concrete system. The precast concrete design provided a number of benefits, including speed of erection and better design flexibility.

The project, designed by Merriman Associates Architects in Dallas, Tex., was created for Construction Management Technology (CMT) in Addison, Tex., which also served as general contractor. After the design was converted to a total-precast concrete structure, the precaster completed drawings, approvals, production, and erection in 14 weeks from receiving the Notice to Proceed until the structure was finished.

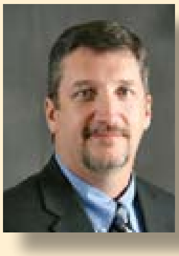
"It typically takes that long just to get the project drawn and approved," notes Mark McKeny, sales manager for **Coreslab Structures (TAMPA) Inc.**, which supplied 634 precast concrete components for the project, including double-tees, exterior and interior columns, shear walls, spandrels, inverted-tee beams, stairs with landings, flat slabs, wall panels, and curbs.

CMT decided on the conversion for several reasons, says Richard Roder, president. "We needed to complete the garage in a very short time frame while taking account of the likelihood for adverse weather." The precast concrete design provided one source for both the interior and exterior structural components, and it also offered a reduced number of interior columns, which provided a greater clear span.

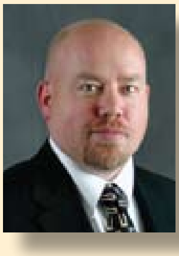
Tindall Names New Georgia GM

CONLEY, GA.

– Phillip J. Iverson



– Charles Wynings



– Jeff Lepard

Phillip J. Iverson has been named general manager of the Georgia Division for **Tindall Corp.** Iverson previously served as director of business development for Spancrete of Illinois. Earlier, he served as technical director for PCI.

In addition, Tindall has made two promotions at its Virginia Division in Petersburg, Va. Charles Wynings, formerly engineering manager, has been named general manager of the division. Jeff Lepard, formerly project engineer, has been named engineering manager.

'Big House' Adds Precast Arches
ANN ARBOR, MICH.

The University of Michigan's football stadium, known as the Big House owing to its 107,501-seat capacity, which makes it the second-largest football stadium in the country, is undergoing an expansion that will include 50 dramatic brick-clad precast concrete arches.

The project, which will add about 500 new seats, will widen seats and aisles and elevate concourses, adding restrooms and concessions. More seating for disabled fans also will be added, as will a new press box for media and game operations. In addition, two new buildings will be added on the north end and another building will be added to the south side to house restrooms and concessions.

The design, by HNTB Michigan Architecture Inc., is "elaborate, ornamental, intricate, and historic in nature and character," says Ed Fatur, project manager at **National Precast Inc.** in Roseville, Mich., which is producing the arches. The project uses 50 sizes, shapes, and colors of Belden brick, to be completed by two masons. One of the contractors, Leidal & Hart, asked National Precast to see if the brick-clad arches it was creating could be cast in precast concrete to eliminate the costly scaffolding and conventional type of masonry construction that would be required.

Four styles of precast concrete arches are being produced at a significant cost savings for the project. On the east side, twelve 16-ft-diameter arches, with an 8 in. by 4 ft cross section, will be set approximately 11 ft above the main concourse level, and twelve 18-ft-diameter arches will be set approximately 49 ft above the concourse level. The same pattern will be used on the west side, with one more of each type of arch. The bottom 4-ft-wide soffit of the arched concrete slabs is faced with brick soaps in a stack-bond fashion. The exterior edge that is exposed to view on the slab was faced with a single brick soldier course extending the full 180-degree length of the arch.

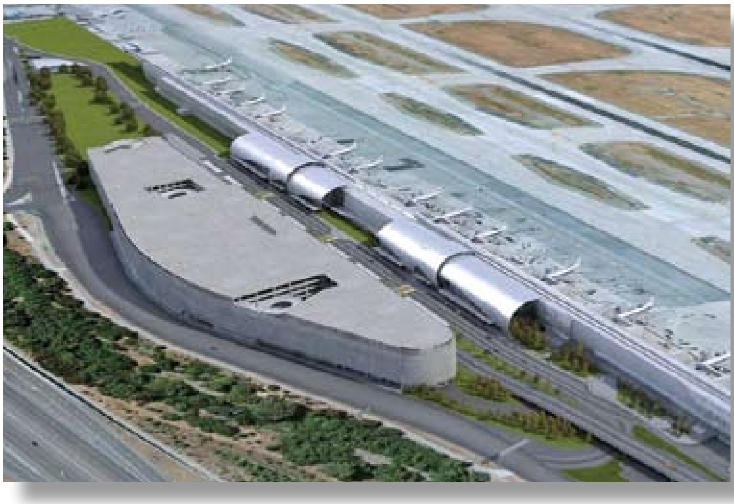
Producing the arches required a brick formliner with 1/2-in. ribs, creating the "mortar" joints. This allowed the mason to tuck-point the joints in the precaster's yard after the arch panels were cast, stripped, and prepared for transport. Formwork for the lower arches was built in the vertical position, while the upper arches were cast on their sides with the 2-ft-tall (three soldier course) exposed-to-view face cast down in the form.

The arches were stored and shipped vertically and required special drop-deck trailers for shipment. Erection required a special cradle assembly to ensure that the arches were installed horizontally in the stadium's steel superstructure with little to no tolerance in the vertical and lateral directions. The arches could not be lowered into place because of overhead structural-steel obstruction. The cradles also were designed and built to accommodate two different radii, Fatur noted.

HNTB is serving as the structural engineer on the project, with Barton Mallow Co. serving as general contractor. The renovation work began after the 2007 football season and is expected to be completed in August 2010.

5000+ Car Parking Structure Under Way
SAN JOSE, CALIF.

The City of San Jose is constructing a 1.8 million ft² parking structure at the San Jose Airport to serve as a centralized hub for the major rental-car companies. The structure, using a total-precast concrete system, will provide parking spaces for more than 5000 cars.



The project, under the direction of the construction-management firm of Hensel Phelps Construction Co. in Irvine, Calif., began work in May 2008. **Clark Pacific** in Fontana, Calif., produced 3817 precast concrete components, comprising double-tees, rectangular beams, L-beams, inverted-tee beams, transfer girders, columns, and spandrels. Erection of the components began in October, and final topping out is scheduled for May 2009.

The structure features a precast concrete gravity design with a post-tensioned alternative seismic design option to ensure that it can meet the high seismic requirements of the area. The project was designed by Watry Design in Redwood City, Calif., with Tran Systems Corp. in Phoenix, Ariz., serving as structural engineer.


– *Jeffrey D. Smith*


– *Thomas M. McEvoy*


– *Craig Thompson*


– *Frank Ike*


– *Yoo-Jae Kim*

High Concrete Makes Personnel Moves

DENVER, PA.

Jeffrey D. Smith has been named president of **High Concrete Group LLC**. Having previously served as senior vice president of operations at High Industries Inc., Smith brings 24 years of industrial-management experience, including leadership roles with CertainTeed Corp., Elk Corp., and Colgate Palmolive.

Thomas M. McEvoy, previously president of **High Concrete Group**, has assumed the role of executive vice president. In his new role, McEvoy will focus on business development and diversified growth. He also is serving as the 2009 chairman of the Precast/Prestressed Concrete Institute.

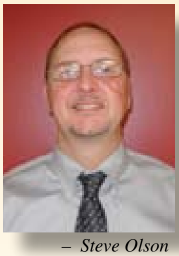
The company also has named Craig Thompson to be vice president of operations. He previously served within High Industries Inc. as director of manufacturing for the company's High Steel Structures Inc. He offers nearly 25 years of experience in management and planning at Case New Holland and Armstrong World Industries.

Frank Ike has joined the company as director of continuous improvement, a new position. He will lead and execute multifunctional continuous-improvement initiatives focused on strategic planning and policy deployment. He has 14 years' experience in a variety of manufacturing companies.

In addition, the company announced that Yoo-Jae Kim has earned his credentials as a LEED Accredited Professional (AP). He joins a growing multidisciplinary team of LEED APs at High Concrete Group.

Hanson Adds Olson

MAPLE GROVE, MINN.


– *Steve Olson*

Steve Olson joined **Hanson Structural Precast Midwest Inc.** as sales representative. Olson will work with a client base of designers and contractors in the Minneapolis-St. Paul, Minn., metro area, northern Minnesota, and eastern North and South Dakota, offering product knowledge and customer service.

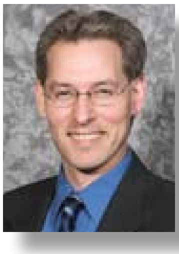
PCI Foundation Adds Pledges

CHICAGO, ILL.

The **PCI Foundation** has received pledges of more than $3 million toward its $5 million goal, following several fund-raising events at its annual convention, held in October in Orlando, Fla.

The foundation currently supports Architectural Design Studios at the Illinois Institute of Technology in Chicago and at the University of Wisconsin–Madison, and funding for a third studio was approved for the 2009–2010 school year.

PCI has extended the Founding Donor program to the end of 2009. To become involved or donate to the PCI Foundation, contact Michael Potts at mpotts@pci.org.


– *Brian Miller*

Miller to Head PCI Business Development

CHICAGO, ILL.

Brian Miller has been named managing director of business development at **PCI**. The position is newly created and brings together duties and responsibilities from several departments. Miller joined PCI in January 2007 as director of engineering and technology.

In his new position, Miller will be handling all marketing and communications programs for both internal and external activities, as well as membership functions, events, and communications with regional affiliates. He also will continue to coordinate PCI's business and operational planning activities and serve on PCI's technical team.

The shift in responsibilities comes as Chuck Merydith, PCI's former managing director of marketing and communications, leaves PCI to return to his marketing and public-relations consulting work.

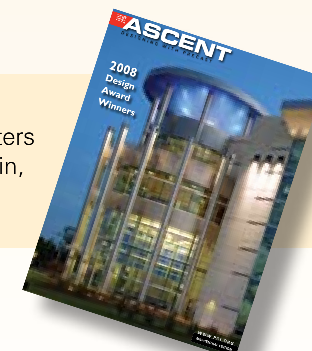
Blakeslee Hosts Army Cadets

BRANFORD, CT.

Blakeslee Prestress Inc. recently hosted a visit from the senior class of the Civil & Mechanical Engineering Department of the United States Military Academy at West Point, N.Y. The precaster has been hosting groups of students for the past several years. Forty-two cadets and two instructors attended the event, which included a demonstration of three-dimensional modeling and a plant tour.

Correction

A news item in the Fall issue of *Ascent* incorrectly noted the location of the headquarters for Gate Construction Material Group, which has been reorganized under Dean Gwin, president and chief operating officer. The company is headquartered in Jacksonville, Fla.



Hollow-Core Help for Housing

Q. How can I install a radiant-heating system in my floor assembly using precast concrete hollow-core?

A. Installing a radiant-heating system along with hollow-core units helps offset energy price increases while enhancing environmentally friendly design.

Precast concrete units can serve as a radiant-heat source that is more comfortable and more efficient than forced-air heat. In-unit hydronic heaters warm the living space from the floor rather than from the ceiling down.

With the automated manufacturing process used for hollow-core, it is easier to install these systems in the field. Tubes are inset into the concrete topping applied to the units. Insulation is provided to reduce heat loss around the hollow-core edges. The tubing layout is secured, and the concrete is placed.

The heat source can be any boiler, water heater, or solar collector to provide a warm-water source. Most hydronic-system manufacturers have software to design the layout of the tubing system, as well as to calculate heat loss.

No special concrete topping is required. As long as the tubing is protected during placement and a 2-in.-clear cover of concrete is maintained, the topping and hollow-core placement construction can be completed as if no tubing were present. Ideally, the tubes should be charged with water during placement to avoid crushing.

Q. Do I need topping when specifying "carpet ready" for hollow-core systems?

A. Hollow-core units are prestressed products and will have camber (upward deflection) that can require topping. But in situations where differential camber can be controlled, some hollow-core systems can be carpet ready after only sealing the joints between the units.

The design and layout will affect how much variation there will be between the hollow-core units. Hollow-core spanning in opposite directions will have more variation. Special attention should be given to areas around doors to obtain proper finished elevations.

For other hollow-core systems, a $^{3}/_{4}$ in. gypsum topping should be considered. Cement-based toppings can also be specified. For composite structural toppings, a minimum thickness at midspan should be 2 in., and for nonstructural toppings, the minimum should be $^{1}/_{2}$ in.

For more details, refer to PCI's *Manual for the Design of Hollow-Core Slabs*, 2nd edition.

More Information

This column answers frequently asked questions about designing, casting, and erecting precast concrete components. This issue's responses were provided by the Mid-Atlantic Precast Association (www.mapaprecast.org) and by PCI of Illinois and Wisconsin (www.pci-iw.org). If you have a question about precast concrete components, please send it to Executive Editor Brian Miller at bmiller@pci.org.

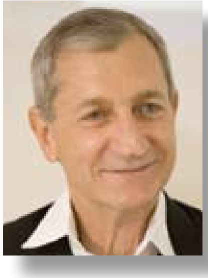
Photos: Courtesy of Spancrete.

In situations where differential camber can be controlled in hollow-core components, they can be carpet ready after only latexing the joints between the units.

Serving Global Clients Locally

— Craig A. Shutt

DMJM H&N reorganizes as AECOM Design to create more efficient business units to serve clients around the globe by addressing key local issues and desires



—Ray Landy, president, AECOM Design, Architecture; and former president of DMJM H&N

"This move aligns our operating companies to take better advantage of our global growth in recent years."

—Mike Kerwin, design principal

"What differentiates us from other firms of our size is that we have both the capacity to design and manage projects at the highest level in a great variety of contexts."

—Michael Mann, principal and regional leader

"If you're just chasing LEED points, you're coming at design from the wrong direction."

The reorganization of DMJM H&N into AECOM Design presents a new face to the firm's clients, combining the capabilities of DMJM H&N, Earth Tech, and HSMM into one unified operation. The plan will create more efficient access for all design resources within the multinational firm, while still allowing it to meet its global clients' needs at the local level, executives say.

The integration of these services, which began in October 2008, will create five expertise-based organizational entities from what were DMJM H&N and other AECOM subsidiaries: AECOM Design, AECOM Water, AECOM Transportation, AECOM Energy, and AECOM Environment. The change will offer clients easier access to the firm's capabilities and improved delivery of its services and technologies, according to Ray Landy, president of the architecture practice.

'We look at these projects from a completely different angle than most companies.'

"This move aligns our operating companies to take better advantage of our global growth in recent years," he explains. "It was becoming clear from a global perspective that we had some of the same skills in various business lines that had grown over time. This approach reorganizes those skills so it will be easier to coordinate them." A number of divisions practiced architecture, he says, but they couldn't access the wider expertise in other divisions. "It makes sense for us to align all of our architectural expertise into one business line and bring all of the architects together, first in the United States and then internationally, as a community. It makes us a more powerful entity and better able to serve our clients' needs.

It especially works to the benefit of multinational companies, he notes. "They like to buy single-point resources and ensure responsibility is derived from a single platform that is global." No matter where the company has projects beginning, AECOM can handle their needs and ensure that its resources around the world can be brought to bear on the challenges. The organization also will allow AECOM Design to tap into the expertise of the other four divisions as needed for larger infrastructure or planning programs, he adds.

Clients of All Sizes Benefit

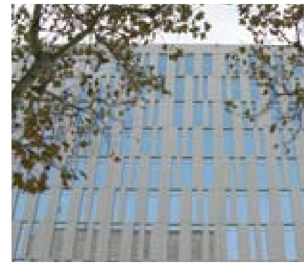
That doesn't mean the designers don't work with smaller, domestic companies. For instance, construction is being completed on the new Administration Building for the Los Angeles Police Department (LAPD), while the William H. Hannon Library at Loyola Marymount University in Los Angeles, Calif., will open in 2009. Both projects feature striking, geometrical facades that make full use of precast concrete panels and components.

"We understand local politics and neighborhood issues," explains Michael Mann, principal and regional leader. "We're fairly balanced in terms of work for public and private clients, but currently, more of our work is in the public arena due to the economic times." Overall, about 60% of the firm's revenues are derived from public clients, he estimates.

Those clients are spread widely through various types of functions, bringing commissions for a host of building types, including workplace and office designs; public-safety and justice facilities; higher-education needs including classrooms and libraries; and hospitality and leisure, which includes resorts and hotels. "We are also doing some retail work as part of major

PROJECT SPOTLIGHT

Los Angeles Police Department Administration Building



Location: *Los Angeles, Calif.*

Project type: *Office/public-safety building*

Area: *500,000 ft²*

Designer: *AECOM Design, Los Angeles*

Owner: *City of Los Angeles Bureau of Engineering, Los Angeles*

Contractor: *Tutor-Saliba Corp., Sylmar, Calif.*

PCI-certified precaster: *Coreslab Structures (L.A.) Inc., Perris, Calif.*

Description: *The new Los Angeles Police Department (LAPD) Administration Building, finished in late 2008 with a silver LEED rating, features below-grade parking for 355 cars and includes areas dedicated to police administration and investigative operations. It also includes several large assembly areas, including hearing rooms, a conference center, and a state-of-the-art computer command center; a public cafe; and a public auditorium.*

The design features architectural precast concrete panels on the highly geometric facade. It also includes a west facade studded with tall, thin windows of varying widths that appear random but in fact were created with only six concrete forms. The bottom sills on the window openings are extremely thin, requiring close control of reinforcement placement. Tolerances were quite tight, so window installation progressed smoothly.

The building's apex on the north side, which points to city hall, features a 130-degree angle achieved with a vertical truss that was completely clad in precast concrete. The solid panel is finished on both sides with a pattern of varying textures. The wall panels were sandblasted, with a texture that was continued into the texture used for the glazing system, creating a uniform look.

The final design evolved through a process of evaluating numerous alternatives leading to a preferred concept and subsequent refinements made by the design team and the Bureau of Engineering with the LAPD, accompanied by reviews, comments, and collaboration with other stakeholders. These groups included the Department of Public Works; City Council members; the Office of the Mayor; the Chief Administrative Office; Chief Legislative Analysts; the Cultural Affairs Commission; the Project Restore First Street Design Team; and community members, who participated in more than 30 meetings and workshops.

(For technical information on this project or other Project Spotlights, contact the precaster; see the Plant Certification Supplement at the end of this issue.)

The LAPD Administration Building in Los Angeles features textured architectural precast concrete wall panels, including a west facade with tall, seemingly randomly placed windows that were in fact created with only six different wall panel forms.

A basket-weave design was created for Sunny Isles Beach Government Center in Florida using a ribbed pattern on architectural precast concrete panels.

PROJECT SPOTLIGHT

Sunny Isles Beach Government Center

Location: *Sunny Isles Beach, Fla.*

Project type: *City hall and justice center*

Area: *58,000 ft²*

Designer: *AECOM Design (Spillis Candela DMJM), Coral Gables, Fla.*

Owner: *City of Sunny Isles Beach*

Contractor: *Weitz Construction Co., West Palm Beach, Fla.*

PCI-certified precaster: *Gate Precast Co., Sarasota, Fla.*

Description: *The government center is located on a 2.5-acre site on an oceanfront boulevard at the center of an emerging business and residential area. The four-story building includes administration, police, library, and city council functions.*

The design floats a three-floor curving bar of administration and police functions over the ground-floor public spaces. A three-level parking structure slides underneath the western leg and integrates public-related functions at the base. A one-story restaurant attached to the City Hall side features a roofscape partially screened with a large-scale tensile canopy.

Architectural precast concrete panels in a white-ribbed texture were specified for the facade because that material could provide the ribbed design to articulate the strong shade and shadow patterns that move across the facade. The ribs go both vertically and horizontally and intersect, creating a basketweave design that adds visual interest and color. The panels also were chosen because of the durability they provided against the oceanfront environment.

Glazings for the three upper floors consist of square "punched" windows with clear anodized mullions. The Council Chamber is veneered with a blue, integral glass mosaic tile, while the elevator core features black granite.

'Precast concrete is a chameleon material.'

mixed-use projects," he notes.

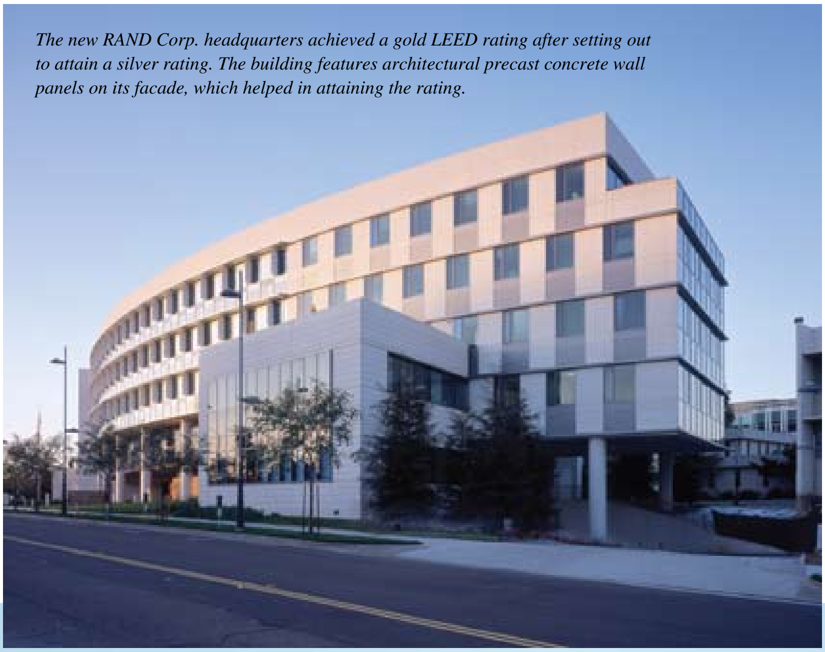
One area in which AECOM stands out is the work it has done with infrastructure facilities, adds Mike Kerwin, design principal in Miami, Fla. That work spotlights an unusual array of projects comprising transportation centers, rental-car facilities, highway architecture, and toll plazas. "We look at these projects from a completely different angle than most companies, seeing them as really wonderful opportunities for public architecture that people generally don't expect to be beautiful or intense."

One recent project that spotlights that approach is the Consolidated Rental Car Facility and Parking Garage at the Fort Lauderdale-Hollywood (Fla.) International Airport. The nine-story structure consolidates 12 rental-car companies and their vehicles into one facility, which accommodates 9000 cars and a full range of concessions and visitor parking. A pedestrian bridge connects the structure to the terminal. The design features a total-precast concrete structure that blends glass and dimensional concrete on its facade to create a distinctive appearance.

"What differentiates us from other firms of our size is that we have both the capacity to design and manage projects at the highest level in a great variety of contexts," says Kerwin. "Some firms have strength in managing or designing complex projects, but few can do both equally well."

A 'Chameleon Material'

As noted by the previous examples, precast concrete often plays a role with this wide variety of projects, regardless of the building type or client. "Precast concrete is a chameleon material," Kerwin says. "Our



The new RAND Corp. headquarters achieved a gold LEED rating after setting out to attain a silver rating. The building features architectural precast concrete wall panels on its facade, which helped in attaining the rating.

PROJECT SPOTLIGHT

The RAND Corp. Headquarters

Location: *Santa Monica, Calif.*

Project type: *Corporate office building*

Area: *310,000 ft²*

Designer: *AECOM Design, Los Angeles, Calif.*

Owner: *The RAND Corp.*

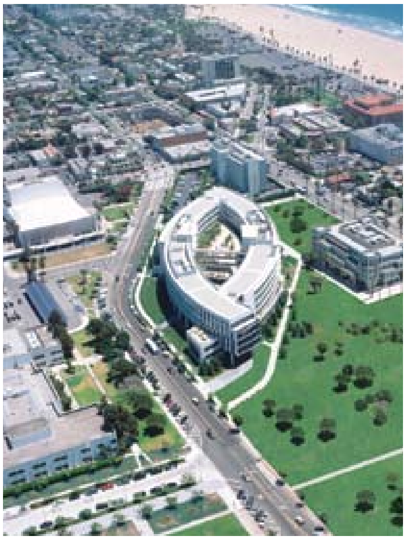
Contractor: *Turner Construction Co., Los Angeles*

PCI-certified precaster: *Walters & Wolf Precast, Fremont, Calif.*

Description: *RAND officials wanted to consolidate and update its operations in a new headquarters that would be used on a 24-hour, seven-day basis for the next 50 years. Aesthetic impact was important, but so was functionality and flexibility, as well as support for the firm's culture and work style.*

The building, which achieved a gold LEED rating, was clad with architectural precast concrete wall panels that were attached in a vertical fashion. Horizontal ledges provide shade from the sun and protection from glare and are supplemented with coated glass to reduce heat gain.

The building envelope and systems were designed to maximize energy performance. Computer simulations were run to assess energy performance, resulting in a 50% improvement in the proposed building performance rating compared with the baseline.



‘We spend a lot of time with the fabricators, producing mock-ups and playing with formliners, to ensure we find just the right approach.’

use of it cuts across all building types, playing a role in the skinning of many types of buildings. It has the capacity to look like every type of material—metal, masonry, brick, stone—and we can put real brick or stone onto it. It really provides untold flexibility and economy.”

The company also has been using precast concrete’s structural capabilities, he adds. “We’ve used it in Miami as a structural material for more than three decades, as a way of attacking design challenges, especially for parking structures.” Precast concrete structures have been popular, he notes, because their durable, sturdy composition provides strong protection against hurricanes, and they minimize maintenance costs even in coastal areas inundated with salt and water spray. “There are so many ways that we can use the material that it always comes up in discussing facade options,” he says.

“It’s a pretty easy sell to owners on the West Coast,” agrees Mann. “We typi-

PROJECT SPOTLIGHT

207 Goode

Location: *Glendale, Calif.*

Project type: *Commercial office building*

Area: *188,000 ft²*

Designer: *AECOM Design, Los Angeles, Calif.*

Owner: *Maguire Partners, Glendale, Calif.*

Contractor: *Hathaway Dinwiddie, Los Angeles*

PCI-certified precaster: *Clark Pacific, Fontana, Calif.*

Description: *This eight-story speculative office building is located between two existing office buildings, so special attention was paid to siting and exterior design. The building was positioned along the southern property edge to allow as much sunlight as possible to filter into the space.*

This daylight-enhancing approach was encouraged by a pure glass curtain wall framed by architectural spandrels and wall panels made of glass-fiber-reinforced concrete in a white color with no reveals. The spandrel panels were typically about 30 ft by 7 ft, while the wall panels were 12 ft by 6 ft 6 in. The casting and erection of the materials went smoothly, with easy access to the site available.

An office building in Glendale, Calif., was fit between two existing buildings, with glass-fiber-reinforced concrete wall panels and spandrels helping to blend the structures. Along the south wall, a large expanse of glass framed by spandrels helped bring daylight deep into offices.

PROJECT SPOTLIGHT

William H. Hannon Library

Location: *Los Angeles, Calif.*

Project Type: *University library*

Area: *120,000 ft²*

Designer: *AECOM Design, Los Angeles*

Owner: *Loyola Marymount University, Los Angeles*

Contractor: *Snyder Langston, Irvine, Calif.*

PCI-certified Precaster: *Clark Pacific, Fontana, Calif.*

Description: *Set to be completed later this year, the library is located on a dramatic bluff overlooking the Pacific Ocean. Combining the materials and services found in traditional libraries with the technological advancements of today's digital libraries, the facility offers 500,000 volumes in open stacks and up to 1.4 million volumes in an automatic storage and retrieval system sized for future expansion.*

The building features a combination of architectural precast concrete wall panels and glass-fiber-reinforced concrete spandrels in two colors: beige and white. The most striking feature is the precast concrete fins, which frame tall, thin windows that give the building the image of a car air filter sitting on a base.

The circular structure offered a variety of challenges for the precaster, including the creation of many radiused panels to achieve the required curves and a difficult site with limited access due to its bluffside location. A large crane was used to reach to the far side of the building up to 225 ft away to erect the panels.

The new William H. Hannon Library at Loyola Marymount University in Los Angeles, to be completed later this year, features a combination of architectural precast concrete wall panels and glass-fiber-reinforced concrete spandrels to create a distinctive, finned facade.

'We can gain so much control of the finishes and textures, so we can achieve the exact color and consistency that we want.'

cally approach design from a compositional aspect, organizing the appearance around solids and glass areas. How we mix those elements differs in each case, and precast concrete works very well in achieving the goals we set, no matter what they are. It's a very natural product for us to use."

The LAPD building offers a good example of those compositional contrasts, featuring a strong geometric layout and a west wall that appears to be made of tall, randomly spaced windows set into precast concrete panels. But, in fact, the apparently random pattern was created with only six concrete forms. Another example of precast concrete and glass combining in interesting ways can be seen at 207 Goode in Glendale, Calif. The commercial office building features a facade along the main street that consists of a solid curtain wall framed by a precast concrete perimeter. Along other facades, the precast concrete acts as spandrel panels between lengths of glazing.

"One of the real advantages of precast concrete is that we can gain so much control of the finishes and textures, so we can achieve the exact color and consistency that we want," adds Kerwin. An example of strong textures can be seen in the company's work for the Government Center in Sunny Isles Beach, Fla. The project features architectural precast concrete panels in three textures: smooth, vertical reveals, and horizontal reveals. The two types of reveals intersect, creating a basket-weave appearance. Tall bay windows jut from a smooth facade on another side, with much wider-spaced reveals used.

"We spend a lot of time with the fabricators, producing mock-ups and playing with formliners, to ensure we find just the right approach," Mann says. "Most of the fabricators are happy to work with us in that way, because they enjoy the creativity. And we find it's the best way to get what we're looking for with the highest value for the client."

Sustainability Interest Grows

Precast concrete also aids in meeting owners' sustainability goals—and almost every owner has such goals today. "Sustainability is at the forefront of every project," says Landy. And that's a global phenomenon, he reports. "Even in places where it hasn't been important, such as the Middle East, it's become a key driver."

Precasters aid that process in the United States in a variety of ways. Typically, the plant is close to the site, reducing transportation emissions and costs. Precast concrete also aids with energy efficiency, moisture control, and other factors. "Precast concrete can fit into many climates and perform in a variety of ways," Kerwin notes.

But projects that select specific products simply to boost their LEED rating ultimately won't be as successful as they could, stresses Mann. "If you're just chasing LEED points, you're coming at design from the wrong direction," he says. "We like to think there are rational, pragmatic reasons to choose options that go beyond

PROJECT SPOTLIGHT

Blue Cross/Blue Shield of Florida

Location: *Jacksonville, Fla.*

Project type: *Office complex*

Area: *775,000 ft²*

Designer: *AECOM Design (Spillis Candela DMJM), Jacksonville, Fla.*

Owner: *Blue Cross/Blue Shield*

PCI-certified precaster: *Gate Concrete Products, Jacksonville, Fla.; and Gate Precast Co., Ashland City, Tenn., and Monroeville, Ala.*

Description: *A 775,000 ft² expansion was added to the original project and consists of three 200,000 ft² office buildings and a 175,000 ft² multipurpose building housing a conference center and employee cafeteria. The expansion complements an existing five-building, 1 million ft² complex also designed by AECOM Design. Another recent addition is the 34,000 ft² Event Center, which includes a 10,000 ft² ballroom that can seat 1300 people and can be subdivided into eight venues. Five meeting rooms can accommodate multiple activities simultaneously.*

The facilities feature architectural precast concrete wall panels that help unify the campus while reducing the scale of the structures. As part of the third phase of the project, the architectural firm also created a four-level, 1450-car parking structure that features an all-precast concrete structure including beams, columns, and double-tees. The parking structure was designed to complement and harmoniously blend with the architecture of the existing and planned office buildings on the site.

sustainability."

Designing for sustainability goes beyond plugging in specific products, he explains. "We often can achieve a LEED rating without spending extra money if we approach the design properly. If you are spending a lot of money to add another point, you may not ultimately achieve what you want with the building."

Adds Kerwin, "There really is a sea change occurring in the entire construction industry about sustainable design, and we are retooling to meet those challenges right now. The standard baseline is shifting on us, and moving higher, and it's going to be even higher in five years as we come to adapt technology to the very real environmental challenges that face us."

Technology is driving products to provide more sustainable options and make that aspect inherent as part of the product's total function. Those rapid changes are being monitored by AECOM's designers. "We need to explore new technologies—but we also can't try to embrace them until they're proven," Kerwin warns. "That can be a slippery slope. New buildings are going to be around for longer than past designs were planned for, and we have to be certain we aren't using them as laboratories."

Here, too, the trend leads the designers to using precast concrete components to

'There really is a sea change occurring in the entire construction industry about sustainable design.'

meet their needs. "The quality and technology behind precast concrete has improved significantly in recent years," says Mann. "We can accomplish many more shapes and other goals."

Total-precast concrete structures and high-performance concrete also are making rapid advances, Kerwin adds. "The entire concept of using precast concrete and plank systems with higher strengths, using steel fibers, creates a significantly different product. Likewise, high-density concrete that can act as its own rain screen will change design approaches." Some of these ideas have progressed further in Europe to date, he notes, but the United States is quickly catching up.

High-performance concrete will allow precast components to "invade the tall-building market in ways it hasn't done to date, due to the advantages it will offer in fireproofing alone," Kerwin predicts. "Taller buildings will turn to precast concrete more often because of the advances that are being made."

The ability of materials to adapt to sustainable concepts as they evolve will be a driving force in their growth, he adds. "The challenge for precasters is to adapt their materials as necessary to keep up with sustainable designs and new technology."

For instance, Mann currently is involved with several projects in which new techniques are being used to evaluate solar-heat models for buildings. "We're looking at how heat builds up on the building's skin so we can create architectural diagrams and designs that can help us select the best building material to respond to that heat gain and make the best use of it."

The expanding Blue Cross/Blue Shield headquarters in Jacksonville, Fla., features architectural precast concrete wall panels that help unify the buildings.

Interfaces Are Critical

That continued evolution will be critical as other building materials evolve, and their uses change. "How precast concrete can interact with glass and metal skins is changing, and how it adapts to new technology will be important," says Landy. He points to new techniques incorporating photovoltaic cells and solar panels into projects and facades. "These ideas have to be blended with the structure from an aesthetic standpoint, as well as a functional one," he says. "Currently, retrofitting a building with solar panels can make it look ugly. But creating ways to hide them while achieving full efficiency can create a spectacular design."

Creating spectacular designs will remain at the forefront of AECOM Design's direction as it adapts to its new organization and distribution of services. "There will be quite a bit of realignment for us in 2009 and into 2010," Landy says. "This is only the first step being taken right now. But it will help us better organize our talent, knowledge, and potential for innovation so that we can create a critical mass that will influence markets and designs in ways that small operating companies couldn't do." ■

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

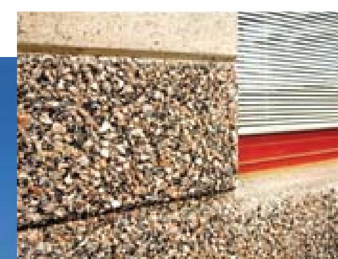
Making the Grade with Precast Concrete

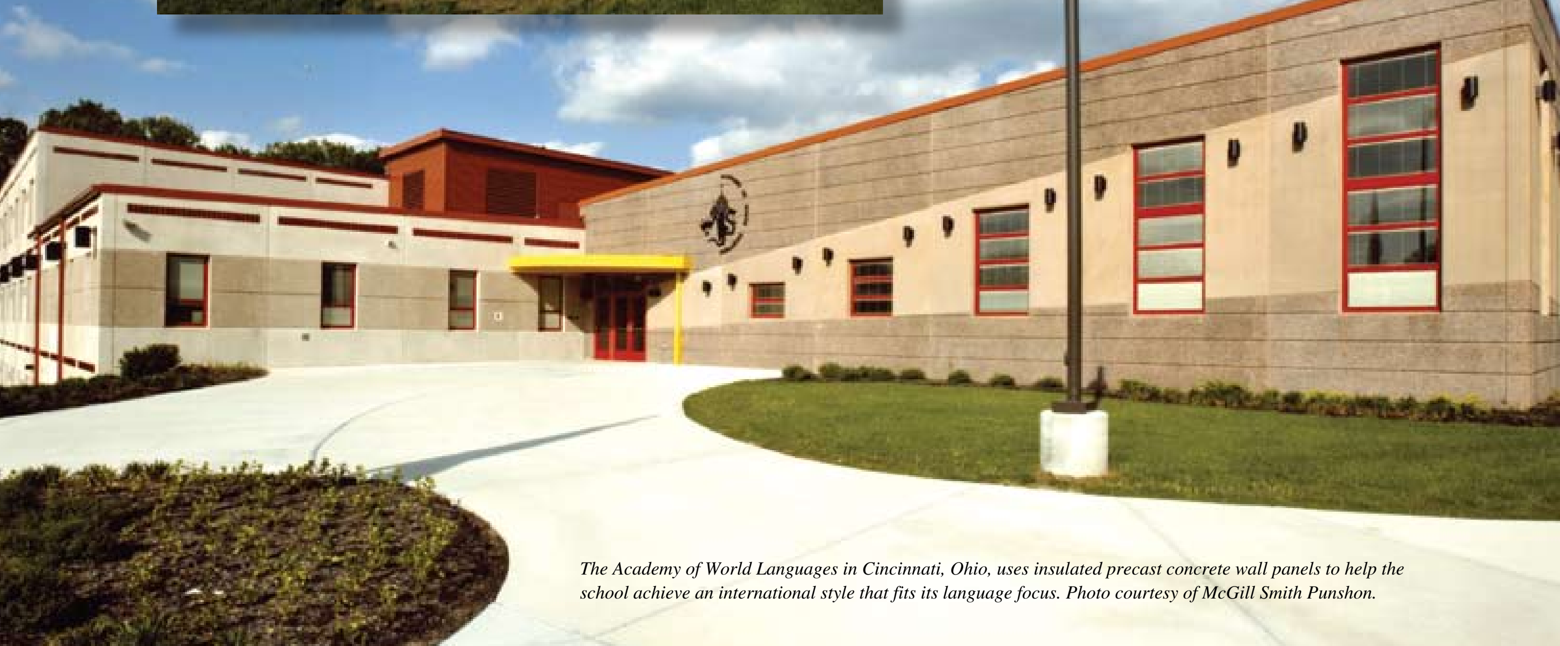
— Anne Patterson

School projects are using precast concrete to meet tight schedules, save money and energy, and create community-pleasing looks

With school districts nationwide looking to expand, upgrade, or replace their educational facilities, administrators face challenges with budgets, timetables, and community acceptance. To meet those needs, more architects are selecting precast concrete for facade and shell requirements instead of masonry, which many schools traditionally favor.

Precast concrete offers architects, owners, and contractors a number of important benefits. Chief among them is the speed with which it can





The Academy of World Languages in Cincinnati, Ohio, uses insulated precast concrete wall panels to help the school achieve an international style that fits its language focus. Photo courtesy of McGill Smith Punshon.

Precasters' recommendations are a significant help in learning the most cost-effective ways to create desired design details.

help complete both design and construction activities in an industry where time is money.

Architects' time is reduced when they obtain input from the precast fabricators during a project's design phase, usually allowing the structural and precast design to take place simultaneously. The precasters' recommendations are a significant help in finding the most cost-effective ways to create desired design details. "Their input early on helped us control costs," says architect Marvin Coker with McMillan Smith & Partners of Spartanburg, S.C., referring to a recent high-school project in Greenville, S.C.

The need for rapid construction can be the decisive factor. Enclosing a school building with structural precast concrete sandwich wall panels speeds up the project by eliminating material needs, providing an already insulated component, and offering an interior finished wall.

An example can be seen in a recent school project in Mableton, Ga. "Thanks to precast wall panels, the school was completed in record time—a mere 14 weeks from groundbreaking to certificate of occupancy," says project architect Ron Talens with Perkins+Will Inc. in Atlanta, Ga. The precast concrete components were fabricated while the building site was being prepared. In addition to added constructability, sandwich wall panels' insulation between two wythes of concrete also provides thermal advantages, keeping schools warmer in the winter and cooler in the summer, producing energy savings.

Architects also benefit from precast concrete's design flexibility, which al-

Fact Sheet

Project: *Academy of World Languages*

Type: *Magnet elementary school*

Location: *Cincinnati, Ohio*

Designer: *McGill Smith Punshon, Cincinnati*

Engineer: *M-Engineering, Westerville, Ohio*

Contractor: *Monarch Construction, Cincinnati*

Owner: *Cincinnati Public Schools*

Precaster (wall panels): *High Concrete Group LLC, Denver, Pa.*

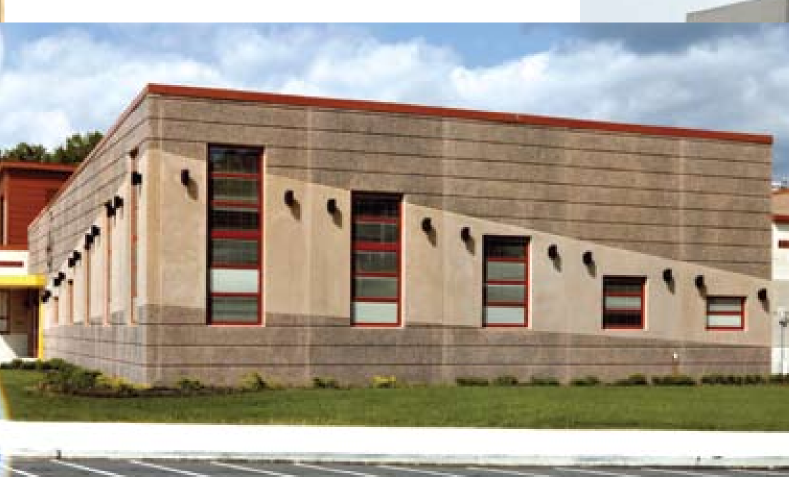
Precaster (interior precast concrete components): *Total Precast Solutions LLC, Fairfield, Ohio*

Size: *85,500 ft²*

Precast concrete components: *Sandwich wall panels, solid wall panels, hollow-core, interior load-bearing walls, stairs with landings*

Project cost: *$17.6 million*

Cast-in red tile on the classroom wing of the Academy of World Languages emphasizes the precast concrete panels' horizontal lines. Photo courtesy of McGill Smith Punshon.



Precast concrete insulated wall panels helped Imagine School's new Mableton, Ga., facility meet a tight deadline for the fall session. The building contains classrooms, an administration office, a media center, and a cafeteria/multipurpose room.

The precast concrete components can be fabricated while the building site is being prepared.

Fact Sheet

Project: *Imagine Schools*

Type: *Charter elementary school*

Location: *Mableton, Ga.*

Designer: *Perkins+Will, Atlanta, Ga.*

Engineer: *Uzun & Case Engineers, Atlanta*

Contractor: *Bouma Construction Co., Grand Rapids, Mich.*

Owner: *Imagine Schools School House, Arlington, S.C.*

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

Size: *41,000 ft²*

Precast concrete components: *Composite exterior wall panels*

Project cost: *$4.5 million*

lows them to create details that give a school building aesthetic appeal and help it relate to the surrounding community. "Precast provided aesthetic flexibility, giving our design team the ability to play with colors and textures," says Randy Merrill, principal with McGill Smith Punshon (MSP) in Cincinnati, Ohio. Mike Moose, design principal with Glaserworks, architects and urban designers in Cincinnati, agrees. "I've always liked precast, especially for its plasticity," he says.

Creating an International Look

The architects at MSP took advantage of precast concrete when they created the details on the Academy of World Languages, an 85,500 ft² K–8 magnet school in Cincinnati, where students learn Arabic, Russian, Japanese, and Chinese, as well as English as a second language. Their goal was to create a sleek, stylish international building that fit the school's mission, providing a welcome change from the undistinguished facility it replaced.

"We were able to obtain cost savings in precast fabrication through repetitive patterning," notes Merrill. Specifying precast concrete wall panels also enabled designers to incorporate details that contributed to the stylish look. Outside and in, the school features bright colors and dynamic patterns.

On the front facade, cast-in red tiles accentuate the structure's horizontal lines, which are enhanced by contrasting diagonal bands of sandblasted and retarded finishes. Double rows of blue tile on some classroom exteriors

emphasize the panels' vertical joints. Squares of set-in colored tile and prefinshed red window frames add bright notes. The central gymnasium is clad in precast concrete panels with a retarded finish. High Concrete Group LLC, based in Denver, Pa., fabricated the precast concrete insulated sandwich wall panels in its Springboro, Ohio, plant, while Total Precast Solutions LLC in Fairfield, Ohio, supplied the interior components.

The structural panels provided additional insulation, eliminating the need for drywall and the dust associated with finishing it. "We had a clean building after enclosure," says Merrill. "The panels saved labor costs."

The school complex incorporates four building groups: the classrooms, the administration section, the library/media center, and the gym. A judicious use of scale and massing, with the bulk of the gym in the background, keeps the building's size from appearing overwhelming. In addition to the exterior precast wall panel system, precast concrete components included much of the remaining structural system, including hollow-core, interior load-bearing walls, and stairs with landings.

Competing with Masons

In Ohio, most public schools have featured block-and-brick facades because the Ohio School Facilities Commission did not approve the use of precast concrete until 2004. MSP de-

Precasters' recommendations are a significant help in learning the most cost-effective ways to create desired design details.

Fact Sheet

Project: *Fairview Clifton German Language School*

Type: *Magnet elementary school*

Location: *Cincinnati, Ohio*

Designer: *Glaserworks, Cincinnati*

Engineer: *M-Engineering Inc., Westerville, Ohio*

Contractor: *Turner Construction Co., Cincinnati*

Owner: *Cincinnati Public Schools*

Precaster (exterior wall panels): *High Concrete Group LLC, Denver, Pa.*

Precaster (interior precast concrete components): *Total Precast Solutions LLC, Fairfield, Ohio*

Size: *84,143 ft²*

Precast concrete components: *Structural sandwich wall panels, hollow-core, interior walls, stairs, beams*

Project cost: *$15.8 million*

After being erected, the precast concrete panels are braced during construction of the Fairview Clifton school. Photo courtesy of Glaserworks.

Fairview Clifton German Language School in Clifton, Ohio, features a nearly total-precast concrete structure due to the energy efficiency, speed of construction, and weather resistance that the material could provide.

Precast concrete sandwich wall panels were erected quickly at the J. L. Mann High School, helping to meet a tight budget. Photo courtesy of McMillan Smith & Partners.

Inset brick on precast concrete insulated wall panels allowed the J. L. Mann High School in Greenville, S.C., to retain a classical Southern appearance while offering 21st-century energy efficiency. Photo courtesy of McMillan Smith & Partners.

Fact Sheet

Project: *J. L. Mann High School*

Type: *Magnet high school*

Location: *Greenville, S.C.*

Designer: *McMillan Smith & Partners Architects, Spartanburg, S.C.*

Contractor: *B E & K Building Group, Greenville*

Owner: *School District of Greenville County*

Precaster: *Metromont Corp., Greenville*

Size: *248,000 ft²*

Precast concrete components: *Load-bearing wall panels and non-load-bearing wall panels*

Project cost: *$31.4 million*

signed the first total-precast elementary school in Ohio, Roberts Paideia Academy, which opened in 2007 in Cincinnati. (For details, see the Winter 2008 issue.) "I was pleased to be able to use precast again, because Roberts Academy has been a great success," says Merrill.

Another nearby example is the Fairview Clifton German Language School in Clifton, Ohio, a Cincinnati suburb. The 84,143 ft² school was constructed using almost entirely precast concrete components, except for the use of steel joists over the gym and cafeteria. The architects at Glaserworks specified precast concrete because masons in the area were busy and prices were rising.

"A precast concrete building will be more energy efficient and weather resistant than one with traditional masonry," says Glaserworks' Moose. "Additionally, by using precast, we were able to shorten the construction schedule by a month." High Concrete Group and Total Precast Solutions also supplied the precast concrete components for this project.

Enjoying an excellent scholastic reputation since its founding in 1974, the Fairview Clifton German Language School is a magnet school for 650 students in pre-K through 6th grade. It was one of the first schools in the country to immerse primary students in the German language.

Situated on a knoll, the architects designed an L-shaped facility with classical proportions, giving the building a presence appropriate to its civic importance, Moose noted. They also wanted to relate it to two other nearby buildings. A stone carriage house located at a right angle to the new school forms one side of a courtyard, while a 1905 school building is located across the street. The community plans to develop the carriage house into a cultural arts center, which will share its performance space with the school.

The school building features a one-story commons wing and a three-story classroom wing. The commons contains the gym, media center, art and music rooms, the cafeteria, and administration offices. Structural precast concrete sandwich panels designed to an 8 ft 8 in. module are used to enclose the building. The panels are 11 in. thick, with the tallest ones measuring 39 ft high. The precaster used 219 high-performance insulated wall panels.

The panels feature 2 to 2.5 in. of insulation between two concrete wythes connected with carbon-fiber trusses that transfer in-plane shear forces and allow both concrete wythes to be load bearing. The 100% structurally composite panels, which are thinner than block-and-brick and noncomposite designs, are thermally efficient and prevent thermal bridging. The insulated wall panels keep occupants comfortable year round and provide expected energy savings over the life of the school.

Three finishes were specified for the panels' exterior surfaces. Gray concrete echoes the stone on the adjacent carriage house, and yellow thin-set brick replicates the color of the brick on the nearby 1905 school building. A dark band, using a black aggregate in the concrete, anchors the building to the ground.

"The precasters were a great help during the design process," says Moose. "They assisted in the detailing of the panels, making them easy and economical to fabricate. They also produced mock-up panels to show us possible colors and finishes."

Meeting the Deadline

When faced with a tight completion deadline, designers often find that precast concrete components are the only option available. For example, block and brick were originally considered for the exterior of the new 41,000 ft² charter elementary school in Mableton, Ga., owned by Imagine Schools. The elementary school for grades K through 5 is the first phase of a master plan still under way. The new building contains classrooms, an administration office, a media center, and a cafeteria/multipurpose room.

However, during the design phase, it became apparent that school could not be finished by the deadline using these materials. Groundbreaking had taken place in May 2007, and the school had to be ready for classes in the fall. Enclosing the school with composite precast concrete wall panels made it possible to obtain a certificate of occupancy by August 1.

"One major element in expediting the erection of the building was the use of structural precast panels on the exterior," says project architect and designer Ron Talens. "The rapid erection of the wall system allowed the building to be quickly enclosed, so interior construction could take place." Typical panels, which were produced by Metromont Corp. at its Hiram, Ga., plant, are 12 ft wide by 35 ft high; the interior insulation layer provides an R-value of 11.

The precast wall panel system provided an additional benefit, notes Talens. The minimal joints in the concrete panels prevent water penetration, which is particularly important in the South. The panels also eliminated the need for drywall on the interior side, which is a potential food source for mildew and mold. Portions of the exterior walls were painted red to add visual interest, and the balance of the building was coated in white.

Quick Brick Solution

The J. L. Mann magnet high school in Greenville, S.C., offers a program concentrating on math and science and also provides an environment responsive to the district's physically handicapped students. It has enjoyed a reputation of being one of South Carolina's premier high schools, with 86% of the students advancing to college. But the existing school facility was badly outdated and overcrowded.

Before designing the new school, architects at McMillan Smith & Partners received a good deal of input from the school district and neighboring businesses and residents. The consensus was that the 248,000 ft² school for 1500 students should have a classical Southern appearance. Usually, this would lead to a brick exterior, but masonry construction was incompatible with the school's aggressive construction schedule.

'One major element in expediting the erection of the building was the use of structural precast panels on the exterior.'

Precast sandwich wall panels with thin-set brick contributed to the desired look while helping to speed up the building's completion, which was finished six months sooner than originally estimated. Precast concrete column covers added to the building's traditional look. Metromont also supplied the precast components for this project.

The gym and auditorium, which form the core of the building, are masonry block on a steel structure. Erected on steel framing, the precast concrete wall panels enclosing the rest of the building offer a combination of cast-in thin-brick veneer and a sandblasted pigmented concrete. Insulation is incorporated between the exterior and interior wythes of concrete. The interior concrete wythe includes cast-in conduit for wiring and a steel-trowel finish that is paint ready.

"Although the school district did not actively pursue LEED certification, an important goal of the building program was to create an energy-efficient building that would meet many of the sustainable criteria necessary for certification," says Marvin Coker, project designer and manager.

Specifying precast concrete ensured use of local and regional materials and recycled content, including brick formliners and fly ash. Specifying 5/8-in.-thick brick veneer instead of 3 5/8-in. full-brick veneer translated into an 80% reduction in energy expended for mining, kiln firing, and transportation costs. All precast concrete components were manufactured off-site in a controlled environment, resulting in less disruption on the jobsite and a minimum of waste materials.

Several of the architects who designed the schools described here indicated that LEED certification could have been fairly easily achieved because of their extensive use of precast concrete, which makes it possible to meet so many of the required criteria for a creating a green building. In one case, only more energy-efficient windows would have been needed. But school budgets usually are very tight, and the school districts involved did not want to seek such certification.

Even so, the architects were enthusiastic about the advantages precast concrete offers and see its expanded use as the wave of the future. "You can do a lot of wonderful things with precast," Merrill says. "I am looking forward to using it again soon." ■

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

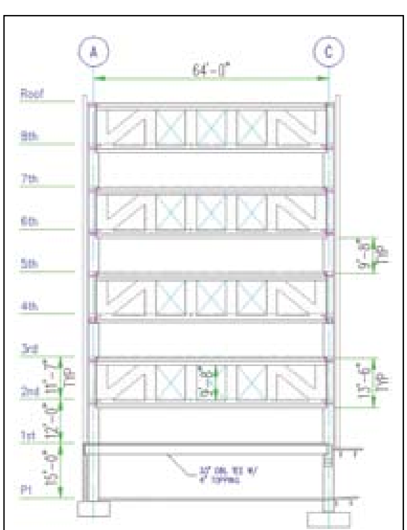
Innovative Housing Concepts Grow

— Craig A. Shutt

Precast concrete aids all types of housing to achieve sustainable, economical designs

Although the residential-housing market is not at its peak, housing projects of all types are still progressing. Many are in specialized markets such as university housing and assisted-living facilities. No matter the type of housing being created, precast concrete concepts can be applied to create sustainable, cost-effective, attractive designs.

"There aren't many condominium projects being built right now, because money is hard to come by," notes Gary Pooley, sales representative for Hanson Structural Precast Midwest Inc. in Maple Grove, Minn., which has worked on a number of such projects in recent years. "But those same designs are being used in apartment buildings, dormitories, assisted-living facilities, and other types of housing. They use similar types of designs and components, and those projects are definitely continuing."



This rendering of a 3-D schematic shows the column-free alternating floors provided by the precast concrete truss system. The system works well for housing, allowing a central corridor that remains open, similar to a double-loaded housing design.

Precast concrete offers a variety of benefits to housing projects, including:

- **Design freedom.** Precast concrete provides durability that stands up to transient residents as well as heavy equipment, including exercise machines. Hollow-core can minimize floor-to-floor heights to meet zoning restrictions while also saving material costs and labor. Hollow-core can span long distances, eliminating columns on lower floors while providing support for upper levels. And the concrete mass offers acoustical and vibration control to ensure good neighbors.
- **Sustainability.** Precast concrete's high thermal mass minimizes energy consumption naturally, aiding in the regulation of room temperature and shifting HVAC use to non-peak times. Insulated sandwich wall panels provide even higher energy efficiency. The material contributes to a variety of points in the Leadership in Energy & Environmental Design (LEED) program. And its inorganic composition and few joints ensure that moisture cannot penetrate to encourage mold growth. Wall panels also offer a durable interior concrete face, eliminating the cost of drywall, which can provide food for mold if residents allow moisture to linger.
- **Safety and security.** Precast concrete is inherently noncombustible, meeting fire codes with no additional treatment necessary, saving time and money. Its structural stability provides strong resistance to hurricane and tornado damage, and new design techniques can ensure that precast concrete buildings survive seismic events and can quickly be reoccupied.
- **Expedited schedules.** Precast concrete designs can be executed quickly, because there is less detail needed with precast's panelized system. Its ability to replicate components easily and economically speeds the construction process. The components also can be fabricated while site work begins, ensuring that components are ready to erect when the site is ready. And the panels can be erected all year round, even in harsh winter weather. Insulated sandwich wall panels provide a finished interior wall surface, eliminating the time and expense of furring strips and drywall.
- **Aesthetic options.** Precast concrete can replicate a variety of stone, granite, and brick appearances, either with embedded pieces or by casting the panels with formliners. It can adapt to any shape, curve, or geometric need, and it can be

The Cobalt Condominium project in Minneapolis, Minn., features an innovative precast concrete truss system that creates column-free space on every other floor.

Fact Sheet

Project: *Cobalt Condominiums*

Type: *Residential units, retail, parking*

Location: *Minneapolis, Minn.*

Designer: *Pope Associates Inc., St. Paul, Minn.*

Engineer: *Ericksen Roed & Associates, St. Paul*

Contractor: *McGough Construction Co., St. Paul*

Owner: *Exeter Realty Co., St. Paul*

Precaster: *Hanson Structural Precast Midwest Inc., Maple Grove, Minn.*

Size: *309,000 ft² (172,000 ft² of residential, 42,000 ft² of retail, and 95,000 ft² of parking)*

Precast concrete components: *Double-tees, open-space trusses, inverted-tee beams, truss columns, planks, solid slabs, architectural panels, spandrels, and insulated wall panels (Patent #7,010,890 and #7,275,348.)*

Project cost: *$44 million*

'The bay spacing provided by the exposed-truss system is very efficient for housing designs.'

provided in any color desired, including two tones in one panel. Designers completely control the finished appearance with the help of range samples and mock-up panels.

Innovative Truss Eliminates Columns

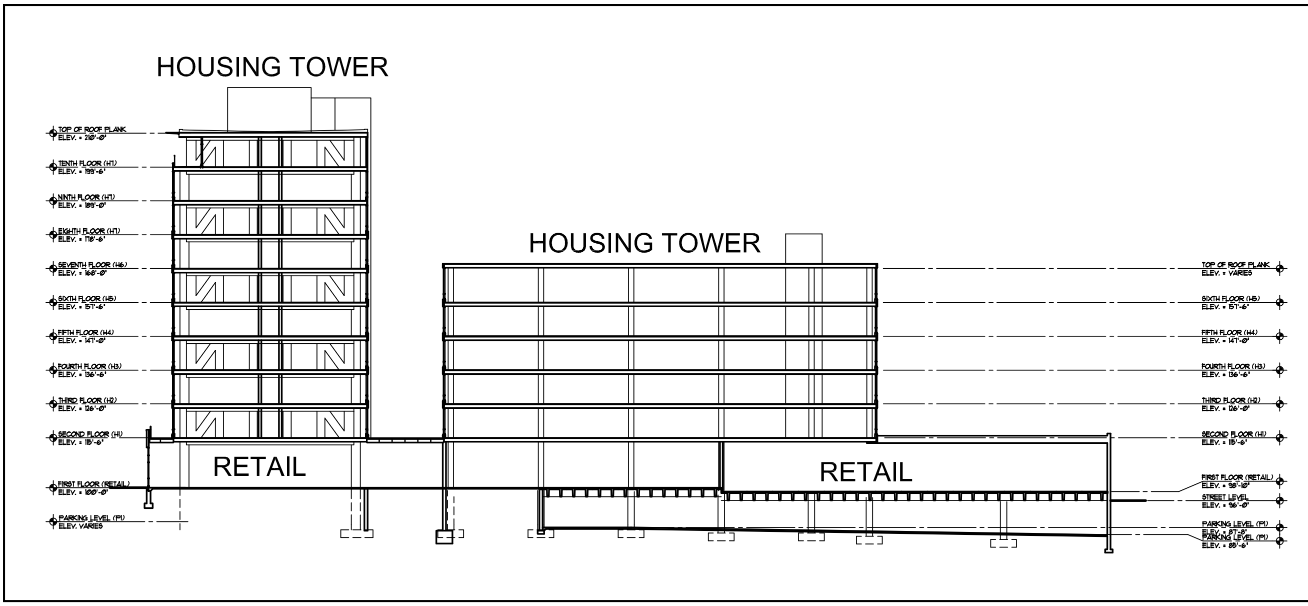
In addition to these benefits, precasters and engineers continue to find ways to refine and expand the material's capabilities, providing more diversity and flexibility for meeting designers' needs. A strong example of what can be achieved is found in the Cobalt Condominiums project in Minneapolis, Minn., which was completed in 2007. The project features an innovative precast concrete truss system that eliminated interior columns on every other floor of the complex, which consists of six- and ten-story towers plus a supermarket on the first floor.

"The bay spacing provided by the exposed-truss system is very efficient for housing designs," explains Steve Doughty, project manager for Pope Associates Inc. in St. Paul, Minn. It provides 64-ft-clear spans on alternate levels and maintains the shallow floor-to-floor height that was desired. "Even on the levels with the trusses, the design works well with housing."

The system, designed and patented by structural engineers Ericksen Roed & Associates of St. Paul, had been incorporated into several projects. These include a 9-story, 45-unit residential development in Minneapolis and a Courtyard by Marriott hotel in Rochester, Minn.; Turtle Creek Casino Hotel in Traverse City, Mich; 14- and 7-story apartment towers in Oak Park, Ill.; Staybridge Suites Hotel in Milwaukee, Wis.; and the Gateway Center student housing for Augsburg College in Minneapolis. The benefits, especially for mixed-use projects with retail on the first floor, are significant in terms of design flexibility, sustainability, and speed of construction.

The 309,000 ft² Cobalt Condominiums project features a variety of precast concrete components, including architectural panels, hollow-core, long-span truss beams supported by exterior columns, wall panels at stair/elevator shafts, and insulated panels at the foundation walls. A two-story, 95,000 ft² parking structure features double-tee decks, interior beams and columns, below-grade insulation foundation walls, and precast concrete grade beams.

"One of the driving forces behind using a system that created column-free space was the owner's need to maximize the number of parking stalls within the underground parking structure and create flexible retail layouts on the main floor," Doughty explains. Any columns penetrating the parking level to reduce the open-span length would have reduced the number of parking stalls,



The patented ER-POST system, visible at the top of the construction, provides maximum flexibility for layouts by opening every other floor, a critical benefit in the housing market.

which relates directly to the number of planned condominiums. "To optimize usable space in the project, the interior columns in the parking and retail levels needed to be minimized."

That goal was accomplished with the open-truss system, called the ER-POST system, which was value-engineered into the project after it was initially planned to use a post-tensioned, cast-in-place system. The ER-POST system features precast, prestressed concrete trusses that support two floors simultaneously. The trusses, which span between the exterior walls, are located at each column line, with bottom and top chords supporting floors. The trusses are located on every other floor, allowing odd-numbered levels to be free of interior structural supports, Doughty notes. Cobalt's ground level was designed to be as open as possible, with the exception of the extended perimeter columns and shafts from the condo tower above.

Truss Offers Benefits

In addition to its design flexibility, the ER-POST system provided some additional advantages, Doughty says. The large, modular structural members helped accelerate the construction schedule by minimizing the number of pieces to be erected, helping to enclose the building rapidly. It also allowed construction to take place on a restrictive building site, because there were minimal on-site manufacturing, laydown-area requirements, and piece erection. It could be erected in cold weather, eliminating weather-related delays and allowing work to progress quickly through the winter.

The truss system also allows exterior walls to be non-load-bearing, establishing greater flexibility in fenestration and cladding designs. It reduces the total material use for the precast concrete structure, minimizing costs and eliminating weight to make the pieces easier to handle and erect. The cross-bracing on the structural levels features supports along both sides of an open corridor, perfectly matching the typical housing design with a double-loaded corridor.

> The truss system also creates greater flexibility in fenestration and cladding designs.

The system minimized floor-to-floor heights, which was another key benefit for the owner, Doughty notes. The building code restricted the structure's height, making it critical to efficiently use the space available. "Our goal was to design as many units as possible, and the truss system provided the same benefit in that regard as the cast-in-place system."

The system added sustainable-design concepts, including enhanced thermal performance for the building, the use of recycled materials such as fly ash to replace cement, and the use of regional materials. By minimizing material use, it saved raw materials and costs as well. The elimination of interior columns also boosted daylighting, maximizing solar illumination and unobstructed views from the core of the building. The open floor plan available on every other floor, especially the first-level retail space, ensures ease of design for future tenants and less waste of materials.

"The openness was a wonderful benefit in terms of planning," Doughty says. Initially, the supermarket tenant rejected a layout that included cast-in-place columns 30 ft on-center throughout the space. The design with the ER-POST system required only eight columns in the entire space. "That's a very significant benefit," he says. It also provides a marketing benefit for future tenants, as the space can adapt to any needs that arise.

The ER-POST system did create some challenges owing to the size of the components, he notes. They required a larger crane to hoist them into place rather than tower cranes as originally planned, which created logistic concerns on the tight site. In addition, extra scheduling coordination was needed because interior crews could not work directly below where trusses were being erected on higher floors, to ensure safety. "It required more construction management to ensure the smooth construction and maintain the highest levels of safety," Doughty says.

'The precast wall panels reduced the mildew risk, because they inhibit water penetration and eliminate drywall.'

The cornice was topped with a white sandblast finish. The panels all feature $\frac{1}{2}$-in. reveals that impart surface relief to reduce the vast scale of the facade.

University Commons at Georgia State University in Atlanta, Ga., the country's largest privately funded student-housing complex, used insulated precast concrete sandwich wall panels for the shell of the four buildings in the project, which range from eight to fourteen stories and contain 2000 beds in all.

The system's fast erection played a key role in the project's success. "The speed of construction that the truss system provided was acknowledged early on, because it helped complete the project faster," he explains. "That cut loan costs and generated revenue more quickly." He estimates that the system saved $1 million for the $44 million project and cut approximately two months off the construction schedule.

"We'll be using it more, because it offers benefits," he says. In fact, some clients have approached the company about its use after seeing it utilized in the Cobalt project and others. "The speed with which the system can bring a project to market and its benefits for residential floor-to-floor needs make it a strong choice."

Dorm Uses Insulated Panels

Precast concrete components also aided the country's largest privately funded student-housing complex, University Commons at Georgia State University in Atlanta, Ga. The project consists of four buildings ranging from eight to fourteen stories, containing 2000 beds in all. The 646 apartment-style units feature a full kitchen, dining room, and living room. The buildings encircle a large, landscaped courtyard and include 17,982 ft² of retail space.

"The sheer scope of the project magnified any design decisions, good and bad," says Dale McClain, senior project manager at Niles Bolton Associates, the architectural firm on

The sheer size of the University Commons project at Georgia State University magnified any design decisions, resulting in the project team selecting non-load-bearing precast concrete sandwich wall panels with 4 in. of expanded polystyrene insulation.

Inset brick was embedded in panels used at street-level height at University Commons, to provide the same look as other buildings in the neighborhood. Higher on the building, the panels feature a buff sandblast finish.

Fact Sheet

Project: *University Commons Student Housing at Georgia State University*

Type: *University housing*

Location: *Atlanta, Ga.*

Designer: *Niles Bolton Associates Inc., Atlanta*

Structural engineer: *Browder & LeGuizamon & Associates, Atlanta*

Contractor: *Hardin Construction Co. LLC, Atlanta*

Owner: *Board of Regents of the University System of Georgia, Atlanta*

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

Size: *1.16 million ft²*

Precast concrete components: *Insulated sandwich wall panels with expanded polystyrene insulation and carbon-fiber wythe connectors*

Project cost: *$168 million*

the project. "The project team had to weigh every option for the building envelope and consider cost, performance, speed of completion, logistics, aesthetics, and many others."

After all factors were evaluated, the team specified insulated precast concrete sandwich wall panels with 4 in. of an interior expanded polystyrene insulation and carbon-fiber connectors connecting the 2- and 2.5-in.-thick concrete wythes. The connectors provide relatively low thermal conductivity, preventing hot or cold spots from forming. Metromont Corp.'s Hiram, Ga., plant provided the components.

"Initially, we planned to create a building with precast concrete panels at the base and conventional brick veneer on a metal-stud back-up above," explains McClain. "But steel availability was very tight, and the cost was high, as well as for drywall. We looked at other options, and the escalating construction costs and tight time frame led us to the precast concrete panels."

The general contractor, Hardin Construction Co. in Atlanta, previously had used the system for several low-rise projects and knew it would work just as well for this high-rise design, he says. In addition, the insulated panels provided an *R*-value of 13, compared with an *R*-value of 7.1 for the brick/metal studs/batt insulation approach.

Several Weeks Saved

Precast concrete panels were specified for several additional reasons. "Since the panels were finished on the exterior and ready to paint on the interior, it limited the cost and unpredictability of field labor as well as finishing materials," he says. "It knocked weeks, if not months, off the construction schedule."

Because the complex is located in a humid region, administrators were concerned that mildew could form in the building. "The precast wall panels reduced the mildew risk, because they inhibit water penetration and eliminate drywall from the exterior enclosure, a potential food source for mildew and mold," he says.

The wall system will provide an annual savings in fuel costs of about $54,000 when compared with the alternative system, according to a third-party MEP consultant. The panel system overcame challenges of a tight site, with space for staging and construction limited, McClain says. The panels were delivered for immediate erection, eliminating site congestion and material- and equipment-storage needs required for field-construction methods.

"Time is money," he notes. "The erection benefits of precast not only allowed the team to meet the deadline, but it reduced the anticipated and indirect costs of field labor that would have been more sensitive to price fluctuations." That was critical, he adds, because the project experienced some of the industry's highest levels of inflation in recent history during the project's programming and design phase. "We closely monitored the design to understand the impact of the project's evolution." Variance reports were provided with every estimate to keep costs in check.

Inset brick was embedded in panels used at street level to provide the same look as other buildings in the neighborhood. Higher on the building, the panels feature a buff sandblast finish. The cornice was topped with a white sandblast finish. The panels all feature $^{1}/_{2}$ in. reveals that impart sur-

Fact Sheet

Project: *Symphony House*

Type: *Condominium residences and theater*

Location: *Philadelphia, Pa.*

Designer: *BLT Architects, Philadelphia*

Engineer: *The Harman Group, King of Prussia, Pa.*

Construction management: *Intech Construction, Philadelphia, Pa., and L. F. Driscoll Co., Bala Cynwyd, Pa.*

Owner: *Dranoff Properties, Philadelphia, Pa.*

Precaster: *High Concrete Group LLC, Denver, Pa.*

Size: *507,000 ft², including 5000 ft² of retail and 400-seat theater*

Precast concrete components: *Insulated wall panels with expanded polystyrene insulation and carbon-fiber wythe connectors*

Project cost: *$125 million*

Three colors were used for the panels, with two integral with the casting and the third applied after the panels were created.

The 32-story Symphony House luxury condominiums and theater in Philadelphia, Pa., features carbon-fiber-reinforced precast concrete architectural cladding to achieve a classical look with architectural details throughout the facade. The project was honored as the best high-rise building of 2008 in the recent GreenSite Project awards.

face relief to reduce the vast scale of the facade.

The building helped create a unified image for the university, which had housed students in former Olympic sites some distance away, requiring transportation to reach classrooms and fragmenting the campus. The new facility both houses students and expands the campus, unifying it. Administrators wanted to take advantage of that by providing the housing facility with a strong appearance. "They see this building as a way to centralize their students and create a better presence overall," he explains.

Additional buildings nearby have subsequently been purchased to serve as office buildings, solidifying the university's presence in the neighborhood. "Administrators were wary that we were delivering an unproven system that could be a future maintenance issue," he says. "We had to ensure them that this was a tried-and-true system, and when we showed them the reports and examples of other buildings, everyone became comfortable with it."

McClain expects to use the precast concrete panels more in the future, he notes. "We are open to using them on other applications, even beyond housing," he says. "There is a lot more potential for the panels going forward with other projects that we're involved with."

Adding Green Benefits

Some buildings seek sustainable design; others have it thrust upon them as an inherent part of their construction. The latter occurred with the 32-story Symphony House luxury condominiums and theater in Philadelphia, Pa. Upon the project's completion, it was singled out as winner of the High-Rise category in the GreenSite Project of the Year 2008 competition sponsored by two concrete magazines.

The owner did not set out to create a project focusing on sustainable-design concepts, says Michael Ytterberg, principal at the architectural firm BLT Architects in Philadelphia. "The owner didn't have a strong goal of going green, and we didn't go out of our way to build a green project," he says. "But once we decided to use precast concrete panels, they added a significant inherent sustainable aspect that paid off for the project."

> 'Once we decided to use precast concrete panels, they added a significant inherent sustainable aspect.'

The building features carbon-fiber-reinforced precast concrete architectural cladding produced by High Concrete Group in Denver, Pa. The lightweight material reduced superstructure and foundation requirements, while innovative slab-attachment procedures reduced the number of columns in the tower, permitting more open floors. Precast concrete components also were used on the seven-level parking structure.

Designers considered creating a brick facade, but that proved too expensive and too heavy for the structure, Ytterberg explains. "We looked at other thin-concrete-panel options than the carbon-fiber-reinforced, foam-insulated panels, but none provided the benefits, especially with the amount of three-dimensional articulation we could achieve with the foam-insulated panels." At the same time, the 7-in.-thick concrete flange provided better sealing of the building than is possible with other thin-concrete-panel systems.

That detailing was critical for the design, which features a lot of setbacks and expanses of glass framed by the 7-in.-thick panels, reminiscent of 1930s art deco designs. "Some of the pieces are quite extraordinary in their design," he notes. They include the entryway, which is one architectural piece 25 ft across, 10 ft tall, and 3 ft deep.

Three colors were used for the panels, with two integral with the casting and the third applied after the panels were created. "We specified dark colors, which sometimes require so much pigment that the concrete can be difficult to make flow into the forms properly," Ytterberg explains. "But we experienced no problems."

The carbon mesh and insulated core helped lighten the panels. That allowed them to be set on the edge of the post-tensioned slab without the need for a perimeter beam. This approach avoided the need to connect the panels column to column, allowing for the elimination of some columns while creating larger openings in the wall. It also sped up the erection process.

Speed a Critical Element

Speed turned out to be critical for the project's success, he notes. Four other high-rise condominiums were being built at the same time in 2007, creating a large supply of units just as demand was dropping. Symphony House was the first to market, beating the next-closest project by nearly one year, he says. The others have recently finished or are expected to finish construction later this year.

"In this market, that speed was critical," he says. "The owner was able to sell units before the condo boom went bust. And that allowed the owner to pay off loans faster." By the end of 2008, the project was 90% occupied—and the construction loans had been paid off for one year. The next project to finish still is struggling to find buyers, he says.

"We're proud of the fact that we could use 21st-century design techniques for the building's skin while using that skin to aspire to a historic form that reflects the neighborhood and provides a rich, attractive appearance. And we achieved that while providing savings and speed that helped make the project a success."

It also was a success with the GreenSite Awards, which honored Symphony House for such factors as innovative techniques, use of innovative materials, cost- and time-saving methods, innovative engineering, workmanship, and creativity.

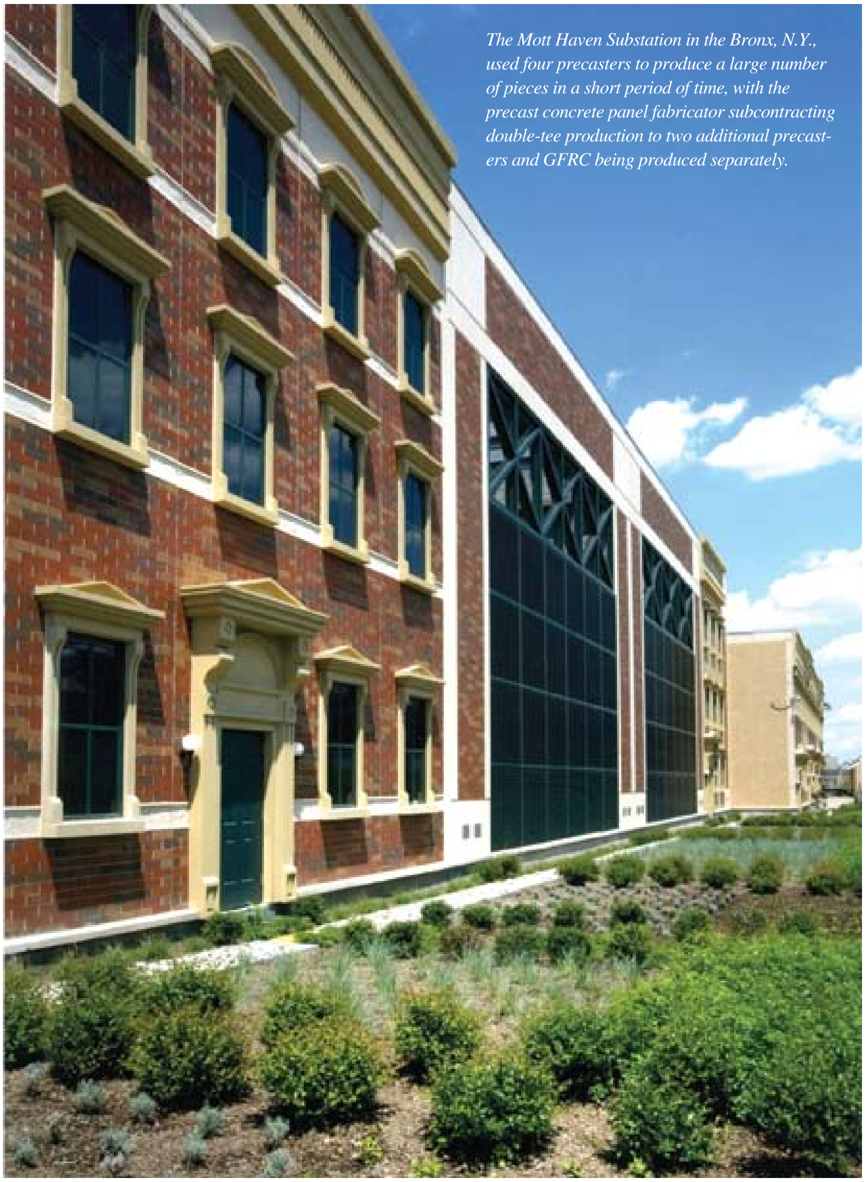
"The owner didn't focus on those ideas originally, but he does now. All of his projects are green," Being able to market high-performance residences while providing attractive, cost-efficient, and quickly constructed designs creates a successful project in any market for any type of housing project. ■

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

Precaster Partnerships Offer Project Benefits

— Craig A. Shutt

Using several precasters on a project can create benefits in speed, economics, and quality



The Mott Haven Substation in the Bronx, N.Y., used four precasters to produce a large number of pieces in a short period of time, with the precast concrete panel fabricator subcontracting double-tee production to two additional precasters and GFRC being produced separately.

Photo courtesy of Con Edison Co. of New York.

PCI-certified precasters often compete for projects in their markets. But in some cases, they team up to provide the precast concrete components necessary to complete a project. The reasons for creating partnerships, and the formats that are used, vary with the type of project and the needs of the construction team. But such partnerships can produce key benefits in speed, economics, and quality without creating challenges for the designer.

A good example of such a partnership is the Mott Haven Substation in the Bronx, N.Y., on which owner Con Edison Co. of New York served as designer and engineer. The project consisted of constructing a massive, two-story, 125,000 ft² substation in a dense urban environment on a tight schedule. It features 1150 structural and architectural precast concrete components, including wall panels, double-tees, beams, columns, and fence posts.

In addition, 2942 pieces of glass-fiber-reinforced concrete (GFRC) detail pieces were created for door and window trim, cornices, and pediments. The pieces help minimize the building's mass and create a unique neighborhood-sized facade for the structure.

The design team awarded the precast concrete contract to Coreslab Structures (CONN) Inc. in Thomaston, Conn. Coreslab, in turn, subcontracted fabrication of the double-tee units to two additional precasters, J. P. Carrara & Sons in Middlebury, Vt., and William E. Daily Inc. in Shaftsbury, Vt. In addition, David Kucera Inc. in Gardiner, N.Y., supplied the GFRC components. The project won a 2008 Design Award for Best Manufacturing Facility in PCI's design awards competition.

Single Point of Contact

"From our perspective, it was not apparent that there were multiple vendors working on the job," says Mike Corcoran, Con Edison's senior architect on the project. "And that's the way we wanted it. We needed a single point of contact to coordinate and guarantee the job and make sure all the pieces fit together. When I

Photo courtesy of Con Edison Co. of New York.

wrote the spec, I allowed for the precast to be subcontracted as needed, provided the subcontractors also were PCI-certified plants."

As Rob Del Vento Jr., sales manager for Coreslab Structures (CONN) Inc. adds, "Designers typically prefer to have a single source of communication and responsibility for these types of projects. Having to deal with multiple precasters and detailing firms can create some confusion. We recommend a single-source precaster as the lead and contract holder, giving the client a sole source of contact who manages all aspects."

There are a variety of reasons for using more than one precaster, either in a partnership coordinated by the architect or through subcontractors with one precaster as the single source of contact. The reasons include:

Schedule. "Like many of our projects, Mott Haven had a very tight schedule, with a drop-dead deadline," Corcoran explains. Due to the complexities of switching electrical services between stations, bringing a new facility online can be done only in off-peak periods. "When I need to put electricity into the system, it has to be now," he says. "Being ready to go one week from now doesn't do me any good. At that point, I might have to wait 6 months, and you can imagine the carrying costs on that."

Using several precasters splits up the work so it's easier for each fabricator to fit the production needs into the schedule. At Mott Haven, for instance, the components were erected in less than $4^1/_2$ months. That, in turn, allowed faster access for interior trades to begin installing the sensitive and complicated electrical equipment.

Coordinating between precasters isn't a problem, because each takes on the work knowing the deadline and fits it into his timetable, explains Matt Ballain, vice president and general manager at Coreslab Structures (INDIANAPOLIS) Inc. in Indianapolis, Ind.

Coreslab provided structural components while Gate and High Concrete teamed up to produce architectural components for Lucas Oil Stadium, the new home of the National Football League's (NFL's) Indianapolis Colts. Coreslab produced risers, rakers, beams, columns, vomitory walls, and slabs, while Gate Precast Co. in Ashland City, Tenn., received a separate contract for architectural precast concrete panels.

Gate assisted the architects in the early design phase and produced the portion of the 400,000 ft² of insulated sandwich wall panels required for the long east and west walls, as well as all of the arches. These panels featured an Indiana-limestone finish with blasted accents and embedded brick. The panels for the two gabled walls, which feature a similar finish, were subcontracted by Gate to High Concrete Group's plant in Paxton, Ill., with the two precasters coordinating their production of the architectural components.

Gate also subcontracted the erection of the panels to Sofco Erectors Inc. in Indianapolis, while Coreslab similarly subcontracted with the same erector for the structural components.

"There is more coordination needed among the precasters when more than one is involved," says Ballain, "but it's not that difficult because erection still comes under one company's control. The company that is delivering the pieces to be picked and erected each day is seamless."

Early Involvement. Bringing the precaster onto the project early creates a significant benefit, especially when the project's large size or schedule will require splitting the contract, Corcoran adds. "We bring the precaster in early, even before the general contractor, so he can begin working on shop drawings and create a package that we can let to the general contractor. No matter how the contract is being let, the critical issue is to involve the precaster early."

The early entry not only allows the precaster to find the most effective and efficient design for casting, delivering, and erecting the pieces, but it provides time for creating the subcontractor documents prior to needing them completed. In addition, it ensures the project a guaranteed slot in the precaster's production schedule. "By getting the contracts out early, we know we will have product coming out when we need it, because the precaster has us scheduled in advance," Corcoran explains. "Hitting that production schedule is critical to being on time. You want to get the contract out early and get on the schedule."

> 'Architects and general contractors like to take advantage of partnerships that are a good fit.'

Project Size. The sheer size of the project is just as important a driving force to using more than one precaster as schedule can be. "With large, expansive projects, it's hard to work with only one precaster and have it delivered on time," says P. J. Carrara, project manager at J. P. Carrara & Sons on the Mott Haven project. "When there are more precasters working on the project, it means it will be produced faster."

Del Vento agrees. "On Mott Haven, we determined that we would need to subcontract the double-tees to two

The load-bearing architectural precast concrete panels used to clad the 4339-car Bergen Town Center parking structure in Paramus, N.J., were subcontracted to a second precaster after the project was value-engineered to change the structural design.

precasters due to the volume," he says. "Based on the companies' production capabilities and work volume, there were 6 months' worth of tees to be produced, and we only had 3 months to do it."

This ultimately focuses on scheduling as well, but a massive size can create problems for one precaster even if the capacity is available. High Concrete Group, a subcontractor on Lucas Oil Stadium, partnered with Architectural Precast LLC in Middleburg, Pa., to bid the precast concrete components together for a new residential hall at Kean University that is still under construction on the Union, N.J., campus.

"That was a partnership of need, because we didn't have the capacity to produce the number of components that were needed," explains Mike Achilles, New York state sales representative for High Concrete. "Working with Architectural Precast ensured that together we could produce everything."

Maximizing Capacity. High Concrete also has worked with Architectural Precast through a subcontracting agreement, letting a contract to the company to produce architectural brick-faced panels and other architectural elements on a new parking structure at Bergen Town Center in Paramus, N.J., a 4339-space facility. In that case, High Concrete could have provided the panels, but it wanted to use its capacity for other purposes.

"The architect approached us about the project, which has a high number of architectural panels," explains Achilles. "We are set up to produce structural components much faster than high-end architectural panels such as those used at the Bergen Tower Center, which had to be finished on three sides and required more form changes. We decided it made more sense to use our available capacity for projects where we could provide the structural components without needing to produce panels separately. So we subcontracted the architectural panels to Architectural Precast to use our capacity more efficiently."

Skill Set. Maximizing each precaster's skills often drives a division or subcontracting arrangement. "Using several precasters can ensure you receive the best product from the best vendor," says Con Edison's Corcoran. "Coreslab produced superior architectural panels for us, but they didn't have the facilities to do those as well as the structural components. So they subcontracted the double-tees and flat slabs to make the whole job work together."

Typically in such divisions, one precaster focuses on structural elements while the other produces architectural pieces. Such a division requires little coordination, as each is fabricating a type of component with a specific function, and creating an interface for them is no different than if one precaster was producing both parts.

"Any concern about interfaces can be easily overcome by coordination meetings during the preplanning and designing of individual components," says Coreslab's Del Vento. Having a single firm design and detail all of the components regardless of which precaster produces them also can smooth this process.

Dividing contracts for architectural precast concrete, as was done on Lucas Oil Stadium, can create a separate challenge because of the high quality of finish that is required. By using PCI-certified precasters, owners and designers are assured that quality-control procedures will be followed, and the precasters can coordinate aggregates and finishes to ensure a close match between plants.

Location. In some cases, the complexity of the project and concerns about sustainability and energy use drive the decision to add a precaster. J. P. Carrara, for instance, was subcontracted by Metromont Corp. in Greenville, S.C., to produce specialized components for Gillette Stadium in Foxboro, Mass., home of the NFL's New England Patriots.

Some of the required raker beams created oversized loads, and it was more efficient for J. P. Carrara to produce those components in its Vermont plant to transport to nearby Massachusetts rather than have Metromont transport them from South Carolina. "We produced and delivered the beams based on Metromont's drawings, just as we'd do with our own drawings," Carrara says.

A similar approach worked for Tindall Corp. in Spartanburg, S.C., when it landed a contract to produce precast concrete components for a prison in Glen Falls, N.Y. Some of the required components were large and oddly shaped, restricting them from using rail cars for transport. Tindall instead subcontracted with J. P. Carrara to deliver the pieces from its Vermont plant.

Value Engineering. In some cases, benefits are derived from converting projects to precast concrete designs during the design process. Value engineering can save significant time and money, but it can result in needing more precast production time, sometimes more than the original precaster can provide.

That was the case at the Bergen Town Center Parking Structure, which was initially designed with architectural precast concrete wall panels supported by a concrete frame. High Concrete value-engineered the project to feature load-bearing precast concrete panels, eliminating the structure behind the panels but requiring the production of a new type of component. That led to subcontracting panels to Architectural Precast.

"A key challenge for the precast team is ensuring timely returns for the production-schedule changes that can occur on a large project," Coreslab's Del Vento says. "Understanding the project's schedule sequence and how it relates to the production sequence on each plant's individual portion is the key to success."

Partnership or Subcontract?

In some cases, architects prefer to control the entire precast concrete contract and split it for separate bids. Since Mott Haven was completed, Con Edison has completed four other stations, and designers purchased the precast concrete directly on two of them. "It gives us an advantage on some projects, because we can bring in all of the precasters earlier to get them working on shop drawings," he says. "When we're doing total-precast concrete projects, we've found that we can coordinate the various parts ourselves. On smaller projects, we may let the general contractor coordinate the work."

Typically, Coreslab's Ballain says, architects want to have one point of contact and a single source for responsibility. On total-precast concrete projects, that usually falls to the structural precaster, as that contract is larger and drives the architectural-panel plan. In some cases, two structural precasters bidding the same job will work with one architectural precaster. "We ensure everyone knows who we're working with up front," says High Concrete's Achilles. "We don't bid the job and then go shopping for an architectural precaster."

In some cases, the lead precaster will be determined by who has the longest relationship with the construction partners, he notes. "Architects and general contractors like to take advantage of partnerships that are a good fit. It serves the owner best when the team works well together from the beginning, and it helps us because they feel confident listening to our suggestions that can add efficiency."

The variety of benefits can build on each other, creating significant advantages to the entire project, notes Coreslab's Del Vento. "The benefit for a designer to have multiple precasters is often not realized until the final project comes together," he says. "It is important that the designer feels comfortable with the lead point of contact managing the team of precasters, as that firm can organize the project according to each plant's strengths."

Regardless of the reasons for the division of production or the specific format that the relationship takes, designers and precasters anticipate that such partnerships will continue to grow. "Especially with steel prices going up and designers becoming more familiar with the benefits of the system, there is a lot of potential for an increase in total-precast concrete structures," says Coreslab's Ballain. "As that complexity and scope grows, it will create more interest and need for using precaster partnerships." ■

'I allowed for the precast to be subcontracted as needed, provided the subcontractors also were PCI-certified plants.'

The $720 million Lucas Oil Stadium in Indianapolis, Ind., home to the NFL's Colts, features a variety of structural precast concrete components produced by one precaster, while two others fabricated 400,000 ft² of insulated sandwich wall panels in similar finishes.

Photos courtesy of Gate Precast Co.

GETTING STARTED DESIGNING ARCHITECTURAL PRECAST CONCRETE

Designer's NOTEBOOK

CONTINUING EDUCATION AIA

GETTING STARTED DESIGNING ARCHITECTURAL PRECAST CONCRETE

Whether the project being considered is a small one-story building or a high-rise structure, involving the precaster in the early design development stage of a project is advisable. Ideally, a precaster performs value engineering in response to performance requirements or offers design alternatives in response to identified needs early in the preliminary design phase to control construction costs, improve structural efficiency, facilitate erection, enhance precast concrete performance, and meet aesthetic objectives.

When the design team includes the precaster in early discussions of the design intent and desired aesthetic and functional aspects of the building's facade, it is more likely that the full benefits of architectural precast concrete will be realized. After being provided with concept drawings and, if available, plan and elevation renderings, the precaster can be a valuable resource to the design team. As the project develops, the design team and precaster can discuss:

- panel joint locations,
- panelization (panel sizing and weights),
- types of finishes and the sample process,
- cross sections,
- shapes,
- drips,
- reveals,
- panel returns,
- repetitive use of efficient and economical precast concrete modules,
- structural systems,
- approaches for connecting panels to a structure to substantially minimize costly supplemental structural framing or bracing,
- delivery schedule,
- access or site restrictions,
- erection procedures,
- and sequencing.

PCI's Architectural Precast Concrete Committee discusses some general design guidelines and coordination suggestions to begin designing architectural precast concrete.

The designer should always ask the precaster what is or is not possible or cost effective.

Many precasters also employ professionals accredited by the U.S. Green Building Council as part of its Leadership in Energy and Environmental Design (LEED) program. LEED accredited professionals (APs) can identify areas where precast concrete can contribute to achievement of sustainability objectives and LEED credits.

If unfamiliar with architectural precast concrete, the designer should visit an architectural precast concrete manufacturing plant to view the production process prior to designing wall panels. It is also advantageous to visit any projects that are under construction with finish characteristics that are the same as or similar to the proposed project. This way the designer can become familiar with the manufacturing processes and installation procedures and, most importantly, establish realistic expectations for the finished product that are consistent with his or her design objectives.

During a project's conceptual or schematic design stage, the designer has many variables to consider that affect aesthetics and precast concrete cost. Piece size and unit repetition typically have the most significant cost impacts. In addition, material selection, color, textures, surface geometries, cross sections, erection details, jobsite access conditions, and connections can affect cost.

Color and Texture Selection

Early input from the precaster on panelization and finishes can be beneficial in developing options for creating an economical design that also satisfies the designer's aesthetic requirements and meets the owner's budget. The designer should discuss the desired types of finishes and whether the precaster can accomplish the intended aesthetics.

Most precasters are eager to assist the architect in developing a design reference sample (12 in. x 12 in.) as early as possible. The best method in selecting a color and sample is to visit the precast concrete plant to view a multitude of samples and finished panels stored in the yard. Alternatively, a designer can refer the precaster to a selection from the PCI Architectural Precast Concrete – Color and Texture Selection Guide, to an existing project, or provide a piece of natural stone (or other material) to match or refer to. Samples must be made at a precaster's plant to confirm the desired colors and ensure that textures are satisfactorily matched.

Precast concrete panels may also be cast compositely with other materials to provide an entirely different finished surface. Clay products (brick, tile, and terra cotta) and natural stones (granite, marble, limestone, and sandstone) have all been used successfully as veneer facing.

Once the 12-in.-square samples are within an acceptable range, larger samples should be made to confirm that the mixture proportions, vibration, and finishing techniques necessary to make production-sized pieces could duplicate the aesthetic qualities of the small sample pieces. These panels should incorporate full-scale details of architectural features, finishes, textures, and transitions from one color or texture to another.

After award of the contract, at least three range sample panels, 15 ft^2 to 20 ft^2 (full scale, but not necessarily full size) should be produced for large projects with multiple approving entities to demonstrate actual planned production conditions. These should establish the range of acceptability with respect to color and texture variations; uniformity of returns; frequency, size, and uniformity of surface air-void distribution; surface blemishes; and overall appearance.

The designer should also view initial production or mock-up panels to evaluate conformance with approved samples. The proper use of samples and mock-ups is an important element in ensuring the project's success.

Panelization

In the interest of both economy and function, precast concrete panels should be as large as practical, while considering production efficiency and transportation and erection (crane capacity and site access) limitations. By making panels as large as possible (at least 150 ft^2 and ideally larger than that), numerous economies can be achieved: the number of required panels is reduced, fewer joints (waterproofing requirements) and connections are required, and the overall erection cost is lower (Table 1). The cost difference in handling and erecting a large rather than a small unit can be insignificant compared with the cost-reducing effects of fewer panels to erect resulting from the increased square footage of a large unit. Some precasters have size or weight limitations for panels based on their in-plant capabilities. Most precasters have

Table 1. Effect of panel size on erection cost per square foot
(Erection costs are for illustration only.)

Panel size, ft^2	Erection cost per piece, dollar amount per ft^2			
	500	1000	1500	2000
50	10.00	20.00	30.00	40.00
100	5.00	10.00	15.00	20.00
150	3.33	6.67	10.00	13.33
200	2.05	5.00	7.50	10.00
250	2.00	4.00	6.00	8.00
300	1.67	3.33	5.00	6.67

limits to size and weight of panels based on highway department limits without permits.

The maximum panel size that can be transported is affected by local conditions such as those of bridge and overhead utility clearances, site access, crane capacity, and requirements of regulatory agencies such as state and federal departments of transportation. In general, a panel up to 12 ft tall and 45 ft long is a manageable size, although larger sizes may be appropriate in certain applications where permitted.

Panel size is also a function of the design loads and support locations for connections. Panels should be designed in specific widths to suit the building's modular planning. When such a building is designed to take the best advantage of modularity, the economic advantages are significantly increased. The designer can ensure a good average piece size by spanning a full bay with spandrels and designing multistory column covers and large wall panels.

Rustications or Reveals

When using large units, if the appearance of smaller panels is desired for aesthetic reasons, rustications or reveals can be used to achieve this effect. Also, dividing large areas into smaller ones by means of rustications or reveals can help de-emphasize the visual effects of variations in texture.

When selecting accent reveals or rustication lines, it is important to tie them in to the chosen joint size. Triangular reveals should be avoided where possible because they are difficult to affix to the forms. Instead, a trapezoidal reveal will provide a flat nailing surface for the mold builders and help minimize possible nail-hole irregularities.

Table 2. Effect of repetition on panel mold square foot cost
(Mold cost is for illustration only.)

Number of uses	Panel size, ft^2	Mold cost	Mold cost per ft^2
1	200	$5000	$25.00
10	200	$5000	$2.50
20	200	$5000	$1.25
30	200	$5000	$0.83

When two different mixtures or finishes are used within the same panel, it is strongly recommended that designers include a reveal between the two mixtures to provide a distinct stopping point for each mixture and help reduce color bleed. This will help ensure an unwavering and smooth break line between the two colors or finishes.

When choosing a reveal size, also consider limiting its depth to ¾ in. Deep reveals decrease the effective structural section of the panel, thereby reducing panel strength and increasing the chance for panel cracking to reduce cost. Reveals and rustications should be placed in a repetitive pattern in order to minimize modifications throughout a mold's life.

Repetition

Two key elements to cost-effective production are minimizing the number of molds required for a project and mold changes and maximizing the number of castings from each mold (Table 2). Understanding the master-mold concept will greatly benefit the design team.

The master-mold concept is to design the largest possible mold for a particular unit, whereby several variations from the same basic (master) mold can be produced by varying mold component accessories. Units cast in this mold need not be identical, provided changes in the units can be accomplished through simple mold modifications. These modifications should be achieved with minimum change-over time and without jeopardizing the usefulness or quality of the original mold.

Cost premiums are introduced to a project when panel cross sections become more complex or intricate surface features are added. The use of bulkheads, blockouts, or reveals placed on top of the mold surface is less expensive than cutting into the mold surface for a projecting detail. Projecting cornices, bullnoses, formliners, bottom and/or top returns, and curves are the most typical features to be added. The exact sizes, shapes, and locations are some of the designer's options. Cost will also be added to the project if the locations of these features within a mold are required to be changed frequently. Alternatively, these intricate features can be added at minimal cost if they are used repetitively in the overall design or the cost can be controlled by adding details to specific forms only.

If the precaster is provided with sufficient lead time, duplicating molds to meet project schedule requirements is unnecessary. But occasionally, to meet a tight schedule, a precaster may need to construct multiple forms to produce the required number of panels within a certain time period. For designers, such a necessity can often be turned into a benefit, allowing for the creation of a completely different form that adds variety to a facade without additional cost.

With panel profiles, it is important to consider the draft required to strip the precast concrete unit from the mold as well as the draft required to achieve a specific finish. Generally, the minimum positive draft for ease of stripping the unit is 1:12, with 1:8 preferred. The draft should be increased to 1:6 for units with many openings, for narrow ribbed panels, or for very delicate units. Vertical sides or reverse drafts are to be avoided when possible, because they could entrap air voids and require costly form breakdowns and repairs after each production cast. Designers should consult their local precasters for specific draft recommendations.

Functional Aspects

One of the early decisions that the design team needs to consider is the functional attributes of the panels. In addition to acting as cladding panels, the precast concrete panels may perform other functions: they may be load bearing, be wall supporting, serve as formwork or shear walls, or be used as grade beams; they may be insulated or may provide the interior finish; they may serve partly or fully as containers of mechanical/electrical services; or they may combine several of these functions to become a wall subsystem. The total cost of an architectural precast concrete wall system may be lowered by taking full advantage of the ability of the precast concrete portion to serve multiple functions.

To take maximum advantage of load-bearing and wall-supporting units, the decisions as to their functions should be made before structural design of the building frame has progressed to a stage where revisions become costly for a given project schedule. Both the engineer of record and precast concrete design engineer should be involved from the initial concept stage of the project. Considerations should include the load effects on member dimensions, coordination of temporary bracing, connections, and erection sequencing. When using load-bearing units, it is usually necessary to award the precast concrete contract earlier than for non-load-bearing facades (cladding). See the representative project schedules given in Figures 1 and 2 showing that the precaster is a member of the design team during the schematic design phase for load-bearing projects. For cladding, the precaster usually becomes part of the team during the design development phase.

In some building configurations, the most economical application of architectural precast concrete is as gravity- and lateral-load-bearing aesthetic/structural elements. Each load-bearing element plays an essential role in the structural integrity or stability of the building. Load-bearing panels can eliminate a separate perimeter structural frame and may reduce or eliminate interior columns, a structural core, or interior shear walls, particularly in buildings with a large ratio of wall area to floor area. The increase in floor space gained by eliminating columns can be substantial and, depending on the floor plan, partition layout flexibility can be enhanced.

Wall-supporting panels, similar to cladding panels, are designed to carry no loads from the floor or roof slabs. The building frame carries only lateral loads from the panels, as all axial loads from the wall panels are supported by the foundation. This reduces the need for larger structural members around the perimeter of the building, resulting in a more economical superstructure.

Corners and Edges

Each individual project requires special attention to the design and detailing of its corners to create optimum appearance, jointing, and economy. For this reason, corner detailing should be decided early. Economy results when the building elevations are designed from the corners inward, using typical panels and avoiding special-sized end or corner pieces. Wherever possible, the designer should avoid fragile edge details.

All edges of precast concrete units should be designed with a reasonable radius, chamfer, or quirk, rather than leaving them as sharp corners, to reduce edge damage and mask minor irregularities in alignment. This is particularly important where the panels are close to pedestrian or vehicular traffic. The size of the edge's radius should be discussed with the local precaster because determination of the optimum radius depends on the selected aggregate size, mold materials, and production techniques.

Window Frame Location

Consideration should be given to the relationship between window frames and architectural features such as reveals and projecting elements on a precast concrete panel. For example, window installers discourage attempts to align the frame exterior with a series of reveals. A more successful design features window returns that create a smooth surface against which the installer can set and plumb the frames. Also, the window connection system needs to be reviewed with the precaster.

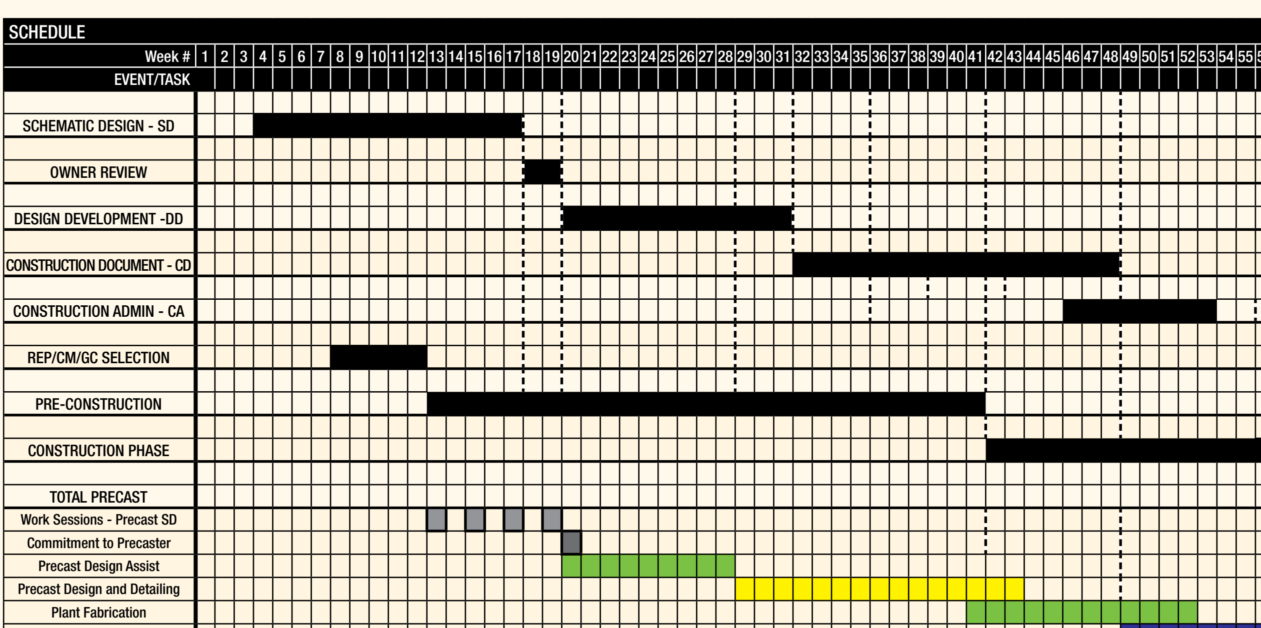


Fig. 1. Schedule for load-bearing precast concrete projects.

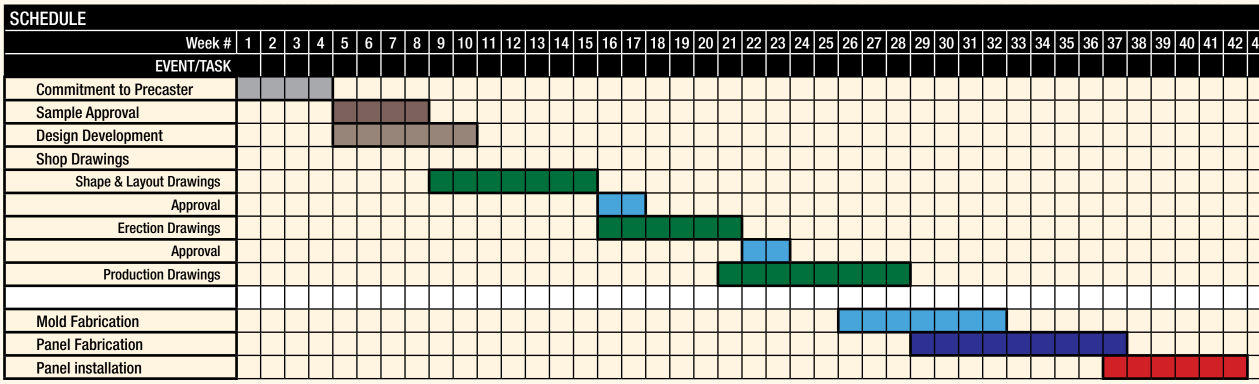


Fig. 2. Architectural precast concrete cladding project schedule.

More-accurate opening sizes are produced by panels incorporating punched openings rather than ribbon windows created by a column and spandrel system. This can be an important factor if the glass system is preordered on the job.

Contract Documents

The contract drawings prepared by the design team should provide a clear representation of the configurations and dimensions of individual architectural precast concrete units and their relationship to the structure and to other materials. Isometric sketches can help the precaster visualize details, particularly in the case of nontypical conditions such as outside and inside corners, intermediate roof levels, nontypical floors (such as ground level or mechanical floors), and entrances. Dimensional locations of details should always be tied back to a structural grid or column line.

The contract documents should supply the following information:

- *Elevations, wall sections, and dimensions necessary to define the sizes and shapes (profiles) of each different type of precast concrete element along with drip details beneath soffitted pieces;*
- *Locations and dimensions of joints and reveals, real (functional) or false (aesthetic) (the architect's drawings may only show reveals or design articulation, allowing the precaster to determine panel sizes suitable to their handling and erection capabilities in order to achieve economy and flexibility in production and erection);*
- *Required materials and color and finish treatment for all surfaces, with a clear indication of the extent of all surfaces to be exposed to view when installed;*
- *Identification of the various precast concrete finishes on the elevations and a specification or finish schedule that identifies that finish type or procedure or sample reference number;*
- *Corner and return details;*
- *Sandwich panel construction and insulation systems independent of the precast concrete;*
- *Details for jointing and interfacing with other materials (coordinated with the general contractor), including windows, roofing (connections should not puncture flashing), and other wall systems;*
- *Openings for services and equipment, with their rough opening size and location;*
- *Details for special or unusual conditions and, if the project requires fire-rated panels in specific locations, the locations and hourly ratings for these;*
- *Governing building codes, design loads including concrete strength requirements, deflection limitations, and temperature considerations;*
- *Specified dimensional tolerances for the precast concrete and the supporting structure, location tolerances for the contractors' hardware, clearance requirements for proper interfacing with other elements of the structure, and erection tolerances for the precast concrete along with clearance between the back of the panels and the structural frame of the building (in accordance with PCI's* Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products *(MNL-117);*
- *Support locations for gravity and lateral loads as well as supplemental framing or bracing to support the precast concrete (it is preferable to leave actual design of connections to precasters so they can design details and connections suitable for their production and erection techniques);*
- *Building location and site access; and*
- *Delineation of lateral bracing for structural beams or any unusual erection-sequence requirements.*

The contract documents should make reference to MNL-117, which includes Category A-1 certification of the production facility, as the industry guideline for production of architectural precast concrete elements. Exceptions to this standard or other specific requirements should be clearly set forth in the contract documents.

Prebid Meeting

It is recommended that a prebid meeting for all precasters intending to bid the project should be held at least three weeks before the bid date. At this meeting, the design team presents the precast concrete concept drawings along with plans and elevation renderings, if available, so that competitive and accurate bids will be obtained. Providing this information improves communications and resolves outstanding questions prior to preparation of cost estimates and bids. Items to be discussed at the prebid meeting include:

- *Specifications, PCI plant certification requirements, and any special provisions;*
- *Design responsibilities and lines of communication;*
- *The architect's approved finish samples with information on the mixture proportions, where applicable;*

- Prebid submittal requirements, such as proposal drawings and finish samples;
- Project schedule, shop drawing submittal requirements, and architectural review turnaround times;
- Panelization of precast concrete units;
- Mock-ups, if applicable;
- Potential problems, discrepancies, or both, found in the contract documents;
- An explanation of how and where the project's precast concrete units will be structurally attached to the building frame;
- Interfacing with other trades;
- Responsibility for designing, providing, and installing embedded items, anchor bolts, connection hardware attached to structural steel, bracing, and other structural items;
- Hardware and reinforcement finishes;
- Special erection needs (access, crane limitations, and sequence) and logistics; and
- Responsibility for caulking of precast concrete panel joints.

Production Drawings

The precaster uses the information from the contract documents to generate shape and erection (coordination) drawings and design calculations. These drawings detail elevations showing panel sizes (panelization), surface features, and panel relationships; sheets showing panel cross sections, special edge conditions, and feature details; and connections showing mechanisms and locations of load transfers to the supporting structure. If a natural stone- or brick/tile-type finish is desired, detail the stone panel to panel joints or the brick bond pattern. Panel dimensions may be dictated by brick unit dimensions to eliminate the cost of cutting the brick.

The architect reviews the precaster's erection and shape drawings in a timely manner primarily for conformance to the contract documents, then passes them along to the engineer of record for review of conformance to the specified loads and connection locations.

Penetrations and Cast-In Material

Penetrations through the precast concrete that may be required for wall hydrants, pipe penetrations, and light fixtures can be cast into the panels if locations and sizes are provided early in the precast concrete shop drawing preparation. Ideally, the location and size of these penetrations should be given to the precaster about eight weeks prior to fabrication. This amount of time ensures that the information can be incorporated into the shop and fabrication drawings. For openings less than 2 in. square or round, it is recommended that the penetrations be field cut.

Precasters can also cast various items needed by other trades into the precast concrete. These items are generally designed and supplied by others and installed in the manufacturing plant during production. It is important to coordinate this information and provide the precaster with locations and details of the cast-in items well in advance of production. As with penetrations, the precaster should be provided with locations and part details at least eight weeks prior to the start of manufacturing in order for them to be detailed into the precast concrete shop drawings. The hardware should be delivered to the precaster at least four weeks prior to the start of fabrication.

Wall-mounted devices such as canopies, awnings, flagpoles, or antennae should be clearly identified on the contract drawings (along with design loads). These devices should then be discussed with the precaster so the structural forces transmitted into the panels by those items can be evaluated and adequate panel reinforcement designed.

Mock-ups

If desired for the project, the architect and owner should authorize an expenditure for mock-ups—either of a full-scale portion of a panel or the entire typical unit—to evaluate the production methods and the finished product, including window elements. The mock-up is also an ideal mechanism for coordination of all trades with abutting materials. Mock-ups may be several modules wide by one or two stories high. Investing in such mock-ups removes uncertainties held by both the architect and owner and may lead to modifications that improve the appearance and possibly reduce the overall project cost.

If mock-ups are implemented in a timely manner, cost and schedule implications associated with revisions to the design may be avoided and measures adopted promptly to address items requiring attention, if any. Also, it may be desirable to separate the mock-up costs from the base bid so the cost can be evaluated separately.

After Award of Contract

Once the precast concrete subcontract is awarded, the designer should discuss realistic precast concrete engineering and production lead times for the project with the precaster. In addition, the architect will be asked to approve finishes and samples and promptly respond to requests for information to ensure that erection or, at least, shape drawings are approved and mold manufacture can begin on schedule.

Because mold production requires the greatest amount of production lead time, the common goal of both the architect and the precaster at the shop drawing stage is to expedite all of the details regarding the size and shape of the precast concrete panels. Shop drawings may be approved initially for mold production and subsequently for panel production.

It is vital to include precast concrete scheduling information with the bid documents. Key schedule items, such as mock-up panels, shop drawings and design submittals (including review time), mold production, production start and durations, and erection start and durations (if applicable) should be discussed with the selected precaster. The architect should work with the precaster to understand their overall schedules, not just the project schedule.

Teamwork

Properly implemented, an early and continuing partnering dialogue between the design team and the precaster will ensure optimum product quality and appearance at a minimum installed construction cost.

AIA Learning Units

This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

The Precast/Prestressed Concrete Institute (PCI) is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on request.

Instructions

Review the learning objectives below.

Read the AIA Learning Units article.

Answer the 11 questions at the end of the article and submit to PCI. Submittal instructions are provided on the Learning Units form. You will need to answer at least 80% of the questions correctly to receive the 1.0 HSW Learning Units associated with this educational program. You will be notified when your learning units are submitted to AIA.

Learning Objectives

After reading this article, learners should be able to identify the variables that have the most significant impact on costs when designing with architectural precast concrete; identify important color and texture selection issues when designing with architectural precast concrete; demonstrate understanding of the issues related to cost-effective production when designing with architectural precast concrete; identify appropriate use of contract documents when designing with architectural precast concrete; and demonstrate understanding for the functional aspects of designing with architectural precast concrete.

Ascent 2009—Getting started questions

Name (please print)**:**____

AIA member number: ____

Email (for verification of successful completion)**:** __________________________________

Q1. *Which variables have the most significant cost impacts?*
- a. Material selection, color, and texture
- b. Piece size and unit repetition
- c. Erection details and connection

Q2. *Due to the maximum transportable length in many states, panels usually do not exceed __ ft in length.*
- a. 25
- b. 35
- c. 45

Q3. *The ideal depth of reveals or rustications is __ inch.*
- a. ½
- b. ¾
- c. 1

Q4. *What is the preferred draft for ease of stripping the unit from the mold?*
- a. 1:6
- b. 1:8
- c. 1:12

Q5. *An earlier award of the precast concrete contract will be necessary when using non-load-bearing facades (cladding) than for load-bearing units.*
- a. True
- b. False

Q6. *Savings due to elimination of a separate structural frame are greatest with:*
- a. Low- or mid-rise structures
- b. Small ratio of wall-to-floor area
- c. Large ratio of wall-to-floor area

Q7. *Items not discussed at the prebid meeting include:*
- a. Panelization of precast concrete units
- b. Connection locations
- c. Openings for services and equipment

Q8. *The optimum edge radius depends on the selected aggregate size, mold materials, production techniques, and cost.*
- a. True
- b. False

Q9. *Window installers discourage aligning the frame exterior with a series of reveals.*
- a. True
- b. False

Q10. *The precaster should be provided with penetration and cast-in item locations at least four weeks prior to start of fabrication.*
- a. True
- b. False

Q11. *Mold production requires the greatest amount of production lead time.*
- a. True
- b. False

Turn it in!

When you are finished with the questions, mail to PCI, attn: Michael Potts, 209 W. Jackson Blvd., Ste. 500, Chicago, IL 60606. Or you can send your answers via email to mpotts@pci.org or fax to (312) 786-0353.

Tell us what you thought of the program!

Use the link below to complete a brief evaluation survey so that we can improve on this and similar types of educational programs.
http://www.zoomerang.com/Survey/?p=WEB228GYAT47AP

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)]."

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 Products*

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.

Please note for Group B, Category B1: Some precast concrete 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.

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 Concrete 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 supersedes Group B in the same category. For instance, a plant certified to produce products in Category B2A is also 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 Hollow-Core and Repetitive Products
Standard shapes made in a repetitive process prestressed with straight strands. Included are hollow-core 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 supersedes Group C in the same category. For instance, a plant certified to produce products in Category C2A is also 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.

ALABAMA

Gate Precast Company, Monroeville (251) 575-2803 **A1, C1A**
Hanson Pipe and Precast Southeast, Birmingham (205) 663-4681 **B4, C4**
Standard Concrete Products, Theodore (251) 443-1113 **B4, C2**

ARIZONA

Coreslab Structures (ARIZ) Inc., Phoenix (602) 237-3875 **A1, C4A**
TPAC, 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 **C3**
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**
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**
Mid-State Precast, L.P., Corcoran (559) 992-8180 **A1, C3A**
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 **A1, C1, G**

COLORADO

EnCon Colorado, Denver (303) 287-4312 **B4, C1**
Plum Creek Structures, Littleton (303) 471-1569 **B4, C3**
Rocky Mountain Prestress, Inc., Denver (303) 480-1111 **B4, C4**
Rocky Mountain Prestress, Inc., Denver (303) 480-1111 **A1, C3A**
Rocla Concrete Tie, Inc., Denver (303) 296-3505 **C2**
Stresscon Corporation, Colorado Springs (719) 390-5041 **A1, B4, C4A**
Stresscon Corporation, 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 of Delaware, Inc., Delmar (302) 846-3645 **B3, C4**
Rocla Concrete Tie, Inc., Bear (302) 836-5304 **C2**

FLORIDA

Castlestone Inc., Winter Garden (407) 877-2120 **AT**
CDS Manufacturing Inc., Gretna (850) 875-4651 **B4**
CDS Manufacturing Inc., Midway (850) 875-4651 **B3, C4**
Cement Industries, Inc., Fort Myers (239) 332-1440 **B3, C3**
Coreslab Structures (MIAMI) Inc., Medley (305) 823-8950 **A1, C4A**
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 Precast Industries, Inc., Sebring (863) 655-1515 **C2**
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**
South Eastern Prestressed Concrete, Inc., West Palm Beach (561) 793-1177 **B3, C3**
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 **C3A**
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, Conley (800) 849-6383 **C2A**
Tindall Corporation, Conley (800) 849-6383 **C4A**

HAWAII

GPRM Prestress, Kapolei (808) 682-6000 **A1, B3, C4**

IDAHO

Hanson Structural Precast Eagle, Caldwell (208) 454-8116 **A1, B4, C4**
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., Aurora (630) 355-8118 **A1, C3**
Egyptian Concrete Company, Salem (618) 548-1190 **A1, B4, C4**
High Concrete Group LLC, Paxton (217) 379-9790 **A1, C3A**
J.W. Peters, Inc., Rochelle (815) 562-4136 **A1, B4, C4A**
Lombard Architectural Precast Products Co., Alsip (708) 389-1060 **A1**
Mid-States Concrete Industries, South Beloit (608) 364-1072 **C3**
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, Greenfield (317) 891-6280 **C2**
Coreslab Structures (INDIANAPOLIS) Inc., Indianapolis (317) 353-2118 **A1, C4A**
Hoosier Precast LLC, Salem (812) 883-4665 **B3, C1A**
Precast Specialties, Inc., Monroeville (260) 623-6131 **A1**
Prestress Services Industries LLC, Decatur (260) 724-7117 **B4, C4A**
StresCore, Inc., South Bend (574) 233-1117 **C2**

IOWA

Andrews Prestressed Concrete, Inc., Clear Lake (641) 357-5217 **B4, C4**
IPC, Inc., Des Moines (515) 243-5118 **C4**
IPC, Inc., Iowa Falls (515) 243-5118 **A1, B4, C4A**
IPC, Inc., West Burlington (515) 243-5118 **A1, B4, C3A**
MPC Enterprises, Inc., Mount Pleasant (319) 986-2226 **A1, 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 **C3A**

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 (270) 826-6244 **B4, C3**
Prestress Services Industries LLC, Lexington (859) 299-0461 **A1, B4, C4A**
Prestress Services Industries LLC, Melbourne (859) 441-0068 **B4, C3**

LOUISIANA

Boykin Brothers, Inc./Louisiana Concrete Products, Baton Rouge (225) 753-8722 **A1, B4, C3A**
F-S Prestress, LLC, Princeton (318) 949-2444 **B4, C3**
Fibrebond Corporation, Minden (318) 377-1030 **A1, C1**
Rotondo Weirich, Pollock (215) 256-7940 **C1**

MARYLAND

Atlantic Metrocast, Inc., LaPlata (301) 870-3289 **B3, C1**
Larry E. Knight, Inc., Glyndon (410) 833-7800 **C2**
Oldcastle Precast Building Systems Div., Edgewood (410) 612-1213 **A1, C3A**

MASSACHUSETTS

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

Dura-Crete Products, Warren (586) 759-4286 **B2, C2**
Gerace Construction Company, Inc., Midland (989) 496-2440 **A1, B3, C3**
Grand River Infrastructure, Inc., Grand Rapids (616) 534-9645 **B4, C1**
International Precast Solution, LLC, River Rouge (313) 297-7700 **A1, C3**
Kerkstra Precast Inc., Grandville (800) 434-5830 **B1, 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**
Stress Con Industries, Inc., Saginaw (989) 239-2447 **B4, C3**
Stress-Con Industries, Inc., Detroit (313) 873-4711 **B2, C3**

MINNESOTA

Cretex Concrete Products North, Inc., Elk River (763) 545-7473 **B4, C2**
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**

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MISSISSIPPI

F-S Prestress, LLC, Hattiesburg (601) 268-2006 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., Jackson (601) 321-8787 A1, C2A
Prestress Services Industries of MS, LLC, Ridgeland (601) 856-4135 B4, C1
Tindall Corporation, Moss Point (228) 435-0160 C4A

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, 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 (605) 718-4111 B4, C3

NEBRASKA

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

NEW HAMPSHIRE

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

NEW JERSEY

Jersey Precast Corp., Hamilton Township (609) 689-3700 B4, C3
Newcrete Products, Folsom (609) 704-9400 A1, C1
Precast Systems, Inc., Allentown (609) 208-1987 B4, C4

NEW MEXICO

Castillo Prestress, Belen (505) 864-0238 B1, C1
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 Div., Manchester (585) 289-3530 C3
Oldcastle Precast Building Systems Div., South Bethlehem (518) 767-2116 B3, C3A
Rotondo Weirich Enterprises, Inc., Yaphank (404) 414-4649 C1
The Fort Miller Co., Inc., Greenwich (518) 695-5000 B1, C1
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, C4
S & G Prestress Company, Wilmington (910) 763-7702 , B4, C3
S & G Prestress Company, Wilmington (910) 397-6255 B4
Utility Precast, Inc., Charlotte (704) 596-6283 B3A

NORTH DAKOTA

Concrete Inc., Grand Forks (701) 772-6687 C4A

OHIO

DBS Prestress of Ohio, Huber Heights (937) 878-8232 C2
High Concrete Group LLC, Springboro (937) 748-2412 A1, C3
KSA, Sciotoville (740) 776-3238 C2
Mack Industries, Inc., Valley City (330) 483-3111 C2
Prestress Services Industries LLC, Grove City (614) 871-2900 B4
Sidley Precast, Thompson (440) 298-3232 A1, C4A
Total Precast Solutions, LLC, Fairfield (513) 829-3448 B1, C3
United Precast, Inc., Mt.Vernon (800) 366-8740 B4, C3
United Precast, Inc., Mt.Vernon (740) 393-1121 B3, C1

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, C1
Coreslab Structures (TULSA) Inc., Tulsa (918) 438-0230 B4, C4
Rotondo Weirich Enterprises, Inc., Sayre (215) 239-7589 C1
Tulsa Dynaspan, Inc., Broken Arrow (918) 258-1549 C3

OREGON

Knife River Corporation, 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
Castcon Stone, Inc., Saxonburg (724) 352-2200 C1
Concrete Safety Systems, LLC, Bethel (717) 933-4107 B1, C1
Conewago Precast Building Systems, Hanover (717) 632-7722 A1, C2A
Dutchland, Inc., Gap (717) 442-8282 C3
Hanson Pipe & Precast, Pottstown (610) 970-2216 B1A, C1A
High Concrete Group LLC, Denver (717) 336-9300 A1, C3A
High Concrete Group LLC, Williamsport (570) 329-4228 C3
J & R Slaw, Inc., Lehighton (610) 852-2020 A1, B3, C3
Newcrete Products, Roaring Spring (814) 224-2121 B4, C4
Nitterhouse Concrete Products, Inc., Chambersburg (717) 267-4505 A1, C4A
Oldcastle Precast Building Systems Div., 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, Youngwood (724) 755-0205 C3
Top Roc Newcrete Products Company, Erie (814) 838-2011 B4
Universal Concrete Products Corporation, Stowe (610) 323-0700 A1, C3A

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, Charleston (843) 853-9118 B4, C2
Tindall Corporation, Fairforest (864) 576-3230 A1, C4A

SOUTH DAKOTA

Gage Brothers Concrete Products Inc., Sioux Falls (605) 336-1180 A1, B4, C4A

TENNESSEE

Construction Products, Inc. of Tennessee, Jackson (731) 668-7305 B4, C4
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
Prestress Services Industries of TN, LLC, Memphis (901) 775-9880 B4, C3
Ross Prestressed Concrete, Inc., Bristol (423) 323-1777 B4, C3
Ross Prestressed Concrete, Inc., Knoxville (865) 524-1485 B4, C4
Rotondo Weirich - Trousdalz, TN, Hurtsville (215) 631-4264 C1
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., Hillsboro (254) 580-9100 B1, C1
Enterprise Concrete Products, LLC, Dallas (214) 631-7006 B3, C3
Gate Concrete Products Company, Pearland (281) 485-3273 C2
GFRC Cladding Systems, LLC, 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
Lowe Precast, Inc., Waco (254) 776-9690 A1, C3A
Manco Structures, Ltd., Schertz (210) 690-1705 B4, C4A
North American Precast Company, San Antonio (210) 509-9100 A1, C4A
Rocla Concrete Tie, Inc., Amarillo (806) 383-7071 C2
Tindall Corporation, San Antonio (210) 248-2345 C2

UTAH

EnCon Utah, LLC, Tooele (435) 843-4230 A1, B4, C3A
Hanson Structural Precast Eagle, Salt Lake City (801) 966-1060 A1, B4, C4A, G
Owell Precast LLC, Bluffdale (801) 571-5041 C3

VERMONT

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

VIRGINIA

Atlantic Metrocast, Inc., Portsmouth (757) 397-2317 B4, C3
Bayshore Concrete Products Corporation,

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Cape Charles (757) 331-2300 **B4, C4**
Bayshore Concrete Products/Chesapeake, Inc.,
Chesapeake (757) 549-1630 **B4, C3**
Coastal Precast Systems, LLC, Chesapeake (757) 545-5215 **B4, C3**
Metromont Corporation, Richmond (804) 222-8111 **C3**
Rockingham Precast, Inc., Harrisonburg (540) 433-8282 **B4, C3**
Rotondo Weirich Enterprises, Inc., Salem (215) 631-4264 **C1**
Smith-Midland Corporation, Midland (540) 439-3266 **A1, B1, C3**
The Shockey Precast Group, Fredericksburg (540) 898-1221 **A1, C3A**
The Shockey Precast Group, Winchester (540) 667-7700 **A1, C4A**
Tindall Corporation, Petersburg (804) 861-8447 **C4A**

WASHINGTON

Bellingham Marine Industries, Inc., Ferndale (360) 676-2800 **C1**
Bethlehem Construction, Inc., Cashmere (509) 782-1001 **B1, C3A**
Central Pre-Mix Prestress Co., Spokane (509) 533-0267 **A1, B4, C4**
Concrete Technology Corporation, Tacoma (253) 383-3545 **B4, C4**
CXT, Inc., Spokane (509) 921-8716 **B1**
CXT, Inc., Spokane (509) 921-7878 **C2**
EnCon Washington, LLC, Puyallup (253) 846-2774 **B1, C2**
Wilbert Precast, Inc., Yakima (509) 248-1984 **B3, C3**

WEST VIRGINIA

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

WISCONSIN

Architectural Precast, Inc., Browntown (608) 966-4370 **C3A**
County Materials Corporation, 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., Burlington (800) 877-9040 **A1, C3A**
MidCon Products, Inc., Hortonville (920) 779-4032 **A1, AT, C1**
Precast Concrete Specialties, Inc., Omro (920) 685-2727 **A1**
Spancrete Industries, Inc., 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, Calgary (403) 248-3171 **A1, B4, C4**
P. Kruger Concrete Products, Ltd., Edmonton (780) 438-2072 **A1, C1**

BRITISH COLUMBIA

Con-Force Structures, Richmond (604) 278-9766 **A1, B4, C3**

MANITOBA

Con-Force Structures, Winnipeg (204) 338-9311 **B4, C3A**
Lafarge Canada Inc., Winnipeg (204) 958-6381 **C2**

NEW BRUNSWICK

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

NOVA SCOTIA

Strescon Limited, Beford (902) 494-7400 **A1, B4, C4**

ONTARIO

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

QUEBEC

Betons Prefabriques du Lac Inc., Alma (418) 668-6161 **A1, C3, G**
Betons Prefabriques du Lac, Inc., Alma (418) 668-6161 **A1, C1**
Betons Prefabriques Trans. Canada Inc.,
St. Eugene De Grantham (819) 396-2624 **A1, B4, C3A**
Prefab De Beauce, Sainte-Marie (418) 387-7152 **A1, C3**
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) 52-1036077 **A1, G**

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

PCI-Qualified & PCI-Certified Erectors

(as of January 2009)

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

Whatever your needs, working with an erector who is PCI qualified/certified in the structure categories listed will benefit you and your project.

- You'll find easier identification of erectors prepared to fulfill special needs.
- You'll deal with established erectors.
- Using a PCI-Qualified/Certified Erector is the first step toward getting the job done right the first time, thus keeping labor costs down.
- PCI-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 are found in the following manuals:

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

MNL–132 *Erection Safety Manual for Precast and Prestressed Concrete*

GROUPS

Category S1 - Simple Structural Systems
This category includes horizontal decking members (e.g., hollow-core 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.

Certified erectors are listed in red.

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, A**

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., Centennial (303) 471-9902 — **S2**
Gibbons Erectors, Inc., Parker (303) 841-0457 — **S2**
Hardrock Structures Inc., Penrose (719) 372-6269 — **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

Blakeslee Prestress, Inc., Branford (203) 481-5306 — **S2**
Jacobs Engineering & Construction, LLC, New Haven (203) 389-4300 — **S2, A**

FLORIDA

All Florida Erectors and Welding, Inc., Apopka (407) 880-3717 — **S2, A**
Concrete Erectors, Inc., Altamonte Springs (407) 862-7100 — **S2**
Finfrock Industries, Inc., Orlando (407) 293-4000 — **S2**
Florida Precast Industries, Sebring (863) 655-1515 — **S2, A**
Gate Precast Erection Co., Jacksonville (904) 757-0860 — **2, A**
James Toffoli Construction Company, Inc., Fort Myers (239) 479-5100 — **S2**
Pre-Con Construction of Tampa Inc., Tampa (813) 626-2545 — **S2, A**
Randy J. Mellor Construction, Inc., Nokomis (941) 321-1826 — **S1**
Solar Erectors U. S. Inc., Medley (305) 825-2514 — **S2, A**
Southeast Tilt-Wall Erectors, Inc., Geneva (407) 349-3545 — **S1**
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 — **S2, A**
Precision Stone Setting Co., Inc., Hiram (770) 439-1068 — **S2, A**
Rutledge & Son's, Woodstock (770) 592-0380 — **S2**

IOWA

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

ILLINOIS

Creative Erectors, LLC, Rockford (815) 229-8303 — **S1**
Mid-States Concrete Industries, 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**

KANSAS

Carl Harris Co., Inc., Wichita (316) 267-8700 — **S2**

MASSACHUSETTS

Concrete Structures, Inc., Marshfield (781) 837-1931 — **S1, A**
Prime Steel Erecting, Inc., North Billerica (978) 671-0111 — **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 Div. / Project Services, Baltimore (518) 767-2116 — **S2, A**

MAINE

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

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MICHIGAN

Alpha Omega Development, Saginaw (989) 399-9436 **S2**
American Erectors Inc., Waterford (248) 674-0060 **S2, A**
Assemblers Precast & Steel Services, Inc., Saline (734) 429-1358 **S2, A**
Devon Contracting, Inc., Detroit (313) 965-3455 **S2**
Jardan Development, Inc., Saint Charles (989) 213-9209 **S2**
Kerkstra Precast Inc., Grandville (616) 224-6176 **S2**
Moyle Construction, Houghton (906) 482-3000 **S1**
Pioneer Construction Inc., Grand Rapids (616) 247-6966 **S2**

MINNESOTA

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

MISSOURI

Acme Erectors, Inc., St Louis (314) 647-1923 **S2**
J. E. Dunn Construction Company, Kansas City (816) 474-8600 **S2, A**
Prestressed Casting Co., Springfield (417) 869-7350 **S2, A**

NORTH CAROLINA

Buckner Steel Erection Inc., Graham (336) 376-8888 **S2**
Carolina Precast Erectors, Inc., Taylorsville (828) 635-1721 **S2**
Rabon Erectors, Inc., Archdale (336) 434-3308 **S2, A**
T & M Concrete, Inc., Waxhaw (704) 843-3292 **S2**
Tri State Erectors, Inc., Oxford (919) 603-0922 **S1, A**

NORTH DAKOTA

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

NEBRASKAA

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

NEW HAMPSHIRE

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

NEW JERSEY

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

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 Div. / Project Services, Manchester (518) 767-2116 **S2, A**
Oldcastle Building Systems Div. / Project Services, South Bethlehem (518) 767-2116 **S2, A**

OHIO

Ben Hur Constructionn Company, Fairfield (513) 874-9228 **A**
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 **S1, A**
Conewago Enterprises, Inc., Hanover (717) 632-7722 **S2**
High Concrete Group, Denver (717) 336-9300 **S2, A**
Maccabee Industrial, Inc., Belle Vernon (724) 930-7557 **A**
Nitterhouse Concrete Products, Inc., Chambersburg (717) 267-4505 **S2**
Patterson Construction Company, Inc., Monongahela (724) 258-4450 **S1**
Say-Core, Inc., Portage (814) 736-8018 **S1**
Structural Services, Inc., Bethlehm (610) 282-5810 **S1**

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**
Sector Steel LLC, Cleveland (423) 472-4552 **S1**

TEXAS

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

UTAH

Hanson Structural Precast Eagle, Salt Lake City (801) 966-1060 **S2, A**
OutWest C & E Inc., Bluffdale (801) 446-5673 **S2, A**

VIRGINIA

The Shockey Precast Group, Winchester (540) 665-3253 **S2**
W. O. Grubb Steel Erection, Inc., Richmond (804) 271-9471 **A**

VERMONT

CCS Constructors LLC, Morrisville (802) 888-7701 **S2**

WISCONSIN

Modern Crane Service, Inc., Onalaska (608) 781-2252 **S1**
Sky High Crane Rental, Inc., Hudson (715) 549-6970 **S2**
Spancrete Industries, Inc., Waukesha (414) 290-9000 **S2, A**
Spancrete, Inc., Valders (920) 775-4121 **S2, A**
The Boldt Company, Appleton (920) 225-6127 **S2, A**

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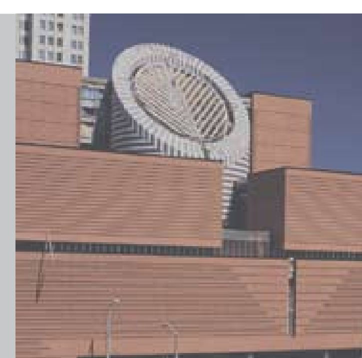

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