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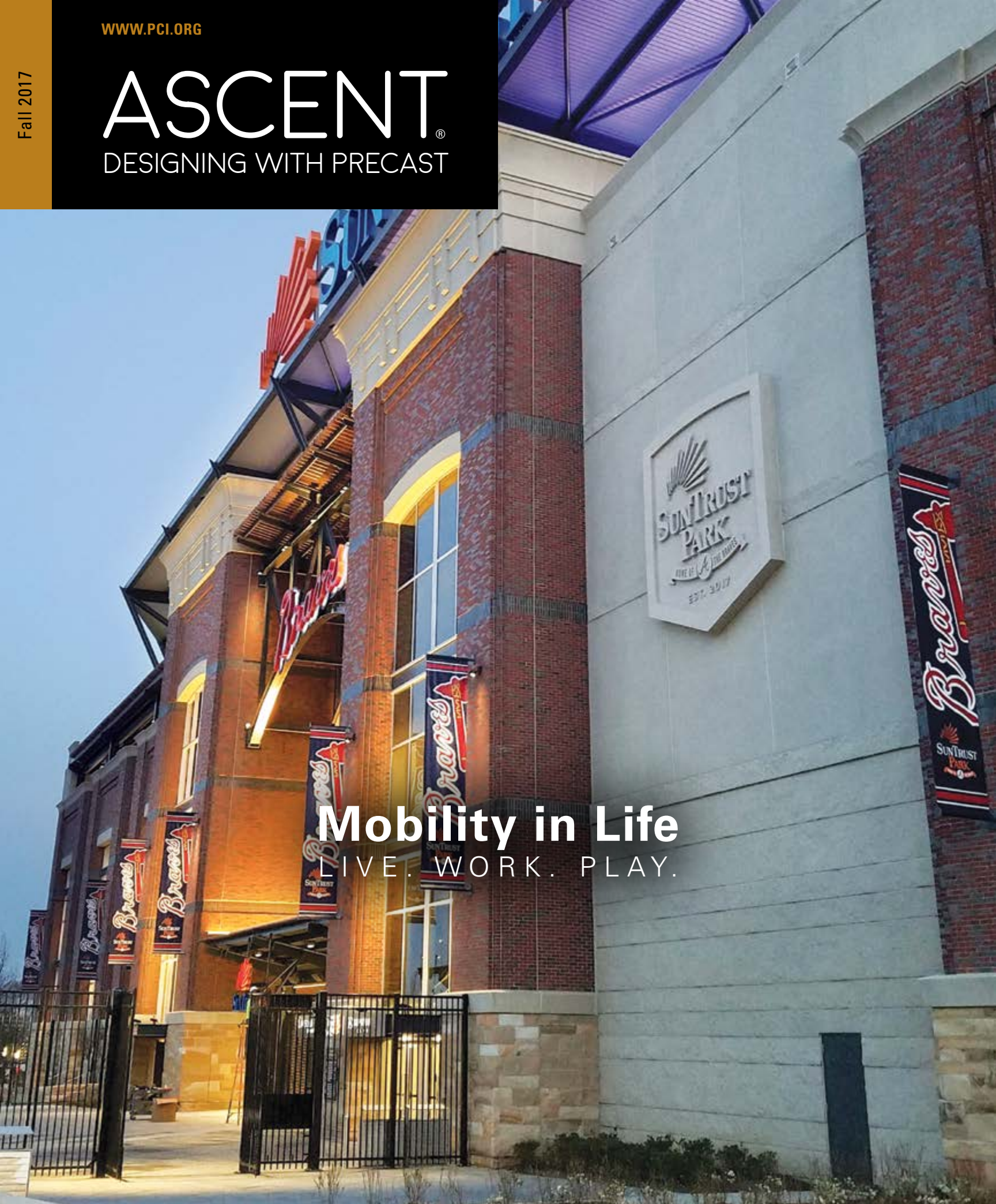

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Precast columns embedded with thin brick that steps out two to three times are flanked by architectural panels replicating chiseled stone.

Populous, Ballpark Designer

SunTrust Park Features Out of the Park Precast Design

The 1.1 million-square-foot SunTrust Park serves as the focal point of The Battery Atlanta development which offers people a live, work, and play experience.

Architectural precast concrete components were key in achieving the designers' vision for the ballpark. In order to meet the project's fast-track schedule and ensure the panels were robust enough to accommodate the wind and seismic loads, weekly BIM-based coordination meetings were held between Gate Precast's in-house engineer, the architect, structural engineer and other trades.

The ballpark's architectural panels are much more than just a façade as it supports multiple exterior systems such as glazing, open mullions, louvers, steel entry trusses and canopies.

The majority of the façade features panels embedded with a three-brick color blend. Some panels are buff with a light sandblast finish to simulate limestone, while others replicate chiseled stone. The exterior architectural look was pulled into the stadium's interior at field level.

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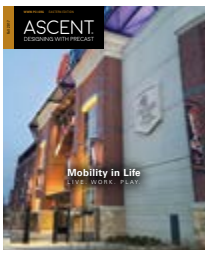

On the cover: SunTrust Park.
Photo: Gate Precast.

FEATURES

University of Chicago Campus North Residential Commons. Photo: Tom Harris Photography.

DEPARTMENTS

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Authenticity, Choices, Integration- Designing for Millennials, By Millennials

How do you build a city for the future—namely Millennials and Gen Z? Phrases like *Live, Work, Play or Place-making* are tired, overused, and contrived; they bore us. As a planner, analyst, and sustainability advocate, I see issues of *mobility, leisure, integration, and longevity* as core values that attract us and translate into design principles across climate, geography, and scale.

Mobility is arguably the most straightforward consideration for any place: how are people moving about? This is measured by the time it takes, not only to move from A to B (your morning commute, for instance), but also your overall integration into a mobility network. Does your neighborhood have a train? What about bike share? Is there an express bus route? These solutions reduce traffic, improve commuter options, and provide option for closing the "last mile" of a trip. It also makes the whole environment more accessible, which creates a stronger sense of attachment and ownership.

Leisure is more than just offering "cool bars" and a yoga studio. Young urbanites expect their environment to be part of their leisure. Part of the draw to cycling, taking a train, or walking is in the benefit provided by not being stuck in traffic, but also in the experience of that activity. Asking questions like, "How can a simple grocery run produce a sense of leisure?" is key! Creating electricity in the mundane is integral to city life (think bazaars and markets of the ancient cities, which were hubs of culture, arts, and commerce). We expect life to be holistic and incorporated with leisure.

Integration and longevity go together-urban places are increasingly designed with singular tastes in mind for very particular lifestyles. It's chic and attractive now, but exposed brick lofts with 15-ft ceilings won't last forever. Many of us swear we'll never want to leave the city for the suburbs, and as such the amenities associated with these places will also shift or require flexibility to meet those needs. These are harder questions to ask of a design, but consider how economic stability can be integrated into a space. What does affordable housing look like in this context? What about families that will have school-age kids in the next 5 to 10 years? A neighborhood predicated on the high turnover of twentysomethings generates a never-ending vacuum. Creating social stratification is an anchor for a community, and ensures that people will not only live in a place, but set roots there and give back to it.

The projects featured in the following pages of Ascent demonstrate how precast concrete contributes to communities and creates mobility, leisure, integration, and longevity.

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O'neil Cinemas Use Hollow-core With Seating

LITTLETON, MASSACHUSETTS

To complete the new state-of-the art movie theater that serves as a centerpiece for The Point mixed-use development in Littleton, Mass., designers turned to precast concrete hollow-core supported on concrete masonry units. The components' speed of erection through three phases of construction ensured a speedy completion.

The $10-million, 540,000-ft^2 Point project is the area's first mixed-use retail destination of its kind in Boston's Metro Northwest. See http://www.thepoint495.com/news/summer-2017-blockbuster-oneil-cinemas-underway-at-the-point. It features the region's only open-air center that combines shops, restaurants, grocery, hotel, and entertainment.

A highlight of the development is the 380,000-ft^2 O'neil Cinemas center, an eight-auditorium theater with wall-to-wall screens and all-stadium seating. The largest theater includes a 72-ft-wide curved screen, the biggest in the region and one of the largest in the United States. The facility includes tabled recliners for in-theater dining and a contemporary lounge with seating capacity to accommodate up to 85 people.

Schroeder & Holt Architects in Milwaukee, Wis., served as the architectural firm on the project, with Hutter Construction Co. the general contractor. Strescon Limited supplied, installed, and grouted 90 pieces of 8-in. Strescore hollow-core to serve as flooring for the stadium seating areas.

After each level of slab was placed and grouted, the erector needed to wait until the masons had built the concrete masonry unit support walls for the next level before installing the hollow-core. Installation of the materials was completed in April.

Precast Parking Supports MGM Casino

SPRINGFIELD, MASSACHUSETTS

The design-build team for the parking structure supporting the new MGM Resort Casino needed to find an economical approach that met all the functional requirements while blending with the nearby historical buildings and undertaking construction in the busy downtown area. To help achieve these goals, they specified a total–precast concrete structural system.

The project, on a 300- by 600-ft footprint, consists of an eight-level structure containing 1.16 million ft^2 to park 3400 cars. The design features double tees, inverted tee beams, columns, shear walls, vertical shear walls, horizontal lite walls, spandrels embedded with thin brick and with a sandblasted finish, stairs, slabs, and wall panels with a formliner to achieve a limestone look. Blakeslee Prestress fabricated and erected the components.

Precast concrete was chosen primarily due to its "significant" savings compared to other options, according to Steve O'Connor, senior project manager for Tishman Construction Co., the construction manager. The 62-ft-long double-tees, at a 12.5-ft width, also fit perfectly with the bay layout. The design required only one expansion joint, compared to many more needed for a cast-in-place design, adds Noli Alarcon, vice president at TimHaahs, the architect/engineer on the project.

The structure's one key adaptation was making the first level twice the regular height, 26 ft, to create a loading dock at the rear of the facility and ensure any delivery vehicles would have access. The loading area was fire-separated from the rest of the parking spaces to meet building codes.

Aesthetic requirements were met with a combination of thin brick embedded in the spandrels and accents finished with a buff-colored sandblast finish to resemble limestones. These included stair towers, some horizontal spandrels, and some of the base. The variations in the appearance help reduce the visual scale of the project. Aesthetics were critical due to the building's location, near the Naismith Memorial Basketball Hall of Fame in a downtown district with historic buildings.

The erection was complicated by the on-going construction of the casino, with the parking structure planned for earlier completion. Material was staged on-site and at an off-site queuing yard, so it was readily available as needed. A large crawler crane was used in the precast erection process, which took nine months and finished in June 2017. The casino is scheduled to open in 2018.

Submit your headline news for consideration in a future issue of Ascent to Becky King at bking@pci.org.

Gage Brothers To Open New Plant

SIOUX FALLS, SOUTH DAKOTA

Gage Brothers has begun construction of a plant featuring a multi-million-dollar investment in state-of-the-art technology rarely used in the manufacture of precast concrete in the United States, according to Gage Brothers president Tom Kelley. It will be located in northeast Sioux Falls, S.D., off Interstate 229.

The $40-million plant will help the firm meet demand for its products, especially its insulated and thin-brick wall-panel systems and its new line of ARCIS ultra-thin panels. Its existing plant, founded in 1915, no longer can keep up with demand, officials say.

The new 21,000-ft^2 facility will consolidate employees and machinery, increase capacity by 60%, and help expand the company's sales area. Approximately 95% of precast concrete production will be handled indoors, compared to 65% at the current location.

JLG Architects in Sioux Falls serves as the architect of record on the project, while construction management is being performed by Fiegen Construction in Sioux Falls.

Riverwalk Pathway Features Precast 'Tubs'

CHICAGO, ILLINOIS

The third and final phase of the Chicago, Ill., Riverwalk construction project opened in late 2016, featuring precast concrete underbridge "tubs" that connect previously constructed portions to the new ones to create a continuous walkway.

Utility Concrete Products fabricated the tubs, which resemble a bathtub, in three pieces that were assembled at the site. They provided the structure to allow cast-in-place concrete to be poured, creating the composite connection that completes each underbridge. The tubs are 10 ft wide × 4 ft tall and vary in length from 38 ft to 86 ft 3¾-in., with the heaviest piece weighing nearly 164,000 lb. They were cast with high-strength, high-performance concrete (HSHPC) to withstand the marine environment.

Each tub was heavily reinforced with large-diameter, epoxy-coated reinforcing bar spanning the longitudinal direction. They were cast with either 6- or 8-ft-diameter openings in the floor to allow installation on similar-size piers in the field. Massive ½-in. steel embed plates were cast into the pieces to connect to the piers. A neoprene seal, installed after construction, ensures a watertight seal.

Pieces were delivered to the site on specially designed barges, fitted with the largest capacity crane in the area. Once loaded, the tubs were welded together and floated to the jobsite. The barges positioned the tubs over previously drilled piers and were lowered to final elevation by a complex jacking system. Once in place, the tubs were heavily reinforced and infilled with the HSHPC.

PCI Certification Turns 50

CLEVELAND, OHIO

During the 2017 PCI Convention and National Bridge Conference, PCI celebrated the 50th anniversary of its Plant Certification Program. Plants continuously certified for 50 years were honored.

The certification concept was approved in 1958, with the first printing of the *Manual for Quality Control for Plants and Production of Structural Precast Concrete Products* coming in 1966. The official beginning came in 1967, when 26 companies operating 35 plants submitted two-year contracts.

OSHA Crystalline Silica Standard Enacted

WASHINGTON, D.C.

Following a delay of several months, the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has begun enforcing new crystalline-silica standards for the construction industry.

The standard sets requirements for tightened permissible exposure limits as well as for exposure assessment, medical surveillance, employee training, and other activities.

Submit your headline news for consideration in a future issue of Ascent to Becky King at bking@pci.org.

Seaport Square Features Hollow-core Balconies

BOSTON, MASSACHUSETTS

Precast concrete balcony slabs are being used on two 22-story residential buildings in the $600-million One Seaport Square mixed-use development. The balconies project from the residences and provide dramatic open views while offering fast, monolithic construction.

The development's two towers, The Benjamin and VIA, feature their own aesthetic treatments and range of residential units. A total of 832 units are planned, with 354 in The Benjamin and 458 in VIA, from studios to three-bedroom units. Ninety-six units will meet the city's standards for affordable-housing units. Both offer indoor and outdoor community areas, while the Benjamin also includes two courtyards. The development contains 250,000 ft^2 of retail space.

Elkus Manfredi Architects in Boston served as the architectural firm on the project, while John Moriarty & Associates in Winchester, Mass., was the construction manager. Trescon Ltd. in Burlington, Mass., fabricated the precast concrete components.

New PCI Design Handbook Available

CHICAGO, ILLINOIS

The eighth edition of the PCI Design Handbook: Precast and Prestressed Concrete is available as an e-book from PCI's online bookstore (www.pci.org/bookstore/). The book will begin shipping in October.

The new handbook features easy-to-follow design procedures, numerical examples, and both new and updated design aids. They are based on the specifications given in the *Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)*, *Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10)*, the 2015 International Building Code, and other current industry standards.

Also included is new and updated information on dapped-end bearing design, beam-ledge design, the impact of ACI 318-14, a new disproportionate collapse appendix, a new diaphragm seismic-design methodology appendix, and a new blast-design appendix.

Submit your headline news for consideration in a future issue of Ascent to Becky King at bking@pci.org.

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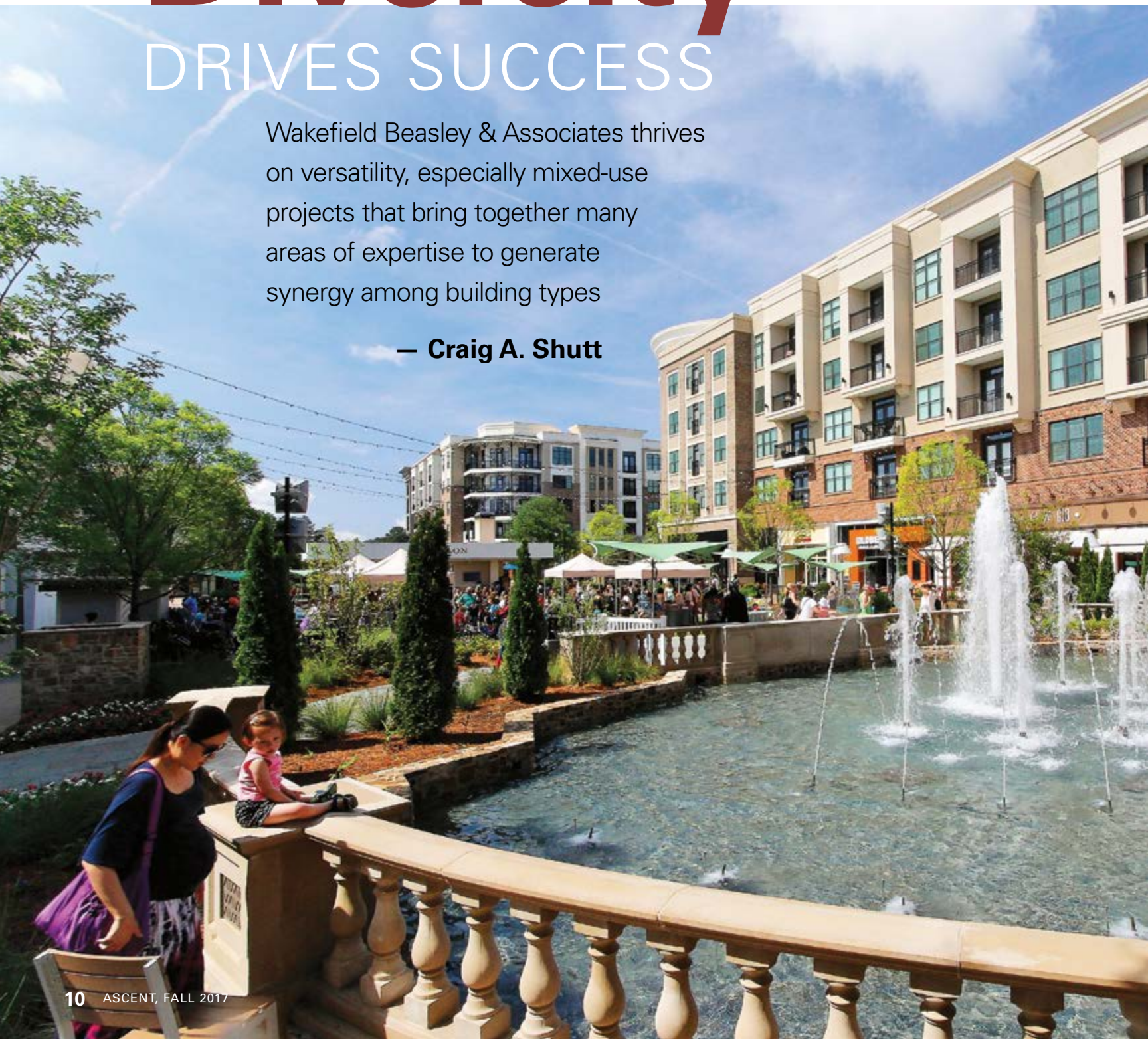
— Craig A. Shutt



SIGNATURE DEVELOPMENT
The 88-acre Avalon in Alpharetta, Ga., became Wakefield Beasley & Associates' signature development, combining various functions to create a popular resort-level hospitality community. Still growing, it features five precast concrete parking structures, with more planned to support new buildings. Photo: Wakefield Beasley & Associates.

PARKING SUPPORT
The variety of activities at The Battery Atlanta™ are supported by a variety of precast concrete parking structures, some with special access for those using nearby facilities. Photo: Wakefield Beasley & Associates.

When Lamar Wakefield and John Beasley opened their architectural firm on May 22, 1980, they envisioned running a small boutique firm focusing on fun, high-end design projects. They revamped that initial plan several times, as larger, more complicated, more high-profile projects came their way. Today, they are known for such signature mixed-use projects as the $600-million Avalon in Alpharetta, Ga., and the $1.1-billion The Battery in Atlanta, Ga., which includes Sun Trust Park, home to baseball's Atlanta Braves. And they continue to grow with even bigger projects.

Those mixed-use developments, which include hotel and residential uses, retail, office, parking, and entertainment facilities, indicate the diversity the firm embraces and how well it has succeeded at integrating many diverse parts into a successful whole.

The two founders met when Wakefield interned at the firm where Beasley was working, to fulfill the requirements for his architectural degree. When Beasley became a partner in another firm, he offered Wakefield a position. But he declined and started his own firm. When Beasley later discovered most of his associates were moonlighting for Wakefield, they decided to partner. Wakefield serves as CEO, while Beasley serves as President.

'We haven't been driven by the bottom line, ever. We have a really different culture.'

"I'd never met anyone with as much energy as Lamar," Beasley has said. "He wanted to build stuff and make money." Making money was a byproduct of their architectural passion, he noted. "We haven't been driven by the bottom line, ever. We have a really different culture."

INNOVATIVE PARKING
Built on the site of a vacant steel mill, the Atlantic Station mixed-use development in Atlanta, Ga., features a precast concrete parking structure that serves as the base for a variety of buildings in the 15-million-ft² project. The 7000-car parking structure, which won an industry advancement award, combines moment frames with shear walls to support factory-topped double tees. Photos: Metromont Corp.

That culture developed as the partners worked from their basements with their children crawling at their feet, Beasley remembers. "I came up in the era where sons of architects worked for their dads, and then someday fathers passed on the businesses. So I was taking a leap of faith."

As they took on more projects, they developed new expertise and added staff to handle the needs. Creating flexibility through new skills proved to be a key to success. "One reason we made it through the most recent devastating downturn was due to the diversity of our work," says Michel Lentz, principal and director of the Mixed-Use/Retail Studio. "We are more diverse by far than any architectural firm I know about. We prepare designs and plans for virtually every type of facility, except airports and heavy-duty hospitals."

SURVIVING DOWNTURNS

That approach allowed them to stay afloat as other firms struggled. "When the economy tanked, we saw many firms go out of business or downsize to a handful of people because they did only one type of product, and that specific type of product wasn't moving forward," says Lentz.

The firm initially focused on office, retail, and public projects, but the founders quickly saw the benefits to diversity. Today, Wakefield Beasley & Associates (WBA) operates eight studios: Mixed Use/Retail, Hospitality, Multi-family, Justice, Higher Education, Office, Institutional (including K-12 Schools), and Industrial. A director runs each, allocating project managers and designers as needed and maintaining close contact with the client.

The Mixed-Use/Retail Studio is by far the largest today, employing 48 people and accounting for approximately one-half of commissions. In most cases, Lentz serves as the point person as new projects come in, and he then hands them off to the studio best suited to their needs. Projects with more than one function tend to be spread over multiple studios.

"Developers who were building big-box retail stores 20 years ago are now building mixed-use properties with some retail," Lentz says. "Mixed-use is hot. People want convenience and mobility in their professional and leisure activities. They want an environment that's easy to access and walk

'Mixed-use is hot. People want convenience and mobility in their professional and leisure activities.'

through, with social events and shopping nearby. That change is being driven especially by millennials. They don't want to own; they want to rent to increase their mobility and flexibility. That drives the types of mixed-use projects we do. Fortunately, we've invested a lot of time and expertise in that field."

Developers typically are savvy about the sizes of varying functions that can fit together, he notes. "Some are a little aggressive, but most clients come in pretty close to what realistically be achieved and what mix will work well for them. We sometimes tell them they can add more of one type or adjust as needed to meet the needs of the site as we develop the plan."

Some areas offer restrictions, such as in Florida, where retention ponds often aren't factored into the developer's initial plans but are required due to the high water table.

"Each project takes on its own life due to the personalities of the people involved, the site location and terrain, and its special needs. Developers want to get the highest yield from the best mix possible for that piece of land."

AVALON CHANGED MINDS

Today, however, many developers come in with a special request. "They want their own Avalon," Lentz says. "I can't tell you how many times I've heard that in the last three years." That's because that 88-acre mixed-use development has become known as a signature resort-level hospitality community, with a walkable, seamlessly connected community of shopping, dining, entertainment, living, and working space. It includes 500,000 ft^2 of retail, a 12-screen Regal Cinema theater, 600,000 ft^2 of Class A office space, 101 single family homes, and 525 high-end residential units. The office space includes WBA's corporate headquarters.

The project began with Lentz and Wakefield flying around the country with the developer's team for four days to scout similar projects. They visited locations in Texas, Arizona, and northern and southern California. "We wanted to experience what each community felt like and what the experience was," Lentz says. "We took lots of photos of what we liked and what we didn't like and began our discussions there."

Not every project can be the next Avalon, he notes. "Each project has to bend to the land and the specific needs to be successful." There are some requirements for all of these projects: a dramatic point of arrival, good but not overwhelming density, green areas with pedestrian access, and outdoor event spaces for yoga classes, ice skating, etc. "Those are all big factors. We start with all the puzzle pieces and find the best way to fit them together."

PARKING PLAYS KEY ROLE

A key ingredient, sometimes underestimated by developers, is the need for sufficient parking facilities. "Parking always consumes a lot of discussion time," he says. "It has to be there, as with any project, but it can be fine-tuned in a mixed-use development. The beauty of mixed-use projects is that functions

SIGNATURE DEVELOPMENT
The 88-acre Avalon in Alpharetta, Ga., became Wakefield Beasley & Associates' signature development, combining various functions to create a popular resort-level hospitality community. Still growing, it features five precast concrete parking structures, with more planned to support new buildings. Photo: Wakefield Beasley & Associates.

Photo: Wakefield Beasley & Associates.

often can share parking because their peak demand times vary. So they can overlap and cut the ratio. That saves on materials, asphalt, lighting, and many needs. Structured parking also allows more green space and revenue-generating options."

Typically, WBA hires a third-party parking consultant to help work out needs through the day and to optimize locations so buildings can share these support functions. "They have to be convenient to everyone, so they have to be strategically placed without being dominant."

In most cases, WBA designs them as precast concrete structures. "Precast is quicker to build than other options, and it can be completed before other functions, so it's ready when they are. It works almost like LEGO® blocks. So we prefer to use it if possible."

The Avalon project features three precast concrete parking structures. The 450-car Central Deck was constructed with 449 precast concrete pieces, with embedded thin brick throughout and graceful arches cast into the second-level spandrels that match the design used on the North and South Decks, which were completed earlier. The 650-car North Deck, using 419 pieces encompassing 133,851 ft^2, serves the theater, while the 375-car South Deck, composed of 218 pieces encompassing 61,943 ft^2 of precast concrete, serves the grocery store.

Additional precast concrete was used as accents on nearby buildings. "We use a lot of precast for building bases and wainscot," Lentz says. "I'm not a big fan of running softer façade materials to the ground, where they can be kicked or damaged. I prefer hard, durable materials there, and precast offers a good option." (For more on this project, see the Overview article in this issue.)

Precast concrete parking was critical to an earlier WBA signature project, the 138-acre Atlantic Station. The project, Atlanta's first mixed-use development, was a $2-billion brownfield redevelopment of the former Atlantic Steel Mill with 15 million ft^2 of office, retail, residential, and hotel space, along with several acres of parks. The parking structure provides 7000 stalls and serves as a platform for the cast-in-place concrete buildings above it. The project, which won the 2006 Harry H. Edwards Industry Advancement Award from PCI, combined moment frames with shear walls to support factory-topped double tees. "It set the standard for mixed-use attractions in the Southeast," says Beasley.

'The beauty of mixed-use projects is that functions often can share parking because their peak need times vary.'

MIXED-USE BATTERY
SunTrust Park stadium anchors the $1.1-billion mixed-use The Battery Atlanta project, where Wakefield Beasley & Associates, working from a master plan by Jerde, coordinated with stadium designers Populous to create a unified design. Precast concrete was used inside and outside the stadium and on a variety of parking structures, as well as in complementary designs on nearby buildings. Photo: Wakefield Beasley & Associates.

THE BATTERY ATLANTA

The Battery Atlanta used precast concrete in multiple ways, especially within SunTrust Park, the $622-million, 41,000-seat stadium for Major League Baseball's Atlanta Braves. There, it was used for seating units, structural walls, architectural façade panels, and parking structures. The project involved working with the Braves, who then hired a third-party program manager to handle the stadium, office, and multifamily elements.

"We worked with all of them," says Lentz. That meant coordinating with four point people, including the Braves' representatives. "There were a lot of people and interests involved that had needs to be met." Using precast concrete finishes on the stadium and adjacent structures helped ensure complementary appearances while finishing them quickly. (For more on this project, see the Case Study article in this issue.)

CLIENT RELATIONSHIPS VITAL

WBA juggles these needs and meets the variety of requirements due to its close connection with clients. Wakefield has long been known for his ability to connect with clients and set them at ease during the complicated design process. "The design business is about making relationships and maintaining relationships," he says. He regularly stays in contact with past clients to stay abreast of changes in their organizations and goals, so WBA is ready when new design opportunities come along.

Wakefield vividly remembers an experience early in his career when he saw a well-known architect chew out a general contractor for a misaligned construction detail—even though the mistake was in the drawings. That arrogance made Wakefield vow that his firm would be known for treating everyone with respect, he says.

Beasley likewise attributes the firm's success to its relationships with people. "We thrive because of the talented personnel on staff and their ability to connect with clients across the world," he says. "The bottom line means nothing if the firm can't take care of its people or its clients. That's why WBA is run by architects, not by accountants. It's rare and unusual."

WBA often finds itself working for previous clients on new projects, especially as its reputation for handling large, complex, mixed-use communities grows. Approximately 80% of the company's projects come from repeat clients, Lentz estimates, with one client having partnered with the firm for 31 years. In many cases, older retail partners have expanded into mixed-use properties that are developed and then sold to investment groups while the developer moves on to a new project.

UNDER DEVELOPMENT
The Camperdown development in Greenville, S.C., focuses on a plaza surrounded by luxury retail, restaurants, and service kiosks interwoven with water features and landscaping, 240 upscale multifamily rental units, a 125-room hotel, a fitness center, two office buildings, and condominiums. Rendering: Wakefield Beasley & Associates.

PROJECTS STILL GROWING

Some projects continue to expand, as Avalon has. Phase 2, containing offices and a new parking structure, opened earlier this year, two and a half years after the first phase was completed, and more additions, supplemented by parking structures, are planned for later. "Many of these types of projects have multipart phases that allow them to continue to develop and grow," Lentz says.

These successes are leading developers to even larger projects. WBA currently is working on a 175-acre mixed-use property in Sayreville, N.J., and another one of similar size in Charleston, S.C. Both would be more than twice the size of Avalon and contain a variety of functions, including retail, office, hotel, multifamily, entertainment, and other uses.

They also are finishing design work on Camperdown, the redevelopment of the former Greenville News facility in Greenville, S.C., one of the most iconic buildings and sites in the downtown area. The mixed-use development will include a plaza surrounded by luxury retail, restaurants, and service kiosks interwoven with water features and landscaping, two office buildings comprising about 200,000 ft^2, 240 upscale multifamily rental units, a 125-room hotel, a fitness center, and 18 luxury condominium units.

Directing this work as it expands has required adding new people and locations. In July, Lentz shifted to the firm's Ponte Vedra Beach, Fla., office to lead a seven-person crew to gain new business. In all, the company operates nine offices of varying sizes (see the sidebar).

"We don't make a retail product we can sell, we sell only our time and talent," Lentz explains. "When we hire people, we want to do it for the long term." Wakefield and Beasley pride themselves on hiring the best people to lead the studios and giving them the autonomy to thrive. "His commitment to focusing on people is Lamar's greatest strength," Beasley says.

"Making and maintaining relationships are what keeps us in business," Wakefield says. "Introductions are change-makers. When we get a referral, we'll run through a wall to be sure we deliver for that client."

"Clients come first," agrees Lentz. "If we need manpower to meet their needs, we'll work to find them. We have so many long-term projects that we need people who are looking to develop and grow their careers with us."

If that means adding new offices, they will do that as well. Currently, the firm is evaluating several markets for potential office locations. "We want to be where the work is," Lentz says. "We will open new offices where we see growth. We can best serve our clients by being close to them and staying in close contact."

Its diversity and ability to integrate all aspects of professional and leisure activities will keep WBA growing in the future, no matter where clients or the economy takes it. Says Beasley, "I look forward to seeing what next great project, employee, or mission the firm takes on in the next decade and beyond."

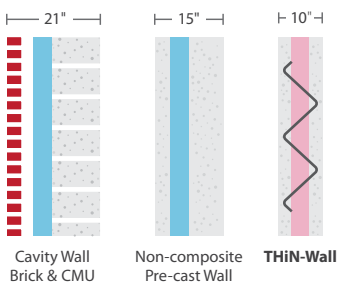
37 Years of Growth

Since opening on May 22, 1980, Wakefield Beasley & Associates has grown from a two-person office focused on smaller projects to one with 180 employees spread through nine offices and satellite offices.

Among its signature work was its initial milestone project, Metro Atlanta's first office/condominium project, Governor's Ridge in Cobb County. The Forum on Peachtree Parkway took the firm to the next level, while Atlantic Station gave it another leap forward. Those in turn led to Avalon and The Battery Atlanta.

The bulk of the company's employees (160) operate from the Alpharetta, Ga., corporate headquarters (located in Avalon). Additional offices are in Ponte Vedra Beach, Sarasota, and Orlando, Fla.; Charleston, S.C.; Dallas, Tex.; Seattle, Wash.; Panama City, Panama; and Shanghai, China.

THERE'S A THiN WALL BETWEEN SUSTAINABILITY AND STRENGTH.



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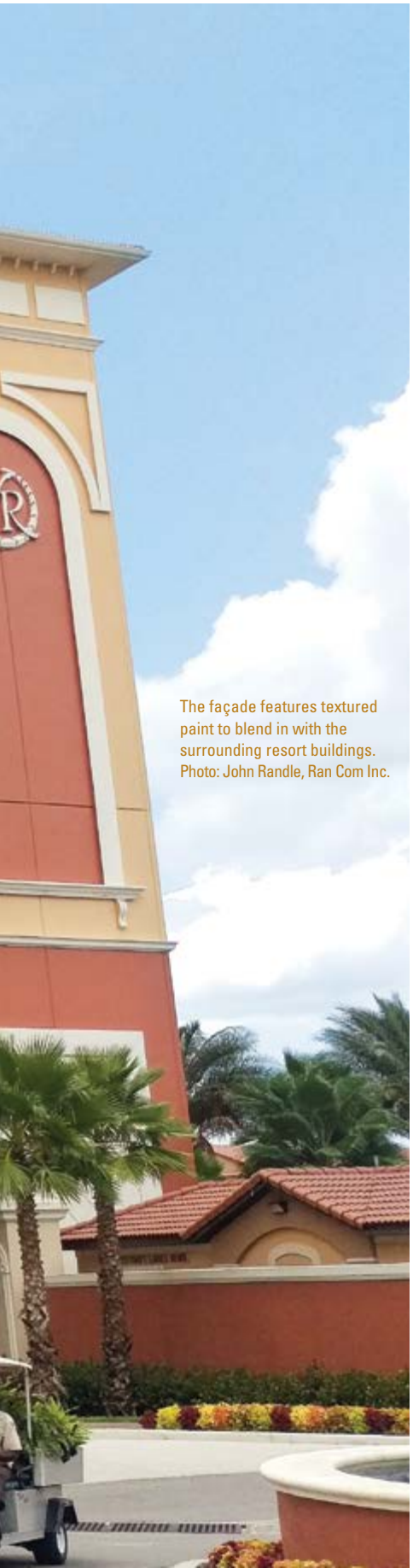


The façade features textured paint to blend in with the surrounding resort buildings. Photo: John Randle, Ran Com Inc.

PRECAST CONCRETE SUPPORTS MIXED-USE

'Live, Work, Play' Developments

The versatility offered by precast concrete provides considerable added value when owners want to combine residential, commercial, retail, and entertainment space in a single structure or development **— Monica Schultes**

"Live, work, play" have been the buzzwords for mixed-use developments. These developments have evolved for a variety of reasons. Some emerged out of sustainable design, others are integral components of transit oriented or traditional neighborhood developments, and others created as "livable communities."

The hierarchy of basic human needs: shelter, employment, health, food, water, clothing, and belongingness, have to be satisfied for survival. So it is human nature to want to find these essentials in a one-stop shopping environment. As technology advances and as millennials become the dominant generation, they transform where we reside, what our work week looks like, and how we recreate. The combination in one property of both residential and commercial spaces offers tenants the flexibility to do all those things within the boundaries of the development. Baby boomers are also drawn to the convenience and wide range of amenities that come with living in a multiuse environment.

Using space efficiently has become a key driver for owners to create multiuse buildings. The versatility offered by precast concrete systems provides considerable added value. These sites often have minimal staging areas and require a method of construction that is efficient, fast, and safe, with reduced impacts on residents and neighboring offices or merchants. Precast concrete erects very quickly and more cleanly than competing systems.

Design flexibility is essential in the marriage of these often competing building programs. The long spans provided by a precast concrete structural system allow for a variety of uses within an open floor plan. A precast concrete structure can support parking, office, or residential usage, while architectural precast concrete can incorporate the aesthetics desired to set these collaborations apart.

The following projects demonstrate how precast concrete can play a part in the evolution toward livable communities.

WESTGATE RESORTS, ORLANDO, FLA.

Westgate Resorts, one of the largest resort developers in the world, has properties in many popular travel destinations. They have eight resorts in Orlando, Fla., alone and embrace the concept of providing their rental customers and villa owners the conveniences of walkable communities. They are well aware

POPULAR AMENITIES
The Patio bar is a popular amenity and within easy walking distance from the residential units. Photo: John Randle, Ran Com Inc.

that amenities can set a property apart and make it stand out. Parking is one of the most sought-after conveniences among travelers, along with easy access to restaurants and entertainment.

A combination of services within one community was the catalyst for building the newest component to the Westgate Lakes property. While Roger B. Kennedy Construction has worked extensively with Westgate Resorts, this project was a departure from its typical design.

Mike Sundquist, senior project manager with Roger B. Kennedy Construction, explains, "This is the first precast building we have done for Westgate. It would have been more difficult to install and meet the schedule with other materials." The budget and site constraints led them to work with Coreslab Structures (TAMPA) to supply the precast concrete for the entire structure. The main entrance to the resort had to be reconfigured to allow for space to install the parking structure, and the facility was squeezed into a very tight site.

PARKING LEVELS ABOVE AND BELOW CONDITIONED SPACE

The seven-story precast concrete structure includes five parking levels sandwiched between occupied space for guest amenities on the first and seventh levels. The top floor is 25,000 ft^2 of banquet hall with a full kitchen. The first level is multipurpose, with a market, deli, bowling alley, sports bar, arcade, and another kitchen to support those features, and has 30,000 ft^2 of built-out space. The remaining floors are used for parking for the surrounding time-share condominiums.

"Westgate was creating a village and this project had a big impact on the feel of the resort. This building is a key piece of the master plan for how it operates—it is at the hub of the resort," says Craig McElroy, principal at McElroy Engineering.

WESTGATE RESORTS – PARKING AND RETAIL

LOCATION
Orlando, Fla.

PROJECT TYPE
Mixed-use (parking, retail, entertainment)

SIZE
220,000 ft^2

COST
$11 million

DESIGNER
General Design Inc. Architecture, Branson, Mo.

OWNER
Westgate Resorts, Orlando, Fla.

STRUCTURAL ENGINEER
McElroy Engineering, Orlando, Fla.

CONTRACTOR
Roger B. Kennedy Construction, Altomonte Springs, Fla.

PCI-CERTIFIED PRECASTER
Coreslab Structures (TAMPA) Inc., Tampa, Fla.

PRECAST SPECIALTY ENGINEER
The Consulting Engineers Group, Mount Prospect, Ill.

PRECAST COMPONENTS
Double tees, light walls, shear walls, beams, columns, stairs, and landings.

This project was a key piece of the Westgate master plan—it is at the hub of the resort. Photo: John Randle, Ran Com Inc.

DOUBLE TEES
Coreslab Structures (TAMPA) manufactured more than 200,600 ft² of double tees for the structure. Photo: John Randle, Ran Com Inc.

McElroy adds that there were challenges due to some of the special conditions added late in the design process. He explains, "Usually with a stand-alone garage, the loads from vehicles are known. With additional penetrations on the roof and heavy chandeliers, that complicated things." Coreslab had the foresight to incorporate double tees that could handle additional loads. The large meeting space and ballroom were added after the design had begun and the design team had to make sure the precast concrete could adapt to the different usage.

McElroy recalls that a folding partition wall added additional weight on the double-tee flooring system. "Luckily the precaster had allowed for additional capacity in the double tees. Coreslab gave us a limit of what they could handle and we worked from there and distributed the loads."

Mark McKeny, sales manager for Coreslab Structures (TAMPA), said they manufactured more than 200,600 ft² of double tees. "Coordination for delivery was critical, given the site and access constraints. Frequently the transport vehicles were staged along the route, waiting for the signal that the crane was ready for the next piece." More than 15,200 ft² of shear walls and light walls as well as more than 84,750 ft² of vertical wall panels that ranged from 8 to 12 in. thick were manufactured at the Coreslab plant and delivered just in time to erect the precast concrete structure.

'The biggest challenge was how difficult the site was, especially because we were working around the main entrance of a major vacation property.'

The local building department was not familiar with the concept of occupied levels above parking. The project team worked through the issues of meeting code requirements to allow a large amount of people to egress through seven elevators and four stair towers. Ultimately, the width of the stairs had to be increased due to code constraints.

The precast concrete double tees were topped with concrete on the upper level and insulated, which is unique in Florida. "The conditioned space above had to be separated from the open parking garage levels," explains McElroy.

Given the height of the building, there was some coordination between Coreslab and the engineer of record. There was a lot more than usual to coordinate, clarifies McElroy. "This was due to concern about the shear walls on the end of the structure because of the high wind loads. We completed a 3D model to evaluate the loading and an expansion joint was incorporated to allow the structure to move in one direction and alleviate forces on the shear walls."

"Since there was really only one level that was occupied above the parking, acoustic separation wasn't as critical. So the precast required no additional sound mitigation. We added additional concrete to attenuate vibration. Given the use of the space above as a ballroom, the slab needed to be thickened," says McElroy.

Permits were received in December and the parking structure was completed in May of the following year. The fit out of the other spaces was staggered and not completed until later. The entire exterior of precast concrete vertical wall panels was painted with a textured coating.

TIGHT SITE AND SCHEDULE

Sundquist recalls, "The biggest challenge was how difficult the site was, especially because we were working around the main entrance, and the inherent logistics surrounding a major vacation property." McElroy adds, "Anytime you have a parking garage, you have to contend with grade changes for entrances to the building. The site was beyond tight."

Sundquist explains, "We were installing this building within 20 ft of adjacent time-share buildings, which were in use at the time. We had to work with noise restrictions imposed by the county as well as time restrictions. Precast helped complete the structure more quickly so that the install did not last as long and inconvenience the resort guests over additional months."

"The project would have been six to eight weeks longer and we would have missed the opening date [Memorial Day weekend] had it been built with anything other than precast. Coreslab manufactured and staged along their delivery route, and delivered as promised. They followed through with their capability to erect in a timely fashion," says Sundquist. He predicts: "I anticipate Florida will see a lot more mixed-use, especially retail combined with light commercial and apartments."

The owner is steadily booking events and conventions in the banquet hall, which helps balance the periods when the time-shares are not in use by their owners. The restaurant, entertainment, and retail amenities are popular and within easy walking distance from the residential units. Westgate Resorts are happy with the result and vacationers are pleased with the additional amenities. "This was the right decision for this project," concludes McElroy.

CITYLINE DEVELOPMENT, RICHARDSON, TEX.

Given the saying, "Everything is bigger in Texas," it stands to reason that Texas is home to one of the largest mixed-use developments in the country. CityLine is a 186-acre development in Richardson, Tex., featuring a dense mixture of office buildings, apartments, restaurants, entertainment, and open space, with easy access to two major highways and a light rail system. CityLine currently includes more than 25 dining options, with Whole Foods Market as a retail anchor, an Aloft hotel, seven office buildings home to State Farm and Raytheon, and a wellness office building anchored by Texas Health Resources and Children's Medical Center.

Employers are drawn to North Texas for its labor market, quality of living, and proximity to an international airport. With these amenities comes a price: long commutes in and around Dallas/Fort Worth. Like many areas of the country, parking is a sought-after employee amenity, and companies are looking for affordable, quality dining options in and around their offices. Many employers go one step further and offer the entire employee experience: not just an on-site fitness center, but the whole lifestyle package.

State Farm was a forward-thinking employer and the catalyst for the huge $1.5 billion CityLine project. They challenged KDC Development to create a facility that embraces the "live, work, play" lifestyle of its employees. At full build-out, CityLine will contain 6 million ft^2 of office space, two hotels, 3925 multifamily residential units, 300,000 ft^2 of grocery, restaurant, entertainment, and retail space, and three parks. Approximately 30,000 people are expected to live and work at CityLine. The development is located near a DART (Dallas Area Rapid Transit) public transit line.

URBAN WALKABILITY IN THE SUBURBS

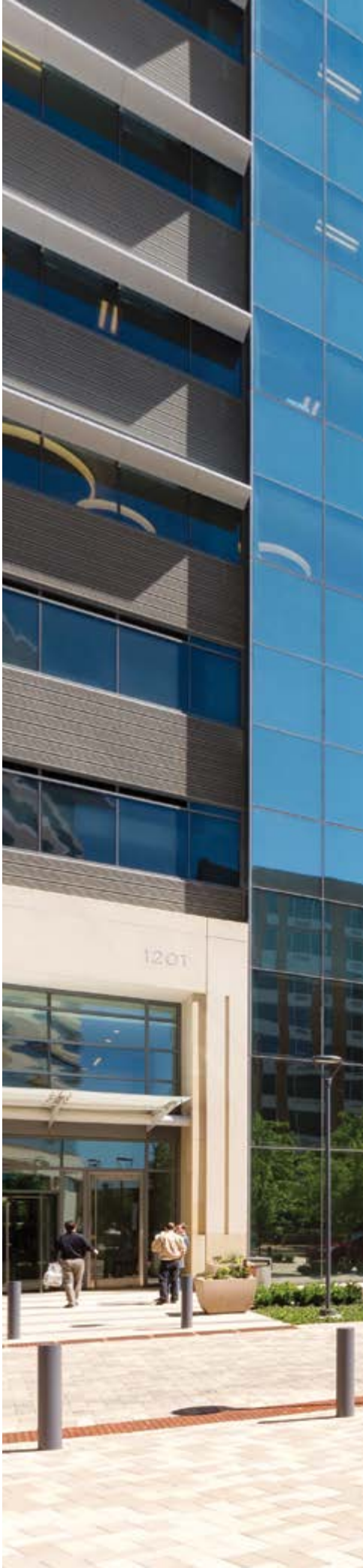
For State Farm, the central location and access to a DART rail station on-site helped make the decision. Construction of 13-, 15-, and 21-story office towers began in April 2013 as part of the initial phase. Shortly thereafter, the mixed-use development added apartments to give employees direct access to all of the amenities (several corporate campuses, mass transit, major highways, numerous restaurants, retailers, and parks) that make CityLine an all-inclusive destination.

Gate Precast was selected to work with the construction team for State Farm office towers 1, 2, and 3 concurrently. It was just the start of the massive construction project that would become CityLine. A precast concrete envelope was used to clad both the parking levels and the office towers. The same color was used in the mixture design to blend the parking structure into the surrounding environment. The three towers were clad with architectural precast concrete totaling more than 350,000 ft^2 of spandrel panels.

To create architectural interest on the panels, they used buff, dark tan, and grey colors with an acid wash finish. "We generated an architectural design that allowed for three distinct patterns and colors. Working with Gate Precast, we used 12 × 12 in. samples before finalizing colors using large mock-ups on-site that showcased the final colors in concert with the glazing selections," explains James Adams, senior associate at architecture firm Corgan.

'We used 12 × 12 in. samples before finalizing colors using large mock-ups on-site that showcased the final colors in concert with the glazing selections.'

Jay Givens, Gate Precast project manager recalls, "At the time, it was one of the largest projects the Gate Precast (Hillsboro, Tex.) facility had manufactured. It was the primary job going through the plant for several months." Installation was staggered, so all three buildings were not online at the same time, allowing enough lead time to optimize production of the panels. Three cast-in-place concrete contractors were brought on board for the supporting structures.



CORPORATE CAMPUS
State Farm was the catalyst for the huge $1.5 billion CityLine project. They wanted to create a corporate campus that embraced the "live, work, play" lifestyle for its employees. Buildings that incorporate several uses are key to CityLine master plan. Photo: Corgan.

CITYLINE DEVELOPMENT – STATE FARM OFFICE COMPLEX

LOCATION
Richardson, Tex.

PROJECT TYPE
Mixed-use (office, parking, multifamily housing, retail, entertainment)

SIZE
2 million ft² of State Farm office space

COST
$1.5 billion

DESIGNER
Corgan, Dallas, Tex.

OWNER
KDC, Dallas, Tex.

STRUCTURAL ENGINEER
L.A. Fuess, Dallas, Tex.

CONTRACTOR
Austin Commercial, Dallas, Tex.

PCI-CERTIFIED PRECASTER
Gate Precast, Hillsboro, Tex. (architectural precast); Gate Precast, Pearland, Tex. (hollow-core slab)

PRECAST COMPONENTS
Architectural precast on State Farm office buildings; hollow-core slab for the Aloft hotel.

Photo: Gate Precast.

Gate Precast helped accelerate the construction schedule by producing precast concrete panels off-site and delivering pieces to the tower crane to ensure continuous installation. Panels were installed quickly, allowing the office towers and parking structures to be rapidly enclosed. The 7-in. solid panels were hung on post-tensioned frames.

LIKE A GOOD NEIGHBOR

In addition to architectural precast concrete for the State Farm towers, Gate Precast manufactured precast concrete hollow-core slabs for the 150-room Aloft Hotel across the street. Scheduled to open in August 2017, the modern hotel is within walking distance to CityLine's prime restaurants and entertainment venues. The hotel architect and general contractor was One Build Design Group, with the owner being CLSH148 LLC.

The nine-story hotel was constructed with Gate-Core slabs on structural metal studs. Erection of each level (10,000 ft²) was scheduled approximately every seven days, with precast concrete erection, connections, and grouting taking approximately three days. Jim Stini, vice president of Operations, Gate Precast (Pearland, Tex.) says, "The total turnaround time per floor was ten days, which included wall framing, CMU [concrete masonry unit] block at the elevator/stairs, and precast floors. Due to the small footprint, Gate Precast was able to set up a crane in a single location for each mobilization and erect the entire floor without breaking down, which ultimately saved time."

KDC topped out the first three office towers in July 2014, only 16 months after the start of construction. Each building is situated above a five-level parking structure with more than 92,000 ft² of retail, restaurant, and entertainment options integrated into the base of the towers.

State Farm maintained their corporate presence on the exterior of the office towers and designers turned to the interior of the structures to capture the hearts and minds of employees. A far cry from

THE ALOFT HOTEL
The Aloft Hotel serves State Farm corporate and CityLine visitors and includes 90,000 ft² of precast concrete hollow-core slab. Photo: Gate Precast.

generic cubicles, the layout is very modern and designed with collaborative work spaces, comfortable furniture, and break areas to balance productivity and teamwork.

State Farm employees have easy access to public transportation, fully equipped gyms, and cafés with healthy food options. The campus towers include large floorplates with low-walled offices close to natural light and management offices on the interior of the towers. Throughout the floors there are a number of huddle rooms, breakout areas, and meeting rooms for employees to collaborate. A sky bridge connects CityLine 1 and 2 at the sixth level to connect conference and training areas.

Givens explains, "Gate Precast was brought on board when it was still just the State Farm office complex. The first three towers were awarded under one contract. Then State Farm added a fourth office tower two years later." Now State Farm is one cog in the giant wheel of the massive CityLine development. State Farm's campus encompasses 2.2 million ft^2 and more than 8000 employees work out of the insurance giant's four-building campus.

The fourth tower covers 535,000 ft^2 and consists of a 12-story office building, a six-level parking structure, and approximately 31,000 ft^2 of retail space. The building exterior features and LED lighting are what people will likely notice at first glance.

"There are a series of ribbon LED fixtures across the various buildings that are attached to the aluminum curtainwall system. Four CityLine, the easternmost tower, has uplighting attached directly to the precast. We also included sconces on the colonnades on the ground level. Gate Precast worked with us to create 'leave-outs,' openings in the precast panels, to install these light fixtures within them," recalls Adams.

The vertical fins on both sides of the building are unique, as is the horizontal eyebrow, which creates an architectural element but also creates shading. Sunshades were used on the building to reduce energy use, which was one goal of the project. Because it was aiming for LEED Silver certification, low volatile organic compound materials were used, as well as materials delivered from within a 500-mile radius. The architectural precast concrete, fabricated in nearby Hillsboro, met both requirements.

The fourth tower's construction, which began in September 2014, wasn't without challenges. The team had to make up several weeks lost to rain, snow, and ice in 2015, the wettest year on record. Adams recalls, "Austin Commercial worked diligently to keep the project on schedule. Gate Precast played a large part by proactively working with the design and construction team to understand what they could deliver and what decisions they needed from the owner to do so."

'The expansion of mass transit options allows people to commute to work; however, they need dense, walkable blocks once they arrive.'

Adams adds, "'Live, work, play' continues to be a huge factor in the design of new urbanism developments. People want a sense of arrival and a place for community. The expansion of mass transit options allows people to commute to work at transit-oriented developments such as CityLine; however, they need dense, walkable blocks once they arrive in order to get lunch or meet friends and coworkers during the day."

State Farm at CityLine reflects the workplace of the future for millennials: a 24-hour neighborhood, apartments over restaurants, offices over shops, hotels over nightclubs, and everything mixed together.

The design team for CityLine had the unique opportunity to design a community from scratch. The opportunity on such a large scale is rare; most towns and cities are cobbled together over the years. CityLine was made possible by the commitment made by both State Farm and Raytheon to anchor it. This ready-made base of consumers supported the simultaneous development of residential, hotel, entertainment, and retail space. The result is a walkable urban/suburban development.

URBAN PLAZA
CityLine development features a centrally located urban plaza with outdoor seating and space for concerts and festivals. Photo: Corgan.

GATEWAY TRANSIT VILLAGE

LOCATION
New Brunswick, N.J.

PROJECT TYPE
Mixed-use (parking, retail, residential)

SIZE
632,000 ft² (278,000 ft² parking structure)

COST
$143 million

DESIGNER
Meltzer Mandl, P.C./Ehrenkrantz Eckstut & Kuhn Architects, New York, N.Y.

OWNER
New Brunswick Development Corporation (Devco), Pennrose, New Brunswick, N.J.

STRUCTURAL ENGINEER
Severud Associates, New York, N.Y.

CONTRACTOR
AJD Construction, Leonardo, N.J.

PCI-CERTIFIED PRECASTER
High Concrete Group, Denver, Pa.

PRECAST COMPONENTS
10-in. hollow-core slabs, 8-in. solid panels, 10- and 12-in. solid slabs, rectangular beams, specially sized beams, and stairs.

Photo: High Concrete Group.

GATEWAY TRANSIT VILLAGE, NEW BRUNSWICK, N.J.

In an unconventional interpretation of mixed-use, the New Brunswick Development Corporation (Devco) completed Gateway Transit Village, consisting of a 24-story building with a connection to the New Jersey Transit/Amtrak station. Located in the heart of downtown New Brunswick, N.J., across from the Rutgers University campus, the new $150-million, 632,000-ft^2 structure is the tallest building in the city and has become the epicenter for transit in the area. Its disparate demands were met by an equally diverse set of structural systems.

Built as part of an ongoing revitalization effort, the new complex is intended to help bring renewed life to a site that had been underused for many years. The public-private partnership behind the project set aside 20% of the apartments and condominiums for moderate- and low-income families.

Gateway Transit Village consists of a 10-story precast parking structure with 697 parking spaces, topped by a 14-story steel-frame and hollow-core residential tower containing 150 apartments and 42 condominiums. The structure is wrapped by 120,000 ft^2 of office and street-level commercial space for tenants, including the Barnes & Noble College Rutgers University Bookstore and offices for the New Brunswick Parking Authority and the Rutgers University Press.

To maintain the pedestrian-friendly nature of the area, the residential tower was developed over a lower-scale podium. This design provides excellent views of the Raritan River and easy proximity to downtown amenities for residents. Gateway Transit Village's new parking structure is incorporated into the base of the structure, without dominating the view or compromising the adjacent historic setting of St. Peter's Church or the original Old Queens building of Rutgers University.

PARK-LIKE ELEVATED PROMENADE
A large, iconic clock spelling out "RUTGERS" adorns the main façade of the bookstore and a park-like elevated promenade is adjacent to the building. A pedestrian walkway connects the structure to the commuter rail platform served by both Amtrak and New Jersey Transit. Photo: High Concrete Group.

UNIQUE COMBINATION

The project is unique in several ways. J. Benjamin Alper, associate with Severud Associates Consulting Engineers, explains, "We have utilized precast concrete in many mixed-use projects. However, for Gateway Transit Village, we have a tall residential building sitting directly on top of the precast garage, which is much less conventional."

Alper adds, "We have not seen many other structures that combine a tower and parking garage in the way this one was structured. There were numerous different structural systems studied for the Gateway Transit Village. In the end, the time savings for the precast system along with the associated cost savings, made it the most economical for the project."

The building offers public gathering spaces in the bookstore, where a large, iconic clock spelling out "RUTGERS" adorns the main façade, and an adjacent park-like elevated promenade. A pedestrian walkway connects the structure to the commuter rail platform served by both Amtrak and New Jersey Transit.

The parking structure required a 36-ft bay spacing to optimize the parking spaces and precast concrete double tees. Ned Schneider, senior engineer with High Concrete Group, explains, "Typically with parking structures that support steel, the bay spacing is dictated by the steel framing above. This particular project used a 36-ft bay so it made sense to use 12-ft double tees. We are currently working on a similar project with 30-ft bays where we are using 15-ft tees."

'There were numerous different structural systems studied for the Gateway Transit Village. In the end, the time savings for the precast system along with the associated cost savings made it the most economical for the project.'

PEDESTRIAN FRIENDLY
To maintain the pedestrian-friendly nature of the area, the residential tower was developed over a lower-scale podium. The majority of the parking structure is a standard buff architectural concrete mixture and finished with a light sandblast. Photo: High Concrete Group.

Gateway Transit Village is unique in the amount of parking and its value to the residential space above. "Maintaining the 12-ft spacing was imperative for the economy of the parking garage" recalls Alper. "We worked with the architect to find ways to mold the residential tower to work utilizing the same grid. Utilizing 10-in. precast hollow-core planks, we were able to achieve longer spans and found that bays varying between 24 ft and 36 ft worked well to achieve the architectural intent while still maintaining an economical structure."

The proximity of Amtrak's power lines and the narrow streets surrounding the site made constructability an important issue. After weighing the various constructability concerns of both, a traditional structural steel frame supporting precast concrete slabs was selected for the residential tower. This system used few interior beams between column lines, thereby allowing the architects to increase the efficiency of the interior spaces. Since fewer beams were used, the architect was able to put all the beams on partition lines and use the full height of the space from top of slab to bottom of slab as the floor space; no drop ceilings were required. The dissimilarities between the parking layout and the residential layout necessitated the transfer of every single residential column, which was accomplished with a deep structural steel transfer truss system.

The office space north of the parking structure was separated from it by an expansion joint, thereby eliminating the transfer of sound and vibration between the parking structure and the office space. The residential tower above the podium straddles both the west office/retail segment and the parking structure. An expansion joint between the west office/retail and the parking structure was not feasible, as it would have required an expansion joint through the residential tower. Accordingly, the architects planned the areas adjacent to the parking structure as communal hallways and lobbies, where sensitivity to sound and vibration was not as critical.

IT TAKES A VILLAGE

Teamwork played a key role throughout the project. "Our design team spent six to eight weeks during design development with the architect, engineer, and general contractor prior to the start of precast shop drawings," says Schneider. "There were regular meetings held throughout the project to keep things on track."

Alper agrees that communication was critical. "Project specifications required both the structural steel and precast trades to attend regular coordination meetings with the design team. It was common for meetings to include representatives from the owners, architect, parking consultant, structural engineer, precast fabricator, precast engineer, steel fabricator, connection designer, steel detailer steel/precast erector, and the general contractor. Meetings would often include reviewing a 3D structural model together, discussing structural analysis assumptions, reviewing steel-to-precast connection details, discussing conflicts between trades and any other issues that were outstanding. BIM [building information modeling] and 3D modeling notwithstanding, we found that putting all the right parties in a room together is still the simplest way to achieve quick coordination and keep the project moving ahead."

The connections between steel and precast concrete required a high level of coordination. Alper recalls that during coordination meetings, "We came up with conceptual details that worked structurally and were also efficient for erection. The connections were then all drawn on the structural construction drawings in shop drawing level detail to ensure no issues. In the end, everything fit together seamlessly."

Schneider agrees. "These structures are very different than solely precast parking structures, where most of the design responsibility is delegated to the precast engineer. On projects like this with two structural systems, the design responsibility for establishing lateral/diaphragm loads needs to be done by the engineer of record, but it would be beneficial to have the precast engineer involved early."

AVALON DEVELOPMENT, ALPHARETTA, GA.

Avalon is a $600-million, 2.3-million-ft^2 development in Alpharetta, Ga., that offers a signature design that some say has set a new standard for experiential-based mixed-use projects. Phase 1 included 500,000 ft^2 of retail, a 12-screen Regal Cinemas theater, 105,000 ft^2 of Class A office space, 101 single-family homes, and 250 apartment units. The complex was designed as a resort-level hospitality community, with walkable, connected areas of shopping, dining, entertainment, living, and working blended together.

To achieve a pedestrian atmosphere in the urban-like, high-density development, careful consideration was given to the location, size, and appearance of all parking structures, says Rick Norton, associate with the Mixed-Use/Retail Studio at Wakefield Beasley & Associates (WBA), the architect for the project. (For more on Avalon's concept and WBA's approach to mixed-use developments, see the Architect's Profile article in this issue.)

"From the beginning, we did analyses for every phase of the project—which are still underway—to locate and size the parking structures," Norton says. "We analyzed how much parking was needed at each phase to ensure it wouldn't be a surprise later." The many types of activities provided benefits. "There were lots of opportunities for shared parking among the residential, retail, and entertainment facilities."

'There were lots of opportunities for shared parking among the residential, retail, and entertainment facilities.'

PEDESTRIAN ATMOSPHERE

To achieve a pedestrian atmosphere in the $600-million Avalon, an urban-like, high-density development in Alpharetta, Ga., designers gave careful consideration to the location, size, and appearance of all parking structures. The complex features walkable, connected areas of shopping, dining, entertainment, living, and working spaces. Photo: Wakefield Beasley & Associates.

SOUTH DECK
Avalon's South Deck, which serves retail customers and residents, features 375 parking spaces and was constructed with 218 precast concrete components, including 61,943 ft² of double tees. It features several finishes, including inset brick and arched entries. Photo: Metromont.

TWO STRUCTURES IN FIRST PHASE

Phase 1 included two total–precast concrete parking structures. The South Deck, which serves primarily retail customers and residents, features 375 parking spaces, with the top level reserved for residents with private access to living areas. The North Deck, which serves primarily retail customers, theatergoers, and residents, features 650 spaces, with the top level reserved for residents with private access. It connects to nearby apartment buildings through covered pedestrian bridges. A third structure, the Central Deck, contains 450 spaces and was added between Phases 1 and 2 of construction to support retail, office, and theatergoers.

"Precast concrete was chosen for the parking decks for a number of reasons, including speed of construction, flexibility in giving us the look we wanted for exterior façades, and the cost-effectiveness of the total package," says Michel Lentz, principal and director of the Mixed-Use/Retail Studio. "Precast concrete really aided with creating effective designs, cost optimization, and scheduling parameters." WBA also considered cast-in-place concrete, he notes.

'Parking represents a major expense, so we want to use out-of-the-box pieces.'

Finding the proper sizes and shapes requiring examining options, Norton says. "We started out using trial and error to mix height and footprint to find the most efficient combination. We take the demand and try various footprints and number of levels to find the best approach. Precast concrete helps us do that, because it provides a modular setup, so it's easy to determine bay sizes and accessibility."

The structures were designed to maximize their repetition, making them as rectilinear as possible. "Parking represents a major expense, so we want to use out-of-the-box pieces, with few custom designs to minimize costs," Norton says.

HIGH AESTHETIC NEEDS

Architectural precast concrete panels helped meet the city's strict aesthetic requirements. "The city's Design Review Board required a high level of architectural design on the exposed sides of the parking decks. As a result, we fabricated faux-brick façades for these structures." The panels feature thin brick embedded in the panels, along with arched openings with accents. Stair towers were planned with large openings and storefront glazing to provide weather protection but maintain openness, while the first levels were raised to provide more volume, creating a welcoming, less claustrophobic environment.

'The design of the parking was driven by the goal of creating a total experience from the time you arrive to the time you leave.'

"The owners desired a very high level of hospitality and appearance, to ensure every part of the complex had a welcoming feel," Norton adds. This ensured that, no matter where a resident, customer, or visitor first encounters or views the development, they feel at ease. "The design of the parking was driven by the goal of creating a total experience from the time you arrive to the time you leave." This is carried over into every aspect of the property and its operation.

Six colors of brick and mortar were incorporated into the building design mix, Norton explains. "We wanted it to look like the structures were built over time but ensuring they remained complementary. The thin brick selected for the parking decks spandrel panels mimics this concept."

The South Deck's 218 precast concrete components were erected in 20 working days, while the 419 pieces in the North Deck were erected in 35 working days. The North Deck's pedestrian bridges, about 30 ft long, feature precast concrete flat slabs that were faced with brick-embedded spandrels and glass panels.

SCHEDULE POSED CHALLENGE

The schedule was the biggest challenge, especially during Phase 1 when two parking structures were being built together, says Mark Schaffer, in preconstruction/sales at Metromont, the precast concrete producer. "The buildings were underway when we began, so the parking had to be completed when they were ready to open," he says.

"It created some challenges because there were so many moving parts—grocery store, retail, and other needs—underway as we worked. But it was coordinated smoothly with no real issues." The areas around the parking sites were tight, so as deliveries arrived, the pieces were picked and erected directly.

"The schedules were comfortable but not long," Norton says. "From the beginning, we identified parking as part of the critical path for each specific service, knowing they had to be online when the buildings were ready. So we ensured they started early enough to achieve that."

For the retail segments, the schedule was tighter. "We needed to get that parking deck finished in an extremely aggressive manner to meet the demands of the holiday season," Lentz says.

Photo: Metromont.

AVALON

LOCATION
Alpharetta, Ga.

PROJECT TYPE
Mixed-use development with four precast concrete parking structures

SIZE
2.3 million ft²

COST
$600 million

MASTER ARCHITECT/RETAIL DESIGNER
Wakefield Beasley & Associates, Alpharetta, Ga.

RESIDENTIAL/DESIGNER
Dwell Design Studio, Alpharetta, Ga.

HOTEL DESIGNER
Cooper Carry, Atlanta, Ga.

OWNER
Prudential Financial, Atlanta, Ga./Avalon North LLC, Alpharetta, Ga.

DEVELOPER
North American Properties, Atlanta, Ga./Jones Lang LaSalle, Atlanta, Ga.

STRUCTURAL ENGINEER
McVeigh & Mangum, Smyrna, Ga.

PARKING CONSULTANT
Southern Site Solutions, Kissimmee, Fla.

CONTRACTOR
Hoar Construction, Birmingham, Ala.

PCI-CERTIFIED PRECASTER
Metromont, Greenville, S.C.

PRECAST COMPONENTS
Six parking structures constructed with double tees, columns beams, spandrels, and related components, comprising:

- North Deck, with 419 pieces, including 133,851 ft² of double tees
- South Deck, with 218 pieces, including 61,943 ft² of double tees
- Central Deck, with 449 pieces, including 152,183 ft² of double tees
- Phase 2 apartment parking at core of residential building, including 148,000 ft2 of double tees
- Office 8000 parking, adjacent to office building, including 260,000 ft² of double tees
- Hotel parking (under construction), including 270,000 ft² of double tees

NORTH DECK
The North Deck parking structure at Avalon features 419 precast concrete components, including 133,851 ft² of double tees. Designed to serve retail customers, theater-goers, and residents, it includes space for 650 cars and features covered pedestrian bridges connecting to nearby apartment buildings. Photo: Metromont.

CENTRAL DECK
After the first two parking structures were completed, a third, the Central Deck, was added between Phases 1 and 2 of construction to support retail, office, and theatergoers. It contains 450 spaces and was built with 449 precast concrete components, including 152,183 ft² of double tees. Photo: Metromont.

Phase 2 featured more multifamily residential space with first-floor retail and included a parking structure at its core. The residential units were built around the parking in a "Texas doughnut" style, in which the stick-built residential spaces wrap the parking, creating residential façades and ensuring parking is accessible to every unit.

This phase, now complete, also included a 250,000-ft² office structure with detached parking to support offices and additional ground-level retail. A hotel conference center, currently under construction, will offer its own adjacent parking.

The last phase of construction will include another office building, Building 10000, with adjacent parking planned to start in 2018. All of the parking structures will be built with precast concrete components.

The result of this continued planning and building has been a hugely successful development that continues to grow. WBA is in good position to see that growth, as it moved its offices to an Avalon building that looks out onto one of its aesthetically pleasing parking structures.

These four projects depict how the increased density in planned communities can be seen in urban and suburban markets across the country. It follows that precast concrete has a role in the ever-changing landscape of smart, mixed-use developments.

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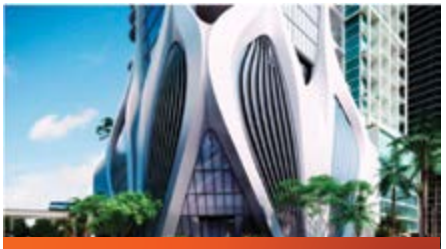

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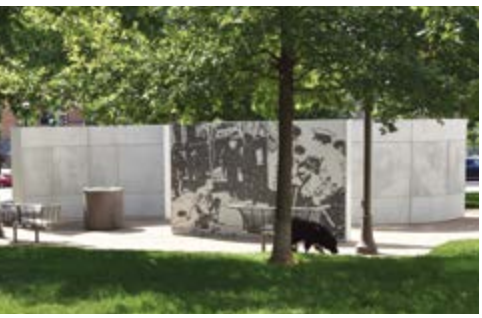
WITNESS Walls

Illustrating historic acts of heroism using precast concrete panels

— Cheryl Lewis

When Nwaka Mullins Hughes of Atlanta, Ga., walked with her husband up to the Witness Walls in Nashville, Tenn., she was imagining the long-ago steps of her mother and others who changed history in the early 1960s. Hughes' mother, Patricia Guthrie Mullins, was just six years old when she was led by her mom, Camilla Guthrie, to Buena Vista Elementary School to enroll with two other African American students, thus launching the city's desegregation. This scene is depicted on one of the art installation's precast concrete panels, along with others illustrating acts of heroism and history during Nashville's Civil Rights Movement.



"I felt a sense of pride and sadness at the same time," says Hughes of first seeing the walls. "My mother and grandmother displayed calmness, composure, and strength in a time of unimaginable change, turmoil, and unrest."

Commissioned by Metro Nashville Arts Commission after being approached by the Nashville Civil Rights Veterans Association, the Witness Walls is a $300,000 project that was funded through the Percent for Public Arts Program and features the vision of Oakland, Ca., artist Walter Hood. His designs are based on historical images from the Nashville Banner archives.

"We hoped to design a set of spatial experiences through the creation of several small rooms," says Hood of the installation. "Concrete exemplifies the 20th century and I wanted to use a ubiquitous, ordinary material to refer to a specific time period. I love the multidimensional quality of the surfaces that were achieved, one through a surface exposure and the other through a CNC [computer numerically controlled] formwork liner. Both methods produced surfaces where light and shadow are present on the wall."

Gate Precast in Ashland City, Tenn., produced the series of architectural panels, including both curved and flat walls that are 7 ft 6 in. tall.

"This project was a bit unusual for us," says Chris Winfield, design manager. "We've produced other art projects, but this was unique from a production standpoint. It's the first time we've used liners and stencils on a project. Coordination was one of the big challenges. The flat walls had images selected by the artist that were transferred to a stencil. We applied a special coating on our mold and then the stencils were laid down. The portions intended to reveal the aggregates had to be removed from the stencil; the parts not removed

Nwaka Mullins Hughes of Atlanta, Ga., daughter of Patricia Guthrie Mullins, who is pictured on the wall holding the hand of her mother, Camilla Guthrie. At age six, Mullins was one of the first African American student to be integrated into the Davidson County schools in Nashville, Tenn. Hughes is accompanied by her husband, Dr. Robert Hughes. All photos: Cheryl Lewis.

created the smooth face. It was a challenge to estimate the labor, because we knew the stencil work was going to be time-consuming."

The curved walls posed other problems, since the graphic images were envisioned to stand out from the curved concrete surface. Innovative Brick in Boulder, Colo., was selected to produce formliners as a solution.

"Flutes too deep mute the resolution; flutes too shallow don't shadow well," says Mark Scott, Innovative Brick's president, of the challenge faced. "Trial and error finally got us to $^{1}/_{8}$-in.-deep, 60-degree fluting."

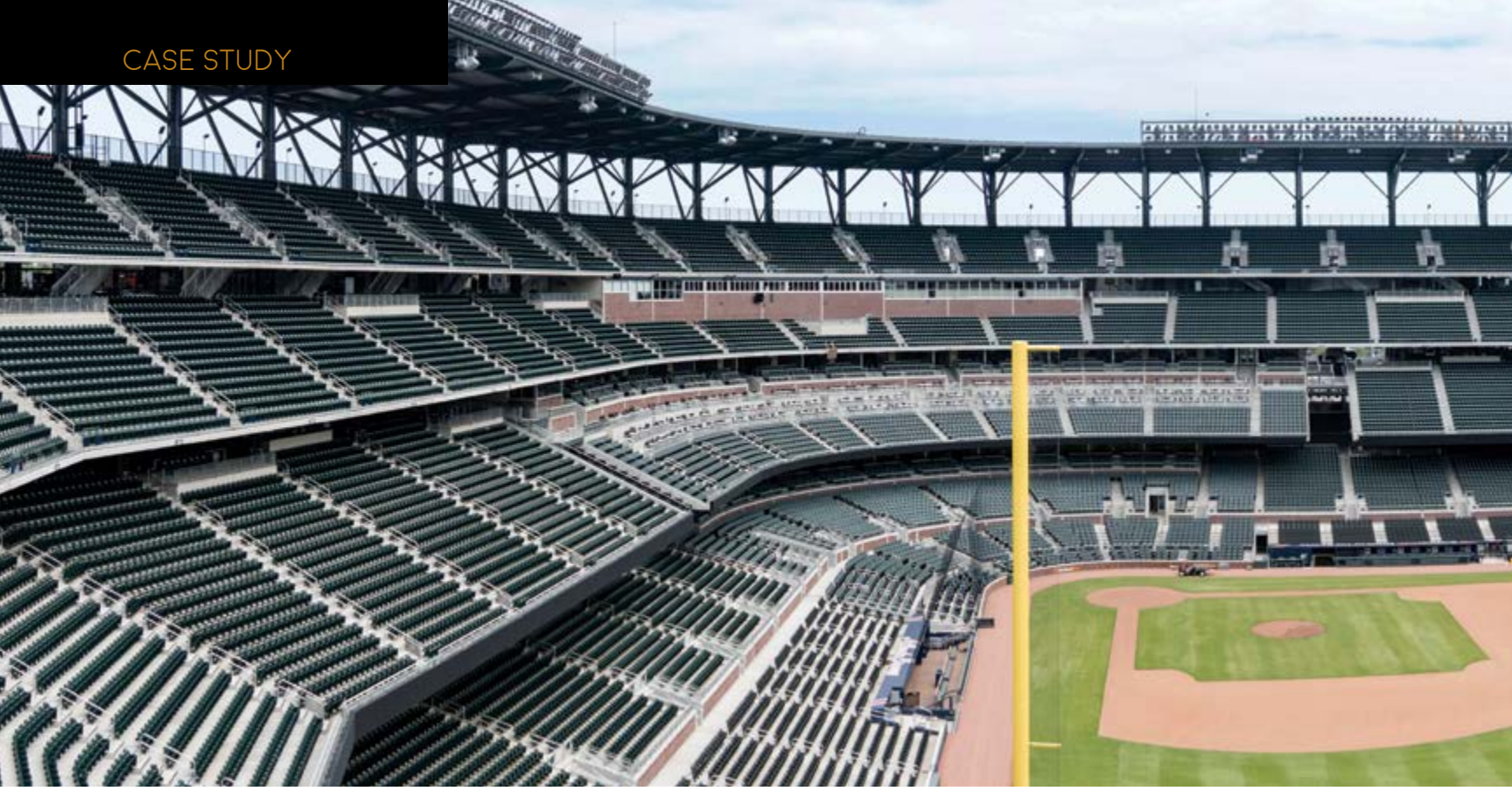
Photos were transformed into the fluted relief that displays each image through varying stages of shadow. These reliefs were then replicated in a thin sheet of plastic, against which the concrete was cast. The resulting 4 × 4 ft image was actually part of the concrete surface.

The finished project, located in Nashville's Public Square Park, is an enduring tribute to the city's historic Civil Rights Movement.

"The public display of the Witness Walls in such a prominent location is truly an honor to our family and others," said Hughes as she gently touched the textured rendering of her mom. "I believe it is important to have the Witness Walls to show the growth of our country, but also a mirror reflection of where we once were."

'We appreciate this wall. It depicts a time that was pivotal in my mom's life. She would still talk about this day when she was 40 years old. She passed away of breast cancer when she was 46.'

– Nwaka Mullins Hughes



Baseball Stadium ANCHORS 'ECOSYSTEM'

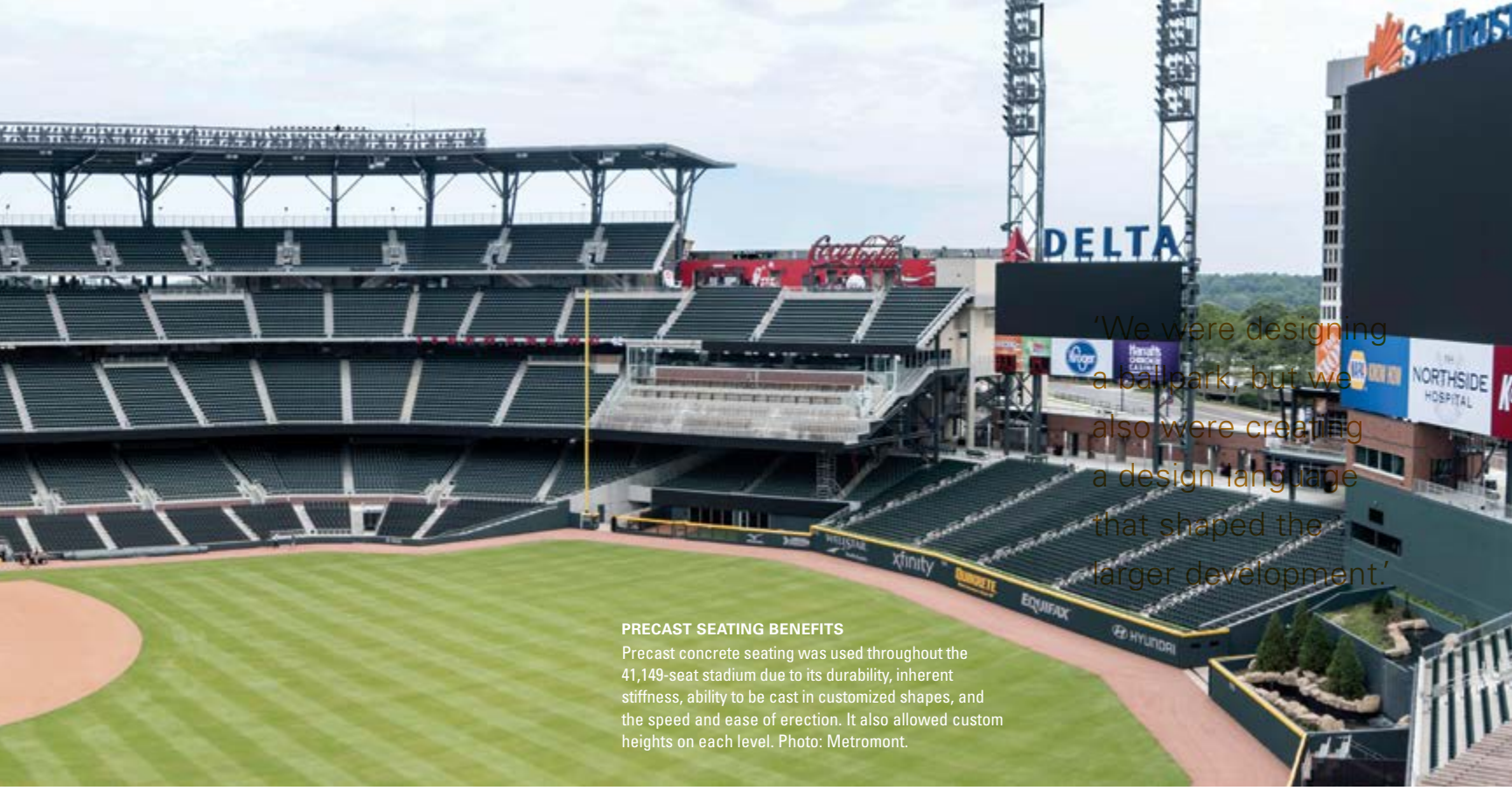
The Battery Atlanta™ development features Braves' SunTrust Park at its core with varied residential, office, retail, restaurant, and entertainment facilities adding year-round vitality

— Craig A. Shutt

Owners of the Atlanta Braves had a bigger vision than to simply produce an upscale home for their Major League Baseball (MLB) team. They wanted to create a complete environment surrounding the Atlanta, Ga., stadium where people could work, live, and play in a variety of ways, even if they didn't attend games. With SunTrust Park at its core, the new development has become a go-to location for Atlanta area residents, some of whom now call it their home and workplace as well. Precast concrete architectural and structural components helped to achieve some of the designers' key goals in the development, especially at the stadium that serves as its focal point.

Executives at Populous, which designed SunTrust Park, worked closely with the team at Wakefield Beasley & Associates (WBA), which designed many of the related structures, and with Jerde Partnership, which produced the master plan. "We were designing a ballpark, but we also were creating a design language that shaped the larger development," explains Zach Allee, senior architect technician and senior associate in the Kansas City, Mo., office of Populous.

"The goal is for fans to live, eat, work, and, yes, play in and around the ballpark development, 365 days of the year. The Braves' forward-thinking approach and vision for the ballpark and surrounding development, I believe, will change the way we view ballpark design in the future," says Allee. MLB Commissioner Rob Manfred agrees, calling it "revolutionary" in an interview with the Associated Press.



'We were designing a ballpark, but we also were creating a design language that shaped the larger development.'

PRECAST SEATING BENEFITS
Precast concrete seating was used throughout the 41,149-seat stadium due to its durability, inherent stiffness, ability to be cast in customized shapes, and the speed and ease of erection. It also allowed custom heights on each level. Photo: Metromont.

REGIONAL SIGNIFICANCE

The hotel and entertainment facilities are part of the Braves' view of their importance to the region, one with a long-standing history, explains Populous founder Joe Spear. For many years, the Braves were the region's only baseball team, especially after its long 1990s winning streak.

"The region's baseball roots still run through Atlanta," he says. "The implications from a design standpoint are huge. When out-of-town fans arrive, they unpack and stay awhile. The action [on the field] remains the main attraction, but it's part of a larger entertainment ecosystem. Residential units infuse the place with more personality. Front-office leadership was front and center in creating the environment."

The 57-acre site consisted of an oblong, mostly undeveloped property (due to pipelines running underground) near a major highway interchange. Among its key venues are One Ballpark Center, home to Comcast's regional offices; Roxy Theater (operated by Live Nation), a 4000-occupant venue for live music; a 16-level Omni Hotel; Punch Bowl Social, a bowling alley; the Residences apartments; a variety of chef-driven restaurants; and a plethora of shopping areas.

TWO AESTHETIC THEMES

Two themes were used to create the aesthetic look for this vast complex, says Michel Lentz, principal and director of WBA's Mixed-Use/Retail Studio. "The western end [away from the stadium] is designed in a slightly more traditional manner, using materials such as brick and stucco. As you move closer to the stadium, the design transitions to slightly more of an industrial feel, utilizing some similar detailing to that used on the stadium."

The stadium was clad with architectural precast concrete wall panels, many inset with thin brick, in complicated formats that often challenged the structural design. Using the panels offered a panelized system that could be erected quickly while providing the masonry aesthetic desired. It also provided an easily reproduced concept for WBA to use on nearby structures, where it was featured on wainscoting, planter caps, and decorative features.

MAKING CONNECTIONS
The configuration of the panels, with very little real estate for connectivity to the structure, necessitated load-bearing connections that included a 'rocking' tieback. Photo: Gate Precast.

THE BATTERY ATLANTA™ (FEATURING SUNTRUST PARK)

LOCATION
Atlanta, Ga.

PROJECT TYPE
Stadium and mixed-use development

PROJECT SIZE
57 acres

STADIUM SIZE
1.1 million ft² (41,149 seating capacity)

STADIUM COST
$672 million

MASTER PLAN
Jerde Partnership, Venice, Calif.

DEVELOPMENT DESIGNER
Wakefield Beasley & Associates, Alpharetta, Ga.

STADIUM DESIGNER
Populous, Kansas City, Mo.

OWNER
Cobb-Marietta Coliseum & Exhibit Hall Authority, Atlanta, Ga.

OPERATOR
Atlanta National Baseball League Inc., Atlanta, Ga.

STRUCTURAL ENGINEER
Walter P Moore and Associates Inc., Atlanta, Ga.

CONTRACTOR
American Builders (joint venture of Brasfield & Gorrie, Mortenson Construction, Barton Malow, and New South Construction), Atlanta, Ga.

PCI-CERTIFIED PRECAST PRODUCER (ARCHITECTURAL PANELS)
Gate Precast Co., Monroeville, Ala.

PCI-CERTIFIED PRECAST PRODUCER (STRUCTURAL COMPONENTS)
Metromont Corp., Greenville, S.C.

PRECAST CONCRETE SPECIALTY ENGINEER
Consulting Engineers Group, Mount Prospect, Ill.

STADIUM PRECAST COMPONENTS (ARCHITECTURAL)
555 pieces encompassing 127,377 ft², including wall panels in three finishes, spandrels, and column covers.

STADIUM PRECAST COMPONENTS (STRUCTURAL)
1009 tread-and-riser sections encompassing 225,778 ft² in four depths and in single-, double-, and triple-seat configurations; 179 raker beams; various columns, stairs, flat slabs, and walls.

PARKING PRECAST COMPONENTS
Double tees, columns, beams, spandrels, solid wall panels, stair/elevator panels, and related components for construction of five parking structures.

MORE THAN A FAÇADE
The stadium was clad with architectural precast concrete wall panels, many inset with thin brick, in complicated formats that often challenged the structural design. Photos: Gate Precast.

"We were able to use some of the same brick color and manufacturer in our precast panels as were used on the stadium," Lentz says. "It brought a little more cohesiveness between the two parcels." (For more on WBA's concepts for The Battery Atlanta™ and other mixed-use developments, see the Architect's Profile article in this issue.)

"The decision to utilize architectural precast concrete was made as the result of careful consideration of its benefits to both the project design and construction," explains a group representing Populous and Walter P Moore, the structural engineers. The group comprised Brad Albers, associate principal, and Mark Palmer, principal at Populous, along with Mark Larsen, senior principal, and Tim Santi, principal at Walter P Moore.

"Precast concrete is a great choice when long-term durability, cost, and speed are all critical. Due to the project's accelerated schedule, precast concrete was determined to be a superior solution for cavity-wall construction. Since the exterior façade of the ballpark is exposed to the elements on all faces, precast concrete provides durable, high-quality finishes."

'Precast concrete is a great choice when long-term durability, cost, and speed are all critical.'

The thin-brick panels, which feature a three-brick color blend, were complemented by two additional finishes. Some panels were cast in a buff color with a light sandblast to replicate limestone, while others have a formliner-cast appearance to replicate chiseled stone, according to Clay Hudson, project manager at Gate Precast, the producer for the architectural precast concrete components. Some of these panels also were used on the interior, especially at field level, to pull the exterior look inside.

BUILT INTO HILLSIDE

The ballpark's location on the side of a wooded hill required significant excavation of soil and rock, with the stadium entry being 35 ft below the grade near the outfield walls. As a result, the soil height varies continuously, requiring the hybrid concrete-steel structural frame to be supported at the bottom of the excavation, isolated from the adjacent soil.

"This created intense challenges for the support of the precast concrete cladding," the Populous/Walter P Moore group explains. Floor-to-floor heights were as tall as 35 ft in some locations, requiring brick-clad panels weighing as much as 56,000 lb. "The panels needed to be robust to accommodate the wind and seismic loads."

Typically, the panels would be supported at grade and connect laterally at each floor level. This wasn't possible due to the ballpark's isolation from the soil, requiring they be supported by the elevated ballpark structure. "This increased the demand on the structure significantly."

It also complicated the coordination among the structure, the precast concrete, and the soil, especially as the panels' bottoms needed to vary continuously to match the soil elevation. The ultimate design makes this complexity disappear due to the close communication throughout the process among the architect, structural engineer, and precast concrete producers.

Many of the panels are C-shaped units that are 20 to 35 ft tall and supported vertically at their bases by the elevated steel structure and laterally at their tops by the steel structure. Complex connections were designed to accommodate the large loads and the potential lateral movement of the support structure. These lateral movements, due to wind or seismic forces, could be in the range of 1 in. or more, the group says, and the connections were required to accommodate this range in perpetuity.

'The architectural precast was so much more than just a façade.'

MORE THAN A FAÇADE

"The architectural precast was so much more than just a façade," says Russ Vines, precast specialty engineer at Gate. "The configuration of the panels, with very little real estate for connectivity to the structure, necessitated load-bearing connections that included a 'rocking' tieback."

The panels' heavy weight and large bearing eccentricities from the panels' centers of gravity required formidable connections, including hollow structural section shapes, headed concrete anchors, and weldable reinforcing bars. High-strength threaded rods also were used to allow rocking at the bearings.

"Aligning the panels took close coordination and attention," says Santi. The panels were adjusted in the field using shims. "This was challenging, but ultimately they got it right. It looks great."

The design group agrees. "Within the bay architecture of the exterior cladding, many different conditions exist, with a mix of straight precast panels, glazing, open mullions, louvers, entry trusses, and canopies. All of these systems were supported by the precast concrete, creating significant demands on the precast and requiring focused coordination. But the result is a system that appears seamless and that works together extremely well."

Stadium entries feature large trusses spanning the space, supported by precast concrete columns at each end. Connecting the trusses to the precast concrete components, and then connecting the precast concrete to the structure, created an additional challenge, Vines notes. "The precast not only had to resist the gravity, seismic, and wind loading of the trusses but also the expansion and contraction forces. That required special detailing and the use of Teflon™ shims."

To complement the appearance of hand-laid stone offered by the precast concrete panels, the base of precast concrete pilasters on the exterior façade were recessed to provide space for hand-laid, split-faced stone applied to add texture and color as well as creating a base for the ballpark, the group explains. "They were not added ornamentation, but were designed and engineered to be part of the architectural precast panels at the exterior façade."

RAKER SUPPORT
In some areas, raker beams support other rakers, while others are set on solid slabs or vomitory stairs, and many precast concrete elements are supported on steel beams. Photo: Metromont.

COMPLEMENTARY FINISHES
Architectural precast concrete panels cladding the façade feature three finishes: thin brick, a lightly sandblasted buff tone to replicate limestone, and a formliner-cast texture to replicate chiseled stone. Photo: Metromont.

PRECAST CONCRETE SEATING, WALLS INSIDE

Carving the ballpark into the side of a hill on sloping ground created challenges for the seating design and interiors, notes Walter P Moore's Santi. Metromont Corporation fabricated a range of structural components, including multiple depths of tread-and-riser sections, tub sections, raker beams, columns, stairs, flat slabs, and walls.

"Very little of the seating bowl was built on grade, so the precast concrete rakers had to be supported in every area," he says. In some areas, raker beams support other rakers, while others are set on solid slabs, vomitory stairs, and many precast concrete elements are supported on steel beams. "The beauty of precast concrete is that we could cast the pieces however we needed and get the exact shape necessary that would plug right in when delivered."

The precast concrete components offered "a kit of parts that could easily be pieced together, like a giant LEGO® set," he says. "It's great for that kind of work. This job had many complex, nonrepetitive pieces, but it all fit together well. Given the schedule and complexity, there was no other way we could have done it and achieved such a high level of quality without precast concrete. There was no discussion of other materials. It's almost a given for stadium seating for this type of facility."

The design team agrees. "The precast seating units were ideal for a major league ballpark due to their durability, inherent stiffness, ability to cast customized shapes, and the speed and ease of erection." Many of the raker beams were long-span beams, which helped eliminate columns beneath the lower bowl. "The precast seating units allowed custom riser heights at each level in the ballpark to yield the best possible sight lines."

CUSTOM SEATING GEOMETRY

The seating configuration in the 41,149-seat stadium, as in other new MLB stadiums, differs from that of other types of sports stadiums. "Baseball geometry is more random and cut up, without the standardized field layout of other sports," explains Mark Schaffer, regional sales manager at Metromont. "They also want seating to be closer to the field, even at the top levels, with open sightlines everywhere."

That meant varying the size of the seating risers every few levels. Depths of 33, 36, 48, and 72 in. were specified, along with tub sections in single-, double-, and triple-level configurations, although triple seating units were used the most to minimize piece counts and picks.

ELIMINATING COLUMNS
Each field seat faces the center of the field, with a cantilevered design that places all columns behind the seats. Photo: Metromont.

"Producing those variable heights creates a challenge," notes Santi. "It produces new forms with every level. That's another good reason to be using precast concrete for them." The design group agrees. "A more regular profile that could be repeated more frequently would have created a time savings, but at the cost of sightlines."

Each field seat faces the center of the field, with a cantilevered design that places all columns behind the seats. Due to the risers' profiles, virtually all of the seats are riser-mounted rather than tread-mounted, the design group says. "Riser-mounted seats are ideal in a facility like this because they make cleaning beneath the seats easier."

The three overlapping seating decks were designed to give fans "the sensation of being right on top of the action," explains Populous' Spear. The top deck was split in several locations, creating openings that allow fans to view the field when on the concourse. Inserts were used to support the precast concrete seating units on the rakers, avoiding the use of grout pockets that would have been exposed to view underneath and difficult to maintain. "Erection of the leading-edge tub units were the most challenging and had to be set precisely," the group notes.

In addition, the concourses were designed to be wide and spacious, and all concessions and restroom facilities were moved to outer walls to provide an unimpeded view onto the field. Atop the upper deck is a 90-ft-wide canopy that provides coverage for most of the seating. The goal with seating and layouts is to encourage fans to walk around in the various "neighborhoods" presented throughout the park, creating a more immersive experience, Spears says.

PARKING STRUCTURES SUPPORT

Surrounding the stadium, and elsewhere throughout the mixed-use development, precast concrete parking structures were built to provide easy parking access for visitors. In all, there are five such facilities, with more planned:

PARKING SUPPORT
The variety of activities at The Battery Atlanta™ are supported by a variety of precast concrete parking structures, some with special access for those using nearby facilities. Photos: Wakefield Beasley & Associates.

- The Delta (Blue) Deck, for premium stadium ticker holders, features 737 pieces of precast concrete and parks 1200 cars. Components include 318 factory-topped double tees encompassing 225,000 ft^2. The cladding spandrels feature a sandblasted architectural concrete mixture finish.
- The Orange Deck, for SunTrust Club ticket holders, features 449 precast concrete pieces and parks 500 cars. It includes 111,500 ft^2 of factory-topped double tees, with an exterior finish consisting of a sandblasted architectural concrete mixture.
- The Red Deck, for ticket holders with a special permit and The Battery Atlanta™ restaurant patrons, parks 1800 cars and features 1746 precast concrete pieces, including 533,129 ft^2 of factory-topped double tees. It also includes a hidden but massive precast concrete storm water vault beneath it that can hold 4.2 million gallons.
- The Green Deck, for the residents of the adjacent apartment building, parks 400 cars and includes 105,000 ft^2 of elevated factory-topped double tees.
- The Purple Deck, at the core of the apartment building, parks 450 cars and features 140,922 ft^2 of factory-topped double tees.
- The Yellow Deck, for a future apartment building, is planned to be added.

The only parking structure that created unusual challenges was the Red Deck, which was built in a heavily excavated area. "It was essentially a detention vault, requiring significant retaining walls," says Schaffer. "We had to carefully figure out crane paths to gain access around the vault and walls."

Several of the parking structures adjacent to the stadium received an architectural finish with an integral color mixture to complement the stadium's masonry appearance. The Red Deck received a smooth finish in preparation for screening and banners that were added after completion.

"The parking structures were fairly typical, but they were very schedule-driven," Schaffer says. "They absolutely had to be completed on time to ensure they were ready when the stadium opened. But the project had a good concept, and it had an easy sequence to follow."

They also had to skirt around other construction sites that were underway simultaneously. The sites had fairly open access, Santi notes, with large landscaping areas planned around them that could be used for staging areas. "Using precast allowed the parking to get started as soon as the site was prepared, which saved a lot of time and helped meet the schedule."

ERECTION MOVED SMOOTHLY

Erection of the stadium's architectural panels also moved smoothly, according to Gate's Hudson.

"There was a lot of hard work by our engineering group and our Monroeville, Ala., plant to make sure we had precast components ready," he says "Gate and our erector, Precision Stone Setting Co., allocated additional manpower to meet the needs of the project when necessary." Precision Stone used a 250-ton crawler crane to erect the panels, with staging areas around the stadium provided by the contractor to help sequence the panels.

Deliveries for the stadium components were made at the outfield side of the project, where they could access grade level on the sloping terrain. This also provided direct access to an adjacent street. An open area in this location provided an easement for delivery, and it will remain undeveloped to serve as a repository for the underground pipelines, which were rerouted to this area.

'SunTrust Park is the culmination of more than a quarter century of experience at Populous designing major league ballparks.'

Coordinating all these venues created daunting challenges, but the result has been a signature mixed-use development for the city. "SunTrust Park is the culmination of more than a quarter century of experience at Populous designing major league ballparks," says Spears. "It prioritizes the fan experience above all else. It is the next generation."

Adds Populous' Allee, "There is a desire for our buildings to be more, do more, and reach more people. SunTrust Park speaks to this desire to blur the lines between the ballpark and the outside, so that the ballpark becomes a true living room for the community. The community can take ownership of the experience in and around it in an authentic way."

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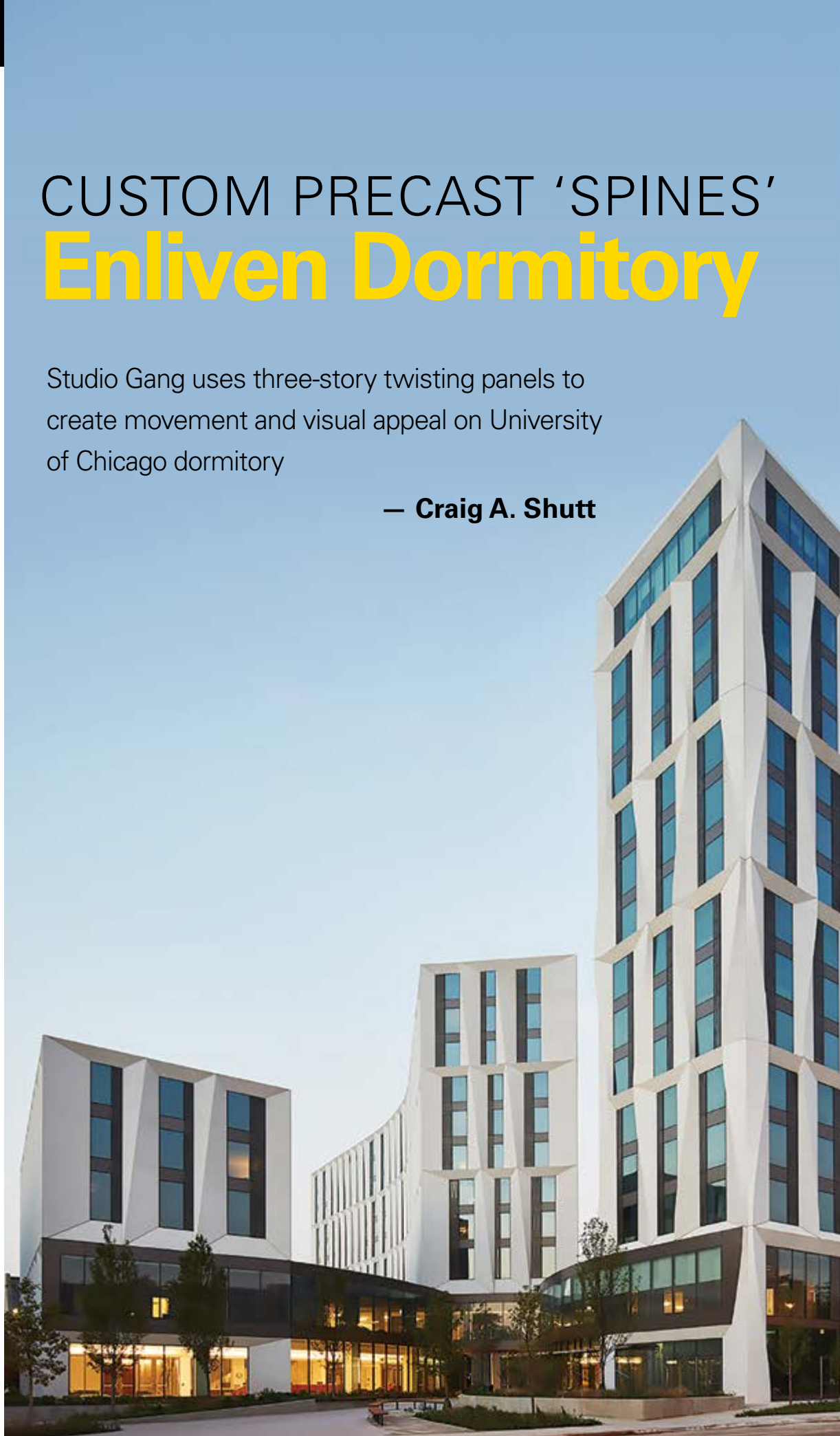
CUSTOM PRECAST 'SPINES' Enliven Dormitory

Studio Gang uses three-story twisting panels to create movement and visual appeal on University of Chicago dormitory

— Craig A. Shutt



UNIVERSITY OF CHICAGO NORTH RESIDENTIAL COMMONS

LOCATION
Chicago, Ill.

PROJECT TYPE
Student housing, office, retail

SIZE
400,000 ft²

COST
$148 million

DESIGNER
Studio Gang, Chicago, Ill.

OWNER
University of Chicago, Chicago, Ill.

STRUCTURAL ENGINEER
Magnusson Klemencic Associates, Chicago, Ill.

CONTRACTOR
Mortenson Construction, Chicago, Ill.

PCI-CERTIFIED PRECASTER
International Concrete Products, Germantown, Wis.

PRECAST SPECIALTY ENGINEER
Midwest Structure Engineering, West Allis, Wis.

PRECAST COMPONENTS
1034 panels with deep, triangular cross sections and sloping sides reaching a line that shifts from left to right or vice-versa at the "spine." Concrete shipping cradles reused on-site as sculptural seating elements.

GATEWAY TO CAMPUS
The location led Studio Gang to design the complex as a gateway to the campus. The buildings' varying heights create a bulwark against the busy adjacent boulevard while stepping down to meet the residential scale along the cross street. Photos: Tom Harris Photography.

The goal of blending a contemporary aesthetic with a neogothic campus provided a key challenge for Studio Gang when it began work on the Campus North Residential Commons at the University of Chicago. Using some of the elements of gothic architecture (tracery, depth, window grilles, and verticality), Studio Gang used dramatic three-story precast concrete panels cast with shifting "spines" that provide movement and changing shadow lines through the day.

"We chose precast concrete for the façade because we wanted the building to be in dialogue with the campus's Gothic architecture," explains Emily Licht, Studio Gang design team member and the façade coordinator. "We don't carve stone like that anymore, so we looked for a material that could replicate the fluidity of Gothic architecture using contemporary labor and building practices."

The $148-million project comprises three slender residential towers, containing 15, 11, and 5 stories set atop a two-story dining hall and student commons that connects the buildings. The towers feature precast concrete spandrel panels, deep-set windows, and metal grilles.

Encompassing 400,000 ft^2, the complex houses 800 students and sits on the northeast corner of the campus. The buildings' varying heights mediate between the busy boulevard adjacent to the Commons and the campus, while the towers step down to meet the residential scale along the cross street.

That location led Studio Gang to design a building that could serve as a gateway, knitting together the neighborhood and the university's campus. The complex also includes space for classrooms and offices, along with student amenities such as music-practice rooms, study spaces, community commons, and a 24-hour reading room. About 12,000 ft^2 of locally based retail in five parcels was added as well, generating activity all day and amenities shared with the neighborhood. Each community of 400 students includes a planted courtyard on the second level.

PANELS IDENTIFY HOUSES

The precast concrete panels were cast three stories tall to make visible the 100-person "houses" within the building. They feature a medium acid-etch and snow-white sand mix to achieve a bright white appearance. Enhancing the university's house system, which encourages collaboration between students of different years to support social and academic success, the buildings are organized around house hubs, three-story communal spaces that are designed to feel comfortable and homey.

The student accommodations are organized radially around the hub, clustering first- and second-year students closest to the hubs, while third- and fourth-year students are placed toward the more

CONSTANT MOVEMENT
The precast concrete spines create an undulating wave that creates a sense of motion and changes its shadow line through the day. Photo: Tom Harris Photography.

private ends of the building. These hubs are visible on the exterior of the building as expanses without precast concrete panels that span three stories, and the direction of their stacking is reflected in the spine of all the precast concrete panels on that tower. "The three-story panels reflect how the university houses its students, and show the intricacy of how the houses are developed," Licht explains.

The panels slope outward to create either a curved or angled spine that twists from left to right or vice-versa from top to bottom. The direction and angle vary between towers and references the way that the hubs inside the building stack. "The panel depth echoes the deep façades on Gothic buildings while also providing necessary sun shading and thermal mass for a highly sustainable building," Licht explains. International Concrete Products (ICP) fabricated all the façade panels, which total more than 1000 pieces.

'The panel depth echoes the deep façades on Gothic buildings while also providing sun shading and thermal mass.'

The panels separate the residences' in-swinging, fully operable windows. The windows are covered with custom metal grilles that Studio Gang designed to allow natural ventilation into every room and substantially reduce the overall energy load of the building.

Aiding thermal performance is continuous spray-foam insulation applied to the panel's reverse sides. The university had a strict energy usage intensity cap for the project and is targeting LEED Platinum. Inside each hub, the building's real-time energy use will be displayed on monitors once the operating system is installed and running. The monitors will allow the eight houses to "compete" for energy efficiency and see their standings.

DESIGN-ASSIST CAPACITY

The project was completed as a design-build project, with the precast concrete manufacturer brought on early in a design-assist capacity. "We worked very closely with the precast engineers to align our design intent with their molding capabilities," explained Licht.

Several mock-ups were created to assist in the design and construction of the project. They helped Studio Gang and UChicago choose an acid-etched finish for the panels. A full-scale, two-story mock-up ultimately helped determine how all of the components would fit together on-site.

"The mock-up was a critical learning tool that allowed the precaster and the different trades to realize challenges early and practice working together to understand how everything could come together before installation began," Licht says. "This ultimately ensured that the installation process was quick and efficient on-site."

The ability to share drawings during the design-build process allowed tolerances to be tighter and erection to move smoothly. Approximately 80% of the panels were heavily repetitive and cast from a limited number of molds, while the corners and unique conditions where the buildings met the ground accounted for the additional, more custom shapes.

To cast the varying shapes required, ICP constructed custom forms, including some mirror-image versions to reverse the direction of the spine's slant. The shapes were cut with a custom program that allowed the casting to move more efficiently. The three-dimensional shape added weight to the three-story panels, making some weigh as much as 30,000 lb.

"These were very sizable panels, which added to the challenges of the erection," says Rob O'Riordan, project manager for Mortenson Construction, the general contractor. Designers provided a more robust reinforced-concrete frame than would be typical. The height of the panels led to the use of a 150-ft crane to clear the space.

TEST RUNS
Panel mock-ups helped determine how all of the components would fit together on-site, helping make installation more efficient. Photo: Studio Gang.

SECURING HEAVY PANELS

Adding steel embedments to the panels and to the concrete structural supports created a key element in securing the panels during erection. "The embeds added to the congested reinforcement patterns in the panels," says O'Riordan. "Coordinating those embedments with the specific floor positions where they would be positioned required close communication and a specific sequence of panel delivery."

The embedments were placed at each end of the panel, with corresponding plates cast into the concrete structural beams at the third, sixth, ninth, twelfth, and fifteenth floors. The plates in the columns consisted of upturned (bottom) or downturned (top) positioning to match the panel interface. Structural beams on intervening levels were more robust to help carry column loading between the structural columns, he adds. Haunches also were cast into the beams to help carry the panel loading.

"The use of embedments was a typical design, but the sheer number required to carry the panel loading and the number of types that were used was unique for us," O'Riordan says. "It was a challenge, but we worked through it very smoothly."

Connecting the precast concrete panels to the cast-in-place concrete structure created tolerance discrepancies due to the varying material standards, he notes. This required close coordination to ensure the panels and frame were aligned and plumb as the erection progressed. Vertical edge-of-slab surveys were completed at multiple points to ensure proper alignment of each story as it was placed. Alignment between the material joints were controlled to within ¾ in. and then sealed.

The erection of panels proceeded as each three-level structural frame was completed. As the first layer of panels was set in place, the frame was being built above. At that point, the panel sequencing became critical.

FITTING TOGETHER
Erection of the façade was complicated by the upper panels often sliding behind the top point of the lower panel. Photo: Tom Harris, Hedrick Blessing Photographers.

"Due to the geometry of each panel, they had to be set in a precise location, so we couldn't leapfrog around the building as we might do with repetitive panel shapes," O'Riordan explains. That meant if one panel was damaged in handling or erection, a new panel would have to have been cast to fit that slot, with work stopping until it was complete. Fortunately, no damage occurred to any panels.

The erection also was complicated by the upper panels often sliding behind the top point of the lower panel. "Many of the panels were trapped horizontally as well, so the erection sequence was very defined and precise."

Compounding the challenges was the installation of the windows, which carried their own tolerances. "The control points were very carefully laid out, and we worked closely with the curtain wall installer and the precaster to allow the necessary tolerances to create a tight seal around the perimeters."

ICP was able to stage panels nearby, filling in new panels with deliveries from their Wisconsin plant as earlier ones in the sequence were delivered and erected. "As morning picks were rolling out to the site, deliveries were rolling in with the next day's load at the other end," he says. "We always ensured we had the next panel in the sequence arriving for erection as it was needed. It all moved very smoothly."

"Watching the façade go up was pretty incredible," Licht says. "Because of the level of detail early in the design process, they could geolocate the position of each panel within $^{1}/_{16}$th of an inch and connect it quickly. It was like a ballet."

'Watching the façade go up was pretty incredible. It was like a ballet.'

CUSTOM CONCRETE CRADLES

The careful handling of the precast concrete panels was aided by the use of custom concrete cradles installed on the trucks to ensure panels were held securely during transit. They created a reverse image of the panels being transported, and Studio Gang opted to repurpose a number of the cradles as sculptural seating in the quad.

Connecting the building to its construction, added a unique design element of reuse to the design. "This project was very unique for us due to the high profile of the design and the very exciting result," says O'Riordan. "The frame was far from typical, and it was a challenging construction. But the precast concrete gives it a very sculptural feel that adds movement both in its appearance and throughout the day and year as the sun changes the shadow lines."

"High Concrete saw our design as a wonderful opportunity to really show off their skills, talents and products. It has been a sincere joy to work with a group of precasters who are as engaged as they have been, willing to roll up their sleeves to work on solutions rather than seeing obstacles, and I am sure that they are proud of their efforts as much as we are."
Kai-Uwe Bergmann, *AIA, RIBA, partner, BIG—Bjarke Ingels Group*

THE NEW SHAPE OF PRECAST

1200 Intrepid at the Philadelphia Navy Yard is the newly completed precast concrete work of art designed by world-renowned starchitect Bjarke Ingels Group (BIG). The front entrance façade gently curves inward while stretching outward creating a startling and gravity-defying visual that mimics the curved bows of the nearby battleships. The unique engineering requirements of the project meant that the gravity loads flowed directly to the ground and were not tied to the steel frame. Almost every piece of the front entrance façade is unique. This very complicated project presented a challenge that required an innovative solution using technical, engineering and creative expertise, and would not have been possible without the use of BIM and 3D modeling. For more information on this project and others visit us at www.highconcrete.com/news.

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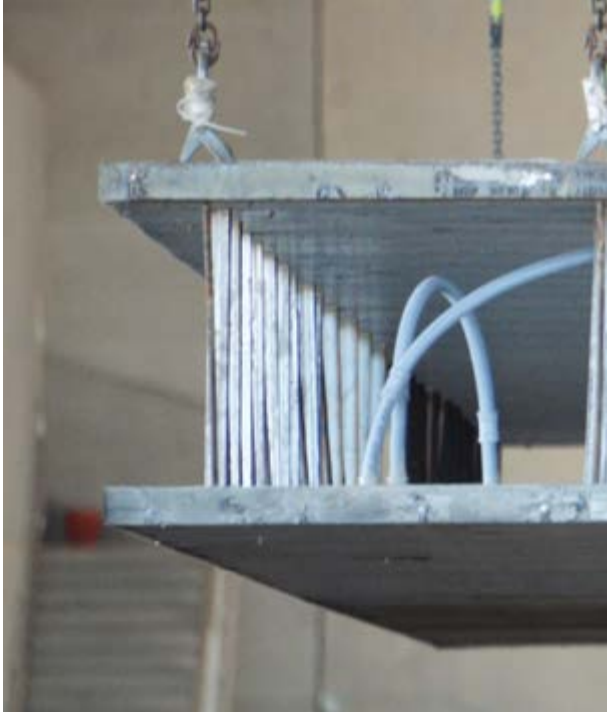


NEXT-GENERATION Flooring Systems

The industry is developing new flooring systems using the latest technology to complete the missing link for high-performance precast structures

— Monica Schultes

For the past 65 years, precast, prestressed concrete has been widely known for providing economical, efficient floors. It has been the go-to system for all types of projects, especially residential, commercial, and mixed-use, and for good reason: precast concrete provides strength and durability in an economical system.

With the demand for better, lighter, and faster construction from architects, engineers, and owners, precast concrete manufacturers are researching and developing the next generation of flooring systems. Using their vast experience to make use of economies of scale, they are producing quality products that are manufactured in the plant to speed installation in the field. The next generation of structural floor-ceiling assemblies also stems from the efficiency of prestressed concrete slabs for load capacity and span length, as well as the excellent fire resistance and sound transmission characteristics associated with concrete.

A NEW BUILDING METHOD

One new method is a building system that incorporates the patented DualDeck™ by FINFROCK. Their latest brainchild is a composite truss designed for long spans of column-free support. DualDeck™ is made by attaching two 2.5-in.-thick precast, prestressed concrete slabs with high-strength reinforcement and steel angles. Each structural member is typically up to 14 ft wide, 68 ft long, and between 20 and 24 in. thick.

The top panel of a DualDeck™ is lifted out of the form and moved to a rotating vacuum table located in the center of the production area. Once the top slab is inverted, it is set in the form where the bottom slab is being poured. The DualDeck™ is complete once the bottom slab has cured. Because panels are poured upside down and flipped over, both sides of the product are perfectly flat, creating steel-formed floor and ceiling surfaces quicker and with less finishing costs.

The interstitial space between the two concrete surfaces provides an accessible area for the mechanical, electrical, and plumbing subsystems. These are placed during DualDeck™ fabrication. FINFROCK uses StructureWorks LLC's technology for three-dimensional modeling and laser projection for placement of the utilities. Putting the utility components inside the DualDeck™ in a controlled environment guarantees accuracy, significantly reducing requests for information and change orders, and eliminates core drilling. All of this contributes substantially to speeding on-site construction. The final fit out of the interior follows the leading edge of the installation, which increases the speed of construction.

FINFROCK served as developer, contractor, and architect of the new $30 million waterfront Hyatt House in Naples, Fla. (see the Summer 2017 issue of Ascent for more on this project).

POSITIVE FEEDBACK

Building information modeling (BIM) technology has proved instrumental in commercializing the DualDeck™ building system. FINFROCK chairman Robert Finfrock affirms, "Without BIM, manufacturing the DualDeck™ would not be possible." Laser technology is used to position mechanical, electrical, plumbing, and fire-protection systems in the product. Casting these systems into an efficient structural product during manufacturing compresses schedules and minimizes site disruption.

When you look at the patented DualDeck™ product, it seems to be a better mousetrap. Allen Finfrock, CEO, recalls, "Twelve years ago, my father and I were kicking around various ideas. 'Why can't we

FINFROCK DUAL DECK
FINFROCK uses StructureWorks LLC's technology for laser projection placement of the utilities in its new DualDeck™. Photo: FINFROCK.

do a nice smooth surface on floor and ceiling?' We went through all kinds of potential solutions." After 10 years of research and development and 50 iterations of the product and manufacturing processes, they arrived at the DualDeck™ system.

They are taking control of their own destiny. "We install everything here in the manufacturing process," explains Allen Finfrock. "It's more than a precast product: this is an integral part of a complete building system."

A top flange bearing system allows supporting members to be hidden or eliminated, so no soffits or build-out walls are required to hide building services. "When you are in the room, you never actually see the support conditions for the DualDeck™," describes Allen Finfrock. FINFROCK hires the plumbing contractor, who installs some of the plumbing in the plant and follows up in the field to complete the assembly.

The ability to plan everything ahead of time and include it in the BIM model allows FINFROCK to improve building quality and deliver buildings faster and at a reduced cost. The DualDeck™ can have long spans, providing more open space and design flexibility. Part of the story is all of the technology that is involved was not widely used 10 years ago. FINFROCK worked hand in hand with StructureWorks LLC to create and fine-tune the process.

Smooth top and bottom surfaces allow flooring to be installed directly, without floor preparation, and paint to be applied directly to the concrete ceiling. The DualDeck™ also has very low camber and members line up with exceptional accuracy.

Robert Finfrock compares it to typical precast concrete construction technology: "It isn't just the speed of erection; it is the entire construction process. It actually facilitates the rapid delivery of the completed building."

In DualDeck™'s infancy, FINFROCK first considered the flooring system as a perfect fit for parking structures. However, it became apparent that its best use was seen in finished buildings such as multifamily housing, due to the product's potential to improve the economic efficiency of other building types.

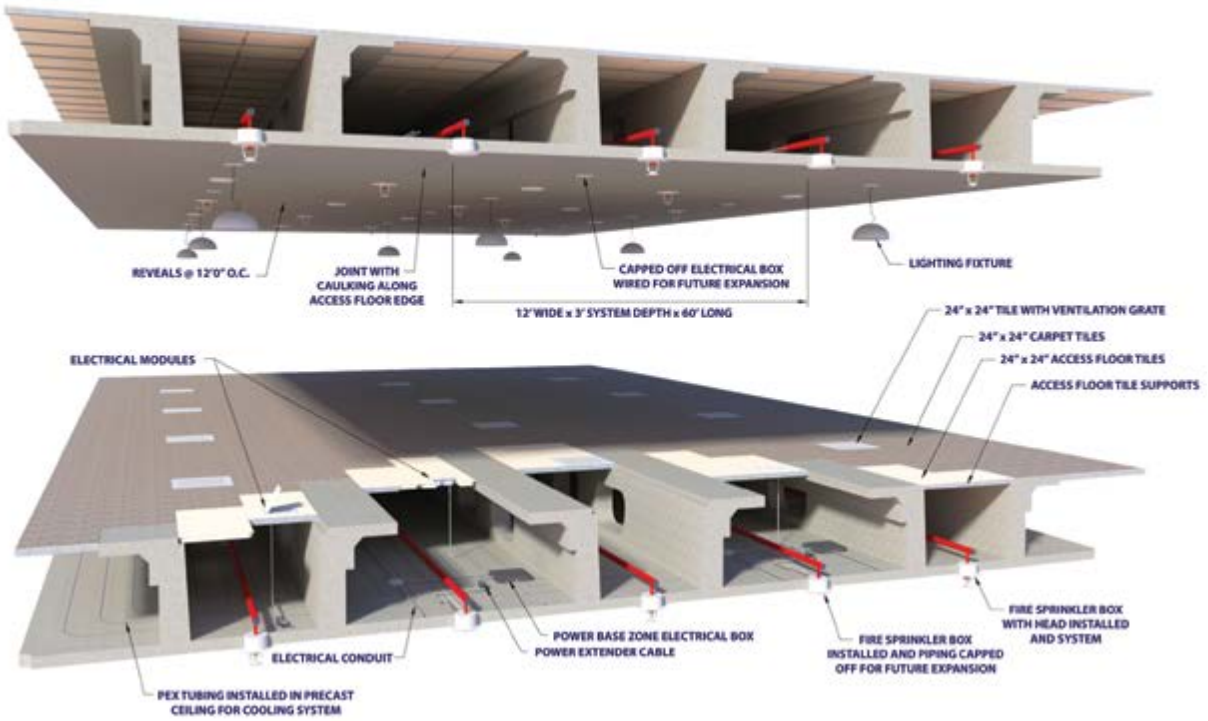
ENABLING HEALTHY BUILDINGS

Another millennial flooring system, developed by California-based Clark Pacific, is geared toward the commercial office market. The Clark Access Deck™, a patent-pending solution, cost-effectively incorporates raised access floors as well as radiant heating and cooling systems while significantly reducing ceiling-to-floor system depths in new construction.

There is a growing movement in the design community to focus more on occupant health. Underfloor air distribution provides fresh air for occupants more effectively and efficiently than overhead air distribution. Similarly, radiant heating and cooling from above achieves thermal comfort more effectively than forced heated or cooled air, and thermal mass provided by exposed concrete provides a better feel than dropped ceilings and painted drywall.

The Clark Access Deck™ is a manufactured integrated building system that delivers healthier air circulation for building occupants and a flexible, accessible interstitial floor space that can be modified to fit clients' needs.

"Our development is the next logical extension from the voided slab system we developed for the Apple Park project," describes



CLARK ACCESS DECK RENDERING
The new system created by Clark Pacific delivers healthier air circulation for building occupants and a flexible and accessible interstitial floor space that can be modified to fit clients' needs. Illustration: Clark Pacific.

Thomas Ketron, marketing director with Clark Pacific. "The access deck comprises a finished ceiling on one side and a structure to support access floor panels above. It resembles an inverted double tee."

How did this new breakthrough come about? "It is fundamentally guided by the principle of prefabrication and maximizing the amount of subassembly systems that can be integrated into our platform and offered to the market place," says Ketron.

The component is manufactured face down in a form like an architectural precast concrete panel (capable of receiving any finish) and has longitudinal stems that are integrally cast with the panel. Mechanical, electrical, plumbing, and fire-protection subassemblies can be installed in the plant or field, as can the corresponding access floor panels. The name says it all. The access floor allows you to lift off the panels, which can be used for various underfloor distribution systems or moved as needed.

"Everything is easily accessible from the top, which is more comfortable and familiar to customers and supports office reconfiguration and flexible work spaces. Unlike a traditional double-tee system, you don't have to climb up into a drop ceiling to make modifications," relates Ketron.

Depending on the needs of the project, related trades might install varying levels of subassemblies and connections at the plant and follow up in the field to complete their work.

Clark Pacific uses BIM in automated fabrication processes and to create custom-manufactured solutions. "BIM is an integral part of our design and manufacturing process and is important for the cross-team and cross-trade communications necessary to successfully deliver this integrated off-site manufacturing approach," says Ketron.

"Precast systems help deliver healthy buildings to owners who are really seeking buildings with the well-being of the inhabitants in mind." Besides its proven occupant-health and comfort features, this integrated solution provides owners and project teams additional benefits, including schedule certainty, superior acoustics and vibration control, long-term quality, program flexibility, and lower life-cycle costs.

'The access deck comprises a finished ceiling on one side and a structure to support access floor panels above. It resembles an inverted double tee.'

Traditionally, precast concrete has always delivered wide, open spaces and maximum distances between columns for office construction. The Clark Access Deck™ goes one step further and meets the needs of customers who want the flexibility to relocate furniture and office systems at any given time. "We look at this as an opportunity as we continue to look for ways to maximize off-site prefabrication for our customers. How many systems can we put together out in the plant and bring as complete as possible to the site? We aren't focusing on just precast concrete, but rather on meeting a real industry need to maximize what can be prefabricated for projects."

Both DualDeck™ and Clark Access Deck™ focus on different market applications, but both build on the core principles of precast concrete to provide strength, durability, and speed in an economical system. With the mainstream use of BIM, the potential to develop innovative precast concrete systems that integrate into construction modules is endless.

Colors, Finishes and Blends **to Fit any Design**

Located in Columbus, Ohio, The James Cancer Hospital and Solove Research Institute is the patient-care component of The Ohio State University Comprehensive Cancer Center. A combination of METROBRICK® colors and sizes were blended to create the brick pattern on this dynamic and vital building. Over 125,000 square feet of METROBRICK was used throughout.

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Photo: Gate Precast Company.

PRECAST/PRESTRESSED CONCRETE

Design Resources

PCI develops, maintains, and disseminates the Body of Knowledge for designing, fabricating, and constructing precast concrete structures and systems. It is from this Body of Knowledge that building codes, design guides, education, and certification programs are derived. Please visit www.pci.org for all of these design resources and more.

Architectural Precast Concrete Color and Texture Selection Guide, 2nd Edition (CTG-10)

The "Architectural Precast Concrete—Color and Texture Selection Guide" has been reprinted with 12 new color and texture pages, plus identification pages with mixture designs. This includes nine new color pages with two new colors per page, two pages of new formliners, and one page of new clay brick-faced precast. The numbers in the guide have not been changed, so that there is no confusion between the old and the new versions. This is a visual guide to assist architects in the initial selection of color and texture for architectural precast concrete. Illustrating more than 500 colors and textures for enhancing the aesthetic quality of precast concrete panels, the guide is an extension of the information included in the architect-oriented Architectural Precast Concrete manual (MNL-122). Cements, pigments, coarse and fine aggregates, and texture or surface finish with various depths of exposure were considered in creating the 287 6.75- by 11-in. color plates, the majority of which display two finishes on the same sample. The materials used to produce the samples are identified in the back of the guide for handy reference. The three-ring binder has removable inserts.

Architectural Precast Concrete, 3rd Edition (MNL-122)

This fully revised edition includes new sections on sustainability, condensation control, and blast resistance. You'll get extensive updates in the areas of color, texture, finishes, weather, tolerances, connections, and windows, along with detailed specifications to meet today's construction needs. Includes full-color photographs and a bonus DVD.

Precast Prestressed Concrete Parking Structures: Recommended Practice for Design and Construction, 3rd Edition (MNL-129-15; e-pub)

Decades of research have proven that precast, prestressed concrete is a cost effective, durable solution for parking structures. Over 140 pages present the latest concepts in design and construction, including 16 pages of full color photography and many details and design examples. This is the most comprehensive publication of its kind.

Designer's Notebooks – Free

The PCI Designer's Notebooks provide detailed, in-depth information on precast concrete relevant to specific design topics such as acoustics, mold, and sustainability.

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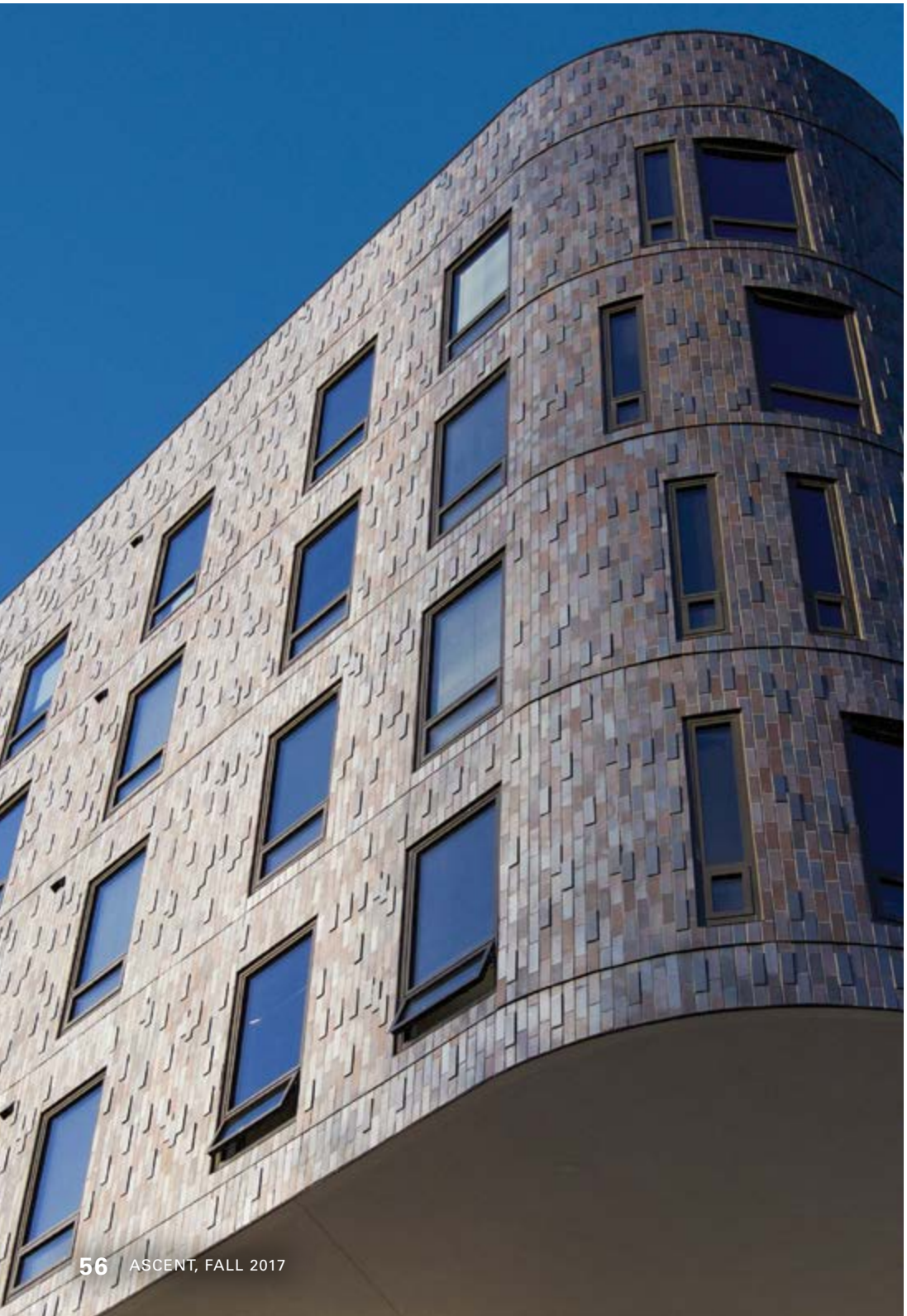
ENDICOTT BRICK

Creating a new dimension of thin brick



The architectural precast industry increasingly demands new ways of capturing dimension. With thin brick, dimension has commonly been limited to a handful of sizes and textures with little to no variation to the wall plane. To truly enrich and shape the quality of a space, varied options for color, texture, size and shape are crucial. Endicott brick offers it all—with a new dimension.

TEXTURE & COLOR

One way to increase design complexity and beauty is through different textures and colors. For the new Atlanta Braves SunTrust Park stadium, the precast panels included a blend of two velour ironspot colors and sanded burgundy color thin bricks, embedded in the panel. This created a unique, vibrant façade that provides timeless appeal.

During its 2016 facility expansion, Endicott wanted to tie in the flexibility for manufacturing textures that were known in the traditional face brick segment, but had yet to be accomplished in an extruded thin brick.

"By developing capabilities to add textures such as vertical score, artisan and matt on an extruded thin clay body while still meting the PCI specification for embedded thin brick provided a challenge," Ryan Parker, Endicott President & CEO, said. "Many recent suppliers have tried to provide thin cladding textures by cutting the faces off of traditional face brick. We

believe in strongly adhering to the PCI specification for embedded thin brick and wanted to create a product that had better size tolerances than slabbed face brick and included a keyback design for a mechanical lock in the concrete."

Endicott is meeting the demand for this new dimension of thin brick, and its customers are thoroughly enjoying the look for their new projects.

"We've received a lot of great feedback from architects, distributors, formliner providers and precasters on the look, design flexibility and sizing precision that these new products provide," Parker said.

SIZE & THICKNESS

The ability to meet PCI tolerance on thin brick size and multiple thicknesses also plays a vital role in design complexity. Endicott recently supplied thin brick for "The Uncommon", a complete student living facility at the University of Virginia in Charlottesville. To help the building stand out and appeal to students, multiple sizes and thicknesses of thin brick were utilized to provide a fresh look in a very traditional masonry market.

"The Uncommon is a great example of how our thin brick can be used in applications where design is anything other than stale or commonplace," Parker said.

In addition to varied thicknesses, Endicott is now manufacturing larger sizes to supply projects that require a more linear look or a bigger unit to balance the appearance in relation to the scale of the wall. The thin brick units that meet these requirements are Roman ($1\frac{5}{8}$" × $11\frac{5}{8}$") and two sizes of Meridian ($2\frac{1}{4}$" × $15\frac{5}{8}$" and $3\frac{5}{8}$" × $15\frac{5}{8}$").

Endicott offers the ideal brick for every project. As precasters work to meet design intent and create buildings that stand apart from the rest, they can count on Endicott. Learn more at endicott.com

Increase your understanding of everything that's possible with thin brick, learn how it can grow your business and discover best practices for PCI-certified plant production. Schedule a plant presentation or AIA-accredited session with an Endicott representative today.

Increase your understanding of what is possible with thin brick in architecture, growing your precast business with thin brick, or best practices for PCI certified plant production with thin brick. Schedule a plant presentation or AIA accredited session now with and Endicott representative.

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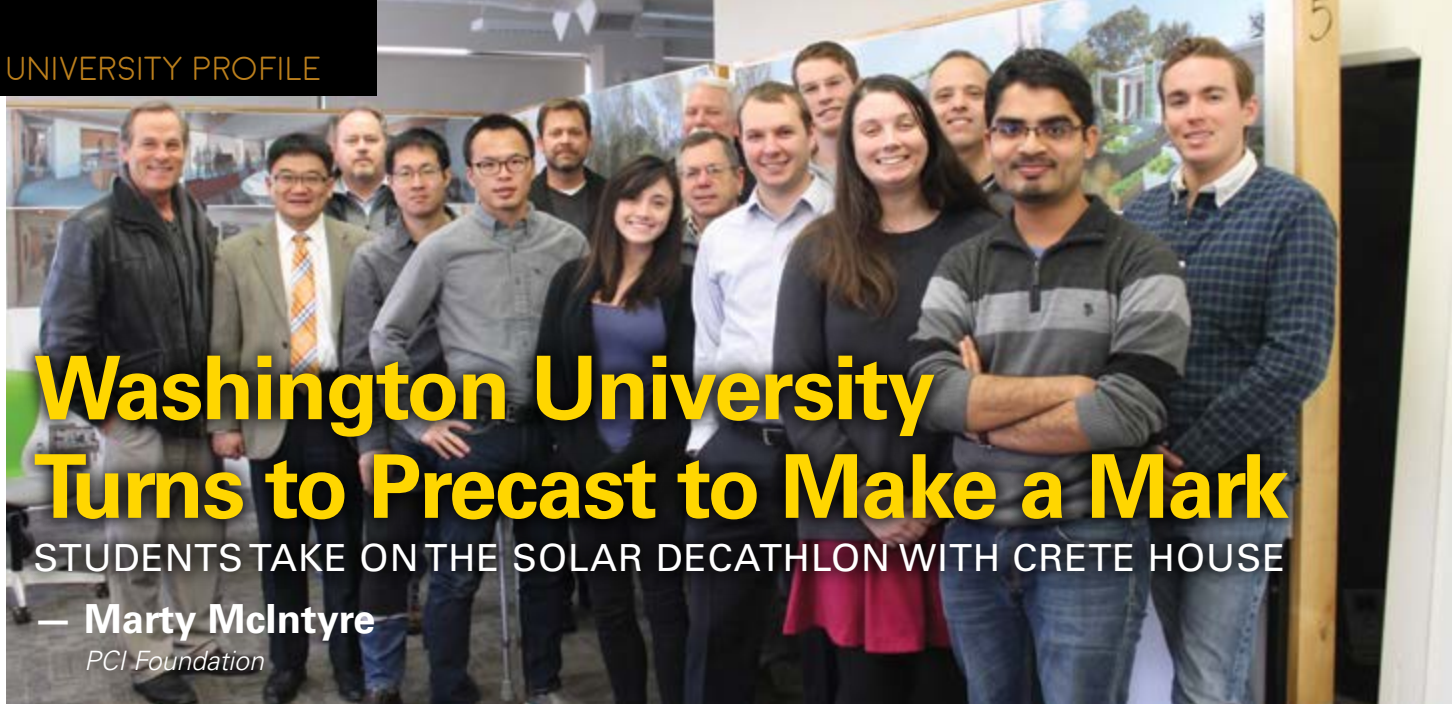

Washington University Turns to Precast to Make a Mark

STUDENTS TAKE ON THE SOLAR DECATHLON WITH CRETE HOUSE

— **Marty McIntyre**
PCI Foundation

Industry champion Brian Bock of Dukane Precast and Professor Hongxi Yin of the School of Architecture (left) line up with the Washington University students. Photo: PCI Foundation.

A group from Washington University (WashU) in St. Louis, Mo., is one of 12 collegiate teams selected to participate in the U.S. Department of Energy Solar Decathlon 2017. The competition will be held in Denver, Colo., from October 5 to 15, 2017. To take on this challenge, the WashU team turned to the precast concrete industry to create a new type of resilient and sustainable house. The PCI Foundation provided a two-year grant and Brian Bock of Dukane Precast in Naperville, Ill., took on the role of industry champion to help find partners with the precast concrete industry.

INTERDEPARTMENTAL TEAMWORK

Team WashU comprises a diverse group of students, faculty, and industry partners with expertise in architecture, engineering, design, innovative materials, and public health. Participants designed and built an 800-ft^2, 100% solar-powered house to demonstrate sustainability and resilience. A team of about 100 students, mainly from the school of architecture but also from the schools of engineering, construction management, computer science, business, and public health, will see their innovative ideas evolve from initial concept to completed construction. They titled their project "Crete House" and managed to incorporate precast concrete walls, roof, floor, foundation, and even precast concrete countertops.

Professor Hongxi Yin, an expert on green community development and the site operations manager for the 2013 Solar Decathlon China, led the team. After the competition, the house will be shipped back to WashU for permanent installation on campus, where students will continue to use the house to research sustainability topics.

WashU Chancellor Mark Wrighton says, "We've had a wonderful process competing in this solar decathlon. I've long wanted to bring architectural design and engineering together, and Hongxi Yin has really done that. We've had more than 100 students involved, we've had faculty from both schools, and we've had staff here and other volunteers engaged in this exciting project. Architecture and engineering should be working more closely together."

"Architecture is about bridging the gap between concept and reality," says faculty project designer Pablo Moyano, senior lecturer in architecture in the Sam Fox School, who is leading the studio with Yin and faculty project manager Ryan Abendroth. "In a typical studio, students can make impressive designs. But with Solar Decathlon, they actually have to build them."

In the fall of 2015, Yin and Moyano offered the first of four semester-long studios. Students began by creating individual proposals, which gradually merged into a final design. They also investigated sustainable strategies for heating, cooling, and ventilation, looking for ways to reduce and/or offset energy consumption while still maintaining a comfortable, functional space.

"Students are exposed to the entire process, from conceptual design to construction and operation," Moyano adds. "That's a unique experience and a valuable lesson."

FOCUS ON ADAPTABILITY

The design will focus on adaptability, supporting a range of potential users while providing a highly flexible and dynamic building envelope. A test bed for technological advances in architectural design and construction, the entry will be a showcase, market-ready home demonstrating market appeal, efficiency, and climate resilience.

Meanwhile, computer science students, working under the direction of Chenyang Lu, the Fullgraf Professor in Computer Science

and Engineering, have worked to develop a custom operating system for the house. Yin and adjunct engineering professor Tim Michels co-taught a course on building energy.

"This is a research project," Yin says. "Our challenge is not to deliver one building. Our challenge is to create a transdisciplinary framework that will improve efficiency throughout the industry."

A diverse, interdepartmental group of students worked on the Crete House at Washington University. Photo: PCI Foundation.

EXPOSURE TO PRECAST INDUSTRY

For students, coordinating with the precast concrete industry gave them a first-hand look at how projects require teamwork in the field. Several students from the team not only worked with the precasters, they also attended the PCI Convention in Cleveland, Ohio, to look for other partners and ideas. "Being able to attend the PCI Convention was an incredibly worthwhile experience as both a student of architecture and construction management, as well as a future young professional," says team leader Adam Goldberg. "As a team leader for Washington University's Solar Decathlon, I was able to connect with industry representatives who were eager to assist in the upcoming construction of our project. Learning how to network and truly interact with professionals in the building industry is an element of the architectural education that is usually left out. However, being able to attend an event like this provided invaluable experience to take with me into the future."

"Concrete has a lot of upsides," Moyano says. "It's resistant to fire, humidity, mold, and insects. It's resistant to extreme weather, such as hurricanes and tornados. It's durable. The main downside is weight. Concrete is heavy."

To counteract that weight, students worked with PCI—particularly its Midwest, Mountain States, Central Region, and Illinois & Wisconsin Chapters—to design and cast sandwich panels using Ductal®, a new high-performance mixture. "Ductal® is six times stronger than regular concrete," Moyano says. "This allows us to create panels that are thinner and about 30% lighter than standard precast concrete."

Perhaps most strikingly, the house does not contain a traditional heating, ventilation, and air conditioning system. Instead, capitalizing on concrete's high thermal mass, the house is primarily warmed and cooled by water coils embedded within the panels.

"This has been the best learning experience that I have ever been a part of," says Ethan Miller, student construction manager. "It has been great to interact with industry partners and get that real experience of building a real project. It's not something that students get to do very often, so we are incredibly happy with this opportunity and we think we are going to compete well in Denver. The precast concrete has its challenges. We had a lot of coordination between all the different precast companies. At the end of the day, it went up very quickly and everything went together beautifully. So we are really happy with the result."

Brian Bock from Dukane Precast has a great success record putting together cooperative industry projects, and has put those skills to work for the Solar Decathlon. "Speaking for our entire industry team, I would like to say that it has been a very rewarding experience working with the multitude of students, professors, and numerous higher level faculty at Washington University in St. Louis on the Solar Decathlon project," he says.

"This has been a tremendous experience over the last two years. The wide-ranging participation amongst individual PCI producer members, our material suppliers and allies, and national and regional PCI staff has been fantastic. We've had precasters from all over the U.S. working on this project, and we've had five precasters donate product to the house, and many others who have offered support and consulting services or tours. It's a very exciting program; we've worked to set up tours not only of precasters, but visited with architectural firms that design in precast concrete. We are enjoying the process and the camaraderie that has developed during this industry effort with academia. We look forward to great things in 2017 and beyond," says Bock.

"The students have been to a number of precaster plants, and we visited jobsites. We also had the students out at the tornado cannon demonstration, and some research folks came along to better understand concrete's resiliency. Students have been just incredibly engaged in this, from the schools of architecture, engineering computer science, business, and public health."

PCI members who provided precast concrete include:

- Dukane Precast, Naperville, Ill.
- Gate Precast, Ashland, Ky.
- Lombard Architectural Precast, Alsip, Ill.
- St. Louis Prestress, Glen Carbon, Ill.

PCI Continuing Education

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 International Code Council (ICC). 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 presented twice during the webinar week, at noon Pacific (3:00 p.m. Eastern) and noon Eastern. 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

November 28 and November 30, 2017: "PCI Handbook 8th Edition–What's New"

> 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 resource at **www.pci.org/elearning**.

In-Person Learning Opportunities

> SEMINARS AND WORKSHOPS

PCI and its regional affiliates offer seminars and workshops 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.

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Level I/II

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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.

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Photos courtesy of U.S. Department of Energy

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Not only are we the global leaders in insulated concrete products, we helped found the industry. No company can match our track-record of success.

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SPOTLIGHT

NREL Energy Systems Integration Facility

The Energy Systems Integration Facility (ESIF) at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) is a state-of-the-art facility for the research, development, and demonstration of advanced strategies and components in modern, clean energy technologies.

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- 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 Structural Precast and Prestressed Concrete Products*
- MNL–117 *Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products*
- 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.

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 nonload-bearing wall panels, spandrels, beams, mullions, columns, column covers, and miscellaneous shapes. This category includes Category AT.

> GROUP B – BRIDGES

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.

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 (but 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 (but not certified to produce any products in 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.

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Pelham, (205) 663-4681

Gate Precast Company A1, C4, C4A
Monroeville, (251) 575-2803

> ARIZONA

Coreslab Structures (ARIZ) Inc. A1, B4, C4, C4A
Phoenix, (602) 237-3875

Green Fuel Technologies LLC dba Royden Precast B4
Phoenix, (602) 269-9206

Stinger Bridge & Iron B4
Coolidge, (520) 723-5383

Tpac, An EnCon Company A1, B4, C4, C4A
Phoenix, (602) 262-1360

> ARKANSAS

Coreslab Structures (ARK) Inc. C4, C4A
Conway, (501) 329-3763

> CALIFORNIA

Bethlehem Construction Inc. C3, C3A
Wasco, (661) 391-9704

Clark Pacific A1, C3, C3A, G
Fontana, (909) 823-1433

Clark Pacific C4, C4A
Adelanto, (626) 962-8751

Clark Pacific A1, B3, C4, C4A, G
Woodland, (530) 207-4100

Con-Fab California, LLC B4, C4
Lathrop, (209) 249-4700

Con-Fab California, LLC B4, C4
Shafter, (661) 630-7162

Coreslab Structures (LA) Inc. A1, B4, C4, C4A
Perris, (951) 943-9119

KIE-CON Inc. B4, C3
Antioch, (925) 754-9494

Midstate Precast, L.P. A1, C3, C3A
Corcoran, (559) 992-8180

Oldcastle Precast Inc. B4, B4A, C2, C2A
Perris, (951) 657-6093

Oldcastle Precast Inc. C2
Stockton, (209) 466-4215

Precast Concrete Technology Unlimited dba CTU Precast A1, C3, C3A
Olivehurst, (530) 749-6501

StructureCast A1, B3, C3, C3A
Bakersfield, (661) 833-4490

Universal Precast Concrete Inc. A1, B1, C1
Redding, (530) 243-6477

Walters & Wolf Precast A1, G
Fremont, (510) 226-9800

Willis Construction Co. Inc. A1, C1
Hollister, (831) 623-2900

Willis Construction Co. Inc. A1, C1, G
San Juan Bautista, (831) 623-2900

> COLORADO

EnCon Colorado B4, C2
Denver, (303) 287-4312

Plum Creek Structures B4, C3, C3A
Littleton, (303) 471-1569

Rocky Mountain Prestress LLC Architectural Plant A1, C3, C3A
Denver, (303) 480-1111

Rocky Mountain Prestress LLC Structural Plant B4, C4
Denver, (303) 480-1111

Rocla Concrete Tie Inc. C2
Pueblo, (303) 296-3500

Stresscon Corporation A1, B4, B4A, C4, C4A
Colorado Springs, (719) 390-5041

> CONNECTICUT

Blakeslee Prestress Inc. A1, B4, C4, C4A
Branford, (203) 481-5306

Coreslab Structures (CONN) Inc. A1, B1, C1
Thomaston, (860) 283-8281

Oldcastle Precast B2, C2, C2A
Avon, (860) 673-3291

United Concrete Products Inc. B3, C3
Yalesville, (203) 269-3119

> DELAWARE

Concrete Building Systems of Delaware Inc. B3, C4
Delmar, (302) 846-3645

Rocla Concrete Tie Inc. C2
Bear, (302) 836-5304

> FLORIDA

Cement Industries Inc. B3, C3
Fort Myers, (800) 332-1440

Colonial Precast Concrete LLC C2
Placida, (941) 698-4180

Coreslab Structures (MIAMI) Inc. A1, C4, C4A
Medley, (305) 823-8950

Coreslab Structures (ORLANDO) Inc. C2
Orlando, (407) 855-3190

Coreslab Structures (TAMPA) Inc. A1, B3, C3, C3A
Tampa, (813) 626-1141

Dura-Stress Inc. A1, B4, B4A, C4, C4A
Leesburg, (352) 787-1422

Finfrock Industries Inc. A1, C3
Apopka, (407) 293-4000

Gate Precast Company A1, B4, C3, C3A
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Gate Precast Company A1, C3
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Precast Specialties LLC C4
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Skanska USA Civil SE B2
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Spancrete C2
Sebring, (863) 655-1515

Stabil Concrete Products LLC A1
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Standard Concrete Products Inc. B4, C3
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Kapolei, (808) 682-6000

> IDAHO

Forterra Structural Precast A1, B4, C4
Caldwell, (208) 454-8116

Teton Prestress Concrete LLC B4, C3
Idaho Falls, (208) 552-6606

> ILLINOIS

ATMI Precast A1, C3, C3A
Aurora, (630) 896-4679

AVAN Precast Concrete Products Inc. A1, C3
Lynwood, (708) 757-6200

County Materials Corporation B3, B3-IL
Champaign, (217) 352-4181

County Materials Corporation A1, B4, B4-IL, C4
Salem, (618) 548-1190

Dukane Precast Inc. A1, B3, B3-IL, C3, C3A
Aurora, (630) 355-8118

Dukane Precast Inc. A1, B3, B3-IL, C3, C3A
Naperville, (630) 355-8118

Dukane Precast Inc. A1, B3, B3-IL, C3, C3A
Plainfield, (815) 230-4760

ICCI Illini Concrete LLC B3, B3-IL
Tremont, (309) 925-2376

Illini Precast LLC B4, B4-IL, C3
Marseilles, (815) 795-6161

Lombard Architectural Precast Products Co. A1, C2, C2A
Alsip, (708) 389-1060

Mid-States Concrete Industries, LLC A1, B3, B3-IL, C3, C3A
South Beloit, (815) 389-2277

St. Louis Prestress Inc. B3, B3-IL, C3
Glen Carbon, (618) 656-8934

Utility Concrete Products LLC B1, B1A, C1, C1A
Morris, (815) 416-1000

> INDIANA

ATMI Indy, LLC A1, C2, C2A
Greenfield, (317) 891-6280

Coreslab Structures (INDIANAPOLIS) Inc. A1, C4, C4A
Indianapolis, (317) 353-2118

Hoosier Precast LLC B3, C1, C1A
Salem, (815) 459-4545

Precast Specialties A1, B1
Monroeville, (260) 623-6131

Prestress Services Industries LLC B4, B4-IL, C4, C4A
Decatur, (260) 724-7117

StresCore Inc. C2
South Bend, (574) 233-1117

> IOWA

Advanced Precast Co. A1, C1, C1A
Farley, (563) 744-3909

Forterra Pipe & Precast B4, C4, C4A
Iowa Falls, (641) 648-2579

MPC Enterprises Inc. A1, C3, C3A
Mount Pleasant, (319) 986-2226

PDM Precast Inc. A1, C3, C3A
Des Moines, (515) 243-5118

> KANSAS

Coreslab Structures (KANSAS) Inc. B4, C4
Kansas City, (913) 287-5725

Crossland Prefab LLC C1
Columbus, (620) 249-1414

Fabcon Precast, LLC C3, C3A
Pleasanton, (913) 937-3021

Prestressed Concrete Construction LLC A1, B4, C4, C4A
Newton, (316) 283-2277

Stress-Cast Inc. C3, C3A
Assaria, (785) 667-3905

> KENTUCKY

Bristol Group Precast A1, B3, B3A, C3, C3A
Lexington, (859) 233-9050

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de AM-RON Building Systems LLC B3, C3, C3A
Owensboro, (270) 684-6226
Forterra Pipe & Precast B3, C3
Louisville, (800) 737-0707
Gate Precast Company A1, C3, C3A
Winchester, (859) 744-9481
Prestress Services Industries LLC A1, B4, C4, C4A
Lexington, (601) 856-4135
Prestress Services Industries LLC B4, C3
Melbourne, (859) 441-0068

> LOUISIANA

Alfred Miller Contracting C3
Lake Charles, (337) 477-4681
Atlantic Metrocast Inc. C2
New Orleans, (504) 941-3152
Boykin Brothers LLC A1, B4, C3, C3A
Baton Rouge, (225) 753-8722
dp Concrete Products LLC B2, C2
Vinton, (337) 433-3900
F-S Prestress LLC B4, C4
Princeton, (318) 949-2444
Fibrebond Corporation A1, C1, C1A
Minden, (318) 377-1030

> MAINE

Superior Concrete LLC B2, C1
Auburn, (207) 784-1388

> MARYLAND

Atlantic Metrocast Inc. B2, C2
La Plata, (301) 870-3289
Larry E. Knight Inc. C2
Reisterstown, (410) 833-7800

> MASSACHUSETTS

Oldcastle Precast Inc. B4, C3
Rehoboth, (508) 336-7600
Precast Specialties Corp. A1
Abington, (781) 878-7220
Unistress Corporation A1, B4, C4, C4A
Pittsfield, (413) 629-2039
Vynorius Prestress Inc. B3, C2
Salisbury, (978) 462-7765

> MICHIGAN

International Precast Solutions LLC A1, B3, C3, C3A
River Rouge, (313) 843-0073
Kerkstra Precast Inc. A1, B3, C3, C3A
Grandville, (616) 224-6176
M.E.G.A. Precast Inc. A1, C3, C3A
Shelby Township (586) 294-6430
Mack Industries Inc. A1, B4, C3, C3A
Kalamazoo, (330) 635-5945
Mack Industries Inc. B3A, C3
Saginaw, (989) 755-4348
Peninsula Prestress Company B4, C1
Grand Rapids, (517) 206-4775

> MINNESOTA

Crest Precast Inc. B3, B3A, C3, C3A
La Crescent, (800) 658-9045
Fabcon Precast LLC A1, B1, C3, C3A
Savage, (952) 890-4444
Forterra Pipe & Precast B4, C2
Elk River, (763) 441-2124
Molin Concrete Products Co. C3, C3A
Lino Lakes, (651) 786-7722
Molin Concrete Products Co. A1, C1, C1A
Ramsey, (651) 786-7722
Taracon Precast C3, C3A
Hawley, (218) 216-8260
Wells Concrete A1, C3, C3A
Albany, (320) 845-2229
Wells Concrete C3
Rosemount, (507) 380-6772
Wells Concrete A1, C4, C4A
Wells, (800) 658-7049

> MISSISSIPPI

F-S Prestress LLC B4, C4
Hattiesburg, (601) 268-2006
Gulf Coast Pre-Stress Inc. B4, C4
Pass Christian, (228) 452-9486
J.J. Ferguson Prestress-Precast Inc. B4
Greenwood, (662) 453-5451
Jackson Precast Inc. A1, C2, C2A
Jackson, (601) 321-8787
Tindall Corporation, Mississippi Div. A1, C4, C4A
Moss Point, (228) 246-0800

> MISSOURI

Coreslab Structures (MISSOURI) Inc. A1, B4, C4, C4A
Marshall, (660) 886-3306
County Materials Corporation B4
Bonne Terre, (573) 358-2773
Mid America Precast Inc. A1, B1, C1
Fulton, (573) 642-6400
Prestressed Casting Co. C4
Ozark, (417) 581-7009
Prestressed Casting Co. A1, C3, C3A
Springfield, (417) 869-7350

> MONTANA

Forterra Building Products B4
Montana City, (406) 442-6503
Forterra Pipe & Precast B4, C3
Billings, (406) 656-1601
Missoula Concrete Construction A1, B3, C3, C3A
Missoula, (406) 549-9682

> NEBRASKA

American Concrete Products Co. B1, B1A, C1, C1A
Valley, (402) 331-5775
Concrete Industries Inc. B4, C4, C4A
Lincoln, (402) 434-1800
Coreslab Structures (OMAHA) Inc. A1, B4, C4, C4A
LaPlatte, (402) 291-0733
Enterprise Precast Concrete Inc. A1, C2, C2A
Omaha, (402) 895-3848

> NEVADA

Western Pacific Precast B4, C2
Sloan, (702) 623-4484

> NEW HAMPSHIRE

Newstress Inc. B3, C3
Epsom, (603) 736-9000

> NEW JERSEY

Boccella Precast LLC C2
Berlin, (856) 767-3861
Jersey Precast B4, C4, C4A
Hamilton Township, (609) 689-3700
Northeast Precast A1, B3, C3, C3A
Millville, (856) 765-9088
Precast Systems Inc. B4, C4
Allentown, (609) 208-1987

> NEW MEXICO

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

> NEW YORK

David Kucera Inc. A1, G
Gardiner, (845) 255-1044
Lakelands Concrete Products Inc. A1, B3, B3A, C3, C3A
Lima, (585) 624-1990
Oldcastle Precast B3, C3, C3A
Selkirk, (518) 767-2116
The Fort Miller Company Inc. B1, B1A, C1, C1A
Greenwich, (518) 695-5000
The L.C. Whitford Materials Co. Inc. B4, C3
Wellsville, (585) 593-2741

> NORTH CAROLINA

Coastal Precast Systems LLC B4, C2
Wilmington, (910) 604-2249
Gate Precast Company A1, C3
Oxford, (919) 603-1633
Metromont Corporation A1, C3, C3A
Charlotte, (704) 372-1080
Prestress of the Carolinas B4, C4
Charlotte, (704) 587-4273
Utility Precast Inc. B3, B3A
Concord, (704) 721-0106

> NORTH DAKOTA

Wells Concrete C4, C4A
Grand Forks, (701) 772-6687

> OHIO

DBS Prestress of Ohio C3
Huber Heights, (937) 878-8232
Fabcon Precast LLC A1, C3, C3A
Grove City, (952) 890-4444
High Concrete Group LLC A1, C3, C3A
Springboro, (937) 748-2412
Mack Industries Inc. C3
Valley City, (330) 460-7005
Mack Industries Inc. B3A,C3
Vienna, (330)638-7680
Prestress Services Industries of Ohio LLC (I-Beam) A1, B4, C3
Mt. Vernon, (740) 393-1121
Prestress Services Industries of Ohio LLC (Box Beam) B3, C3
Mt. Vernon, (740) 393-1121
Rocla Concrete Tie Inc. C2
Sciotoville, (740) 776-3238
Sidley Precast Group, A Division of R.W. Sidley Inc. A1, C4, C4A
Thompson, (440) 298-3232

> OKLAHOMA

Arrowhead Precast LLC A1, C3, C3A
Broken Arrow, (918) 995-2227
Coreslab Structures (OKLA) Inc. (Plant No.1) A1, C4, C4A
Oklahoma City, (405) 632-4944
Coreslab Structures (OKLA) Inc. (Plant No.2) B4, C3
Oklahoma City, (405) 672-2325
Coreslab Structures (TULSA) Inc. B4, C4
Tulsa, (918) 438-0230

> OREGON

Knife River Prestress A1, B4, C4, C4A
Harrisburg, (541) 995-4100
R.B. Johnson Co. B4, C3
McMinnville, (503) 472-2430

> PENNSYLVANIA

Architectural Precast Innovations Inc. A1, C3, C3A
Middleburg, (570) 837-1774
Brayman Precast LLC B3, C1A
Saxonburg, (724) 352-5600
Concrete Safety Systems LLC A1, B3, B3A, C3, C3A
Bethel, (717) 933-4107
Conewago Precast Building Systems A1, C3,C3A
Hanover, (717) 632-7722

Dutchland Inc. C3
Gap, (717) 442-8282
Fabcon Precast LLC A1, B1, B1A, C3, C3A
Mahanoy City, (952) 890-4444
High Concrete Group LLC A1, B3, C3, C3A
Denver, (717) 336-9300
J & R Slaw Inc. A1, B4, C3, C3A
Lehighton, (610) 852-2020
Nitterhouse Concrete Products Inc. A1, C4, C4A
Chambersburg, (717) 267-4505
Northeast Prestressed Products LLC B4, C3
Cressona, (570) 385-2352
PENNSTRESS, a division of MacInnis Group, LLC A1, B4, C4
Roaring Spring, (814) 695-2016
Say-Core Inc. C2
Portage, (814) 736-8018
Sidley Precast Group, A Division of R.W. Sidley Inc. C3
Youngwood, (724) 755-0205
Universal Concrete Products Corporation A1, C3, C3A
Stowe, (610) 323-0700

> RHODE ISLAND

Hayward Baker Inc. C2
Cumberland, (401) 334-2565

> SOUTH CAROLINA

Florence Concrete Products Inc. B4, C3, C3A
Sumter, (803) 775-4372
Metromont Corporation A1, C4, C4A
Greenville, (864) 605-5000
Metromont Corporation C3
Spartanburg, (864)605-5063
Tekna Corporation B4, C3
Charleston, (843) 853-9118
Tindall Corporation, South Carolina Division A1, C4, C4A
Spartanburg, (864) 576-3230

> SOUTH DAKOTA

Forterra Pipe & Precast (Rapid City) B4
Rapid City, (605) 343-1450
Gage Brothers A1, B4, C4, C4A
Sioux Falls, (605) 336-1180

> TENNESSEE

Construction Products Inc. of TN B4, C4
Jackson, (731) 668-7305
Gate Precast Company A1, C3, C3A
Ashland City, (615) 792-4871
Mid South Prestress LLC C3
Pleasant View, (615) 746-6606
Ross Prestressed Concrete Inc. B4, C3
Bristol, (423) 323-1777
Ross Prestressed Concrete Inc. B4, C4
Knoxville, (865) 524-1485

> TEXAS

Coreslab Structures (TEXAS) Inc. A1, C4, C4A
Cedar Park, (512) 250-0755
CXT Inc. B1, B1A, C1, C1A
Hillsboro, (254) 580-9100
East Texas Precast A1, C4, C4A
Hempstead, (281) 463-0654
Enterprise Concrete Products LLC B3, C3
Dallas, (214) 631-7006
Enterprise Precast Concrete of Texas LLC A1, C1
Corsicana, (903) 875-1077
Gate Precast Company A1, C1, C1A
Hillsboro, (254) 582-7200
Gate Precast Company C2
Pearland, (281) 485-3273
GFRC Cladding Systems LLC G
Garland, (972) 494-9000
Heldenfels Enterprises Inc. B4, C4
Corpus Christi, (361) 883-9334
Heldenfels Enterprises Inc. B4, C4
San Marcos, (512) 396-2376
Legacy Precast LLC C4, C4A
Brookshire, (281) 375-2050
Lowe Precast Inc. A1, C3, C3A
Waco, (254) 776-9690
Manco Structures Ltd. C4, C4A
Schertz, (210) 690-1705
NAPCO PRECAST LLC A1, C4, C4A
San Antonio, (210) 509-9100
Rocla Concrete Tie Inc. C2
Amarillo, (806) 383-7071
Texas Concrete Partners LP B4, C4
Elm Mott, (254) 822-1351
Texas Concrete Partners LP B4, C4
Victoria, (361) 573-9145
Tindall Corporation A1, C3, C3A
San Antonio, (210) 248-2345
Valley Prestressed Products Inc. B2
Houston, (713) 455-6098
Valley Prestress Products Inc. B4
Eagle Lake, (979) 234-7899

> UTAH

Forterra Structural Precast A1, B4, C4, C4A, G
Salt Lake City, (801) 966-1060
Harper Precast B2, C1
Salt Lake City, (801) 326-1016
Olympus Precast A1, B3, B3A, C3, C3A
Bluffdale, (801) 571-5041

> VERMONT

Joseph P. Carrara & Sons Inc. A1, B4, B4A, C4, C4A
Middlebury, (802) 775-2301
S.D. Ireland Concrete Construction Corp. B1, C1
Williston, (802) 863-6222
William E. Dailey Precast LLC A1, B4, B4A, C3, C3A
Shaftsbury, (802) 442-4418

> VIRGINIA

Atlantic Metrocast Inc. B4, C4
Portsmouth, (757) 397-2317
Bayshore Concrete Products Corporation B4, C4
Cape Charles, (757) 331-2300
Coastal Precast Systems LLC A1, B4, C3
Chesapeake, (757) 545-5215
Hessian Company LTD t/a Faddis Concrete Products B2, C2
King George, (540) 775-4546
Metromont Corporation A1, C3, C3A
Richmond, (804) 665-1300
Rockingham Precast B4
Harrisonburg, (540) 433-8282
Smith-Midland A1, B2, C2, C2A
Midland, (540) 439-3266
The Shockey Precast Group A1, C4, C4A
Winchester, (540) 667-7700
Tindall Corporation, Virginia Division A1, C4, C4A
Petersburg, (804) 861-8447

> WASHINGTON

Bellingham Marine Industries Inc. B3, C2
Ferndale, (360) 380-2142
Bethlehem Construction Inc. B1, C3, C3A
Cashmere, (509) 782-1001
Concrete Technology Corporation B4, C4
Tacoma, (253) 383-3545
CXT Inc., Precast Division B1, C1, C1A
Spokane, (509) 921-8766
CXT Inc., Rail Division C2
Spokane, (509) 921-7878
EnCon Northwest LLC B1, B1A
Camas, (360) 834-3459
Oldcastle Precast Inc. A1, B4, C4
Spokane Valley, (509) 536-3300
Wilbert Precast Inc. B3, C3, C3A
Yakima, (509) 325-4573

> WEST VIRGINIA

Carr Concrete a division of CXT Inc. B4, C3
Williamstown, (304) 464-4441
Eastern Vault Company Inc. B3, C3
Princeton, (304) 425-8955

> WISCONSIN

County Materials Corporation B4, B4-IL
Janesville, (608) 373-0950
County Materials Corporation B4, C3
Roberts, (800) 426-1126
International Concrete Products Inc. A1, C1
Germantown, (262) 242-7840
KW Precast LLC B4, B4-IL, C4
Burlington, (708) 562-7770
MidCon Products Inc. A1, C1
Hortonville, (920) 779-4032
Spancrete A1, B4, C3, C3A
Valders, (920) 775-4121
Stonecast Products Inc. A1, C1
Germantown, (262) 253-6600
Wausau Tile Inc. AT
Rothschild, (715) 359-3121

> WYOMING

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

> MEXICO

PRETECSA, S.A. DE C.V. A1, G
Estado de Mexico 52, (555) 077-0071
Willis De Mexico S.A. de C.V. A1, C1, G
Tecate BC, MX 52, (665) 655-2222

> CANADA

BRITISH COLUMBIA

APS Precast, a Division of C&S Group Operations Ltd. A1, B4, C3, C3A
Langley, (604) 888-1968
Armtec Limited Partnership A1, B4, C3
Richmond, (604) 214-3243

NEW BRUNSWICK

Strescon Limited A1, B4, C4, C4A
Saint John, (506) 632-7521

NOVA SCOTIA

Strescon Limited A1, B4, C4, C4A
Beford, (902) 494-7400

ONTARIO

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

QUEBEC

Betons Prefabriques Trans.-Canada Inc. A1, B4, C3, C3A
St-Eugene De Grantham, (819) 396-2624
Betons Prefabriques (Bombadier Plant), Alma A1, C2
Betons Prefabriques (Papeterie Plant), Alma A1, C3, C3A, G
Prefab de Beauce Inc. A1, C3
Sainte-Marie-de-Beauce, (418) 387-7152

> UAE

Arabian Profile Company Glass Reinforced Product LLC G
Sharjah, 971(6) 5432624

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When it comes to quality, why take chances?

When you need precast or precast, prestressed concrete products, choose a PCI-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-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-Certified Erector is the first step toward getting the job done right the first time, thus keeping labor costs down.
- PCI-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 certified by the Precast/Prestressed Concrete Institute (PCI) prior to the beginning of any work at the jobsite. The precast concrete erector shall be 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.

> ARIZONA

Coreslab Structures (ARIZ) Inc. A, S2
Phoenix, (602) 237-3875

RJC Contracting Inc. S2
Mesa, (480) 357-0868

Steel Girder LLC dba Stinger Bridge & Iron S1
Coolidge, (502) 723-5383

Tpac, An EnCon Company A, S2
Phoenix, (602) 262-1333

> CALIFORNIA

MidState Precast L.P. A, S2
Corcoran, (559) 992-8180

Walters & Wolf Precast A
Fremont, (510) 226-5166

> COLORADO

EnCon Field Services LLC A, S2
Denver, (303) 287-4312

Gibbons Erectors Inc. A, S2
Englewood,, (303) 841-0457

Rocky Mountain Prestress LLC A, S2
Denver, (303) 480-1111

> CONNECTICUT

Blakeslee Prestress Inc. S2
Branford, (203) 481-5306

> FLORIDA

Concrete Erectors Inc. A, S2
Altamonte Springs, (407) 862-7100

Coreslab Structures (MIAMI) Inc. A, S2
Medley, (305) 823-8950

Florida Builders Group Inc. S2
Miami Gardens, (305) 278-0098

Jacob Erecting & Construction LLC A, S2
Jupiter, (561) 741-1818

Pre-Con Construction Inc. A, S2
Lakeland, (863) 688-4504

Prestressed Contractors Inc. S2
West Palm Beach, (561) 741-4369

Specialty Concrete Services Inc. A, S2
Umatilla, (352) 669-8888

W.W. Gay Mechanical Contractor Inc. A, S2
Jacksonville, (904) 388-2696

> GEORGIA

Bass Precast Erecting Inc. S2
Cleveland, (706) 809-2718

Jack Stevens Welding LLP S2
Murrayville, (770) 534-3809

Precision Stone Setting Co. Inc. A, S2
Hiram, (770) 439-1068

Rutledge & Sons Inc. S2
Canton, (770) 592-0380

Southeastern Precast Erectors Inc. (SPE Inc.) A
Roswell, (770) 722-9212

> IDAHO

Precision Precast Erectors LLC A, S2
Post Falls, (208) 981-0060

> ILLINOIS

Area Erectors Inc. A, S2
Rochelle, (815) 562-4000

Mid-States Concrete Industries S2
South Beloit, (815) 389-2277

> IOWA

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

Industrial Steel Erectors S1
Davenport, (563) 355-7202

Northwest Steel Erection Inc. S2
Grimes, (515) 986-0380

US Erectors Inc. A, S2
Des Moines, (515) 243-8450

> KANSAS

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

Crossland Construction Company Inc. S2
Columbus, (620) 442-1414

Griffith Steel Erection Inc. A, S2
Wichita, (316)941-4455

> LOUISIANA

Alfred Miller Contracting S2
Lake Charles, (337) 477-4681

> MAINE

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

> MARYLAND

DLM Contractors LLC A, S2
Upper Marlboro, (301) 877-0000

E & B Erectors Inc. A, S2
Elkridge, (410) 360-7800

E.E. Marr Erectors Inc. A, S2
Baltimore, (410) 837-1641

EDI Precast LLC A, S2
Upper Marlboro (301)877-2024

L.R. Willson & Sons Inc. A, S2
Gambrills, (410) 987-5414

> MASSACHUSETTS

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

> MICHIGAN

Assemblers Precast & Steel Services Inc. A, S2
Saline, (734) 368-6147

Construction Specialties of Zeeland Inc. S1
Zeeland, (616) 772-9410

G2 Inc. S2
Cedar Springs, (616) 696-9581

Midwest Steel Inc. A, S2
Detroit, (313) 873-2220

Pioneer Construction Inc. A, S2
Grand Rapids, (616) 247-6966

> MINNESOTA

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Newport, (651) 459-9909

Fabcon Precast LLC S2
Savage, (952) 890-4444

Molin Concrete Products Company S2
Lino Lakes, (651) 786-7722

Wells Concrete A, S2
Maple Grove, (800) 658-7049

> MISSISSIPPI

Bracken Construction Company A, S2
Ridgeland, (601) 922-8413

> MISSOURI

JE Dunn Construction A, S2
Kansas City, (816) 292-8762

Prestressed Casting Co. A, S2
Springfield, (417) 869-7350

> NEBRASKA

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La Vista, (402)614-0988

Moen Steel Erection Inc. A, S2
Omaha, (402) 884-0925

Patriot Steel Erection A, S1
Omaha, (402)431-2744

Topping Out Inc. dba Davis Erection–Omaha A, S2
Omaha, (402) 731-7484

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Newstress Inc. S1
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> NEW JERSEY

CRV Precast Construction LLC S1
Eastampton, (609) 261-7325

J. L. Erectors Inc. A, S2
Blackwood, (856) 232-9400

JEMCO-Erectors Inc. A, S2
Shamong, (609) 268-0332

Jonasz Precast Inc. A, S2
Westville, (856) 456-7788

Kenvil United Corp. S1
Kenvil, (973) 927-0010

> NEW YORK

Koehler Masonry Corp. S2
Farmingdale, (631) 694-4720

Oldcastle Building Systems Div./Project Services A, S2
Selkirk, (518) 767-2116

Tutor Perini Corporation Civil S1
New Rochelle, (914) 739-1905

> NORTH DAKOTA

Comstock Construction Inc. S2
Fargo, (701) 892-7236

Magnum Contracting Inc. A, S2
Fargo, (701) 235-5285

Midwest Precast Services A, S2
Fargo, (701) 893-0188

PKG Contracting Inc. S2
Fargo, (701) 232-3878

> OHIO

Precast Services Inc. A, S2
Twinsburg, (330) 425-2880

Sidley Precast Group, A Division of R.W. Sidley Inc. S2
Thompson, (440) 298-3232

> OKLAHOMA

Allied Steel Construction Co. LLC S2
Oklahoma City, (405) 232-7531

> PENNSYLVANIA

Century Steel Erectors A, S2
Kittanning, (724) 545-3444

Conewago Precast Building Systems S2
Hanover, (717) 632-7722

High Structural Erectors LLC A, S2
Lancaster, (717) 390-4203

Kinsley Construction Inc. t/a Kinsley Manufacturing S1
York, (717) 757-8761

Maccabee Industrial Inc. A, S2
Belle Vernon, (724) 930-7557

Nitterhouse Concrete Products Inc. A, S2
Chambersburg, (717) 267-4505

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Davis Erecting & Finishing Inc. A, S2
Greenville, (864) 220-0490

Florence Concrete Products Inc. S2
Florence, (843) 662-2549

Steel Clad Inc. A, S2
Greenville, (864) 246-8132

Tindall Corporation A, S2
Spartanburg, (864) 576-3230

> SOUTH DAKOTA

Henry Carlson Company A, S2
Sioux Falls, (605) 336-2410

> TENNESSEE

Mid South Prestress LLC S1
Pleasant View, (615) 746-6606

> TEXAS

Coreslab Structures (TEXAS) Inc. A, S2
Cedar Park, (512) 250-0755

Derr and Isbell Construction LLC A, S2
Euless, (817) 571-4044

Gulf Coast Precast Erectors LLC S2
Hempstead, (832) 451-4395

Precast Erectors Inc. A, S2
Hurst, (817) 684-9080

> UTAH

Forterra Structural Precast A, S1
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IMS Masonry A
Lindon, (801) 796-8420

OutWest C & E Inc. S2
Bluffdale, (801) 446-5673

> VERMONT

CCS Constructors Inc. S2
Morrisville, (802) 888-7701

> VIRGINIA

The Shockey Precast Group S2
Winchester, (540) 667-7700

> WISCONSIN

J. P. Cullen & Sons Inc. A, S2
Janesville, (608) 754-6601

Miron Construction Co. Inc. A, S2
Neenah, (920) 969-7000

Spancrete A, S2
Valders, (920) 775-4121

The Boldt Company S2
Appleton, (920) 225-6212

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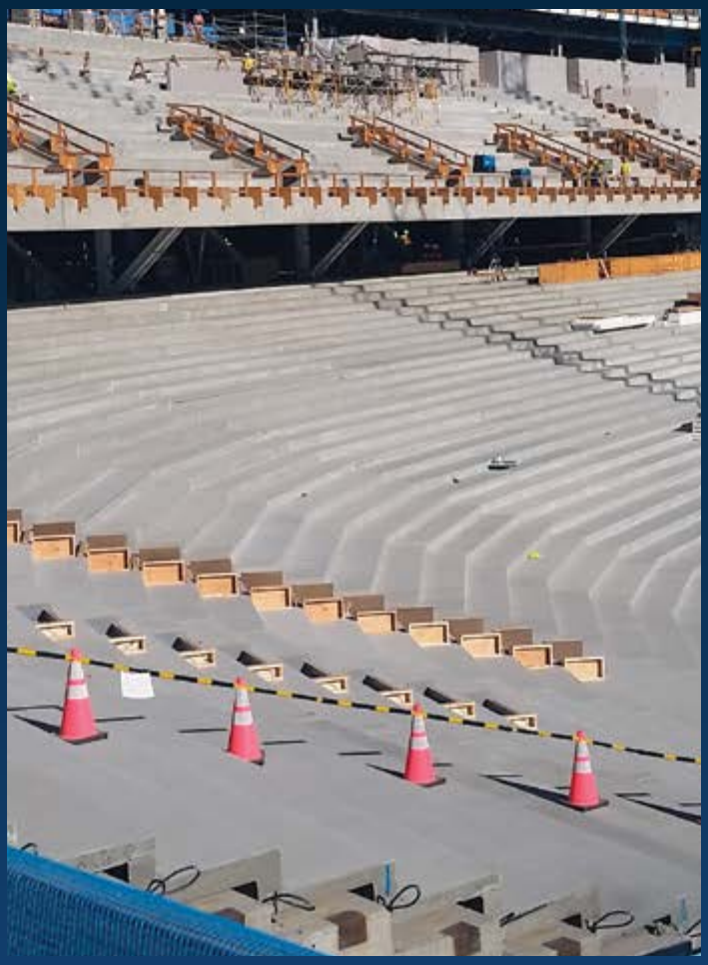
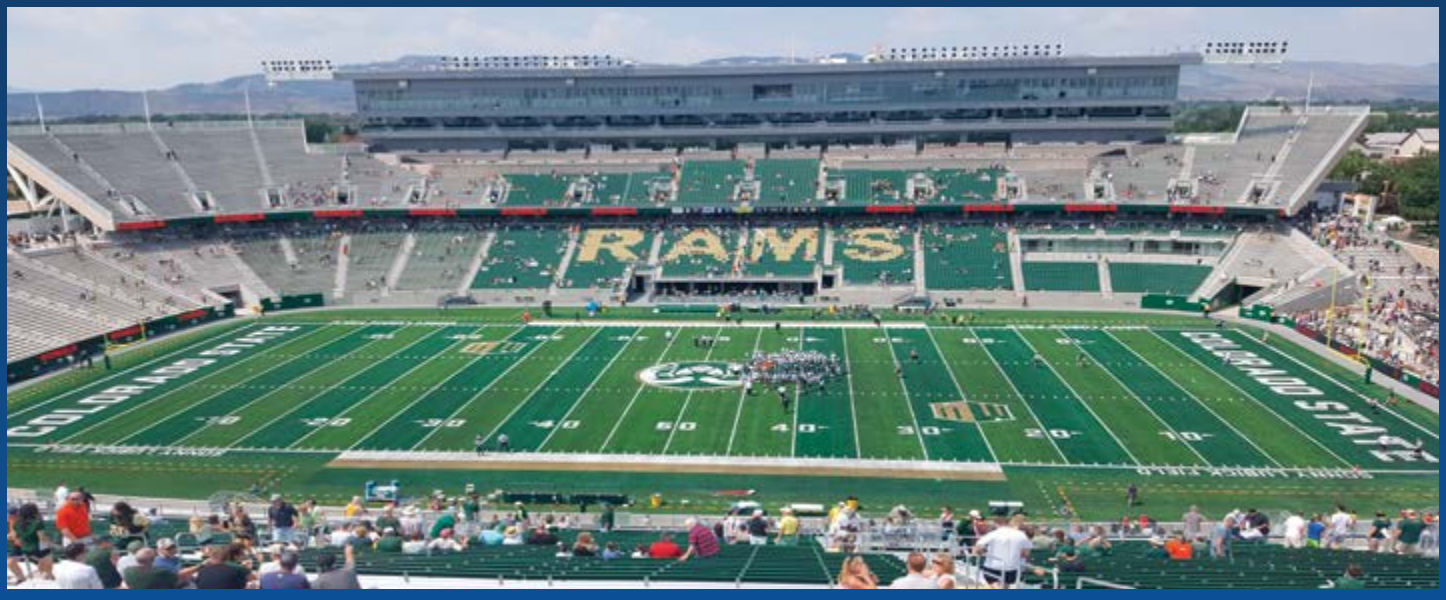


HIGH PERFORMANCE TOTAL PRECAST SYSTEMS AND ENCLOSURES



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