PROJECT DELIVERY ISSUE

SUMMER 2012

# ASCENT®

DESIGNING WITH PRECAST

CONTINUING EDUCATION AIA

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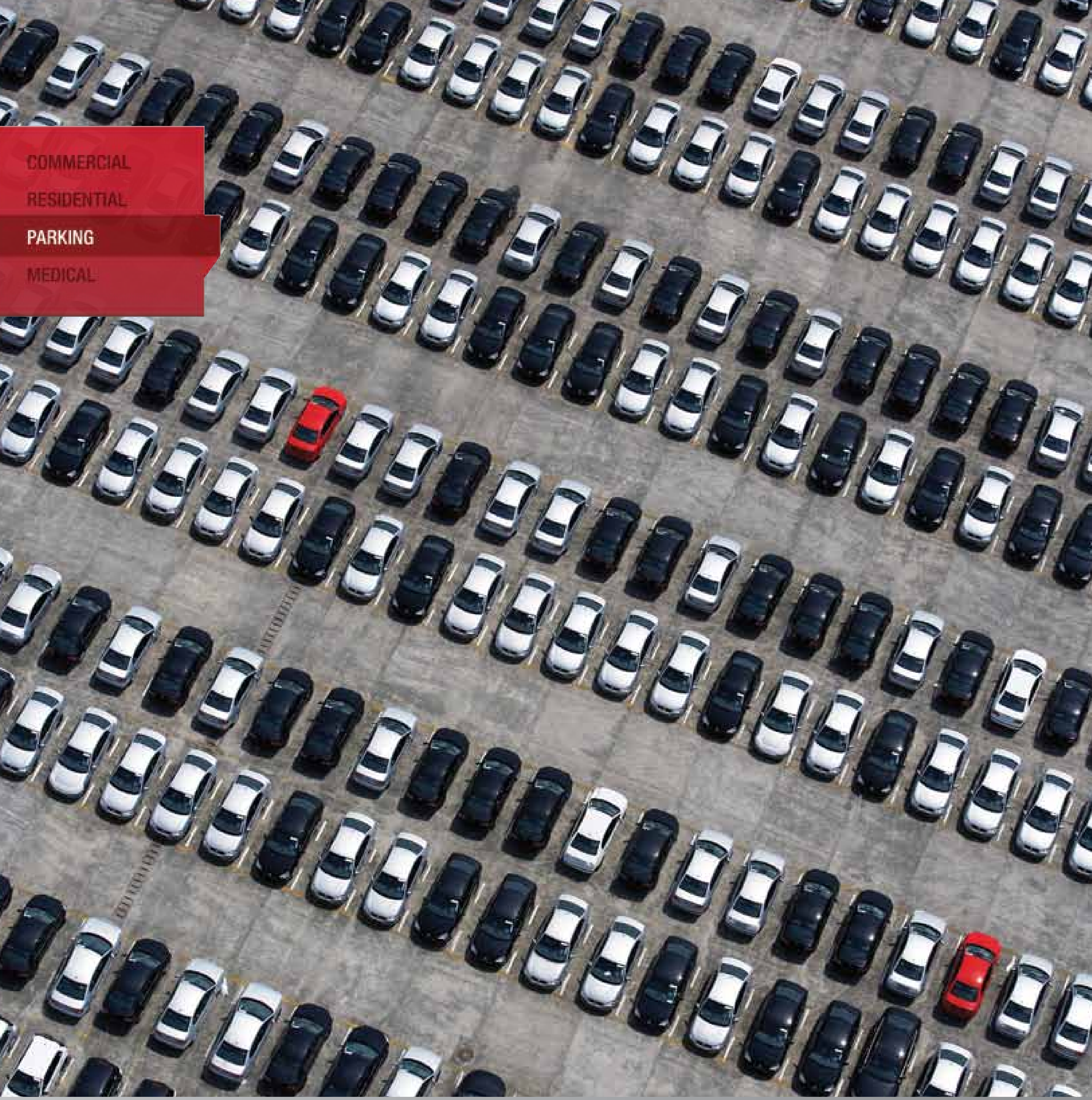
MID CENTRAL EDITION


COMMERCIAL
RESIDENTIAL
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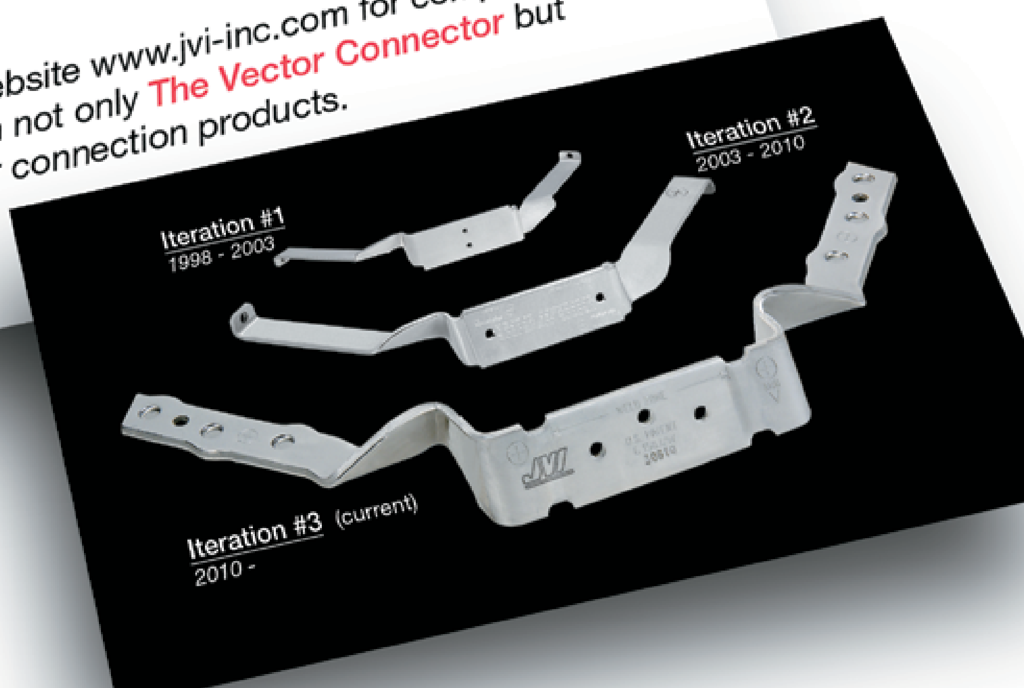
**To:** Precasters, Design Firms, All interested parties
**From:** JVI, Inc.
**Re:** Nomenclature clarification

The third iteration of *The Vector Connector* has rendered previous iterations obsolete. Appropriately, these previous versions of *The Vector Connector* are hereby retired with a hearty "well done"! Henceforth, this third iteration, which until now has been called *The Mid-V*, will now be called - simply - *The Vector Connector*.

Along with *The Vector Connector*, JVI also offers *The Mini-V*, a scaled-down version of *The Vector Connector* for thinner applications.

These two products serve most shear/alignment connection requirements for precast double tees, wall panels, and slabs. Together, they continue the tradition of being the state-of-the-art of connection technology.

*Consult our website www.jvi-inc.com for complete information on not only The Vector Connector but also our other connection products.*

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*Ascent* is a publication of PCI Precast/Prestressed Concrete Institute

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# Successful projects start with assembling the right team!

Scheduled to open in 2013, SCI (State Correctional Institute) Benner is the largest prison facility built by the Pennsylvania Department of Corrections in the past decade and, as with any complex project, teamwork has been a critical requirement for its completion.

General contractor Hensel Phelps teamed with Rotondo Weirich to create more than 1,100 modular precast cells, and US Concrete Precast Group to fabricate nearly 900 sandwich wall panels, both utilizing Thermomass insulation systems. The team approach of these four organizations resulted in cells being fabricated on-site with windows, wiring, plumbing and insulation, as well as insulated wall panels delivered to the job-site ready to tie the building structure together.

Sub-contractors were also included in the planning process, so as each module and panel were put into place, installation operations could be optimized. This increased efficiency has kept the project ahead of schedule, operations running smoothly and has ultimately resulted in a successful project.

Rotondo Weirich, US Concrete Precast Group and Thermomass have shown that a successful project begins with assembling the right team. We look forward to teaming with you on your next design-build enterprise!

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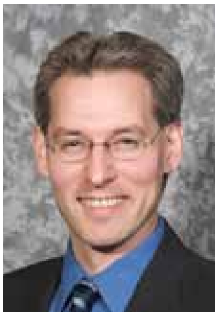
For more information, call (800) 232-1748 or visit www.thermomass.com.

# The New World of Project Delivery



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

What happened to the good old days? I can remember when a gallon of gasoline cost less than $1 for full-service. Growing up as the son of a gas station owner, I remember the concern over how we were going to add a third digit to the pump readouts (which were not digital at the time) to accommodate the famous and scary increase to $1 a gallon. Wouldn't it be nice to fill-up for under $20 today?

Many things have changed in America through the years, and building design and construction are no different. As projects have become more complex, so too have the options for delivering them. From the traditional design-bid-build, new approaches have developed, including a variety of design-build formats and Integrated Project Delivery. Each offers a different way to divide risk among the stakeholders and project team members and incorporate their talents and expertise into the mix to improve efficiencies earlier in the process.

This issue of *Ascent* magazine explores some of these delivery methods. For example, we present an overview of the design-build format, which is becoming one of the most widely used methods for project delivery. The article was written by the Design Build Institute of America, the authority on design-build.

Most of the projects presented in this issue have been delivered using the design-build method. They show a variety of ways that precast concrete components are helping to achieve the goals that design-build formats also strive to reach.

Project delivery is not the only change impacting building construction. Other influences, such as sustainable design, have caused us to think differently about project design, who is involved in it, and when they are included. More often, we are seeing key specialty contractors, such as HVAC, electric, communications, and structural and envelope system providers such as precasters, involved earlier in a project. This can be very beneficial in utilizing their expertise to help optimize designs and meet project goals.

Design Assist, for instance, allows precasters or other specialty contractors to become involved as consultants early in a project. This input ensures that the precaster's unique expertise and understanding of efficiencies—in casting, sizing, architectural finishes, load transfer, delivery restrictions, and erection efficiencies—will minimize time and material cost for these components. The result is more efficient designs, streamlined schedules, fewer project delays, and ultimately better project delivery and performance.

You can read more about Design Assist in this issue's Designers Notebook—for which you can receive 1 LU credit if you complete the included quiz after reading. No matter which method of project delivery you choose for each project, your local precaster can provide valuable input if you include him in the process as early as possible.

We hope you will always consider contacting a PCI-certified precaster as design plans are being made to take advantage of this expertise. Meanwhile, I have to go fill up my car—for about $70—and do it myself. Sometimes change can be tough.

**ASCENT**

**On the cover: The Surf Style retail store and parking structure in Clearwater, Fla. (see page 38)**

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- **POSTMASTER:** Send address changes to *Ascent*, 200 W. Adams St., Suite 2100, Chicago, IL 60606.
  Periodical postage paid at Chicago, IL and additional mailing offices.
- *Ascent* (Vol. 22, No. 3, ISSN 10796983) is published quarterly by the Precast/Prestressed Concrete Institute, 200 W. Adams St., Suite 2100, Chicago, IL 60606.

- If you have a project to be considered, send information to Whitney Stephens,
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  (312) 428-4945
  wstephens@pci.org

## Clark Pacific to Furnish Precast Concrete for New San Francisco 49ers Stadium

SANTA CLARA, CALIFORNIA

West-Sacramento-based **Clark Pacific**, a supplier of architectural and structural precast concrete solutions, will furnish precast concrete for the new San Francisco 49ers stadium being built in Santa Clara, Calif.

The new $1.2 billion, 68,500-seat stadium is being delivered as a design-build project by a joint venture of Turner Construction and Devcon Construction and design work by architect HNTB. It is projected to open in time for the 2014 National Football League (NFL) season. All precast work will be completed by early 2013.

"This is an important, highly visible project for Santa Clara and the San Francisco Bay Area, and it has a very demanding schedule," said Don Clark, president of business development for Clark Pacific. "Precast concrete is a critical aspect of Turner/Devcon's strategy to quickly build a high-quality project that will successfully serve the community for decades to come."

Clark Pacific will manufacture and install over 2,000 precast components, including treads, risers, and steps for the stadium seating as well as various stadium walls. According to Bob Clark, president of operations for Clark Pacific, the stadium components will be produced at the company's plants in West Sacramento and Woodland, Calif., and additional staff will be hired over the next several months.

## Jason Reynolds of Shockey Precast Awarded Designated Design-Build Certification

WINCHESTER, VIRGINIA

Jason E. Reynolds, regional business development manager of **Shockey Precast Group** in Winchester, Va., has been awarded the nationally recognized Designated Design-Build Professional™ certification from the Design-Build Institute of America (DBIA). This certification is awarded following successful completion of coursework and formal examination in all aspects of design-build project delivery. By completing these requirements, candidates earn the right to display "DBIA" after their names, identifying them to design-build end-users and the industry at large as professionals experienced in this form of project delivery.

## Gate Precast Company to Make High Performance Precast Concrete Panels for New Bread Production Facility

HILLSBORO, TEXAS

**Gate Precast's** Hillsboro, Texas, facility will produce high performance insulated architectural precast concrete wall panels for the exterior system of the new Ontario Bakery production facility in Rockwall, Texas.

The load-bearing façade of the bakery combines both aesthetic and structural functions. Six different mix designs will be used on the building and provide a dependable and economical alternative to higher maintenance surface-applied coatings typically used in industrial applications.

The non-corrosive interior precast concrete walls resist airborne contaminants and abrasion. A smooth, hard-trowel finish will be applied to the interior panels reducing the opportunity for mold growth and providing an easily cleaned surface. The floor and roof loads will be transferred through the structure into the foundation which simplifies construction and reduces costs. The project was also designed to take advantage of the exceptional thermal performance of the insulated concrete wall panels, which will improve the energy efficiency of the project.

Gate Precast was awarded the project in mid-March. Utilizing two cranes and two crews, Gate Precast will begin installation of over 400 precast panels on July 24, 2012, and finish enclosing the structure by the first of October. The Ontario Bakery, owned by Allen Foods which is a part of Bimbo Bakeries, USA, will be completed by December 31, 2012.

## EnCon Renew is Newest Addition to the EnCon Family of Companies

DENVER, COLORADO

**EnCon Companies** announces EnCon Renew, LLC, as its latest business venture. EnCon Renew, LLC, is a maintenance and repair company located out of the EnCon corporate office, specializing in structural and architectural concrete restoration.

EnCon provides precast/prestressed concrete systems and services for various structures. With the addition of EnCon Renew, LLC, they are able to supply corporations and individuals with the option of repairing and maintaining their building facades and structures.

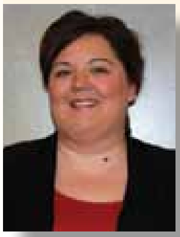
## NMB Splice-Sleeve® Launches New Website

LIVONIA, MICHIGAN

**Splice Sleeve North America, Inc.** has launched a re-designed website. The new website is designed to provide a more convenient format for visitors to find the information they need faster and more efficiently. Visit www.splicesleeve.com.

## Thermomass Names Katie Price Eastern Region Sales Coordinator

BOONE, IOWA



*– Katie Price*

**Thermomass®**, a manufacturer of concrete building insulation systems, has named Katie Price eastern region sales coordinator. Price will have the primary responsibility of coordinating sales for Thermomass' insulation systems in Florida, Georgia, Alabama, Tennessee, North Carolina, South Carolina, Rhode Island, Maryland, Connecticut, New York, Massachusetts, New Hampshire, Virginia, West Virginia, Delaware, Ohio, New Jersey, Pennsylvania, Vermont, and Maine.

## Congratulations to the Winner of PCI's Survey at the 2012 AIA National Convention and Design Expo

CHICAGO, ILLINOIS

*– David Scott*

**PCI** exhibited at the 2012 AIA National Convention and Design Expo, May 17-19 in Washington, D.C. Architects who stopped by the PCI booth were asked to take a five-question survey to be entered into a drawing to win a new Apple iPad. Congratulations to David Scott , AIA, of CRSA, who won the survey drawing and will receive a new iPad!

## Spancrete® Hires New Supply Chain Director and Human Resources Manager

WAUKESHA, WISCONSIN

**Spancrete®** has added two individuals to its team. Gaylen Haas has been named supply chain director and brings more than 18 years of supply chain and operations management experience to his role. Toni Muise has been named human resources manager and will oversee the daily management of the Spancrete® Human Resources department.

Submit your headline news for consideration in a future issue of *Ascent* to Whitney Stephens at wstephens@pci.org.

## Gate Precast Installs Precast Concrete Exterior Wall System for New Rose-Hulman Residence Hall

WINCHESTER, KENTUCKY

**Gate Precast Company** in Winchester, Ky., has finished the erection of precast concrete exterior panels on a new four-floor upperclass residence hall on the campus of Rose-Hulman Institute of Technology in Terre Haute, Ind. The 70,000-square foot, 240-bed residence hall features suite-style apartments on the first floor, and the top three floors are designed for apartment-style living.

According to Jake Wagle, Project Manager of Garmong Construction, precast concrete was selected as the exterior cladding due to speed of construction, quality, and energy efficiency. "The design-assist delivery method is greatly responsible for the success of the project being delivered in a timely manner. This building was erected and fully enclosed in a two-month period. No traditional construction methods could have provided the same quality and construction speed," Wagle said.

The aggressive schedule was driven by the desire to have the dorm ready for the 2012-2013 school year. The project is being constructed over an 11-month period.

"Precast installation enclosed the structure months earlier than traditional hand-laid system and cost less as compared to conventional light gauge framing, sheathing and masonry walls," said Jim Lewis, director of architectural systems for Gate Precast.

The residence hall will be the first structure on campus that meets LEED silver certificate standards. Precast concrete contributed to the sustainability of this project by incorporating integrated design, using material efficiently, reducing construction waste and site disturbance, improving energy efficiency, improving indoor environmental quality, and reducing noise.

## New Courses Added to PCI eLearning Center

"FEMA 361: Community Storm Shelters" is the eighth course to be added to the PCI eLearning Center. The following courses are coming soon:

- "Perspective Gained from the Earthquakes of Japan, Chile, and New Zealand"
- "The International Green Construction Code: The Next Chapter in Design"
- "Designing for Seismic Success with Precast Concrete"

The PCI eLearning Center is a free 24-hour online education resource providing architects and engineers an opportunity to earn continuing education credits on demand. All courses offer continuing education credit accepted in all 50 states.

Visit www.pci.org/elearning for more information or to register for your free profile.

## Congratulations to the *Ascent* Survey Drawing Winners

CHICAGO, ILLINOIS

Thank you to everyone who took the ***Ascent*** Readership Survey. We appreciate your time and feedback.

Congratulations to the winners of the drawing!

**Winner of the Bose SoundDock:** David Sewell, AIA, Heery International Inc.

**Winner of the Apple iPod Touch:** Evan Schwartz, AIA, Perkins Eastman

**Winners of $50 Visa Giftcards:**
Ray Beltran, P.E., Gervasio & Associates Inc.
Lori Kosmatka, AIA, Hyatt Hotels Corp.
Dan Weigandt, AIA, The Austin Company
Vincent Parente, Gilbane
David Loy, AIA, LS3P Associates

# IgCC: The Shapeshifting Code

— By Greg Winkler, AIA, LEED AP, Mid-Atlantic Precast Association

Shapeshifting is a common theme in mythology, epic poems, science fiction, Shakespearean comedy, and *Star Trek*. It can be defined as the ability of a being to change its form from one thing to another at will. It is doubtful that the word has ever been used in reference to a building code, but we finally have the code to which it can apply: *The International Green Construction Code* (IgCC).

The IgCC is an overlay code, designed to work in conjunction with the family of International Code Council (ICC) codes, but particularly with the International Building Code and International Energy Conservation Code. It consists of twelve chapters and four appendices, but the heart of the code's requirements resides in six main chapters:

- Site development and land use
- Material resource conservation and efficiency
- Energy conservation, efficiency, and $CO_2$ emission reduction
- Water resource conservation, quality, and efficiency
- Indoor environmental quality and comfort
- Commissioning, operation, and maintenance

The scope of requirements in the IgCC draws heavily from the template created by the U.S. Green Building Council in their well-known LEED standards. The IgCC addresses, for instance, all the usual suspects created for LEED in defining green buildings, including: alternative transportation, waste management, indoor environmental quality, stormwater management, and material resource conservation. Where it differs substantially from the LEED standards is that the IgCC pushes performance efficiency across all building systems as the primary driver of sustainability. So while the code includes all the requirements popularized by LEED as ways to drive societal sustainability, the overwhelming focus of the IgCC is on specific performance requirements to drive *building* sustainability through greater efficiency.

In *A Midsummer Night's Dream*, Shakespeare created Puck as a mischievous, shapeshifting sprite who both torments and guides the other characters throughout the play; sometimes intentionally and sometimes by accident. The IgCC can be viewed a bit like Puck. It has a number of built-in features that will create higher performing buildings, but the code also has so many customizable options that it will represent a difficult challenge for design professionals who engage with it in a number states. The ability of jurisdictions to partially shape the code to their liking is by design, of course. It responds to the practical and political realities of creating a new code that is both relevant to the particular needs of a region and more likely to gain widespread adoption through particular attention to addressing those needs.

The strategy seems to be working. Though officially launched at the end of March 2012, the IgCC is already in use or has been adopted by nine states, including states in northern, southern, and western regions of the country. What design professionals who engage with the code will find, however, is a fragmented landscape of requirements customized by each state (and in some states, each municipality):

**IgCC or ASHRAE?** IgCC allows a code jurisdiction to select the *ASHRAE 189.1: Standard for the Design of High Performance Green Buildings* as an alternate path of compliance under the code. This was the price of bringing the U.S. Green Building Council (which developed the standard with ASHRAE) under the IgCC tent, but it results in an awkward transition for jurisdictions in adopting IgCC's administrative provisions and applying them to a separate standard outside the code. Architects will need to become familiar with this standard as well as the IgCC provisions.

**ICC 700 for Residential:** IgCC allows the jurisdiction to designate *ICC 700: The National Green Building Standard* (a residential standard developed with the National Association of Homebuilders) as the applicable code for one and two family dwellings, and R-2, R-3, and R-4 occupancies. Conversely, the jurisdiction can require compliance with the International Residential Code, ANSI/CABO, or its own residential code.

**Jurisdictional Electives:** IgCC allows jurisdictions to designate whether 17 specific sections of the code are applicable for buildings in their territory.

*– Greg Winkler, AIA, LEED AP is the executive director of the Mid-Atlantic Precast Association (MAPA), a precast concrete trade organization representing twelve diverse manufacturers in six states and the District of Columbia. A graduate of Georgia Tech with a Masters of Architecture degree, Greg has more than 27 years of experience as an architect and project manager. He is author of three construction-related books and is currently writing a book on the International Green Construction Code for McGraw Hill Professional.*

These optional requirements include: site development and land use restrictions, percentage of waste diverted from landfills, enhanced energy performance by occupancy type, indoor air quality testing, and sound transmission/sound level requirements.

**Whole Building Life Cycle Assessment (LCA):** IgCC does not require LCAs, but it allows the owner/architect team to avoid another significant requirement if they perform one. For instance, providing an LCA allows the team to avoid complying with the building material selection requirements contained in Chapter 5 of the code. The tradeoff? The LCA must demonstrate at least a 20 percent improvement in environmental performance for global warming potential, and a similar improvement over a code compliant reference design in two of five environmental impact areas listed in the code.

**Appendix A--Project Electives:** Appendix A of the IgCC contains a list of an additional 39 requirements, spanning the full breadth of the code. Jurisdictions can use this section to significantly ramp up requirements beyond the code baseline according to their regional needs. In each of five categories, the jurisdiction will state a minimum number of electives that the project team must comply with—up to a maximum of 29 total electives. The owner/architect team can then select which requirements in each category work best with their project. Once selected, these electives become mandatory code compliance requirements for the project.

**Appendix C—The Optional Ordinance:** This section offers jurisdictions an avenue to create, in the words of ICC: "…*a fiscal and evidentiary-based adoption structure utilizing performance bonding requirements tied to the compliance verification process*." This optional adoption ordinance requires that bonds be obtained to guarantee building performance promised in the construction and permit documents. Aimed primarily at the contractor, this requirement would nonetheless introduce additional liability into the construction system, and that liability will touch design professionals as well.

Those are the potential variables in the IgCC, but it also contains some significant built-in provisions that will apply no matter what options the code jurisdiction selects. Despite the fact that the IgCC will appear in different forms in different places, its base provisions should deliver higher performance even where it is adopted in minimal form. Some baseline IgCC requirements:

- Buildings designed on a performance basis must comply with code sections that have requirements for modeled performance pathway requirements and plug load controls.
- Buildings designed on a prescriptive basis must comply with requirements addressing building envelope systems, mechanical systems, water heating systems, and electrical power and lighting systems.
- Section 605.1.1 requires that insulation and fenestration exceed the requirements of the International Energy Conservation Code by at least 10 percent.
- Section 611 requires the commissioning and completion of mechanical, lighting, electrical, and building envelope systems.
- 55 percent of constructed materials selected for each project must consist of some combination of used, recycled, recyclable, bio-based, or indigenous products.

Puck's most famous line in *A Midsummer Night's Dream* is: "*Lord, what fools these mortals be!*" The story of building codes is not always what they begin as, but what they grow into. The building code that delivered greater life safety through enhanced sprinkler requirements also delivered larger buildings of lesser construction as a tradeoff. Those paths cannot always be foreseen by the code authors, awash in the minutiae of prescriptive language, consensus votes, and after-the-fact interpretations.

IgCC has good bones. If it is not everything it could have been, it still possesses the strength of wholeness. All the traits that could eventually turn it into a great code--a powerful driver for building sustainability--are there, though sometimes hidden, Puck-like, in the appendix or in the adoption tables. Still, they are there, as building blocks for the future. We are asked to forgive the variability of the code's requirements as the price of widespread adoption, the price necessary to achieve relevance and impact.

Most importantly, the IgCC is transformational. Going forward, we will view green design mostly through the lens of life cycle costs, operating efficiency, and service life. They are where the carbon footprint, emissions, societal impact, and cost all dwell in large part. They are the new measure of sustainability. IgCC has shifted the definition of what defines sustainability, fusing it to high performance. This is no small achievement.

# Precast – The Perfect Fit for Design-Build Projects

Virtually any type of design-build project can benefit from the capabilities and efficiencies provided by precast concrete components and systems

— Craig A. Shutt

The popularity of design-build projects continues to grow, with many owners, designers, and contractors seeing the benefits in reduced costs and greater speed, constructability, and efficient problem-solving. Precast concrete enhances these benefits through its own inherent capabilities and attributes, as well as the ability of precasters to engineer the material to meet the specific needs of the project.

Precast concrete works especially well with projects where the structural frame is a dominant element in the design. This includes a variety of multi-use projects, where column spacing and the combination of multiple functions adds challenges; and parking structures, where the structural frame provides a large portion of the overall cost and time of construction. Likewise, government and high-security projects benefit from precast concrete's inherent mass and capabilities for meeting Anti-Terrorism/Force Protection (AT/FP) requirements.

Many other types of design-build projects also can benefit from using precast concrete, including offices, retail, residential, higher-education, and other institutional buildings. Fabricating precast concrete components offsite while site-preparation work is underway helps speed the project's construction, and the aesthetic versatility of architectural precast concrete panels offers a wide range of appearance options from matching a historic neighborhood to standing out with a bold, contemporary look.

The following projects give an overview of some of the ways design-build teams are using precast concrete as structural and architectural systems to meet a variety of challenges.

## Twin Retail Buildings

In today's market, developers need to keep tight budgets to ensure the success of any type of project, especially small retail buildings. When Six-Mile Investments in Mount Pleasant, S.C., decided to develop two small plots across the street from each other, the firm needed a plan that would attract tenants and customers while also providing a sturdy and attractive design on a cost-effective budget.

To achieve those goals, the developer hired Southern Construction Services in Mount Pleasant as the construction manager on the design-build team. LS3P Associates in Charleston, S.C., served as the design architect, while ADC Engineering in Charleston served as structural engineer.

"These buildings were being developed at a time when business in the area, as throughout the country, was depressed, so going ahead with any project was risky," explains Gary Long, owner of Southern Construction. "We had to ensure the project remained cost-effective while providing an attractive appearance and effective building for retailers to want to set up shop."

The two buildings, one 10,000 square feet and the other 11,000 square feet, feature a precast concrete structural system consisting of load-bearing architectural precast concrete walls and double tees for the roof structure. Thin brick was cast integrally into some of the panels, providing a contrast with the textured stucco paint used on other portions across the street. Metromont Corporation in Greenville, S.C., worked with the design team to create the precast concrete components.

In determining the most cost-effective design, the contractors considered "every type of system we could think of—stud infill, steel, tilt-up, and others," he says. "We ran all of the numbers, and the owner was still looking for a better alternative. He suggested precast concrete, so we estimated it." The team initially had not priced out precast concrete, he says, because they assumed it would be more expensive than the tilt-up concrete panels. They were surprised to learn that was not the case.

'A hurricane won't take out this building.'

"The price was just about the same, and since precast concrete provides better quality control, that made a great combination. It turned out to be the best choice." Twelve storefronts, six per building, were created for the two structures. With the contractor driving the project, the precast concrete simplified designs and construction by providing a single-source manufacturer for the entire building shell, reducing the number of subcontractors to manage and the associated liability.

The precast concrete components also enhanced the design inside and


*Photos courtesy of Metromont*

*A total-precast concrete structural solution of double tees and load-bearing architectural panels provided the building shell for these two retail buildings across the street from each other in Mount Pleasant, S.C.*

## PROJECT SPOTLIGHT

### Six-Mike Development Retail

**Location:** *Mount Pleasant, S.C.*

**Project Type:** *Two retail buildings*

**Size:** *21,000 square feet (10,000 and 11,000)*

**Designer:** *LS3P Associates Ltd., Charleston, S.C.*

**Owner:** *Six Mile Investments Inc., Mount Pleasant, S.C.*

**Structural Engineer:**

**Construction Manager:** *Southern Construction Services, Mount Pleasant, S.C.*

**PCI-Certified Precaster:** *Metromont Corp.*

**Precast Components:** *Double tees, load-bearing architectural panels.*

The double-tee roof design created column-free areas that made it easy for retailers to lay out their spaces.

out, he notes, as the inlaid thin brick provided architectural details and a traditional look that suited the neighborhood and the owner's marketing plan. A quirk miter joint was used at corners with the brick facing to eliminate corner joints and reduce costs. Inside, the double-tee beams provided 60-foot clear spans. "That makes it really simple for retailers to lay out their store," he says. "There are no structural columns, so any layout will work, and they can change it easily." Chord connections were cast into the double tees, eliminating the need for a structural topping. Roofing material was applied directly to the double tees.

The precast design also sped up construction, he notes. "You spend more time upfront on shop drawings, but time on the site is reduced substantially." Part of the drawing time ran concurrent with foundation planning and surveying. "We wanted to ensure that the weld plates in the footings were precise so when the precast concrete arrived, everything matched perfectly." That meant a shorter construction timetable with fewer disruptions to traffic and other businesses.

With sufficient access around the site, the two buildings were erected quickly, with the smaller one taking only five days and the larger one requiring six days. Some units painted the backside of the precast concrete walls and used them as the finished interior surface, while some tenants did their own finishes such as furring out and drywalling. Some also kept the double-tee stems exposed, painting them to create a distinctive interior look.

Precast concrete's inherent resiliency also helped meet the high seismic needs of the area as well as helping provide wind and impact protection against hurricanes, which sometimes hit the South Carolina coast. "The precast system is so strong that no additional requirements were needed to ensure it could resist the seismic and wind needs," he says. Hurricane-resistant impact glass was used in the storefronts to ensure the buildings could withstand 140-mph winds. "A hurricane won't take out this building."

As a final touch, LS3P architect Brian T. Wurst designed distinctively different aluminum canopies to shade each entry, providing an additional bit of personality to each store and highlighting their entrances. They were secured to the precast panels without a problem.

The result was a quickly erected building that was ready to rent rapidly, and a design that attracted businesspeople. The stores are 100% leased. "Tenants really like the stores, because they have a sense of permanence and durability to them," he says. "Having no structural columns inside is a definite plus."



*Revising the aesthetic plan for the Wickford Junction parking structure as design work progressed allowed the design-build team to create a final look that closely mimicked the appearance of the area's old mill buildings, including brickwork, window designs, and other features.*

## PROJECT SPOTLIGHT

**Wickford Junction Parking Structure**

**Location:** *North Kingstown, R.I.*

**Project Type:** *Parking structure*

**Size:** *250,896 square feet*

**Designer:** *Walker Parking Consultants, Boston, Mass.*

**Owner:** *Rhode Island Department of Transportation, Providence, R.I.*

**Erector:** *Gibbons Erectors, Englewood, Colo.*

**Structural Engineer:** *BVH Integrated Services, Bloomfield, Conn.*

**Contractor:** *Manafort Brothers Inc., Plainville, Conn.*

**PCI-Certified Precaster:** *Blakeslee Prestress Inc., Branford, Conn.*

**Precast Components:** *Double tees, girders, columns, shear walls, wall columns, spandrels, stairs, solid slabs, and wall panels.*

*Photos courtesy of Walker Parking Consultants*

'Making the changes required a complete understanding of the capabilities of the total-precast concrete system and the aesthetics it could provide.'

## Wickford Junction Station

Parking structures require special attention today as communities are more concerned than ever that these facilities blend with their surroundings and do not draw attention to their often massive size. This was exactly the problem facing the designers of a large parking structure in an historic Northeastern community. After a design-build team value-engineered the owner's original design concept for a 1,101-car parking structure in North Kingstown, R.I., the aesthetic goals for the Wickford Junction facility not only blended well into the adjacent architectural fabric but they also invoked the community's past.

The 330,000-square-foot, three-story parking structure and commuter-rail station was developed with a combination of private-development and public funds to provide parking space in conjunction with a commuter railroad station. The town is well known for its Colonial textile-mill buildings, and the owner wanted to invoke some of that context to help the structure blend in.

"The owner's intended design called for a precast concrete structure, and a general plan and exterior elevations had been prepared," says Gary Glines, project manager for Walker Parking Consultants in Boston, Mass. "We worked with BVH Integrated Services and Blakeslee Prestress to refine the design to make it more efficient for precast concrete components, but we didn't change the basic plan diagram. We tried to optimize the use of the floor area and to creatively fit the required number of cars into the smallest space that could be constructed."

The precaster proposed using 12′6″ wide double tees for the 525-foot-long structure, along with columns, beams, shear walls and Kframes, spandrels, stairs, solid slabs, and wall panels. "They created an efficient design that minimized the number of precast pieces, while we adjusted the pattern of vehicular flow and geometrics for functional efficiency," Glines says.

The owner asked for plans for the original design, as well as suggestions for alternative technical concepts explaining how the team could change the plan to make it more cost effective, using fabrication tips, structural efficiencies, and other enhancements. Although the schedule was tight to simply complete the project as designed, Walker's team proposed an alternative technical concept for the exterior appearance, proposing that precast concrete panels embedded with thin brick could provide a more historically appropriate solution than the developer had suggested.

'The process was very proficient and well coordinated.'

To consider this option fully, they studied existing mill buildings in the area as precedent for a new design proposal. The new design, which was accepted by the owner, uses key elements of those historic mill buildings, such as overall massing, the color and style of the brickwork and other materials, window proportions, and articulation of the building elements.

The use of a design-build team allowed the aesthetic touches to be revised without conflicting with the fast-track schedule, Glines notes. "Making the changes required a complete understanding of the capabilities of the precast concrete system and the aesthetics it could provide," he says. The team created a look with embedded thin brick, but it also provided corner details and setbacks to provide shadows and relief.

"A lot of buildings with thin brick can look very flat if you don't take care to understand the nature of the materials and what can be done with them," he explains. At the corners, for instance, the team eliminated the bricks and used exterior precast concrete perimeter columns that simulate limestone. This modification kept the panel widths consistent, expedited production, and avoided corner joints.

Thin brick corner units were used for returns in some areas, such as at recesses, expansion joints, and windows to give the brick a three-dimensional look, Glines notes. In some areas, the design also incorporates soldier-course accents of brick, which are laid vertically to add visual interest. These soldier courses are set back one-inch from each other to emphasize their design.

At the base of the building at grade, a light gray concrete mix with black flecks was used to mimic the look of granite from the area. "Our goal throughout all aspects of the design was to recreate the look of a traditional mill building," he says.

The window opening pattern and rhythm helped the design to meet that goal. "To replicate the tall, narrow windows of traditional mill buildings required some sleight of hand, as the building code requires a vehicular bumper wall and guard rail up to 42 inches above the floor," Glines explains.

The window openings begin at that height and extend to the underside of the double-tee flanges of the floor above. The window openings are placed between the double-tee stems that are located six feet on-center. Placement of these window openings was worked out carefully to avoid having to make any cuts in the thin brick that is cast into the panels.

Flat arches were added at the tops of the window openings using stone-like precast concrete accents. Horizontal bands were added at each level to hide the horizontal panel to panel joints, while vertical joints are often set back into corners and out of sight. "It all went together extremely well, and much of that resulted from our team's knowledge of what the system can do and what could be created using it."

Part of that success resulted from using three-dimensional modeling software to review panel designs and connection details for the large structure. This allowed the precaster to design more efficiently and provide more helpful visual aids when discussing challenges with the architect as the design progressed.

Blakeslee's team used its knowledge and experience of precast concrete in combination with this emerging technology to offer immediate feedback during design development, including cost controls, while maintaining schedule demands. The three-dimensional model was then used to create plans and details for the fabrication and erection of the precast. The highly detailed model and shop drawings accounted for the size, location, and orientation of every brick in the structure.

Erecting the structure also proved challenging, as the adjacent rail line remained operational throughout construction, including high-speed rail service. "The process was very proficient and well coordinated." Blakeslee manufactured 687 pieces and about 20 pieces were erected per day. Most required little or no additional finishing, thus, no additional trades onsite, which saved both time and money.

Even with the change in design, the Wickford Junction parking structure opened on time this April, alleviating the tight supply and encouraging more people to use the train. To prepare for continuing demand for public transportation, the building was designed with a stronger lateral-load system so that two 80,000-square-foot levels could be added on top of the building to serve more commuters.

## Mountain View Medical Center

A panelized façade design of precast concrete and glass-fiber reinforced concrete (GFRC) walls facilitated the delivery of panels on a just-in-time basis for expedited erection, at the Mountain View Medical Center in Mountain View, Calif.

The state-of-the-art, 250,000-square-foot medical office building is owned by the Camino Medical Group of the Palo Alto Medical Foundation, an affiliate of the Sutter Health Systems. The three-story center includes more than 13 physicians' offices, 260 exam rooms, 34 treatment rooms, a 20,000-square-foot outpatient surgery center, 30,000-square-foot laboratory and diagnostic radiology center, infusion-services department,

'We created performance metrics that made the design and building teams accountable to each other.'

*Using GFRC panels on this medical office building lessened the panels' weight sufficiently that a crane could erect them from only one location, helping retain the heritage trees on the site that were used as a healing garden.*

## PROJECT SPOTLIGHT

### CMG Mountain View Campus Medical Facility for Palo Alto Medical Foundation

**Location:** *Mountain View, Calif.*

**Project Type:** *Medical office building*

**Size:** *250,599 square feet*

**Cost:** *$101.5 million*

**Designer:** *Hawley Peterson & Snyder Architects, Mountain View, Calif.*

**Owner:** *Alto Medical Foundation/Camino Division, Mountain View, Calif.*

**Structural Engineer:** *KPFF, San Francisco, Calif.*

**Contractor:** *DPR Construction Inc., Redwood City, Calif.*

**PCI-Certified Precaster:** *Walters & Wolf Precast, Fremont, Calif.*

**Precast Components:** *Glass-fiber reinforced concrete (GFRC) panels and architectural precast concrete panels.*

*Photos courtesy of Hawley Peterson & Snyder Architects*

6,000-square-foot urgent-care center, and a pharmacy. The structure was built with a steel framing system as the support for GFRC panels, many with a two-color integral brick appearance.

The project was designed using integrated-project delivery (IPD), highlighted by virtual-model collaboration and information sharing across the design-construction team which was centered at the jobsite, explains George Hurley, senior project manager on the project and now project executive at DPR Construction in Redwood City, Calif.

"We didn't have a contract that specified IPD, because one was not yet fully developed, but we created performance metrics that made the design and building teams accountable to each other," he says. Those parameters included maintaining the contract price while looking for innovations that would lessen cost and provide efficiencies. "We are seeing more of that type of approach now, because it improves project quality, reduces costs, and promotes faster construction. But at the time a few years ago, it was fairly unusual."

"It was a very fast-track project, which lends itself to this type of delivery system," explains Scott Sass, project manager on the center and now project executive with DPR. "It was very helpful in allowing us to keep the schedule and maintain our commitments on the project."

One of those commitments was a promise to the city to respect the site, which includes a grove of heritage trees. To achieve this, the building was organized along and around the trees, providing a verdant courtyard that serves as a "healing garden" for the medical center's patients.

"We created the design to work around the canopy of trees and produced a workaround to ensure the park area wasn't disturbed," Hurley says. "The goal was to retain the older trees, which also worked very well with the functional needs of the building."

"This created challenges," Sass agrees. "It produced a pinch point at the center of the project that complicated delivery of materials and erection, but it produced an incredible design component." Especially with a major state highway adjacent to the building, the trees help absorb sound and provide a bit of solitude for patients and employees where one otherwise would not exist.

## Retaining the grove of trees created a pinch point at the center of the project.

The connection between the building and this natural site was heightened by the use of brick-like GFRC and a muted, but vibrant color palette that included four colors within the panels. The brick-textured appearance of the GFRC panels was created by laying out a pattern of bricks at the precaster's plant and producing a rubber mold from that pattern, which was then used to cast the panels. Walters & Wolf Precast in Fremont, Calif., developed the plan and provided the GFRC panels.

The panels' authenticity was enhanced by a two-color procedure, in which the brick-red color was cast into the brick modules, like the cups in an egg carton, after which a darker gray color was sprayed on to coat the spaces between the bricks. This created a darker 'mortar' color that simulated the coloration of real brick and mortar. Spandrels with reddish accents were used in other locations to provide contrast, and the three textures—brick, plus light and medium sandblast finishes—added dimension.

Walters & Wolf Precast provided another benefit to the panels by having its glazing division create and install the windows in the panels before they were shipped to the site. Designers devised the panel geometry to ensure the windows could be installed easily into each panel, which was then delivered to the site and picked from the truck for just-in-time delivery. With the windows already installed, the building's shell was virtually complete once the panels were in place. This approach saved about three months in the schedule.

Because of the tight site and the constraint of the highway along one side of the building, all of the panels had to be erected over the building from one crane position on the other side of the building. This necessitated the use of GFRC panels rather than precast concrete panels, as the brick-embedded precast concrete panels would have been too heavy to lift over the building. A 600-ton all-terrain crane was used to erect the GFRC panels, which took only six weeks.

"The fast-track nature of the project led to the GFRC skin being designed at the same time the steel frame was being designed, so there had to be tight tolerances to ensure everything worked," says Sass. "Walters & Wolf Precast was nipping at the heels of the frame design, which is what we needed to keep to our schedule. Early, coordinated involvement by everyone was critical to ensuring this worked."

The east- and west-facing wing walls feature GFRC panels, including some radiused panels, while the pavilion is enclosed with glass in paint-finish aluminum framing and capped by a butterfly roof section raised above the third floor with a cylinder of clerestory windows. It is supported on four monumental GFRC-clad columns. GFRC spandrels interrupt the glass walls at the floor lines as well as forming the perimeter of third-floor balconies on both the north and south sides. Precast concrete sunshades on aluminum frames were designed for the third-floor windows.

The city had final approval on the style and coloring of the panels, and the precaster provided a number of full-size mockups to show the review committee what would be used. "They did a great job of providing just what the committee needed to see to ensure they were satisfied with the final look," Hurley says. "There were many different panel types and colors, and all had to be approved for color, texture, and style."

An adjacent 1,100-space parking structure was clad with architectural precast concrete panels to provide a complementary look to the medical center. The parking structure was constructed concurrently with the medical center, adding additional site congestion and greater coordination.

"The site complications created huge logistics issues that had to be resolved," says Sass. Ultimately, an aisle way was left out of the front of the parking structure, where the crane was positioned, so the contractor could erect the panels on all four elevations of the frame. Then he worked out of another aisle way left out of the center of the parking structure to finish up. The parking structure was built from both ends toward the center, allowing the aisle way to run through the center of the structure to reach the medical center, which then was filled in to complete the project.

## PROJECT SPOTLIGHT

**Defense Information Systems Agency Headquarters**

**Location:** *Fort Meade, Md.*

**Project Type:** *Federal information technology and office center*

**Size:** *1.07 million square feet*

**Cost:** *$369 million*

**Designer:** *RTKL Associates Inc., Baltimore, Md.*

**Owner:** *United States Department of Defense, Washington, D.C.*

**Structural Engineer:** *Thornton Tomasetti Inc., Washington, D.C.*

**Construction Manager:** *Hensel Phelps Construction Co., Chantilly, Va.*

**PCI-Certified Precaster:** *Gate Precast Co., Oxford, N.C.*

**Precast Components:** *Architectural precast concrete panels.*

*Photo courtesy of Gate Precast Company*

*Photo © RTKL.com*

*Photo courtesy of Gate Precast Company*

*Photo © RTKL.com*

*The architectural precast concrete panels fabricated for the three-building Defense Information Systems Agency Headquarters in Fort Meade, Md., had to meet specific blast-resistant criteria as well as provide an air barrier and other characteristics. The precast concrete panels helped the building achieve LEED Gold certification.*

> To meet the fast-track schedule, the team leveraged the efficiencies of each building-system solution.

A coordinated modeling process was created to ensure smooth collaboration and provide a partnership to resolve issues and challenges, Hurley notes. "Better document coordination resulted in fewer construction-coordination issues to resolve and less rework," he says. "There were no RFIs or change orders from interferences for conflicts between the 3D modeled systems." The subcontractors reported only 43 hours of rework out of 25,000 hours of work on the project.

## High-Tech Info Center

The design-build team tasked with creating the Federal Defense Information Systems Agency Headquarters in Fort Meade, Md., faced a daunting challenge. Department of Defense officials wanted the 1.07-million-square-foot building to enable "information dominance in defense of our nation," says Bill McCarthy, vice president in charge of the project at RTKL Associates Inc. in Baltimore, Md.

To reach that goal, the architect partnered with Hensel Phelps Con-

'The precast concrete system provided the most cost-effective, robust solution.'

struction Co., DCEngineering PC, and Gate Precast Company to create a design that features three same-sized buildings clad with architectural precast concrete panels secured to a steel frame. The panels not only provide the aesthetic requirements of the project but also helped achieve the Anti-Terrorism/Force Protection (AT/FP) demands for a high-security government facility and aided in reaching LEED Gold certification.

The complex contains an office building, information-technology lab, conference center, training center, fitness center, and cafeteria. Due to the around-the-clock activity in the center, it was designed with diverse and redundant power, water, and building-automation systems to monitor and control the building. The buildings, which serve 4,300 employees, are connected and surround a central courtyard.

The project used a fast-track design-build process and required the early turnover of a number of program elements, McCarthy says. To meet the schedule, the team leveraged the efficiencies of each building-system solution, including the precast concrete. The precaster served in a design-assist capacity, working with the design-build team during the bidding process to develop an exterior system that was modular, appropriately detailed, aesthetically pleasing, and quick to erect.

"The precaster provided accurate technical information from the very beginning, allowing us to design based on real dimensions and characteristics rather than on assumptions and approximations," McCarthy says. "This improved the quality of the project and also helped manage overall project costs for a competitive-bid award." After the award, he adds, the team worked directly with the client to ensure that design goals were met and the facility achieved the desired appearance.

Creating a modular concept was critical to the project, McCarthy explains. "For a design-build project, it is important to come up with modular solutions that can be well refined in design and coordinated across all disciplines. These lead to budget economies, reduced schedules, and increased quality control."

The precaster was one of several that presented a concept to the design-build team prior to submitting proposals, which was then selected for the team's bid. Before the proposal was submitted, the team met every week to work through issues and create efficiencies in their proposed concept to meet the government's RFP. Although this required much upfront work with no assurance of a return on the investment, it paid off for the precaster, as about 70% of the submittal and shop drawings were completed when the contract was awarded.

The architectural precast concrete panels consist of panels embedded with thin brick along with some buff-colored lightly sandblasted panels. "The use of samples, mock-ups, renderings, and review meetings allowed the team to quickly finalize design intent and get approval for production," McCarthy says. The buff-colored panels were used for accents and to provide contrast, especially at the entry and other key points, such as window sills.

## AT/FP Standards Met

A key element was the need to provide sufficient reinforcing and connection security to ensure the panels would withstand the blast parameters the government set for the facility. Adaptations were made to standard panels to ensure the entire wall system, with windows installed, would resist the blast forces. "The engineered precast concrete system provided the most cost-effective, robust solution for the project," he says.

The most difficult part of the precast concrete design was the sheer volume of the job, which amounted to nearly 175,000 square feet in 780 panels. Typical panel size was about 9 feet, 6 inches by 30 feet, with a weight of 33,500 pounds. Logistics coordination of casting and delivering that volume of material kept the plant busy for many months. But the upfront design-build effort allowed the fabrication to move smoothly with no surprises on site.

The panels were designed and erected in a vertical position so no more than two panels were needed to enclose the building's height. The panels' width was determined by casting them one-third of the column spacing in each section. The most challenging aspect came where the three buildings join at a unique intersection.

"The differences in grades, building geometries, and overall construction accessibility supported the selection of precast concrete as the preferred exterior system," he says.

The panels also needed to include a tested air-barrier system, which was greatly facilitated by the precast concrete panels, McCarthy notes. A spray-foam insulation back-up was applied to the panels, with joints incorporating double-backer rods and sealants. "The final tested system surpassed the project's criteria," he says.

As a Federal government facility, the project also had to meet strict sustainable-design standards of a LEED Silver certification or higher. Ultimately, the project was awarded Gold certification. "A large contributor to this achievement was the use of the precast concrete panels," McCarthy says. "It allowed for an extensive use of recycled materials, use of local materials and production, limited site disruption, and contributed to reduced overall energy costs."

The precast offered other benefits, too, he adds. "The off-site fabrication and efficient modularization also allowed just-in-time delivery and erection." That ensured the site remained free of congestion, increasing safety and helping to speed construction.

The result is a formidable building that serves a large base of government employees while offering a stylish, institutional look. It also provides durability and security while offering one of the most efficient designs for sustainability in the country.

These projects show some of the ways that precast concrete structural and architectural systems can be used to meet the challenges of design-build projects of all types. Regardless of the delivery method used, consulting with the precaster early in the process ensures that the design results in a cost-effective, aesthetically pleasing, and quickly erected project.

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

# Corrections Evolution

HOK's James Kessler has seen designs for correctional and justice facilities evolve due to new philosophies, design-build formats, and precast concrete techniques

— Craig A. Shutt

*James Kessler, AIA, HOK*

Designing correctional facilities may seem like a thankless task, as the imposed limitations reduce an architect's capability to make an architectural statement and are seldom appreciated as much as other buildings are by their users. But James Kessler, AIA, senior principal and director of the Justice Focus Group at HOK in Washington, D.C., has spent his career working in a field others might avoid, but one that he finds interesting. He has seen it evolve to the benefit of all involved.

"It's a fascinating building type to work with," says Kessler, who has been designing correctional facilities since 1980. "It's a highly programmed type of structure that's like a small city. It has administration, healthcare, food service, visiting areas, housing, recreation, and other functions. It's interesting to me to see how much architecture can have a positive effect in this type of trying situation."

Kessler began his architectural career in 1976 after graduating with a Master of Architecture degree from Yale University. He began working at Caudill Rowlett Scott (CRS) in Houston, Texas, and moved to HOK's Washington office in 1978. There, he worked on an un-built effort to redesign the Charles Street Jail in Boston after the courts declared its conditions "cruel and unusual." Ultimately the facility was moved elsewhere and the historic jail became a luxury hotel. But the work provided a wealth of experience and perspective.

"The design meetings were attended by the Mayor's representatives, attorneys for the inmates, attorneys for the City Council, the Sheriff's Office, and representatives for the Massachusetts Department of Corrections," he explains. "They were all a little wary of each other and concerned about whether their goals conflicted. It was challenging to design to meet all of their needs, but they all ended up happy with the solutions we proposed. That experience proved quite useful on many subsequent projects."

More projects arose as the need began to grow. HOK long had a strong reputation in the area, beginning with its replacement design for Alcatraz in San Francisco, which became the Federal Administrative Maximum Facility in Marion, Illinois. Since the 1980s, Kessler has seen the firm's work expand and evolve as new ideas have been introduced.

## Quality vs. Cost

"It's interesting to me to understand the basic principles of corrections and how architecture can serve the needs of the staff, the administrators, and the prisoners," he says. "The goal is always to provide the highest quality while keeping both construction and operating costs as low as possible. It's also important to inject a feeling of hope for everybody in the system, which is an important part of incarceration."

Kessler benefited from "some great thinking" in the 1970s about correctional approaches, especially as it related to the concept of creating housing pods instead of laying

*The Fairfax County Adult Detention Center expansion in Fairfax, Va., designed by Jim Kessler in 1990, was his first project to feature precast concrete. It stacked eight levels of precast concrete cells in two-unit modules on a two-story cast-in-place foundation. The building was erected quickly with modules erected as soon as they arrived at the site. Photos: Copyright Lee B Ewing.*

cells out linearly, as was common at the time. By creating pods of cells around a day room and encouraging socialization in smaller groups, authorities could create a more normal environment while reducing operational costs.

"Prisons operate 24 hours a day, 365 days a year, and they're very expensive to operate," he notes. Operational expenses account for about 90% of 25-year life-cycle costs, with 10% going to capital costs. "Our goal is to build facilities that facilitate operation and minimize staff, reducing costs. Podular designs helped achieve that."

That approach tied in with another major breakthrough concept, Direct Supervision, in which a single staff member can supervise a large group of prisoners through the concept of mutual respect. This management style is facilitated by placing an open officers' station inside each pod. "Direct Supervision freed up our design concepts," he says. "With fewer restrictions on sight lines and adjacencies, it became easier to organize housing pods into different geometries and create new design expressions."

In more recent times, the podular approach has gone further, creating a more decentralized approach in which amenities such as exercise rooms, meal spaces, and other functions also are decentralized to the housing pods. "Pods are growing bigger as confidence in this system grows," he says. Pods have expanded from a common configuration of 24 to 48 cells to as large as 64 cells.

*The Prince William County Adult Detention Center in Virginia features a total precast concrete structural solution, including beams, columns, double tees and double-cell units. The building contains 92 cells and features laid-up brick on precast concrete panels on its exterior to blend with the neighboring buildings. Photo: Copyright Lee B Ewing.*

This new geometry has led designers to feature more precast concrete designs, since this material is particularly suited to a correctional facilities' unique needs. "We also do a cost evaluation based on the facility's configuration and goals for operation, siting, etc." he says. "We look for the best structural approach, and precast concrete has been the way we've been designing projects recently."

## Precast Concrete Modular Cells

In addition to its inherent durability, precast concrete offers high quality control and fast construction, he explains. "Everyone says the future of architecture is in prefabricated components that can be manufactured under ideal conditions in plants and assembled at the site," he says. "Correctional and detention facilities are one of the most applicable building types for that approach due to the ability to take advantage of the repetitive elements inherent in this type of building."

The small, similar cells leverage precast concrete's capability to reuse forms and keep casting. "It's similar to apartments and other housing, except tenants want to personalize the design. With incarceration, the users

*A total-precast concrete structural solution was selected for the $134.6-million, 1,032-bed Richmond Justice Center, which is now being constructed. It features quad cell units, double tees, columns, beams and exterior load-bearing architectural insulated sandwich wall panels. The panels are being cast with the use of form liners that hold thin brick which are embedded in the building façade to create a contextual and rhythmic design.*

*Kessler's work with HOK's Justice Group includes the recently completed McConnell Public Safety & Transportation Operations Center in Fairfax County, Va. The facility brings together several agencies to enhance the effectiveness of public-safety response, improve traffic-congestion management and respond and recover faster from major emergencies. The building features precast concrete architectural panels on its exterior, providing a dramatic look and resilience to natural and man-made disasters.*
*Photos: Lee B Ewing.*

lose those rights and we can create stackable, orderly designs."

Precasters leverage this capability by creating complete cell modules that can be stacked like building blocks. In many cases, these units can be outfitted in advance with furnishings so they're ready to hook up when they're placed.

Kessler's first precast concrete design, in 1990, was for the Fairfax County Adult Detention Center expansion in Fairfax, Virginia. It featured eight levels of stacked precast concrete cells in two-unit modules on a two-story cast-in-place foundation. The applied brick exterior was designed to fit into the urban neighborhood around it.

His work with precast concrete modules continues to this day, with the Richmond Justice Center now underway. "It will be precast concrete top to bottom," he says, featuring quad cell units, double tees, columns, beams, and exterior load-bearing architectural insulated sandwich wall panels. The panels are being cast with the use of form liners that hold thin brick embedded in the surface to create a rhythmic design.

The modules are being cast in four-unit cells, which saves time and money. "Picks are expensive, so the more they can lift in one unit, the better," he says of the 50,000-pound modules. The components, from Tindall Corp., are being cast in the company's San Antonio, Texas, plant and shipped two per rail car to its Petersburg, Virginia, plant, where they are trucked to the site. "There are quite a lot of logistics involved in a project like that, but this approach offered the highest technical score and the lowest price."

## Design-Build Growing

The project was undertaken as a design-build project, under Virginia's Public-Private Education Facilities & Infrastructure Act (PPEA), which allows local governments to create public-private entities to efficiently construct facilities. Kessler sees design-build projects as the wave of the future.

"We're seeing them quite a bit today, because they allow the architect and contractor the chance to work together before the design is finalized. We also gain the expertise of the precaster. He can help us understand what can and can't be done and what's expensive to do. That's not always obvious to the architect."

Design-build projects can create closer cooperation and ensure everyone is working toward the same goal, he notes. "It takes down a barrier in the project and creates collaboration, rather than just linking us through documentation. It takes trust that we're all working to provide quality and low cost, but that trust develops through the working relationship. It's not applicable to every project, or even every detention center, but it works very effectively in many cases."

The best scenarios develop when the owner understands the scope of the project and can articulate all of the needs, he adds. "It produces great creativity and opportunities for effective design. If the owner states the goals clearly, design-build lets you achieve high quality at a low cost."

His work extends into other justice facilities as well. For example, he's recently completed the McConnell Public Safety & Emergency Operations Center in Fairfax County, Virginia, a state-of-the-art 911 Emergency Communications Center and Emergency Operations Center. That building features architectural precast concrete panels on a steel frame, in a design configured to meet anti-terrorist requirements.

His designs in other areas do not mean he has lost enthusiasm for correctional facilities, he notes. "After a career of designing these structures, I'm always surprised at how different each one is in configuration and operational needs. That's what is so fascinating about this field."

# Design-Build – Streamlining Project Delivery

— By Susan Hines

Once considered an "alternative" project delivery method, design-build is rapidly becoming mainstream. Design-build is an integrated approach that delivers design and construction services under one contract with a single point of responsibility. Design-build is transforming our industry by introducing a better way to provide A/E/C services in a manner that readily leverages job-specific products and systems, such as precast concrete.

Established in 1993, the Design-Build Institute of America (DBIA) is the only organization that defines, teaches, and promotes best practices in design-build—what we call "design-build done right." Knowledge of DBIA best practices is especially crucial as design-build is becoming more common. While DBIA and its owner and practitioner members knew this project delivery method was gaining traction, the evidence was purely anecdotal until June 2011, when the Design-Build Institute of America's Reed Construction Data (RCD)/RSMeans Market Intelligence study was released and showed more than 40 percent market share for design-build, with steady growth of the delivery method since 2005.

*– Susan Hines is DBIA's managing director of public relations and information. She came to DBIA in 2009 from the nationally known landscape architecture firm Oehme Van Sweden & Associates. Prior to that, she spent seven years at the American Society of Landscape Architects (ASLA), first serving as founding editor of the e-newsletter LAND Online, and later, working as a staff writer/editor at Landscape Architecture magazine.*

The RCD/RSMeans study cast a wide net and was based on information about actual vertical construction projects over the past five years. Detailed data on nearly 1,000,000 construction projects, 300,000 plans and specifications, historical and current material and labor construction costs, and historical and projected demographic data was integrated for valid comparisons. The research team estimates that 95 percent of public projects and 75 percent of private projects were captured for the purposes of this analysis.

While the use of design-build in horizontal/heavy civil construction was not included in this study, the number of states authorizing the use of design-build for both water/wastewater and transportation projects has surged over the past three years. For example, today 46 states allow design-build project delivery for transportation to some degree. Last year, both New York and Ohio, states that once staunchly resisted design-build procurement, finally approved its use by their agencies. Ohio, in fact, is allowing all state agencies to use design-build.

Although New York limited the use of design-build to just five agencies, its initial foray into design-build will be one of the largest design-build projects procured thus far: The replacement of the Tappan Zee Bridge. The Tappan Zee spans the Hudson River at one of its widest points as it carries traffic across the river just north of New York City.

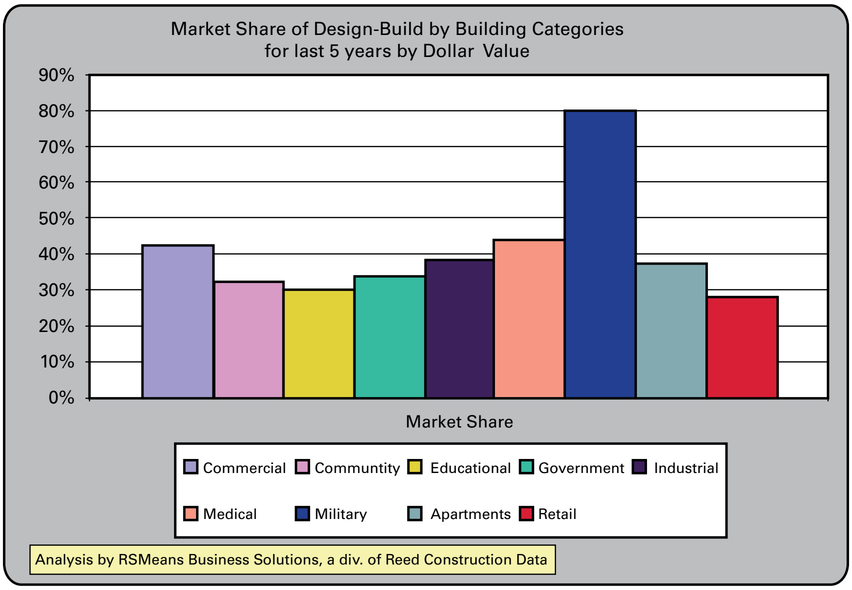
### The Design-Build Advantage

Design-build is a project delivery method that works for everyone. Design-build streamlines project delivery through a single contract between the owner and the design-build team. This simple but fundamental difference saves money and time by transforming the relationship between designers and builders into an alliance which fosters collaboration and teamwork. United from the outset of every project, an integrated team readily responds to both the owner's requirements and those of other team members.

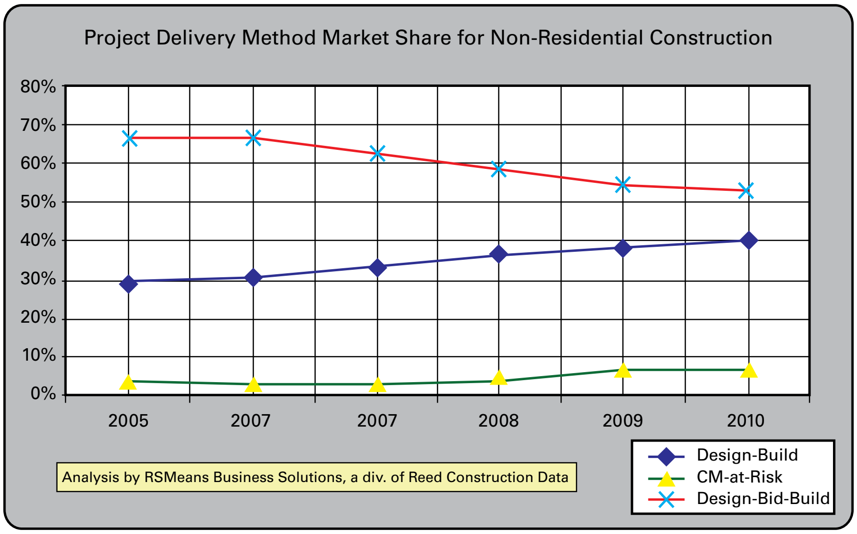
Design-build (DB), design-bid-build (DBB), and construction management (CM) are the three project delivery systems most commonly employed in North America. Under the traditional methods, design-bid-build, in particular, owners contract separately with design and construction firms, with the construction contract frequently going to the lowest bidder. Some problems that may ensue when designers and construction firms work in silos include cost and schedule overruns, change orders, finger pointing, and, unfortunately, litigation.

The advantages of design-build over other construction methods have been quantified. An independent Construction Industry Institute/Pennsylvania State University survey evaluated all three project-delivery systems and found that design-build projects:

- Cost at least 6% less than DBB and 4.5% less than CM.
- Were constructed at least 12% faster than DBB and 7% faster than CM.
- Delivered 33% faster than DBB and at least 23% faster than CM.




*This bar graph from a June, 2011, RSMeans/Reed Construction Data report shows the use of design-build is increasing across all non-residential sectors.*




*The use of design-build rose steadily between 2005 and 2010, while the use of traditional design-bid-build has declined.*

- Achieved highest owner-satisfaction ranking.

Other research - such as a Charles Pankow Foundation study to determine the effect of project delivery methods on achieving higher performing, sustainable buildings - shows that integrated delivery methods such as design-build, are superior in achieving or exceeding Leadership in Energy and Environmental Design (LEED®) certification goals. In the area of construction litigation, a Victor O. Schinnerer benchmarking and claims study shows that from 2001-2010, only 3 percent of claims against A/E firms brought by construction entities were made by design-build contractors while 76 percent of claims against design professionals originated from general contractors working within a design-bid-build framework.

Design-build practitioners, whether GCs, designers, or specialty contractors will tell you that the benefits of design-build project delivery include a higher profit margin (since an integrated team is fully and equally committed to controlling cost) and a significantly decreased administrative burden. Design-build also streamlines communication between designers and builders, which is key to controlling costs, maintaining schedules, and preventing change orders.

Design-build is not just a tweaking of design-bid-build: It is inherently different and requires a shift from a segregated mentality to an integrated mentality, as well as a thorough understanding of contractual obligations, and procurement processes.

Practitioners learn the risks, rewards, and best practices associated with single responsibility contracting. For example, design-build transfers much of the risk associated with the project and the responsibility of managing it, to those better prepared to succeed. Design management and design control are major risks associated with every construction project. Typically, the following risks are identified with the design: contractual performance guarantees, functional failure of the design, shop drawing reviews and analysis, coordination of plans and specs, and satisfaction of permitting requirements.

Under a traditional design-bid-build framework, the designers work directly for the owner and their performance is warranted by the owner. In design-build project delivery, the designers' performance is warranted by the design-builder. When one entity is responsible for conformance to design, cost, and schedule, there is no incentive to blame others for errors, overruns, and other shortcomings. The focus shifts to fixing the problem so that the project can move forward on schedule.

DBIA has also identified the attitudes and values that—if held in common--facilitate integration on a design-build team. These include belief in interdisciplinary fluency, communication, full disclosure and transparency, and benefits of cultivating an environment of trust. But the foundation for these behavioral expectations remains the design-build contract that links the team to one another and provides a single point of responsibility for the owner they serve.

## Design-build and the Precast Industry

Innovation is a hallmark of design-build, so it is not surprising that design-build teams are eager to embrace products and services that enhance value for the owner while streamlining sequencing and delivery. Because of its versatility, quality, and minimal impact on construction sites, precast concrete frequently plays a major role on design-build projects in every sector and precast manufacturers are often considered key team members.

Consider just one example from the DBIA 2011 National Project

*The lobby and reception area of the Rolls Royce Crosspointe Rotatives Facility, in Prince George, VA, are shown, above. Photo by Haskell, courtesy DBIA.*

awards: Anderson Athletic & Recreation Complex at the University of St. Thomas in St. Paul, Minn. This 180,000square-foot facility houses major athletic venues and a three-story office/classroom space. Athletic venues include a basketball/volleyball arena, aquatic center, field house, cardio/weight rooms, locker rooms, and training facilities. Opus Design Build LLC, used a variety of precast concrete elements in the construction of this state-of-the-art Division III athletic facility.

Load bearing precast concrete wall panels supporting long span roof joists were the primary structure in the athletic venues (arena, aquatic center, and field house) in order to eliminate perimeter columns and provide a clear interior wall surface. In addition to the aesthetic and practical advantages, the erection of the precast wall panels was much faster than a traditional structural steel system.

Lifecycle costs can also be an important consideration for owners, especially long-term owners like universities. The University of Houston's new state-of-the-art housing complex, Cougar Village, is a seven-story 291,000square-footfacility that houses 1,132 freshman students. In this case, the design-build team suggested using insulated precast concrete panels as part of the structure. Although there was a slightly higher first cost relative to traditional construction, a tighter building envelope, more rapid construction, fewer trades and general conditions costs all led to lower overall costs and better life-cycle performance. The investment and effort were rewarded: By using precast concrete, the design-builder, Hardin Construction, was able to provide the university with a more efficient building that used a smaller HVAC system, resulting in long-term energy cost savings.

Cougar Village illustrates another important fact about design-build: The expertise of suppliers and specialty manufactures is often critical to project success. DBIA recognizes this fact and will release a new Design-Build Manual of Practice chapter focusing on "Selecting Specialty Contractors" within the design-build delivery method. Available this summer, the chapter recognizes the key role that special contractors like DBIA Industry Partner Member Shockey Precast often play in supplying innovation and keeping a project on time and on budget.

Precast professionals also play important roles within the Institute itself. David Bloxom, DBIA, LEED AP, owner of Speed Fab-Crete, in Fort Worth, Texas, is a true believer in the value that design-build brings to the

*The study hall at the University of Houston's Cougar Village. Photo © Aker/Zvonkovic, courtesy DBIA.*

*PFieldhouse at the University of St. Thomas's Anderson Athletic and Recreation Complex, viewed from the level two concourse. Photo by Ryan Siemers, courtesy DBIA.*

A/E/C industry in general, and the importance that the specialty supplier brings to design-build. Bloxom is also the chairman of Design-Build Certification Board which governs the Design-Build Institute of America's certification program.

Certification is a passion for Bloxom, who encourages his staff to pursue the DBIA credential, and has four designated professionals on his staff. "The DBIA certification program is geared toward helping you be a key player on the design-build team." says Bloxom. "As a DBIA professional, you will typically know more than other team members. Understanding the process of design-build is advantageous to the precaster because it is such a growing concept within our industry and the industry at large." Even on design-bid-build jobs, Bloxom notes understanding the design-build process help suppliers anticipate and ward off problems, as well as giving them the confidence to suggest innovations that generally lie outside the traditional process.

Whether you are an owner, a design or construction professional, or a precast manufacturer—take note: Design-build project delivery has demonstrated its value and is rising in popularity in every sector. Shouldn't you know more about design-build?

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

### About DBIA:

Established in 1993, the Design-Build Institute of America (DBIA) is the only organization that defines, teaches and promotes best practices in design-build. Part of DBIA's central mission is teaching the effective integration of design and construction services to ensure success. Through DBIA, owners learn that communicating knowledge and data relevant to the project via performance based requirements, firmly establishing its own role and responsibilities, and verifying that the team it selects clearly understands their specific tasks and responsibilities are the primary means to ensure a successful project.

### Designated Design-Build Professional

Developed by and for construction and design professionals the Designated Design-Build Professional™ certification is the premier credential for design-build practitioners. The DBIA certification establishes an accepted and recognized standard of design-build knowledge and experience. By pursuing certification through education and by passing a rigorous examination, design-build practitioners and suppliers demonstrate that they understand and can implement established best-practices in design-build project delivery. To learn more, visit www.dbia.org.

# The Aesthetic Versatility of Precast

Aesthetics is of great importance to any project, and precast concrete provides some of the greatest versatility to achieve your aesthetic goals.

Precast concrete is available in practically any color, form, and texture. Precast concrete can also be veneered with other traditional building materials such as brick, granite, limestone, terra cotta, tile, and more. This provides the look and feel of these materials while adding all the benefits of precast concrete.

Different finishes can also be combined for one project, even in one panel, without requiring multiple trades and additional detailing for movement and waterproofing. It offers an efficient way to develop a multitude of façade treatments while reducing costs and risk.

The next few pages highlight some of precast concrete's aesthetic versatility on various projects.

## University of North Florida, Biological Sciences Building

Jacksonville, Fla.

**Architect:** *Perkens+Will/Harvard Jolly Joint Venture, Jacksonville, Fla.*

**Structural Engineer:** *Structural Engineers Group, Jacksonville, Fla.*

**Contractor:** *AJAX Building Corporation, Jacksonville, Fla.*

**Owner:** *University of North Florida, Jacksonville, Fla.*

**Precaster:** *Gate Precast Company, Monroeville, Ala.*

The new Biological Sciences Building is a 117,000 square-foot facility, which varies from two to four levels, housing all six specialized educational programs within the Department of Biology. The building's envelope consists of brick and glass curtain wall systems and insulated Architectural Precast panels of various styles. The 52,000 s.f. of thermally efficient, pre-insulated precast concrete wall panels are composed of a combination of brick cladding, with simulated sandstone accents, and a one-of-a-kind precast wall that has the university's mission statement recessed into the panels. The continuous insulation between the exterior and interior wythe of concrete acts as a vapor barrier and exceeds the specified insulation value of R-10 for the project.

The project showcases a complicated brick layout with three different brick face planes (elevation changes) traveling along two elevations of the building. These planes created a random zigzag pattern. The face planes changed by 1" to 2" and the patterns were in a different location on each panel.

*Photos: Harvard Jolly Architecture.*

## California Department of Veterans Affairs West Los Angeles Veterans Home

Los Angeles, Calif.

**Architect:** *SmithGroupJJR, San Francisco, Calif.*

**Structural Engineer:** *KPFF Engineers, Los Angeles, Calif.*

**Contractor:** *S J Amoroso, Costa Mesa, Calif.*

**Owner:** *California DePARTment of Veteran Affairs, Sacramento, Calif.*

**Precaster:** *Willis Construction Co., San Juan Bautista, Calif.*

*Photos: Willis Construction Co.*

The Retirement/Assisted Living Facility provides 400 beds of skilled nursing, residential care, and dementia long-term care. This project was designed as a prototype for other similar future facilities.

The large institutional scale of the building needed to express individuality, diversity, and community as well as present an equal opportunity for each resident. The challenge was to find a design solution for the façade that was similar but different, repetitive but not the same.

The solution was a modular concept of Glass Fiber Reinforced Panels (GFRC) that allowed a random pattern in the most cost-effective way. The façade's design impact came from using texture variation instead of color variation; alternating flat and corrugated panels in a seemingly random layout. Three-dimensional corrugated textures were used horizontally and vertically in GFRC panels to enhance the undefined façade impression, which changed by natural light depending on time of day, season, and weather. The design intent was well accomplished with the 3D GFRC panels.

## George Washington AutoPark

Winchester, Va.

**Architect:** *Design Concepts, Winchester, Va.*

**Structural Engineer:** *Blue Ridge Design Inc., Winchester, Va.*

**Contractor:** *Howard Shockey & Sons Inc., Winchester, Va.*

**Owner:** *Winchester Parking Authority, Winchester, Va.*

**Precaster:** *Shockey Precast Group, Winchester, Va.*

*Photo: Design Concepts.*

This seven-tier, 547 space parking structure is located within the historical district of Winchester, Virginia. The area had few buildings of such mass, so the architect used texture and color to weave the structure into the historical fabric of the area. The use of precast concrete helped the design team achieve all the goals set for this high profile project.

The first two tiers of the project use a replica limestone base. The finish was achieved by utilizing a custom form, which allowed for rotation of individual forms within the same piece to provide variations more characteristic of limestone. A deep relief was used in the joints to provide shadow lines that break up the uniformity within the precast wall panels.

Two colors of modular-size, embedded, thin brick allowed the design team to tone down the overall mass of the structure and bring it into scale with its surroundings. This also helped the structure blend in with a wide range of surrounding brick masonry that could never be replicated. Flash was added to both thin brick selections to further increase the color ranges across the façade.

Window openings with buff concrete banding and recessed arches along the architectural rhythm helped the façade become more reminiscent of a historical warehouse than a modern parking structure.

## Kauffman Center for the Performing Arts

Kansas City, Mo.


Photo: John Powell Photography.

**Architect:** *Safdie Architects, Somerville, Mass./ BNIM Architects, Kansas City, Mo.*

**Structural Engineer:** *Structural Engineering Associates, Kansas City, Mo.*

**Contractor:** *JE Dunn Construction, Kansas City, Mo.*

**Owner:** *The Kauffman Foundation, Kansas City, Mo.*

**Precaster:** *Enterprise Precast Concrete, Inc. Omaha, Neb.*

Although still relatively new to the city's downtown skyline, this Center for the Performing Arts is already a key recognizable addition. Form follows function in the dual domed facility that houses two performing art center auditoriums. The scaled appearance of the auditoriums is symbolic of a musical instrument.

The 286,031 square-foot facility utilizes approximately 89,000 square feet of architectural precast concrete. There was a combination of insulated and solid precast concrete panels. The design team paid close attention to adjacent buildings in the surrounding area, taking special note of the tone and finishes, which are mostly limestone. The design team decided on an acid-etch precast finish. Pieces of flashing to help support the adjacent metal panels were also cast into the precast.

## Paseo Altozano Mall

Michoacan, Mexico

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

**Structural Engineer:** *Postensados y diseños estructurales, Mexico City, Mexico*

**Contractor:** *Grupo Altozano, Michoacan, Mexico*

**Owner:** *Grupo FAME, Michoacan, Mexico*

**Precaster:** *PRETECSA, Atizapan de Zaragoza, Mexico*


Photos: ©FOTOSENCONCRETO.COM.

This massive shopping center, with approximately 21 acres of commercial and entertainment establishments, is the most innovative development of its kind in the area. The project includes more than 2,500 architectural precast concrete panels in a wide variety of colors and finishes. Simulated slate, and other nature-influenced finishes, achieved a refined and consistent look in an environment surrounded by mountains and forests.

The various finishes were achieved using different forming techniques, combinations of aggregate, acid-etching, hammering, polishing, and staining. For example, the slate-finish was obtained by using rubber molds made at the precaster's facility to develop the textures and manually tinting every "slate block" with penetrating, acid-based stains of various colors. The decision to use precast panels that look like natural slate was influenced by the short time frame in which to complete the project, which would have been impossible using natural stones and other construction methods. The desired slate finishes were achieved with an impressive degree of accuracy. The decision to use precast panels resulted in considerable savings, both in time and dollars.

## Macy's Parade Studio

Moonachie, N.J.

**Architect:** *Russo Development, Carlstadt, N.J.*

**Structural Engineer:** *Russo Development, Carlstadt, N.J.*

**Contractor:** *Russo Development, Carlstadt, N.J.*

**Owner:** *Russo Development, Carlstadt, N.J.*

**Precaster:** *J&R Slaw Inc., Lehighton, Pa.*

For nearly 50 years, Hoboken was the home for the Macy's Parade Studio, where the floats for the parade were created and stored. Due to the growth that the parade has recently seen, Macy's needed a larger facility. The new facility is 72,000 square feet, which is 32,000 square feet bigger than Hoboken and has ceilings reaching 46 feet in height. Precast concrete was the perfect fit for this building as it not only allowed the project to be completed on a tight schedule, but it also provided for a thermally efficient envelope and beautiful aesthetics.

The front and side elevations use 50-foot tall, insulated, precast concrete sandwich wall panels finished with two contrasting shades of thin brick. A unique mortar color was chosen that coordinates with both colors of brick. This approach was much less labor-intensive than hand-laid brick, and provided a more durable wall system requiring less long-term maintenance. The rear elevation uses similar insulated precast walls, but with an integral color and sand-blasted finish. Deeply tinted glass used throughout the building compliments the brick colors and adds to the beautiful, modern look. Meticulous landscaping and exterior lighting add the finishing touches.

*Photos: J&R Slaw, Inc.*

## 88th Security Forces Operations Center

Cincinnati, Ohio

**Architect:** *Emersion Design, Cincinnati, Ohio*

**Structural Engineer:** *Woolpert Inc., Dayton, Ohio*

**Contractor:** *Wilcon Corporation, Dayton, Ohio*

**Owner:** *Woolpert Inc, Dayton, Ohio*

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

This new security headquarters on a midwest military base establishes a strong formal presence at the main entrance of the base. The 52,000 square-foot facility provides a new headquarters consolidating base-wide security, and includes an armory, office space, dispatch center, detention area, and warehouse.

Insulated precast concrete wall panels, with a sandblasted, limestone finish were used for the façade. Reveals in the precast formwork combine with false and real panel joints to create a block-like image that suggests real limestone. The blocks are scaled to give the illusion of height to the first floor of the two-story section. The second story is set back, enhancing this effect. Both stories have regular panel details that suggest columns with pedestals; a bullnose and cornice create a strong horizontal line above the column images to bring a human scale to the façade.

The exterior walls are highly articulated to match the precast of the adjacent training and maintenance facility that was completed ten years before. The precast concrete walls also provide the necessary anti-terrorism and force protection, as well as provide a thermally efficient enclosure which delivers an average R-10 rating. This contributes greatly toward the sustainable performance of the building, which is designed for LEED Silver Certification.

*Photos: High Concrete Group LLc.*

# The Brave New World of Integrated Project Delivery

— By Tom Brock & William Fitzpatrick

In the last decade, the demands of the marketplace and the need to remain competitive have forced most individuals and entities working in the various fields of development and construction to reconsider completely how they conduct their businesses. Today's post-recession market for building delivery demands a better product delivered in less time and for less cost. These trends echo the same forces that transformed the automotive industry at the end of the 20th century, when relatively obscure companies like Honda, Toyota, and Nissan (Datsun) were able to become major players in the global marketplace by delivering better quality than their competitors for lower cost. So it will be with the construction industry in the coming years. The transformation is already underway and those who have already begun to implement integrated delivery practices will enjoy a distinct advantage over their competitors.

Although there is little agreement among analysts on whether construction industry efficiency has been improving or declining since the turn of the century, they do agree that there remains significant room for improvement. A special task force of the National Research Council (NRC) recently identified five "Breakthrough Improvements" from among dozens of potential ideas as having the most potential for impact on efficiency and productivity in the construction industry. (See "Advancing the Competitiveness and Efficiency of the U.S. Construction Industry", NRC, 2009.) At the top of their list is the widespread deployment and use of interoperable technology applications, otherwise known as Building Information Modeling (BIM). But they go on to point out that BIM is not a panacea and should not be considered a stand-alone solution; that its effective use "…requires integrated, collaborative processes and effective planning up front and thus can help overcome obstacles to efficiency created by process fragmentation." According to the NRC, when it comes to obtaining greater efficiencies in building delivery, process fragmentation is at the very heart of the problem.

There are many factors pushing the trend toward further process fragmentation in our industry, the most pronounced of which is that the process of building delivery itself is becoming more complex and difficult. New performance requirements in the form of energy codes and federal- and state-mandated certification procedures like LEED, just to name a few, have added to the steps necessary to deliver a building successfully. Add to this the increasingly litigious environment for design and construction services and the subsequent emphasis on risk management and you can begin to understand why people are moving into silos of specialization: It is easier to manage and protect one's own turf. The other guys? Well, they'll have to fend for themselves.

The NRC's call for integrated, collaborative processes as a way of maximizing the potential benefits of BIM is seen as the best hedge against the factors promoting process fragmentation. Integrated Project Delivery (IPD) is a methodology that can quell these discontinuities by contractually binding the major stakeholders on a project from the onset. Unlike traditional delivery methods, risk and reward within an integrated project is shared among project participants, maximizing project success. Furthermore, parties agree to no-sue clauses, encouraging productive resolutions, as opposed to frivolous litigation and delays due to threats of such. This collaborative approach is enabled by taking full advantage of BIM hardware and software, creating models that are not only three-dimensional but

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*– William Fitzpatrick is a recent graduate of the Master of Integrated Building Delivery degree program at the Illinois Institute of Technology. He also has a Bachelor of Science in Business Administration from Northeastern University with a concentration in entrepreneurship. He has worked in the real estate, construction and design fields for the past eight years. You can see examples of his innovative furniture designs at www.willfitz.com.*


*The $320-million Sutter Medical Center in Castro Valley, California is being delivered under an unprecedented 11-party Integrated Project Delivery (IPD) agreement. Rendering courtesy of Devenney Group, Ltd, Architects*

also contain data regarding time, cost, material properties, and sequencing. By sharing common models, data can be cross-referenced for coordination and clash detections, as well as logistical and programmatic discontinuities.

The major hurdles to true integrated project adoption are the current business culture in the real estate, architecture, engineering, and construction industries, and the deeply ingrained assumptions about the necessity for a "you do your job and I'll do mine" mentality as a hedge against unnecessary risk. While integrated contracts can tie parties financially and legally, contract language speaking to behavioral mandates only serves to weaken the integrity of the document. With the calls for stronger contracts and insurance products being the bulk of voiced concerns around true IPD feasibility, it must be accepted that the pivotal step towards real integration is a culture of trust in the motivations and qualifications of all parties involved. Even with the most ironclad contracts and ideal insurance protections, an integrated project could falter based on eroded relationships between project members.

## A New World of Contracts

A drastic shift in the contractual arrangements among major parties (minimally, owner, architect, and general contractor) is where IPD draws its strength but also creates the necessity for a paradigm shift in the standard operating procedure of the industry. Traditional contractual relationships within a development project have no tie between the contractor and the architect. There is no duty whatsoever to each other apart from their common interests to the owner. This fosters the finger-pointing environment so familiar to those even tangentially associated with the business. An integrated project contract is typically achieved either by the creation of a single-purpose entity (the forming of a business entity whose sole purpose is the completion of a project) or through a multi-party agreement that binds all parties to shared risks and rewards. These relational contracts are fundamentally different from the transactional ones used in current delivery methods. Integrated contracts often require parties to put their profits at risk, a move most are inherently averse to. Transparency is another requirement of such contracts, a step that most business owners view as invasive if not stifling to their financial survival.

There are currently three major standardized contract documents for integrated projects:

- AIA-C191 Series [multiparty agreement]
- ConsensusDOCS300 Series [integrated form of agreement]
- AIA- C195 [single-purpose entity]

These contracts provide a solid

groundwork for structuring integrated business arrangements but most integrated contracts will need to be custom-tailored for each individual project. Contractually, the decision must be made as to what extent team members are willing to be bound to each other.

Multiparty agreements create relational commitments among the major project participants. This is also known as an Integrated Form of Agreement (IFOA) or a tri-party agreement. The agreement sets forth the duties of each party to all other parties, unlike a traditional contract, which only addresses the obligations of each party to the owner. A central management committee is created and an incentive pool encourages a collaborative environment, but silos of responsibility are still intact (Thomsen).

The formation of a single-purpose entity, most commonly a limited liability corporation (LLC), goes a step further than the multi-party agreement and creates a business entity with the sole purpose of developing, designing, and building a project. This corporation then contracts with the major (prime) project participants--who are also the owners of the business--to perform the tasks necessary for the completion of the building. All subcontracts or participants outside the LLC can either be contracted by the individual prime businesses or by the LLC itself. In this scenario the team is truly integrated and given incentive to collaborate. Problem solving becomes a collective activity. No longer can one party sit back and passively wait for another to resolve a mistake or miscommunication. Risks and rewards are shared in this scenario, rather than allocated to individual businesses.

This sharing of risk often involves the key participants to put some, if not all, of their profit on the line, with the potential reward of profits should certain goals be met, such as early or under budget completion. Rewards can be structured in several contractual ways; often the remaining dollars in contingency funds are dispersed at agreed upon percentages based on each participant's involvement. In addition to sharing the left-overs from a successful project, incentives and award fees are used to promote measured progress of team members and further encourage collaborative and innovative behaviors. These mechanisms typically manifest themselves as performance-based bonuses targeted to key participants and may be tied to qualitative analysis in addition to quantitative metrics.

The issue is whether these incentives and alternative payment structures are worth the risk for those involved. David Hatem, a lawyer representing architects and engineers in development projects says his clients are wary about taking on this additional risk. Hatem has written extensively on integrated contracts but is still hesitant about the promises of IPD. He explained that the hurdle to new collaborative approaches does not lie in the complexity of technologies used in the process but rather in the inherent cultural attitudes within the industry.

## A New World of Insurance

New insurance solutions for integrated projects similarly challenge traditional fundamentals of how parties are protected. Insurance policies are structured to be triggered by an "event". The named insured is issued a policy that outlines specifically what qualifies as an insurable event, and based on their involvement with said event, if they are covered and to what extent. This protects not only the insured, when they are at fault, but protects those who may be damaged as a result. In the case of an architect's errors and omissions in construction documents, the insurance will protect the architect from potentially devastating financial exposure by making solvent the general contractor for rework as well as damage incurred to the owner for delays. Within an integrated project all parties agree to hold-harmless agreements that essentially provide a no-fault atmosphere within the team, excepting, of course, cases of gross negligence or fraud.

Additionally, all parties agree to resolve issues as a team regardless of who is at fault. They are contractually bound to ensure that there are no "events," and this can pose a major challenge for insurance companies who must write a policy that is an umbrella that mitigates the risk of the entire team. These policies typically come in the form of an owner controlled insurance policy (OCIP) coupled with a single project policy. Projects may also use a contractor-controlled policy (CCIP). Traditionally, the costs of the innumerable policies carried by the various companies on the project are passed off to the owner as part of the bids. In an OCIP or similar policy the economies of scale can result in a more affordable coverage that is a line item reflected as a true cost in the budget.

Valery Onderka, an underwriter with Lexington Insurance, in speaking about a policy for the new $385 million hospital for Owensboro Medical Health System (OMHS) in Kentucky states, "The premium is reflective of lower risk than traditional design-bid-build." This insurance product has been touted as the first truly integrated solution on the market. Lexington provided a policy that covered the professional liability insurance for the core members on the project team (owner, architect, general contractor, and MEP engineer). The fact that core members of the team participate in phases of the project not typical of their services, such as the contractor in the design, was previously a hurdle to an integrated insurance solution. The Victor O. Schinnerer Company has also released an integrated, project-specific professional liability insurance product for use in IPD projects up to $300 million. These are the first policies designed to mitigate the complex risks associated with integrated projects.

## A New World of Technology

With all core members part of the same company and under common insurance protection, true early collaboration and integrated solutions can thrive. This process is largely enabled by BIM and project management information systems (PMIS). There is no standardized suite of programs and technologies used within an IPD project; much like the contract and insurance solutions these systems must be customized to the project's need and participants. Current modeling software allows a project to be virtually built before ground is ever broken on the site. This provides unique opportunities for the project team to partake in an iterative approach to collaborative design. Using 3D models, the construction of all the components of the design can be simulated to identify problems, from physical misalignments (often called clash detection) to cost and coordination issues. Design teams working on the HVAC systems, for example, can instantly understand how their choices affect the design of electrical systems, physically, financially, and logistically. This platform fosters dialogue around key design decisions and makes available information critical to innovative solutions.

All major parties are able to obtain pertinent project data (with varied levels of access) at a single source. The PMIS is hosted on the web for universal accessibility and acts as the knowledge base for the entire project. This includes current data on cost, schedule, and workflow, as well as outlining the roles and responsibilities of team members (Thomsen). This centralized virtual file cabinet encourages collaboration through the democratization of project documents. Centralization of data insulates a project from waste associated with information redundancies and inefficient document management.

## A Case In Point

Hospitals are often willing to put in the additional up-front resources to insure on time, on budget, quality work. The complexity of these projects, and the commitment to continued construction leads these large institutions to choose IPD as a flexible methodology for efficient development of facilities. The Owensboro Medical Health System elected to use IPD in construction of their new hospital facility. Though this project is yet to be completed, an investigation into the project specifics serves to understand the key decisions necessary in an IPD project and their repercussions. Driven by the owner, an Integrated Form of Agreement was selected as the contract type, which created the IPD Team consisting of:

Owner - Owensboro Medical Health System
Architect – HGA Architects and Engineers
Construction Manager – Turner Universal
MEP Engineer – Smith, Seckman, Reid Inc.
Project Manager – KLMK Group

Each team, with the exception of KLMK who act as an impartial facilitator, received one vote in project decision-making and appointed a representative to the Core Team. The Core Team is charged with directing the project and providing general governance. After a target budget and schedule were set, six Component Teams were established to develop specific aspects of the design. Each team, with its own budget and schedule, contains representatives from the core partners as well as major subcontractors and consultants.

These "cross-pollinated" teams allowed decisions to be made collectively and in a dialogue with the other component teams. Implications of key design decisions were seen through the entire project. A guaranteed maximum price (GMP) was set at 60% completion of construction documents. This was achieved through a collaborative environment of trust among project participants who built relationships over the course of the design process. Transparency alleviated elements of surprise so often prevalent in construction projects. The Core Team along with major trade contractors devised an incentive pool of funds, available for disbursement should the project be delivered under budget and ahead of schedule. As of the writing of this article, the project was proceeding under budget and on schedule.

Another hospital project that is using IPD is the Sutter Medical Center in Castro Valley, Calif. The 230,000 sq. ft. hospital had an unprecedented 11-party agreement. The 164-bed project is over 70% complete, on budget and planned to open six-weeks ahead of schedule in Nov. 2012.

## Planning on IPD

Given the current economic climate and the increasing complexity of building delivery it is increasing likely that construction-related businesses will encounter some form of Integrated Project Delivery in the coming decade. Therefore it is important, whether the idea appeals or not, to stay up to date on the latest thinking and best practices in IPD and, if not already immersed in the discipline, look for contracts that allow for wading into intermediate levels of collaboration rather than full-blown relational contracts. Early identification and definition of total project scope will be an even more crucial aspect in decision-making about involvement in IPD projects, regardless of levels of immersion. Having a work force that is well-versed in integrated project practices may well be the difference that sets firms apart and, much like those backwater automotive companies from the seventies, may allow them to thrive in the conditions of the new marketplace.

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# Adaptable by Design

In-house design-build format allows quick adjustments to meet new requirements, aesthetic changes, and challenges of a tight site

— Craig A. Shutt

Members of design-build teams often laud the ability to provide input early in the process that avoids later surprises or last-minute changes. When the entire team works in-house to start, all employed by one company, the closer communication can enhance the project outcome.

An example can be seen in the Surf Style retail store and parking structure built on the beach in Clearwater, Fla. The team handled last-minute design changes, ongoing aesthetic input from the owner and city, and the challenge of having to construct the facility entirely within the building's footprint. Even with these obstacles, the outmoded building on the site was demolished and the new one was open for business in only eight months.

The project was built on a small parcel of land that contained a small retail store owned by the developer. He wanted to expand the retail space, add a restaurant and provide parking for his own customers and other beach-goers. That combination provided the best return on investment for the small footprint available.

"The store was the largest in the owner's chain, and he wanted to renew the facility and draw more of a crowd to the store," explains Jorge Arboleda, project architect for Finfrock in Orlando, Fla. The firm creates design-build projects, using precast concrete components manufactured in the company's manufacturing facility.

**Value-Engineered Plan**

The original plan was to construct the building from cast-in-place concrete, Arboleda explains, but the cost was higher than the owner anticipated. "We were called in to see if we could make it more efficient, and we found that precast concrete components could reduce costs. But it resulted in a totally different design."

It also produced a more efficient and attractive building, notes Stan Jones, vice president of construction at Finfrock. "A lot of times, designers don't fully understand the implications of putting several uses together one on top of another," he explains. In many instances, designers put parking above retail and drop columns through to the ground level, disrupting


Photos courtesy of Finfrock Industries

*The Surf Style retail store and parking structure built along the beach in Clearwater, Fla., features a total-precast concrete structural solution that resolved a number of key challenges for the project while providing a strong aesthetic and fast erection.*

the retail space. "That reduces leasable square footage and makes the space less attractive. If you're savvy about the capabilities of precast concrete, you can avoid that."

The in-house design-build team provided benefits through shared knowledge and quick communication, the men agree. "We all know the material well and its capabilities and limitations, so we know the design will be constructible and take full advantage of precast concrete's efficiencies," says Arboleda.

Jones agrees. "From a project-management perspective, design-build is different from bidding. Along with design-build subcontractors, we create a pure design-build team that works toward the same goal and looks at the big picture, not just as what's best for each function. That ultimately creates the most efficient design."

Design-build is becoming more commonplace, notes Jones. "We are seeing the design-build process become highly refined, with major subcontractor and supplier experts incorporated early in the development process to take advantage of their cost-saving knowledge. When we are the designer, contractor, and fabricator, owners can be assured of creative, economic, and practical input. They also receive, in the vast majority of cases, a company that is willing to assume the code risk and guarantee a lump-sum price, which reduces owner risk."

Frictions still exist between functions, as each person has his own expertise and ideas on ways to attack problems, Jones notes. "Especially when there's a compressed schedule, it puts pressure on everyone to work as quickly and efficiently as possible. That was definitely the case with this project, where time was of the essence to get the building open for business."

*The facility includes retail and a restaurant on the first floor, with parking above. Note the artwork, a requirement by the city, which fronts a stepback that was also required by the city's Beach By Design guidelines.*

*A speed ramp provides quick access to the first level of parking. It was placed above the first-floor restaurant space.*

'We found that precast concrete components could reduce costs. But it resulted in a totally different design.'

**Total Precast Structure**

The 175,000-square-foot facility consists of 34,500 square feet of retail, 6,000 square feet of restaurant and 134,500 square feet of parking. It features a total-precast concrete structural solution, including load-bearing architectural panels, double tees, columns, beams, and other components. It was built on a site of less than one acre and contains 4 $^{1}/_{2}$ levels of parking above the retail level, including a speed ramp, deceleration lane, and a variety of city-required setbacks.

The site abuts one of the most active portions of Clearwater Beach, and the construction took place during the busy winter tourist season and into the popular spring-break college schedules. "It was imperative that we maintain all construction activities within the building's footprint to ensure minimal disruption to public areas," explains Dan Finfrock, vice president of manufacturing. All of the building's elevations come within 5 feet of the property line, he notes.

The retail level was designed to be customer-friendly, with open spaces for clear sightlines and lots of merchandising racks and flexibility to change their configuration. Initially, the parking elevators were designed to open into the retail space, but they

*The precast concrete structural system allowed for a nearly column-free retail space, providing flexibility for store layouts. A mezzanine was added to this space to add square footage and take advantage of the 25-foot height on this level.*


*The decision to add a FlowRider brand surfing machine was made after construction had begun, necessitating some quick adjustments. Observing the machine in its original home allowed designers to add some precautions to avoid moisture problems in the future.*

were changed to open into a mall-like area adjacent to the store's interior entry. The city requested this change so users could still access the elevator when the store was closed. As it turned out, the store has proven so popular that it remains open 24 hours a day, 365 days a year.

Another change came with the addition of a mezzanine level during the design process to add more retail space. This was added once the 25-foot-tall first level made it apparent that the space could be added without causing clearance issues.

A more drastic change came with the decision during construction to change an aquarium feature planned for the retail level into a 1500-square-foot FlowRider brand surf attraction, which includes an inclined pool that allows customers to try out surfing equipment. The attraction required a separate mechanical room and some rapid, extensive adjustments to the design.

"We could handle the needed changes quickly and efficiently because all of the staff was in-house," says Jones. Only six weeks were added to the schedule to adjust to the last-minute change. Adds Finfrock, "The precast concrete already was being cast when the changes were made, so we immediately stopped casting until everything was priced out and set. Once manufacturing starts, you don't like to stop it, but we wanted to ensure we weren't wasting materials."

The delay provided a benefit, Arboleda notes. While the changes were discussed, the designers visited the building where the in-operation FlowRider unit was located and noted wear to the building. "The pump heats the pool to about 100°, which, combined with the high humidity and chlorides, created a very corrosive environment. Once we saw that, we knew we had to add corrosion protection."

After researching options, the designers used Supertherm water-resistant insulated coating from Superior Products to protect the interior from the high levels of moisture and heat, as well as implementing a UV-treatment chamber to disinfect the pool water in lieu of the traditional chlorine systems.

'Time was of the essence to get the building open for business.'

## Only Four Columns

The retail levels benefited from the shift to precast concrete and the design changes that opened up, says Jones. "Our design allowed for only four column intrusions into the entire retail space. This was accomplished by using load-bearing wall panels that serve as shear walls along the exterior in conjunction with transfer beams that shift the load from the double tees to the shear walls. "This was about as minimal of an intrusion as could be provided, and it was critical for creating the open retail space that was desired."

"We couldn't use lite walls, as commonly would be done, because we wanted to eliminate columns from the first floor," adds Arboleda. The "horizontal lite walls" that were used prevented that by allowing the tees to span column to column. "The framing is pretty unique," says Jones. "But it works in combination with the various types of ramping and uses required in the building."

The speed ramp to the first level of parking proved challenging due to the tall height of the retail level and the city's requirement that the slope be no greater than 12%, Arboleda notes. Likewise, internal park-on ramping could slope no more than 6%, which was challenging to provide in the small two-bay space. The ramps were placed side-by-side at the center, creating a double-helix-like design.

'Our design allowed for only four column intrusions into the entire retail space.'

*A Neoguard brand waterproofing was applied directly to the precast concrete double tees above the retail space to ensure a leak-free retail area below. Connections were cast for access from below as well to provide additional protection.*

*Improved durability and increased erection speed was achieved by integrally casting the cornice into the wall panels.*

Special attention was paid to the concerns about creating parking levels over retail in a sandy, beach environment. It also exemplified the benefits to the owner in working with a design-build team, notes Jones. "If that building leaks, he's coming to one place: us. There's nowhere else to point fingers."

The design team ensured that wouldn't happen by using a water-resistant roofing membrane that comes with a 10-year warranty. In addition, it designed all connections to be accessed from underneath to avoid the possibility of grout wear that could lead to water penetration. "By incorporating stainless-steel connections and a special mix of concrete material, we could ensure the structure resists deterioration from water and chlorides," says Finfrock.

The parking levels were complicated further by the inclusion of cantilevered areas over the retail store's entry. "As we were designing the space and trying to maximize parking, we realized that we had 'free' air space on upper levels that could add dimension to the building and more parking space," says Jones. The beams were lengthened and cantilevered out 10 feet, creating an overhang while providing more space. "It wasn't easy to design these structural members, but they gave us so much bang for the buck that they were worth it."

The cantilever also helped enhance the building's setbacks of 5 feet, which were required by city code every 100 feet to avoid a monolithic appearance, Arboleda notes. These were provided on all sides, although one subsequently was covered with a large panel of artwork, which also was required. This setback, across the building's entry area, was created by providing a load-bearing beam at the center of the span to transfer the exterior-wall loads around the gap and avoiding a column in that space.

## City-Approved Look

The building's aesthetics also had to meet the city's "Beach By Design" requirements, which limited color choices and styles. "The zoning code is very strict, so it required a lot of back-and-forth between the city and the owner and us to find the best aesthetic solution," says Arboleda.

Adds Jones, "There definitely were a lot of discussions because the guidelines are not specific, so we needed to interpret them and fit them to what the owner wanted to do and get the city's permission. He had definite ideas on what would be successful for the retail setting to attract patrons, but the city had a lot of say on what we could do. Our goal was to meet the guidelines and the owner's goals while maintaining the budget and all the other parameters."

That resulted in "constant feedback" on changes and how they would affect the look and whether they were

*The tight site and busy area required the erection to be done almost entirely from within the building's footprint. Precast concrete components were shipped directly to the crane, where they were picked from the trucks to minimize disruptions. Photo courtesy of Aero Photo.*

'Making adjustments by walking down the hall to talk it over makes it a lot faster and smoother to find solutions.'

acceptable to all concerned, Jones says. "Making adjustments by walking down the hall to talk it over makes it a lot faster and smoother to find solutions and get them incorporated. That's pretty powerful in ensuring that the result isn't suboptimized because of so many parameters."

The color scheme, for instance, was planned to reflect the company's logo colors of salmon and bright red, but the bright red proved too similar to a nearby hotel and was too distracting for such a large expanse, Arboleda says. Salmon and a cream color were applied as paint after erection, as decisions were still being made during construction. The panels were given a smooth trowel finish to allow the textured paint to adhere well.

Due to the tight and busy site, the structure was constructed with the crane inside the footprint, walking it out the unfinished final side and closing the street for one week while it was finished. No on-site staging area was available, so components were delivered on a just-in-time basis and erected as needed.

The building was designed to meet all of FEMA's flood-zone standards, which require the structure to withstand 6 feet of standing water without incurring major damage. Additionally, the ground floor slab needed to resist a buoyancy uplift force of approximately 14 million pounds. This was accomplished by incorporating 12-inch-thick structural slabs tied to 50-foot-deep caisson foundations topped with concrete pile caps. A flood-resistant curtain-wall system and removable aluminum flood panels at doorways also were specified.

A final touch consisted of a wave wall constructed in front of the building. It features a 3-foot-tall concrete cap extending above grade, supported by vinyl sheet piles extending 20 feet below grade. The cap, which also provides a concrete seat wall with a precast capstone for the adjacent Beachwalk Promenade, takes the force of any storm surge.

The result of this close cooperation was a dynamic building that met the owners' needs while providing additional parking for the busy area. Best of all, the project came in on budget and three weeks earlier than the contracted delivery date. Demolition on the existing building began on Halloween, and the doors on the new facility opened in time to celebrate the 4th of July.

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# Architectural Precasters' Design Assist Role

PCI designer's notebook

# Architectural Precasters' Design Assist Role

**Design Assist** is the procurement method by which, prior to completion of design, a construction contract may be awarded on a best value basis pursuant to which a contractor/subcontractor provides design assistance to the design team and ultimately the owner.

In recent years, a trend toward early integration of the design/build process has developed into what is now called design assist. This process was first used when implementing environmental goals into project planning where the design team, contractors, and owner collaborated early in design. It was quickly established that the benefit of this process is the ability to respond to escalating demands of the clients for faster, more environmentally friendly, and unified delivery of projects with less risk of price escalation. All of these demands require early and intense collaboration of the building team to be successful. Application of this process for architectural precast concrete is the subject of this notebook.

In this process, the architectural precast concrete producer is selected based on qualifications for executing the demands of the specific project, PCI Certification, and the capability for technical expertise to assist the design and construction team in the development of the project. A contract is then awarded and should, at a minimum, include compensation for the design assistance. Significant benefits can be achieved if the contract also includes the supply and installation of the final products.

Benefits of design assist include development of concrete mixtures and finishes during the development process rather than going through a sample approval process after bid and award. Requests for information (RFI) are eliminated with the precast supplier as a participating member of the design team. Precast erection drawings are prepared as design development nears completion leading to a much smoother shop drawing review process. The structural design of the precast panel connections are completed in collaboration with the Engineer of Record to assure coordination with the design of the supporting and bracing structural system. The construction schedule is coordinated with the precast production schedule to assure timely delivery and installation. Any activity that normally occurs after award in a typical bid/build arrangement would be coordinated much earlier when the total precast contract is executed shortly after the design and construction team is assembled.

Precasters can offer detailed expertise that allows for expedited development of the design with engineering innovations and scheduling improvements while enhancing aesthetics and controlling budgets from conceptual design to project completion. Each element can be made as cost-effective as possible, taking advantage of the inherent performance characteristics of precast concrete. The precaster will be able to contribute design and detailing suggestions to ensure that maximum efficiency is achieved at the lowest erected cost. The result should be a functionally efficient and aesthetically pleasing enclosure that meets or exceeds the expectations for the project.

To maximize the potential of architectural precast concrete construction, the following elements should be considered:

- Color and finish selection
- Mold fabrication
- Casting and finishing techniques
- Handling methods in plant and at site
- Connection concepts
- Locations of connections to structure
- Material costs
- Construction sequencing

The following discussion on the design assist process is broken into the traditional design phases of schematic design, design development, construction documents, and construction administration. While the topics are somewhat arbitrarily assigned to a particular phase, specific project demands may require some activities be done at different times, as design assist is a continuous process. The precaster will inform the project design team when particular precast-related design decisions are best made so that unnecessary costs of major changes being made late in the design process can be avoided.

Finally, the precaster should be considered as a partner on the design team. This will impose a responsibility on the precaster to understand related construction materials that must interface with the precast concrete so details appropriate to all the materials can be developed.

# Schematic Design (SD)

The precast technical representative must be given enough information to understand the design intent regarding aesthetics and functionality. Schedule, budget limitations, and other design and delivery requirements influencing the façade materials and design should be provided. Significant design information that would influence subsequent decisions might include special fire rating requirements, seismic design requirements, and any requirements for blast resistance.

An issue of particular significance that should be addressed early in the process is the finish desired for the architectural precast panels. The precast concrete supplier can provide a multitude of options for both color and texture, including multiple colors and textures within a single panel. Veneers of clay or concrete thin brick, ceramic or porcelain tile, terra cotta, or natural stone may be included in the finish options. The process should be started early and initial samples should be prepared.

Based on a review of preliminary design concepts, whether in the form of renderings, models, or 2D-3D views, the precaster can help determine the massing of volumes and the elements being considered for architectural precast concrete. The precaster would then be in a position to present the key precast options and communicate benefits that would have a significant effect upon the appearance, function, and cost of the project. In this phase the precaster can present options for loadbearing or cladding elements. Either of these may also be supported by the structure or stacked to the foundation. These are options that have unique considerations for each project and are part of the decision-making process for selection of a structural framing, which may include structural steel, cast-in-place concrete, and precast concrete. Another consideration is whether the panels should be non-insulated (solid) or insulated precast panels. Insulated precast concrete panels maximize the energy conservation benefit of thermal mass while providing an interior surface that can serve as the final inside finish.

The proposed bay spacing and floor to floor heights need to be established in order to determine the optimum panel size and panelization scheme. Panel widths usually are dictated by either architectural considerations or the structural grid of the building frame. The panel cross-section (panel geometry or profile) is generally chosen for architectural or aesthetic reasons and needs to be discussed during this phase to determine the practical aspects of casting of the profiles. Configurations of precast corner units and joint details need to be determined as part of the panelization process.

With regard to panelization, the smaller the precast unit, the greater the number of pieces required for the enclosure. More pieces usually means more handling, more joints to be sealed, more connection points, and higher erection costs. Handling and erecting costs can constitute more than 30 percent of the total precast concrete expense. Therefore, large units are preferable unless they lack adequate repetition or incur significant cost premiums for transportation or erection. The cost difference in handling and erecting a large unit compared to a small unit is generally insignificant considering the increased square footage installed with a large unit.

Repetition should also be considered during the schematic design phase. Repetition has more to do with how intricate features are repeated from piece to piece than with consistent panel sizes. The face features will determine the complexity of the mold used for casting. Maintaining consistent feature patterns and dimensions allows the minimum number of molds to be constructed, but still may allow changes in overall panel dimensions. The precast producer can provide valuable input to the design team to control the costs of mold fabrication.

There is a balance between maximizing potential economy of the façade elements and maintaining the economy of the supporting structural system. The key is coordination of the proposed connection locations and loads imposed on the support system with the Engineer of Record. For example, there will be less impact on the support structure when panel gravity reactions are located at columns rather than on perimeter beams or slabs. Panel connection reactions will often be eccentric from framing centerlines and panel centerlines. Early coordination allows consideration of the impact of such eccentricities on both the panels and on the structure so a final solution can be mutually beneficial to both systems.

Site geometry and topography should be reviewed early. Delivery vehicles and erection cranes will require access around the building perimeter and close to the building perimeter. Close access is a prime requirement of an economical precast solution so the reach required of the crane is minimized. If a tower crane becomes a project strategy, the allowable precast panel weight is likely to be reduced due to generally lower capacities and longer reaches experienced with tower cranes as compared to standard ground cranes. The issues to be considered become even more complex when a tower crane is not located in the center of the building footprint. Because of varying lengths of reach, each elevation will have a different limitation on panel weight. This has a significant influence on panelization and needs early resolution to complete the concept of the architectural design.

Discussion should further consider the challenges, and therefore the costs, associated with installing panels that will be set back from the face of a building under overhanging structure. Such panels may require temporary floor openings, double handling, or special equipment to enable panel installation.

A preliminary budget with appropriate contingencies can be generated during the schematic design phase to confirm that the early decisions are in keeping with the project budget.

In summary, the schematic design phase should be used to evaluate options available to the design and construction team to best leverage the benefits of architectural precast concrete in an aesthetically appropriate, functional, and cost-effective manner. The design assist process becomes more technical in nature, more time intensive, and critically important to achieving the project goals as the team moves into the design development phase.

# Design Development (DD)

Based on the options presented and preliminary decisions made in the schematic design phase, further refinement can be accomplished in the design development phase. The following list is both a summary of issues to be addressed and a guide to completion of design development activities relative to the architectural precast concrete.

1. At this point, the preliminary selections of color and texture for the exterior aesthetics can be evaluated for cost effectiveness. Since color can be achieved with various combinations of cement, pigments, and fine and coarse aggregates, cost adjustments can be made to achieve the intent within the budget. There may be several options for adjusting the surface texture should cost adjustments be required. Consideration may be given to using higher cost colors and textures in areas most accessible to the public while using lower cost options that would only be viewed from a distance. The precaster will be of assistance in evaluating the cost impact of these options.

   To assist in establishing the general color and texture, additional samples should be made. Samples at least 4 in. x 4 in. can be used to finalize the color and texture selections. Once the small samples are within an acceptable range, larger samples approximately 3 ft x 5 ft and full thickness should be made to confirm that the mixture proportions, vibration, and finishing techniques necessary to make production-sized units can duplicate the aesthetic qualities of the small sample pieces.

2. The options of nonbearing or loadbearing and supported from the structure or stacked to the foundation must be evaluated considering both architectural and structural design features. Construction scheduling may also be affected depending on the need for grouting horizontal panel joints. The factors to consider include the panel configuration, the building height, the lateral load resisting system for the building, and the gravity loads that might be supported.

   Panel configuration will affect the ability to support gravity loads. Generally, the structural design of panels includes a goal to minimize cracking. If cracking would be anticipated as a loadbearing element, the project would be better served with nonbearing panels. The panel configuration will also affect a decision to stack panels to the foundation. If no direct load path to the foundation is provided, the panels must be supported by the structure whether they are loadbearing or nonbearing. Stacking to the foundation is also influenced by the lateral load resisting system and the building height. Careful consideration must be given to the compatibility of the building drift with a stacked panel arrangement that may not easily accommodate that drift.

3. Consideration should be given to using a precast concrete structural framing system especially when the architectural precast will be used as a loadbearing system. Certain economies can be achieved when the design and installation of the two systems can be coordinated by the precast concrete supplier.

4. A decision whether to use insulated architectural precast panels should be made in the design development phase. This decision affects many of the nonstructural building systems and details. Insulated precast concrete panels can perform all the same functions that could be performed by noninsulated panels. Insulation is provided edge to edge for full continuity of the insulation envelope. Detailing at panel penetrations, such as windows and doors, must be considered to determine whether to interrupt the insulation or cover it with frames or trim. When insulated panels are used, the interior panel surface may be used as the final finished surface. When utilized, the expectation for the interior concrete finish must be understood by all parties.

5. The panelization scheme should be finalized at this point in the project design. Panelization not only expresses the architectural design theme, but also influences production, shipping, and erection strategies based on the final panel sizes. This would also be a good time to check budget constraints that are significantly affected by panel size and count.

   It is also good to start discussions on joint sizes once panelization has been completed. Unless panels are very small, a minimum ¾ in. joint should be used. Very large panels may require larger joints to accommodate tolerances and normal properties for the caulking material.

   Completion of a panelization scheme allows development of other features to be incorporated into the architectural design. Reveals offer a low cost, simple way to break up large wall masses. Reveal patterns must generally be coordinated with jointing so completion of panelization is important if reveals are to be incorporated. Reveals are required to separate multiple colors or finishes within one panel.

6. With completion of panelization and development of the desired panel features, the amount of repetition of patterns can be reviewed for consideration of mold costs. As was discussed in schematic design, minimizing the number of molds required to produce the panels improves efficiency and, therefore, cost. At this

point in the project design development, it may be the last opportunity to adjust design features to maximize repetition.

7. Discussions with the Engineer of Record (EOR) are important at this stage because the structural design scheme is being coordinated with the over-all building design. With panelization complete, final panel connection locations and preliminary connection forces can be determined by the precast engineer and shared with the EOR. The connection concepts should also be established so both parties have an understanding of the load paths and locations of volume change relief.

   Connections cannot be designed without consideration of the interior finishes. The interior drywall finish may limit both the type of connection and its location. In many cases a full-depth blockout down to the top of the supporting beam in a floor slab or recessing of a connection is sufficient to avoid conflict with interior finishes.

   For seismic applications, consideration of interstory drift should start to be discussed. The stiffness of the lateral force resisting system may have to be coordinated with panel layouts so the interstory drift can be accommodated. Using the design assist approach can aid in refining lateral stiffness and connection concepts for best efficiency in both systems.

   Another structural design issue that would be dependent on panelization is vertical stiffness of structural components supporting panels. Where panels are supported on a flexible structure, panel installation tolerances, joint tolerances, and final deflection performance will be controlled by the stiffness of the supporting structure. This is particularly important when supporting panels on a cantilevered structure. In concrete support structures, the effects of creep must be considered to avoid detrimental movements that may not show up for several years. Using the design assist approach allows all expectations to be reviewed with collaborative resolution of issues for best efficiency. Such issues are very difficult to resolve in a traditional design/bid/build arrangement.

   The precaster may identify locations that may require supplemental support, such as projecting brackets, kickers, hardware, and bracing integral to the panel support frame. On steel frame structures, these secondary structural elements may be most efficiently supplied with the structural steel package or the miscellaneous steel package. First, shop fabrication is less costly than field fabrication. Second, a structure that is complete and ready to accept precast panel installation reduces the cost of precast erection. The detailing of these secondary elements would normally be up to the subcontractor engineers. Using the design assist process, this detailing can be accomplished early in the design process allowing for the most efficient material procurement with timing that best suits the project schedule.

8. Jobsite activity requirements and coordination are important to resolve during design development. Coordination meetings should consider all details of safety, loading, types of transportation, routes of ingress and egress for delivery trucks and erection cranes, site access, street use, sidewalk permits, oversized loads, lighting, or unusual working hours. The anticipated production schedule and duration; preliminary delivery schedules; erection methods (craning) and sequencing; the effects of temporary bracing on other trades; onsite storage, if any; and protection, as well as tolerances and interfacing with other envelope materials and interior finishes also should be discussed.

At the conclusion of this phase, the precaster can provide a guaranteed maximum price cost estimate and delivery schedule based on design development drawings with appropriate contingencies. If properly coordinated during this phase, the drawings essentially complete the contract drawings with the details incorporated in the shop drawings.

Other topics to be discussed during design development include:

**Design options or panel enhancements** to add design interest usually with minimal cost increases.

1. Incorporate more than one concrete face mix with multiple colors and finishes throughout the building façade.
2. Add a special shape.
    a. Design an appendage to an existing mold. Doing so likely will cost less than adding a full form, yet will create a unique building detail. Projections, cornices, bullnoses, formliners, sculpted panels, bottom and/or top returns, and curved panels are the most typical features added to enhance visual interest. These features can be added at a minimal cost if they are used repetitively within a unique mold family.
    b. Set windows back from the building's face at one or two column bays, or at certain levels.
    c. Add a few small ornate pieces at the entrance or as site walls. The small panels will be more expensive per square foot, but a few of them amortized over the entire project will add minimal additional cost.
3. Incorporate thin brick, ceramic or porcelain tile, terra cotta, or natural stone accents into the precast concrete.

# Construction Document (CD)

As design development drawings transition into completed construction drawing documents, and as detailed specifications are finalized, the design assist process remains valuable. The precaster can confirm that the refinements of and additions to architectural elevations, sections, and dimensions are in accord with earlier decisions and cost estimates.

The precaster will still provide erection drawings and related calculations showing the loads and final forces from the connections to the structural frame and the connection load locations. These precast drawings and calculations enable the EOR to finalize the structural design of the supporting frame. In the case of a steel frame, detailing of the secondary elements for supporting and bracing the architectural precast panels can be coordinated between the precast erection drawings and structural drawings to avoid duplication of effort. In this phase, dimensional location of slab edges, clearances, specific connection details, and support locations are finalized.

The architectural drawings are completed in this phase. Using the design assist process, details specific to the precast concrete may be completed on the precast erection drawings rather than being incorporated into the architectural drawings. Interfacing details with adjacent materials such as glazing or other façade materials would still have to be included in the architectural drawings so the other trades can be informed of the intended detailing.

The precaster should point out the availability of PCI's Guide Specification for Architectural Precast Concrete on PCI's website www.pci.org. Further, the precaster should review the appropriate parts of the Guide Specification with the architect's specification writer, to help ensure an appropriate comprehensive final specification.

The precast erection drawings should still be reviewed by the contractor, architect, and engineer for conformance to the intent of the project design. In the design assist process, the goal would be to minimize the erection drawing review task since the precaster was included as a partner in the design process. Progress drawing coordination should have promoted resolution of all difficult issues as the process proceeded.

If not already completed, final color and texture selection must be done in this phase. As a last step in the sampling process, the production and approval of range samples is desirable as a visual means of establishing the range of acceptability of precast color and texture variations, uniformity of returns, frequency, size and uniformity of air-void distribution, surface blemishes, and overall appearance. The acceptability of repair techniques for chips, spalls, or other surface blemishes can also be established on these samples.

If the project size warrants, the architect and owner may want to authorize full-size mockups. The mockup, produced prior to start of production with all detail features is an ideal mechanism for coordination of all trades with abutting materials such as windows, caulking, and anchorages.

## Construction Administration (CA)

Product fabrication, delivery, and installation will take place during this phase. The design team is invited to the production facility to view initial panels produced to assure that the desired color, texture, and quality are being achieved. Even with all the preliminary preparation and sample review, it is not uncommon to make minor changes once a full scale panel can be viewed. The impact of such changes will be minimized if done at the beginning of casting.

During the project's construction, the precaster frequently becomes an information conduit to assure smooth operations at the jobsite. The precaster will make onsite visits and attend and actively participate in project meetings. The precaster will monitor installation, and offer modifications to field conditions not anticipated. They will also coordinate handling and erecting details as well as the erection plan including the sequence of erection with the general contractor. The precaster will maintain contact with the firms responsible for both transportation and erection to ensure that the precast units are delivered in a timely manner, properly handled, and erected according to design and project specifications.

The precaster will monitor tolerance and alignment issues during installation, if any, especially at the interface between trades. To close out the project, the design team's punch list items will be addressed and completed. If desired, the precaster can suggest a simple program of inspection and maintenance.

With execution of the cooperative efforts described for the design assist process, all project complexities will have been discussed and resolved early in design and planning, eliminating expensive modifications during construction. The benefits to the owner and design team are a cost-effective design with a time- and money-saving schedule along with optimum product quality and appearance. So contact your local precaster to discuss the design assist process and the benefits design assist can bring to your project.

## AIA Learning Units

The Precast/Prestressed Concrete Institute (PCI) is a Registered Provider with both the American Institute of Architects (AIA) and the National Council of Examiners for Engineers and Surveyors (NCEES). Continuing education credit is reported to both agencies.

All certificates of completion, for architects and for engineers, will be available from the Registered Continuing Education Provider (RCEP) web site at www.rcep.net. PCI reports data twice per month so you should see your credits appear (and your certificate will be ready) within 30 days of our receiving your completed quiz.

If you are new to the Registered Continuing Education Provider system, www.rcep.net will email you a welcome email when PCI uploads your data. That email will contain your account password. Your login name at www.rcep.net will be your email address, so you must include it when submitting your completed quiz.

## 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. 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.

## Learning Objectives:

1. Explain the benefits of the design assist process for precast concrete.
2. Describe when it is desirable to begin the design assist process.
3. Understand how to enhance aesthetics and control budgets from conceptual design to project completion.
4. Describe the importance of design assist for saving time and money while obtaining the desired design objectives.

## Ascent 2012 – Architectural Precasters' Design Assist Role

**Name** (please print): ______________________________

**Company Name:** ______________________________

**Address:** ______________________________

**City:** ____________________ **State:** __________ **Zip:** __________

**Phone Number:** ______________ **Email Address:** ____________________

**Title:** ______________________________

**Background** (circle one): Architect – Engineer – Business – Marketing/Sales – Finance – Other

To receive credit, please submit completed forms to:
Attn: Education Dept. - Alex Morales, Fax (312) 361-8079, Email amorales@pci.org

1. Design assist is appropriate for which of the following delivery methods:
    a. Design/Bid/Build
    b. Design Build
    c. CM-at-Risk
    d. Integrated Project Delivery
    e. All of the above

2. The number of Requests for Information (RFIs) with design assist:
    a. Increases
    b. Decreases

3. The design assist process is:
    a. Intermittent
    b. Continuous

4. Design assist is best started during which design phase:
    a. Schematic
    b. Design development
    c. Construction documents

5. Panel sizes, panelization and finishes are not important considerations:
    a. True
    b. False

6. Proposed connection locations and loads imposed on the supporting structure should be coordinated with Engineer of Record:
    a. True
    b. False

7. Design assist will improve which of the following:
    a. Cost effectiveness
    b. Schedule
    c. Quality
    d. All of the above

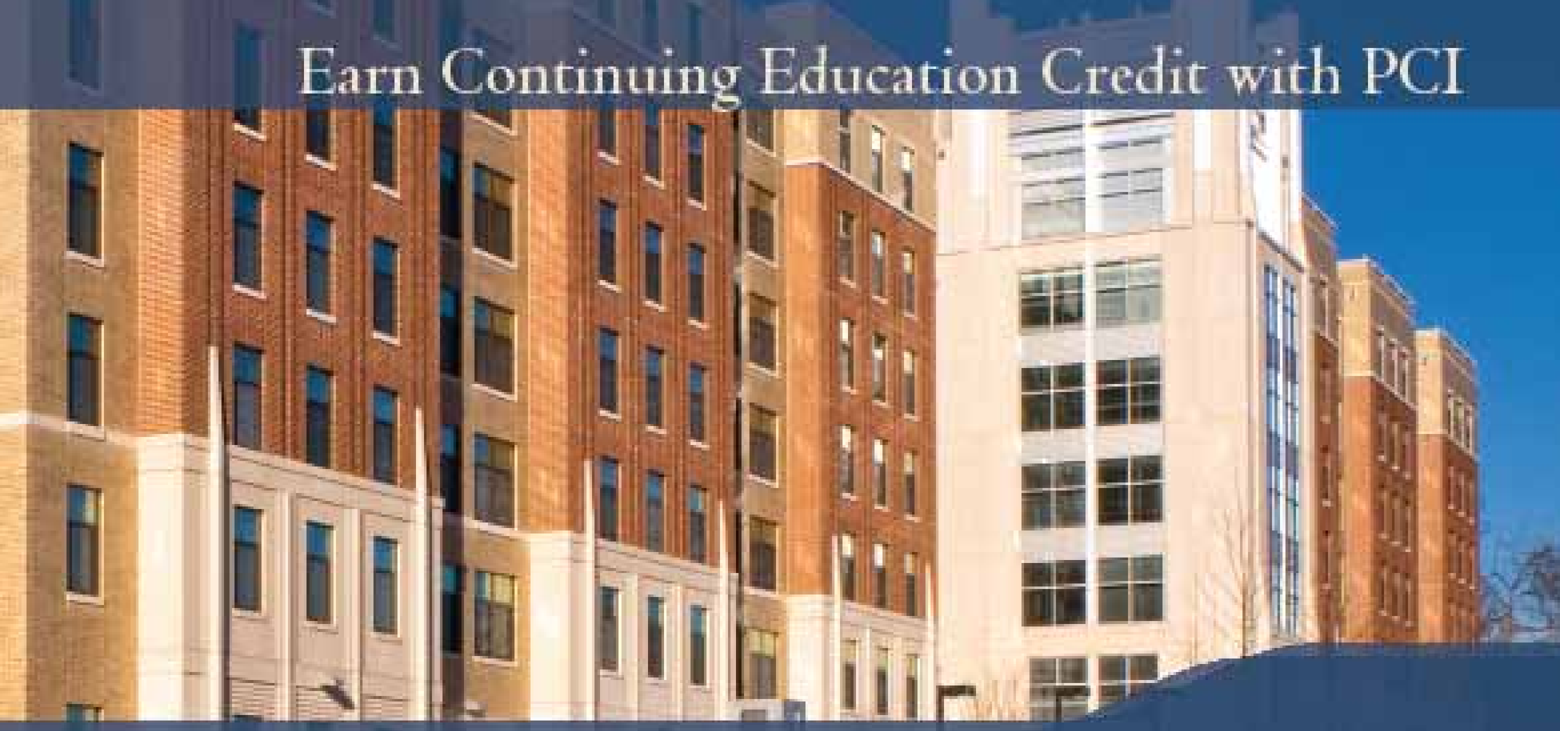
8. Insulated, noninsulated, loadbearing or cladding options should be determined during which design phase:
    a. Schematic
    b. Design development
    c. Construction documents

9. Panelization affects color and finish options:
    a. True
    b. False

10. Reveals are a low cost way to break up large wall masses:
    a. True
    b. False

11. The erection drawing review phase is more complex with the design assist process:
    a. True
    b. False

To receive credit, please submit completed forms to:
Attn: Education Dept. - Alex Morales, Fax (312) 361-8079, Email amorales@pci.org



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PCI webinars are presented live each month by industry experts on a variety of topics, from design and construction to sustainability and more. All webinars are free, one hour long, and scheduled to provide a noon start time in each time zone in the contiguous United States. Webinars provide an inexpensive way to keep up to date on new and improved materials, products, concepts, and more while earning continuing education credits.

Join us for our next webinar:

- June 26 and 28: High Performance Precast Structures and Frames

Visit www.pci.org/webinars to register.

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PCI is a registered continuing education provider with the American Institute of Architects (AIA), and the National Council of Examiners of Engineers and Surveyors (NCEES). PCI also has registered programs with the Green Building Certification Institute (GBCI). PCI's educational offerings include a variety of programs to fit your schedule and preferred learning environment, such as webinars, seminars, lunch-and-learns, and online education. To learn more, visit www.pci.org/education.

# Distance Learning Opportunities

### Webinars

PCI webinars are presented live each month by industry experts on a variety of topics from design and construction to sustainability and more. All webinars are FREE, one hour long, and scheduled to start at noon in each time zone in the contiguous United States. Webinars provide an inexpensive way to stay up to date on new materials, products, concepts, and more while earning continuing education credits. Visit www.pci.org/webinars for the full webinar schedule and registration information.

## Upcoming Webinars:

- **High Performance Precast Structures and Frames**
  June 26 and 28, 2012

### PCI eLearning Center

The PCI eLearning Center is the first education management system dedicated to the precast concrete structures industry. This free 24-hour online resource provides an opportunity for architects and engineers to earn continuing education credits on demand. Each course includes a webinar presentation recording, reference materials, and a quiz. Visit this new resource at www.pci.org/elearning.

## New Courses:

- **FEMA 361: Community Storm Shelters**
- **Perspective Gained from the Earthquakes of Japan, Chile, and New Zealand**

# In-Person Learning Opportunities

### Seminars

PCI and its regional affiliates offer seminars all over the United States on a variety of topics. Visit www.pci.org/education for up-to-date seminar listings, additional information, and registration.

## Upcoming Seminars:

- **Quality Control School**
  Level I/II
  August 29-31, 2012, Chicago, Ill.

### Lunch-and-Learns

PCI's lunch-and-learn/box-lunch programs are a convenient way for architects, engineers, and design professionals to receive continuing education credit without leaving the office. Industry experts visit your location; provide lunch; and present on topics such as sustainability, institutional construction, parking structures, aesthetics, blast resistance, the basics of precast, and many more. Visit www.pci.org/education/box_lunches for a list of lunch-and-learn offerings and to submit a program request.

# PCI-Certified Plants

*(as of June 2012)*

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, C3A**
**Hanson Pipe and Precast Southeast,** Pelham (205) 663-4681 ...... **B4, C4**
**Standard Concrete Products,** Theodore (251) 443-1113 ...... **B4, C2**

## ARIZONA

**Coreslab Structures (ARIZ) Inc.,** Phoenix (602) 237-3875 ...... **A1, B4, C4A**
**CXT Concrete Ties,** Tucson (520) 644-5703 ...... **C2**
**Royden Construction Company,** Phoenix (602) 484-0028 ...... **B4**
**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 ...... **C3A**
**Clark Pacific,** Fontana (909) 823-1433 ...... **A1, C3A, G**
**Clark Pacific,** West Sacramento (916) 371-0305 ...... **A1, C3A**
**Clark Pacific,** Woodland (916) 371-0305 ...... **B3, C3**
**Con-Fab California Corporation,** Lathrop (209) 249-4700 ...... **B4, C4**
**Con-Fab California Corporation,** Shafter (661) 630-7162 ...... **B4**
**Coreslab Structures (L.A.) Inc.,** Perris (951) 943-9119 ...... **A1, B4, C4A**
**CTU Precast,** Olivehurst (530) 749-6501 ...... **C3**
**Hanson Structural Precast,** Irwindale (626) 962-8751 ...... **C4**
**KIE-CON, Inc.,** Antioch (925) 754-9494 ...... **B4, C3**
**Mid-State Precast, L.P.,** Corcoran (559) 992-8180 ...... **A1, C3A**
**StructureCast,** Bakersfield (661) 833-4490 ...... **A1, B3, C3A**
**Universal Precast Concrete, Inc.,** Redding (530) 243-6477 ...... **A1**
**US Concrete Precast Group /dba Pomeroy,** Perris (951) 657-6093 ...... **B4, C2A**
**Walters & Wolf Precast,** Fremont (510) 226-5162 ...... **A1, G**
**Willis Construction Co., Inc.,** San Juan Bautista (831) 623-2900 ...... **A1, C1, G**

## COLORADO

**EnCon Colorado,** Denver (303) 287-4312 ...... **B4, C2**
**Plum Creek Structures,** Littleton (303) 471-1569 ...... **B4, C3A**
**Rocky Mountain Prestress LLC,** Denver (303) 480-1111 ...... **B4, C4**
**Rocky Mountain Prestress LLC,** Denver (303) 480-1111 ...... **A1, AT, C3A**
**Rocla Concrete Tie, Inc.,** Denver (303) 296-3505 ...... **C2**
**Stresscon Corporation,** Colorado Springs (719) 390-5041 ...... **A1, B4A, C4A**

## CONNECTICUT

**Blakeslee Prestress Inc.,** Branford (203) 481-5306 ...... **A1, B4, C4A**
**Coreslab Structures (CONN) Inc.,** Thomaston (860) 283-8281 ...... **A1, B1, C1**
**Oldcastle Precast, Inc./dba Rotondo Precast,** Avon (860) 673-3291 ...... **B2, C1A**
**United Concrete Products Inc.,** Yalesville (203) 269-3119 ...... **B3, C2**

## DELAWARE

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

## FLORIDA

**Cement Industries, Inc.,** Fort Myers (239) 332-1440 ...... **B3, C3**
**Colonial Construction, Concrete, Precast, LLC,** Placida (941) 698-4180 ...... **C2**
**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 ...... **A1, B3, C3A**
**Dura-Stress, Inc.,** Leesburg (800) 342-9239 ...... **A1, B4A, C4A**
**Finfrock Industries, Inc.,** Orlando (407) 293-4000 ...... **A1, C4A**
**Florida Precast Industries, Inc.,** Sebring (863) 655-1515 ...... **C2**
**Florida Rock and Sand Prestress Precast Co., Inc.,** Miami (305) 247-9611 ...... **B3**
**Gate Precast Company,** Jacksonville (904) 757-0860 ...... **A1, B4, C3A**
**Gate Precast Company,** Kissimmee (407) 847-5285 ...... **A1, C2**
**Metromont Corporation,** Bartow (863) 440-5400 ...... **A1, C3**
**Oldcastle Precast,** Jacksonville (904) 768-7081 ...... **C1**
**South Eastern Prestressed Concrete, Inc.,**
West Palm Beach (561) 793-1177 ...... **B3, C3**
**Stabil Concrete Products, LLC,** St. Petersburg (727) 321-6000 ...... **A1**
**Standard Concrete Products, Inc.,** Tampa (813) 831-9520 ...... **B4, C3**

## GEORGIA

**Atlanta Structural Concrete Co.,** Buchanan (770) 646-1888 ...... **C4A**
**ConArt Precast, LLC,** Cobb (229) 853-5000 ...... **A1, AT, C3**
**Coreslab Structures (ATLANTA) Inc.,** Jonesboro (770) 471-1150 ...... **C3A**
**Gulf Coast Pre-Stress, Inc.,** Jonesboro (228) 234-7866 ...... **B4**
**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, LLC,** Kapolei (808) 682-6000 ...... **A1, B3, C4**
**GPRM Prestress, LLC,** Puunene (808) 682-6000 ...... **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 Precast,** Aurora (630) 896-4679 ...... **A1, C3A**
**AVAN Precast Concrete Products,** Lynwood (708) 757-6200 ...... **A1, C3**
**County Materials Corporation,** Champaign (217) 352-4181 ...... **B3, B3-IL**
**County Materials Corporation,** Salem (618) 548-1190 ...... **A1, B4, B4-IL, C4**
**Dukane Precast, Inc.,** Aurora (630) 355-8118 ...... **A1, C3**
**Illini Concrete Company of Illinois, LLC,** Tremont (309) 925-5290 ...... **B3, B3-IL**
**Illini Precast, LLC,** Marseilles (708) 562-7700 ...... **B4, B4-IL, C3**
**Lombard Architectural Precast Products Co.,** Alsip (708) 389-1060 ...... **A1**
**Mid-States Concrete Industries,** South Beloit (608) 364-1072 ...... **A1, B3, B3-IL, C3A**
**Prestress Engineering Corporation,** Blackstone (815) 586-4239 ...... **B4, B4-IL, C4**
**Spancrete of Illinois, Inc.,** Crystal Lake (815) 459-5580 ...... **C2**
**St. Louis Prestress, Inc.,** Glen Carbon (618) 656-8934 ...... **B3, B3-IL, C3**
**Utility Concrete Products, LLC,** Morris (815) 416-1000 ...... **C1A**

## INDIANA

**ATMI Indy, LLC,** Greenfield (317) 891-6280 ...... **A1, C2A**
**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**
**StresCore, Inc.,** South Bend (574) 233-1117 ...... **C2**

## IOWA

**Advanced Precast Co.,** Farley (563) 744-3909 ...... **C1A**
**Andrews Prestressed Concrete, Inc.,** Clear Lake (641) 357-5217 ...... **B4, C4**
**MPC Enterprises, Inc.,** Mount Pleasant (319) 986-2226 ...... **A1, C3A**
**PDM Precast, Inc.,** Des Moines (515) 243-5118 ...... **B3, C4**

## 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**

## KENTUCKY

**Bristol Group, Inc.,** Lexington (859) 233-9050 ...... **C3**
**de AM - RON Building Systems LLC,** Owensboro (270) 684-6226 ...... **B3, C3A**
**Gate Precast Company,** Winchester (859) 744-9481 ...... **A1**
**Prestress Services Industries LLC,** Lexington (260) 724-7117 ...... **B4, B4-IL, C4A**
**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, C1A**

## MAINE

**Oldcastle Precast,** Auburn (207) 784-9144 ...... **B2, 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**



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## 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 ..........**B3, C2**

## MICHIGAN

**International Precast Solution, LLC,** River Rouge (313) 843-0073......**A1, B3, C3**
**Kerkstra Precast Inc.,** Grandville (800) 434-5830 ..........**A1, B3, C3A**
**Nucon Schokbeton / Stress-Con Industries, Inc.,**
Kalamazoo (269) 381-1550 ..........**A1, B4, C3A**
**Stress-Con Industries, Inc.,** Detroit (313) 873-4711 ..........**B3, C3**
**Stress-Con Industries, Inc.,** Saginaw (989) 239-2447 ..........**B4, C3**

## MINNESOTA

**Crest Precast, Inc.,** La Crescent (507) 895-8083..........**B3A, C1A**
**Fabcon,** Savage (800) 727-4444 ..........**A1, B1, C3A**
**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,** Albany (320) 845-2299..........**A1, C3A**
**Wells Concrete Products Co.,** Wells (507) 553-3138 ..........**A1, C4A**

## 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**
**Tindall Corporation,** Moss Point (228) 435-0160 ..........**A1, C4A**

## MISSOURI

**Coreslab Structures (MISSOURI) Inc.,** Marshall (660) 886-3306....**A1, B4, C4A**
**County Materials Corporation,** Bonne Terre (573) 358-2773..........**B4**
**Mid America Precast, Inc.,** Fulton (573) 642-6400..........**A1, B1, C1**
**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**

## 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, C2A**
**Stonco, Inc.,** Omaha (402) 556-5544..........**A1**

## NEW HAMPSHIRE

**Newstress Inc.,** Epsom (603) 736-9348..........**B3, C3**

## NEW JERSEY

**Boccella Precast LLC,** Berlin (856) 767-3861..........**C2**
**Jersey Precast Corp.,** Hamilton Township (609) 689-3700..........**B4, C4**
**Northeast Precast,** Millville (856) 765-9088 ..........**B2, C2**
**Precast Systems, Inc.,** Allentown (609) 208-1987 ..........**B4, C4**

## NEW MEXICO

**Castillo Prestress,** Belen (505) 864-0238..........**B4, C4**
**Coreslab Structures (ALBUQUERQUE) Inc.,**
Albuquerque (505) 247-3725 ..........**A1, B4, C4A**
**Ferreri Concrete Structures, Inc.,** Albuquerque (505) 344-8823 ..........**A1, C4A**

## 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.,** Selkirk (518) 767-2116..........**B3, C3A**
**The Fort Miller Co., Inc.,** Greenwich (518) 695-5000..........**B1, C1**
**The L.C. Whitford Materials Co., Inc.,** Wellsville (585) 593-2741 ..........**B4, C3**

## NORTH CAROLINA

**Gate Precast Company,** Oxford (919) 603-1633 ..........**A1, C2**
**International Precast Inc.,** Siler City (919) 742-3132 ..........**A1, C3A**
**Metromont Corporation,** Charlotte (704) 372-1080..........**A1, C3A**
**Prestress of the Carolinas,** Charlotte (704) 587-4273 ..........**B4, C4**
**S & G Prestress Company,** Wilmington (910) 763-7702..........**B4, C3**
**Utility Precast, Inc.,** Concord (704) 721-0106 ..........**B3A**

## NORTH DAKOTA

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

## OHIO

**DBS Prestress of Ohio,** Huber Heights (937) 878-8232..........**C2**
**Fabcon LLC,** Grove City (614) 875-8601 ..........**C3A**
**High Concrete Group LLC,** Springboro (937) 748-2412..........**A1, C3A**
**KSA,** Sciotoville (740) 776-3238..........**C2**
**Mack Industries, Inc.,** Valley City (330) 483-3111..........**C3**
**Prestress Services Industries LLC,** Grove City (614) 871-2900..........**B4, C1**
**Prestress Services Industries of Ohio, LLC,** Mt. Vernon (800) 366-8740 ...**B4, C3**
**Prestress Services Industries of Ohio, LLC,** Mt. Vernon (740) 393-1121 ...**B3, C1**
**Sidley Precast,** Thompson (440) 298-3232..........**A1, C4A**

## 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**
**Tulsa Dynaspan, Inc.,** Broken Arrow (918) 258-1549 ..........**A1, C3**

## OREGON

**Knife River Corporation,** Harrisburg (541) 995-6327 ..........**A1, B4, C4**
**R.B. Johnson Co.,** McMinnville (503) 472-2430..........**B4**

## PENNSYLVANIA

**Concrete Safety Systems, LLC,** Bethel (717) 933-4107 ..........**B1A, C1A**
**Conewago Precast Building Systems,** Hanover (717) 632-7722..........**A1, C2A**
**Dutchland, Inc.,** Gap (717) 442-8282..........**C3**
**Fabcon East, LLC,** Mahanoy City (570) 773-2480 ..........**A1, C3A**
**High Concrete Group LLC,** Denver (717) 336-9300..........**A1, B3, C3A**
**J & R Slaw, Inc.,** Lehighton (610) 852-2020..........**A1, B4, C3**
**Newcrete Products,** Roaring Spring (814) 224-2121 ..........**B4, C4**
**Nitterhouse Concrete Products, Inc.,** Chambersburg (717) 267-4505 ..**A1, C4A**
**Northeast Prestressed Products, LLC,** Cressona (570) 385-2352..........**B4, C3**
**Pittsburgh Flexicore Company, Inc.,** Donora (724) 258-4450..........**C2**
**Say-Core, Inc.,** Portage (814) 736-8018 ..........**C2**
**Sidley Precast,** Youngwood (724) 755-0205..........**C3**
**U.S. Concrete Precast Group Mid-Atlantic,**
Middleburg (570) 837-1774..........**A1, C3A**
**Universal Concrete Products Corporation,** Stowe (610) 323-0700.....**A1, C3A**

## SOUTH CAROLINA

**Florence Concrete Products, Inc.,** Sumter (803) 775-4372..........**B4, C3A**
**Metromont Corporation,** Greenville (864) 295-0295 ..........**A1, C4A**
**Parker Marine Contracting Corporation,** Charleston (843) 853-7615...**B2, C2**
**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, C3A**
**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**
**Sequatchie Concrete Service, Inc.,** Chattanooga (423) 867-4510 ..........**C2**

## TEXAS

**Coreslab Structures (TEXAS) Inc.,** Cedar Park (512) 250-0755 ..............**A1, C4A**
**CXT, Inc.,** Hillsboro (254) 580-9100 ..............**B1, C1**
**Eagle Precast Corporation,** Decatur (940) 626-8020..............**A1, C3**
**East Texas Precast Co., LTD.,** Hempstead (936) 857-5077..............**C4A**
**Enterprise Concrete Products, LLC,** Dallas (214) 631-7006..............**B3, C3**
**Gate Precast Company,** Hillsboro (254) 582-7200 ..............**A1**
**Gate Precast 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..............**C2A**

## 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**
**Harper Contracting,** Salt Lake City (801) 326-1016 ..............**B2, C1**
**Owell Precast LLC,** Bluffdale (801) 571-5041 ..............**B3A, C3**
**The Shockey Precast Group, LLC,** Harriman (540) 667-7700 ..............**C3**

## VERMONT

**Dailey Precast,** Shaftsbury (802) 442-4418 ..............**A1, B4A, C3A**
**J. P. Carrara & Sons, Inc.,** Middlebury (802) 388-6363..............**A1, B4A, C3A**
**S.D. Ireland Companies,** South Burlington (802) 658-0201 ..............**A1**

## VIRGINIA

**Atlantic Metrocast, Inc.,** Portsmouth (757) 397-2317 ..............**B4, C4**
**Bayshore Concrete Products Corporation,**
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..............**A1, B4, C3**
**Metromont Corporation,** Richmond (804) 222-8111 ..............**A1, C3A**
**Rockingham Precast, Inc.,** Harrisonburg (540) 433-8282..............**B4, C3**
**Smith-Midland Corporation,** Midland (540) 439-3266 ..............**A1, B2, 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 ..............**A1, C4A**

## WASHINGTON

**Bellingham Marine Industries, Inc.,** Ferndale (360) 676-2800..............**B3, C2**
**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 Northwest, LLC,** Camas (360) 834-3459..............**B1**
**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

**Advance Cast Stone Co., Inc.,** Random Lake (920) 994-4381 ..............**A1**
**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**
**MidCon Products, Inc.,** Hortonville (920) 779-4032 ..............**A1, AT, C1**
**Spancrete, Inc.,** Green Bay (920) 494-0274 ..............**B4, C4**
**Spancrete, Inc.,** Valders (920) 775-4121 ..............**A1, B3, C3A**
**Stonecast Products, Inc.,** Germantown (262) 253-6600..............**A1, C1**
**Wausau Tile Inc.,** Rothschild (715) 359-3121 ..............**AT**

## WYOMING

**voestalpine Nortrak, Inc.,** Cheyenne (509) 220-6837 ..............**C2**

## CANADA

### BRITISH COLUMBIA

**Armtec Limited Partnership,** Richmond (604) 278-9766 ..............**A1, B4, C3**

### NEW BRUNSWICK

**Strescon Limited,** Saint John (506) 633-8877 ..............**A1, B4, C4A**

### 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, C3A, G**
**Betons Prefabriques du Lac, Inc.,** Alma (418) 668-6161..............**A1, C2**
**Betons Prefabriques Trans. Canada Inc.,**
St. Eugene De Grantham (819) 396-2624 ..............**A1, B4, C3A**
**Prefab De Beauce,** Sainte-Marie De Beauce (418) 387-7152..............**A1, C3**

## MEXICO

**PRETECSA, S.A. DE C.V.,** Atizapan De Zaragoza (011) 52-1036077..............**A1, G**
**Willis De Mexico S.A. de C.V.,** Tecate (011) 52-665-655-2222 ..............**A1, C1, G**



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# PCI-Qualified & PCI-Certified Erectors

*(as of June 2012*

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 blue.

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

### ARKANSAS
**Coreslab Structures (ARK) Inc.,** Conway (501) 329-3763 ........ **S2**

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

### COLORADO
**Encon Field Services, LLC,** Denver (303) 287-4312 ........ **S2**
**Gibbons Erectors, Inc.,** Englewood (303) 841-0457 ........ **S2, A**
**Rocky Mountain Prestress,** Denver (303) 480-1111 ........ **S2, A**
**S. F. Erectors Inc.,** Elizabeth (303) 646-6411 ........ **S2, A**

### CONNECTICUT
**Blakeslee Prestress, Inc.,** Branford (203) 481-5306 ........ **S2**
**Jacob Erecting & Construction LLC,** Durham (860) 788-2676 ........ **S2, A**

### FLORIDA
**Concrete Erectors, Inc.,** Altamonte Springs (407) 862-7100 ........ **S2, A**
**Finfrock Industries, Inc.,** Orlando (407) 293-4000 ........ **S2, A**
**Florida Builders Group, Inc.,** Miami (305) 278-0098 ........ **S2**
**Florida Precast Industries,** Sebring (863) 655-1515 ........ **S1**
**Gate Precast Erection Co.,** Jacksonville (904) 757-0860 ........ **A**
**Gate Precast Erection Co.,** Kissimmee (407) 847-5285 ........ **A**
**James Toffoli Construction Company, Inc.,** Fort Myers (239) 479-5100 ........ **S2, A**
**Pre-Con Construction of Tampa Inc.,** Tampa (813) 626-2545 ........ **S2, A**
**Solar Erectors U. S. Inc.,** Medley (305) 825-2514 ........ **S2, A**
**Specialty Concrete Services, Inc.,** Altoona (352) 669-8888 ........ **S2, A**
**Structural Prestressed Industries, Inc.,** Medley (305) 556-6699 ........ **S2**
**Summit Erectors, Inc.,** Jacksonville (904) 783-6002 ........ **S2, A**

### GEORGIA
**Big Red Erectors Inc.,** Covington (770) 385-2928 ........ **S2, A**
**ConArt Precast, LLC,** Cobb (229) 853-5000 ........ **S2, A**
**Jack Stevens Welding LLP,** Murrayville (770) 534-3809 ........ **S2**
**Precision Stone Setting Co., Inc.,** Hiram (770) 439-1068 ........ **S2, A**
**Rutledge & Son's,** Woodstock (770) 592-0380 ........ **S2**

### IDAHO
**Precision Precast Erectors, LLC,** Worley (208) 660-5223 ........ **S2, A**

### ILLINOIS
**Area Erectors, Inc.,** Rockford (815) 562-4000 ........ **S2, A**
**Creative Erectors, LLC,** Rockford (815) 229-8303 ........ **S2, A**
**Mid-States Concrete Industries,** South Beloit (800) 236-1072 ........ **S2**
**Spancrete of Illinois, Inc.,** Crystal Lake (815) 459-5580 ........ **S2**

### INDIANA
**Stres Core Inc.,** South Bend (574) 233-1117 ........ **S1**

### IOWA
**Cedar Valley Steel, Inc.,** Cedar Rapids (319) 373-0291 ........ **S2, A**
**Topping Out Inc. / dba Northwest Steel Erection,** Des Moines (800) 247-5409 ........ **S2**

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## KANSAS
**Carl Harris Co., Inc.**, Wichita (316) 267-8700 .......... **S2, A**
**Crossland Construction Company, Inc.**, Columbus (620) 429-1414 .......... **S2, A**
**Ferco, Inc.**, Salina .......... **S1**
**Topping Out Inc. / dba Davis Erection Kansas City,** Kansas City (800) 613-9547 .......... **S2**

## LOUISIANA
**Lafayette Steel Erector, Inc.**, Lafayette (337) 234-9435 .......... **S2**

## MAINE
**American Aerial Services, Inc.**, Falmouth (207) 797-8987 .......... **S1**
**Cianbro Corporation**, Pittsfield (207) 679-2435 .......... **S2**
**Reed & Reed, Inc.**, Woolwich (207) 443-9747 .......... **S2, A**

## MARYLAND
**DLM Contractors, LLC**, Upper Marlboro (301) 877-0000 .......... **S2, A**
**E & B Erectors, Inc.**, Pasadena (410) 360-7800 .......... **S2, A**
**E.E. Marr Erectors, Inc.**, Baltimore (410) 837-1641 .......... **S2, 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**

## MASSACHUSETTS
**Prime Steel Erecting, Inc.**, North Billerica (978) 671-0111 .......... **S2, A**

## MICHIGAN
**Assemblers Precast & Steel Services, Inc.**, Saline (734) 429-1358 .......... **S2, A**
**Devon Contracting, Inc.**, Detroit (313) 221-1550 .......... **S2, A**
**G2 Inc.**, Cedar Springs (616) 696-9581 .......... **S2, A**
**Pioneer Construction Inc.**, Grand Rapids (616) 247-6966 .......... **S2**

## MINNESOTA
**Amerect, Inc.**, Newport (651) 459-9909 .......... **A**
**Fabcon, Inc.**, Savage (952) 890-4444 .......... **S2**
**Hanson Structural Precast Midwest, Inc.**, Maple Grove (763) 425-5555 .......... **S2, A**
**Molin Concrete Products Company**, Lino Lakes (651) 786-7722 .......... **S2, A**
**Wells Concrete Products Co.**, Wells (507) 553-3138 .......... **S2, A**

## MISSISSIPPI
**Bracken Construction Company, Inc.**, Jackson (601) 922-8413 .......... **S2, A**

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

## NEBRASKA
**Moen Steel Erection, Inc.**, Omaha (402) 884-0925 .......... **S2**
**Topping Out Inc. / dba Davis Erection Lincoln**, Lincoln (800) 881-2931 .......... **S2**
**Topping Out Inc. / dba Davis Erection Omaha**, Omaha (800) 279-1201 .......... **S2, A**

## NEVADA
**Cedco Commerical, LLC**, Las Vegas (702) 361-6550 .......... **A**

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

## NEW JERSEY
**CRV Precast Construction LLC**, Eastampton (800) 352-1523 .......... **S2, A**
**J. L. Erectors, Inc.**, Blackwood (856) 232-9400 .......... **S2, A**
**JEMCO-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**
**Structural Services, Inc.**, Albuquerque (505) 345-0838 .......... **S2**

## NEW YORK
**Empire Concrete Systems, LLC**, Pittsford (585) 586-1510 .......... **A**
**J.C. Steel Corp.**, Bohemia (631) 563-3545 .......... **A**
**Koehler Masonry**, Farmingdale (631) 694-4720 .......... **S1**
**Oldcastle Building Systems Div. / Project Services,** Manchester (518) 767-2116 .......... **S2, A**
**Oldcastle Building Systems Div. / Project Services,** Selkirk (518) 767-2116 .......... **S2, A**

## NORTH CAROLINA
**Buckner Steel Erection Inc.**, Graham (336) 376-8888 .......... **S2**
**Carolina Precast Erectors, Inc.**, Taylorsville (828) 635-1721 .......... **S2, A**

## NORTH DAKOTA
**PKG Contracting, Inc.**, Fargo (701) 232-3878 .......... **S2**
**Wells Concrete**, Grand Forks (701) 772-6687 .......... **S2**

## OHIO
**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
**Allied Steel Construction Co., LLC**, Oklahoma City (405) 232-7531 .......... **S2, A**
**Bennett Steel, Inc.**, Sapulpa (918) 260-0773 .......... **S1**
**Coreslab Structures (OKLA), Inc.**, Oklahoma City (405) 632-4944 .......... **S2, A**

## PENNSYLVANIA
**Century Steel Erectors**, Kittanning (724) 545-3444 .......... **S2, A**
**Conewago Enterprises, Inc.**, Hanover (717) 632-7722 .......... **S2**
**High Concrete Group**, Denver (717) 336-9300 .......... **S2, A**
**Kinsley Construction Inc.**, York (717) 757-8761 .......... **S1**
**Maccabee Industrial, Inc.**, Belle Vernon (724) 930-7557 .......... **S2, A**
**Nitterhouse Concrete Products, Inc.**, Chambersburg (717) 267-4505 .......... **S2**
**Patterson Construction Company, Inc.**, Monongahela (724) 258-4450 .......... **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**

## SOUTH DAKOTA
**Fiegen Construction Co.**, Sioux Falls, SD (605) 335-6000 .......... **S2, A**

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

## TEXAS
**Empire Steel Erectors LP**, Humble (281) 548-7377 .......... **A**
**Gate Precast Company**, Pearland (281) 485-3273 .......... **S1**
**Gulf Coast Precast Erectors, LLC**, Hempstead (832) 451-4395 .......... **S2**
**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**

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

## VIRGINIA
**Sprinkle Masonry Inc.**, Chesapeake (757) 545-8435 .......... **A**
**The Shockey Precast Group**, Winchester (540) 665-3253 .......... **S2, A**

## WASHINGTON
**Central Pre-Mix Prestress Co.**, Spokane Valley (509) 536-3334 .......... **S2, A**

## WISCONSIN
**Continental Enterprises Inc.**, Appleton (920) 788-9189 .......... **S1**
**Miron Construction Co. Inc.**, Neenah (920) 969-7000 .......... **S2, A**
**Spancrete**, Valders (920) 775-4121 .......... **S2, A**
**Spancrete**, Waukesha (414) 290-9000 .......... **S2, A**
**The Boldt Company**, Appleton (920) 225-6127 .......... **S2, A**



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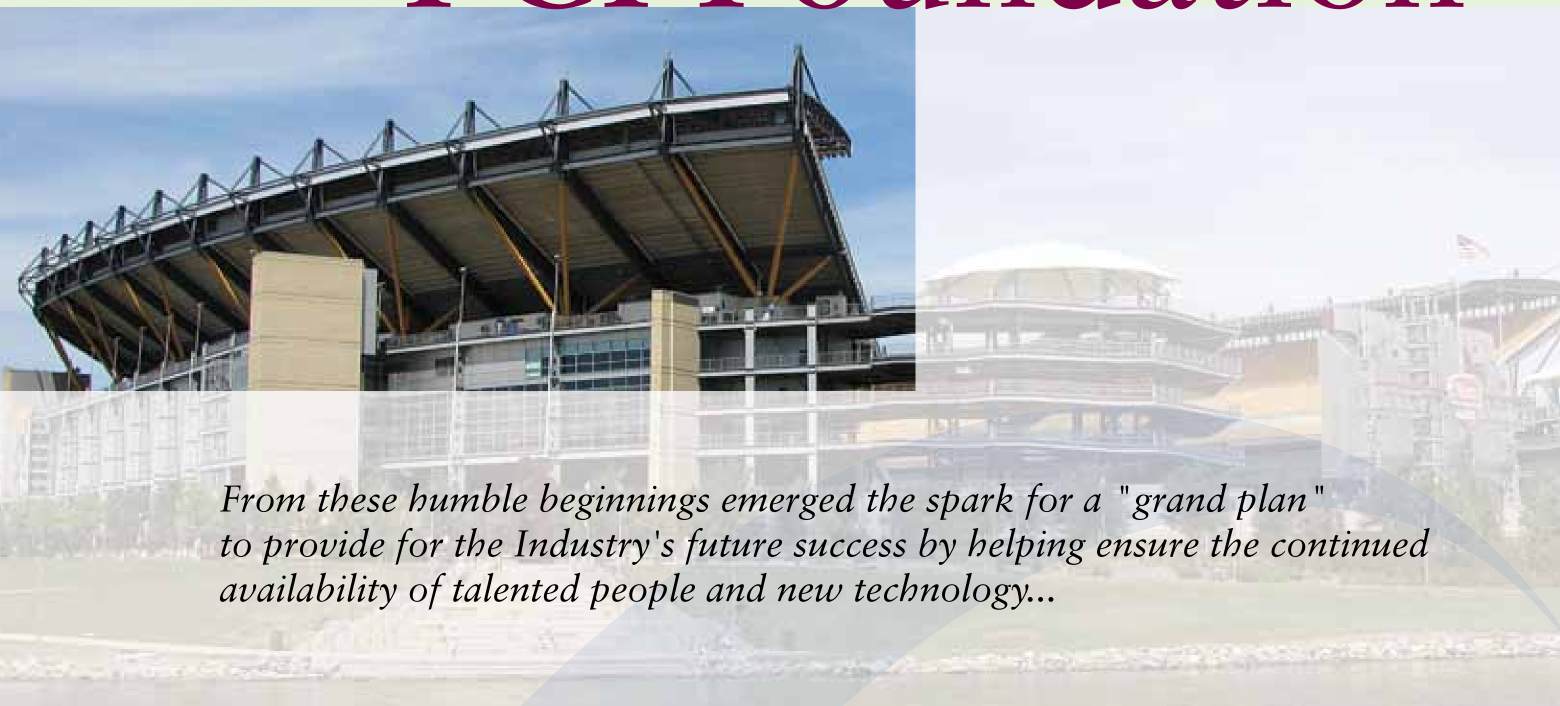

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