

# Precast Aids Uncle Sam

Precast concrete structural and architectural systems are being used more and more by the military in all types of construction

— Craig A. Shutt

**D**esigning military projects for the federal government can be challenging work, owing to additional restrictions, paperwork, and other obstacles. But those who can thrive under those conditions find a wide range of projects being constructed. In many cases, those projects are using precast concrete components more often, as government agencies become aware of the benefits and designers and contractors show how efficiently these designs can be produced.

"Working with the military is not necessarily a disadvantage, you just have to know how they want to work," explains James Cheng, design principal for project design at Emersion Design in Cincinnati, Ohio. The company, three years old, has grown from seven to 25 people in part due to its military work, an impressive feat considering the tough economic times.

"The government has a very structured process. If you're used to doing things in a quick and streamlined fashion, it can be frustrating. But if you can deal with their system, there are benefits." One of the benefits is a clear structure for engaging the many stakeholders from whom input must be gained and balanced during the design process, he explains. "The military system creates a process for building consensus with some very large and complex client groups with multiple parties involved."

Steve Moller, senior architect and project manager at PBS&J, an Atkins company, based in Austin, Texas, agrees. He helped design a recently completed Armed Forces Reserve Center in San Marcos, Texas, which used a total-precast concrete system for the structural frame. "The challenge of military projects is often not

the building itself, it's demonstrating to multiple parties, each with its own specialization, that all aspects of multiple—overlapping, sometimes conflicting, sometimes ambiguous—regulatory documents are satisfied."

In more cases, he notes, precast concrete components are helping to meet those challenges. "Precast concrete very quickly satisfies issues of durability, sustainability, and Anti-Terrorist Force Protection (AT/FP). It's perfect for AT/FP needs. Its great mass means that you don't have to demonstrate the testing and engineering analysis that's often required to ensure a lighter design meets the standards."

'The military system creates a process for building consensus with some very large and complex client groups.'

Those standards also help precast concrete projects meet stringent needs for hurricane protection along the Gulf Coast, he adds. "Hurricane needs are very similar to AT/FP requirements, and precast concrete can meet both of them easily. The material also provides inherent fire protection and insulation."

Precast concrete contributes to a host of credits for achieving Leadership in Energy & Environmental Design (LEED), due to its benefits toward sustainable design. Those benefits are critical for military projects, as all

government construction must meet a Silver (level two of four) rating.

"Precast concrete is very favorable for gaining LEED points," says Moller. "It's a renewable material, recyclable, and locally manufactured. It also provides great thermal mass that can greatly contribute increasing energy efficiency. Those are all big points."

It also aids the designer in achieving aesthetic goals, adds Cheng. "In general, precast can be an advantageous material because it's so versatile," he explains. "Many projects are adding to existing bases, where a certain character has been established. Some of the new buildings may be utilitarian, while others will be more prominent. The aesthetic versatility of precast concrete can be useful because it has such a range of expression. With military projects, it's important to pay attention to the subtleties of expression while remaining within the same palette of materials."

## Design-Build Favors Precast

A key reason that precast concrete's benefits are becoming more apparent stems from the government's long use of design-build processes to speed schedules and leverage the designer and contractor's unique expertise. Federal projects have been using this concept for about 15 years, designers report.

Typically, a lead designer prepares a Request for Proposal (RFP) that includes a schematic floor plan and a project book with performance specifications and expectations, plus options for structural framing and other systems, explains Moller. "Today, those structural options include precast concrete components."

On its recent project, PBS&J worked with Satterfield & Pontikes Construc-



## Fact Sheet

**Project:** Swimmer & Fitness Center at Pensacola Naval Air Station

**Location:** Pensacola, Fla.

**Architect/Engineer:** C. H. Guernsey & Co., Oklahoma City, Okla.

**Contractor:** Dick Corp., Pittsburgh, Pa.

**Owner:** U.S. Navy, Pensacola, Fla.

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

**Precast Specialty Engineer:** PTAC Consulting Engineers, Pensacola, Fla.

**Project Size:** 153,439 square feet

**Precast Components:** Total-precast concrete structural system, including load-bearing wall panels and double tees

The Navy training facility at Pensacola, Fla., features architectural precast concrete panels, a double-tee roof system and hollow-core floors. The system met the architectural requirements as well as AT/FP and structural-durability needs.

Precast concrete double tees allowed an open plan for the swimming center at the Navy training facility and provided a base for overhead equipment to aid in training exercises.



A total-precast concrete structural system was used to create the building shell for the 34,844-square-foot Navy training facility at Pensacola, Fla.



tion in Austin, Texas, which served as the prime contractor on the design-build project. PBS&J produced documents to about 30% of the full design based on the RFP while S&P presented the team qualifications, along with its guaranteed maximum price and the planned schedule (always shorter than what is allowed in the documents). S&P's concept using a total-precast concrete system was selected for the project due to its speed, value, durability, and other benefits.

### Naval Air Station

The range of capabilities that precast concrete can provide for a military project can be seen in several completed recently around the country. The Swimmer & Fitness Center at the Naval Air Station in Pensacola, Fla., was so distinctive that it won the 2009 PCI Design Award from the Precast/Prestressed Concrete Institute for its use of a total-precast concrete

structural system to meet a number of key challenges. The building had to withstand both external moisture and wind threats, especially from hurricanes, as well as interior moisture concerns about mildew and mold due to the high humidity in the pool area.

The 34,844-square-foot building provides a facility to train Navy personnel to rescue swimmers. It includes an indoor wave pool that is 82 feet long and 168 feet wide (large enough to hold two opened parachutes). Above the pool are two simulators, each with a hoist and platform. An adjacent 53,857-square-foot Physical Fitness Center provides students with recreation facilities, including two basketball courts, a fitness/aerobic center, racquetball and handball courts, a multipurpose room, a martial arts room, and more.

To span these complex spaces and complete the project in rapid time, designers at C. H. Guernsey & Co. in

Oklahoma City, Okla., specified a total-precast concrete structural system that incorporates architectural precast concrete panels, a double-tee roof system, and hollow-core floors. The system met the architectural requirements as well as AT/FP and structural-durability needs for building in Florida weather conditions, according to David Oman, director of architecture.

"The architectural precast concrete walls serve multiple roles within the building system," explains Jim Lewis, LEED AP, director of architectural systems at Gate Precast Co. in Jacksonville, Fla. "The walls are designed to carry the loads from the double-tee roof system and provide hurricane protection."

The panels feature an inlaid thin-brick system that allowed the designers to enhance the architectural expression using brick quoins corners, he says. The 10-inch-thick walls contain 2 inches of Isocast-R polyisocyanurate



The panels at the Armed Forces Reserve Center were erected in a vertical fashion, facilitating the design of bays and other penetrations.



The new Armed Forces Reserve Center in San Marcos, Texas, comprises a two-story main building for offices, an Operational Maintenance Shop with work bays, and a heated storage building. The structures were constructed with a total-precast concrete structural system to facilitate the schedule and provide durability.



Clear spans were provided for the facilities at the Armed Forces Reserve Center by using 24-inch-deep double tees to span the spaces. The double tees rest on corbels cast into the interior face of the load-bearing precast concrete wall panels.

### Fact Sheet

**Project:** Armed Forces Reserve Center

**Location:** San Marcos, Texas

**Design-Build Contractor:** Satterfield & Pontikes Construction Inc., Austin, Texas

**Lead Architect/Engineer:** PBS&J Architecture, an Atkins company, Austin, Texas

**Owner:** Texas State Army Reserve and National Guard

**Precaster (structural components and panels):** Heldenfels Enterprises, San Marcos, Texas

**Precaster (hollow-core slab):** Gate Concrete Co., Pearland, Texas

**Precast Structural Engineer:** Schwab Structural Engineering Inc., New Braunfels, Texas

**Precast Concrete Erector:** Precast Erectors Inc., Hurst, Texas

**Project Size:** 109,000 square feet

**Precast Components:** Total-precast concrete structural system, including columns and beams, double-tee beam, hollow-core slabs, load-bearing wall panels

**Project Cost:** \$29 million

## 'The precast concrete design facilitated the fast-track schedule.'

insulation, which provides an R-value of 13. The vapor barrier is built into the facer, eliminating the risk of condensation forming on the building's interior.

During the erection process, the 31-foot-tall wall panels were braced until the 103-foot-long double tees were set on them. The double tees span the entire roof structure in the pool portion of the building, avoiding any additional column supports that would create obstacles. A recessed slot was cast into the back of the panels to support the stems of the double tees, which rested on the corbels.

A 150-ton crane was used to erect the first 101 brick-inlaid architectural panels around the pool's perimeter, in-

cluding 58 insulated panels. The panels had electrical boxes and conduit cast into them at the plant to speed installation at the site. Four double tees were erected per day once the panels were erected and braced.

"The total-precast concrete structural system helped to create a building that is aesthetically pleasing, environmentally responsible and functional for the owner's needs," says Lewis.

### Armed Forces Reserve Center

A total-precast concrete system also was used to construct the Armed Forces Reserve Center in San Marcos, Texas, which consists of three

main buildings. "Each building serves a specific purpose and had unique design requirements," says Gil Heldenfels, vice president and general manager at Heldenfels Enterprises Inc. in San Marcos. The company provided structural precast concrete components, while Gate Precast Co. in Pearland, Texas, provided precast concrete hollow-core slab.

The project comprises a 56,000-square-foot, two-story main building for offices, training facilities, and an attached one-level assembly center; a 25,700-square-foot Operational Maintenance Shop (OMS) with work bays; and a 29,700-square-foot heated storage building and vault. All



three were designed with total-precast concrete structural systems, consisting of grade beams, hollow-core slabs and double-tee beams, column-and-beam structural framing, and load-bearing exterior CarbonCast high-performance insulated wall panels.

The main reason for selecting the total-precast concrete system was the need for quick completion, explains Moller. "The precast concrete design facilitated the fast-track schedule. This project to a great degree was driven by the goal to meet the tight schedule deadline. The speed with which a precast concrete building shell can be constructed is a significant advantage. Additionally, the Heldenfels precast plant is within a few miles of the project site, which provided tremendous savings over typical transportation costs."

The precast concrete components could be cast while site preparation was under way, he explains. Much of that work centered on providing a secure foundation, as the site had poor soil for construction. The location is near a geological fault that rises 200 feet near the site's edge, leaving black clay soil at the site and high rock nearby. Approximately seven feet of soil was removed beneath each foundation to create a void, and a precast concrete suspended foundation was installed.

The double-tee slabs used in the foundation rest on cast-in-place piers an average of 35 feet deep into the clay soils, explains Heldenfels. The tees transferred vertical and shear load to the foundation via three connection types. For continuous beam-to-beam connections, the beams bear directly on the piers. For corner or junction connections, a pier cap distributes the loads into the piers. For load-bearing columns, the grade beams were set into haunches on the column directly bearing on the piers.

### BIM Aids Design

The project used a building information modeling (BIM) system to help coordinate the architectural design, structural elements, and MEP components early in the process. "Institutional clients more and more are requiring BIM on their projects, and we have an internal dictate at PBS&J to use it whenever we can," Moller says. Satterfield & Pontikes also has been using it for five years, making it easy for the designers and the contractor to develop buildings together. "It's a help for designing the structural sys-

*The new office building constructed as part of the sensors-lab project at Wright Patterson Air Force Base serves as the high-profile gateway to the campus. Precast concrete panels helped it achieve a dramatic appearance.*



*In addition to the high-profile office building, the new complex at Wright Patterson Air Force Base includes two high-tech sensors laboratories that offer a monolithic appearance. The precast concrete architectural panels helped to tie the two styles together while achieving the functional goals of each.*



*This overview of the Wright Patterson Air Force Base project shows the new construction, with white roofs. The work included a high-profile office complex (at bottom) and indoor/outdoor ranges (center).*

### Fact Sheet

**Project:** Sensors Lab at Wright Patterson Air Force Base

**Location:** Dayton, Ohio

**Project Designers:** Emersion Design, Cincinnati, Ohio, (architecture); Advanced Engineering Consultants, Columbus, Ohio (MEP); and Barge Waggoner Sumner & Cannon, Dayton, Ohio (civil).

**Design/Build Contractor Team Architects:** Edged & Tinney Architects, Dayton, Ohio, and Kling Stubbins, Philadelphia, Pa.

**Structural Engineer:** THP, Cincinnati, Ohio

**Contractor:** Butt Construction Co., Dayton, Ohio

**Owner:** Army Corps of Engineers

**Precaster:** High Concrete Group Midwest Region, Springboro, Ohio

**Project Size:** 98,000 square feet

**Precast Components:** 113,000 square feet of architectural wall panels

**Project Cost:** \$50 million

tems, and it's a great aid for conflict resolution when adjustments have to be made at the site."

Early communication was critical, Moller notes, due to the total-precast concrete system being cast while other site work progressed. "The structural package had to be submitted early so the precaster could fab-

ricate the pieces. That meant many decisions we made early could not be changed. This early coordination helped to ensure the MEP fit properly when the pieces arrived. They had to fit, because adjusting the location of penetrations was not an option."

Although this approach locked in certain decisions, it proved advanta-

geous from a speed standpoint, he adds. "Once the precast components were designed and approved, there was no reason to review those design elements again. There was no second-guessing or reconsiderations of the roof slope or window configuration or those types of decisions that often arise. That saved time."

In the office facility, 8- and 10-inch hollow-core slabs serve as flooring where additional structural capacity was needed to support heavy MEP components, with raised access flooring used in some locations. The attached assembly area features 24-inch-deep double tees for both flooring and roofing, where a 70-foot clear span was needed.

The double tees also were used to meet clear-span requirements for the OMS building, while the same cross-section with a 2-inch thickened deck handles floor loading. Load-bearing precast concrete columns were used to support the bridge-crane tracks over the maintenance bays.

The vault section of the storage building was constructed with cast-in-place concrete on precast grade beams. The rest of the structure consisted of precast concrete components, including grade beams with double-tee floor and roofing beams.

The panels were erected in a vertical fashion, with no connection complications. "All of the structural elements for the office building were delivered and erected in 14 days. The roof system of double tees was placed on all three buildings to finalize the assemblies.

"We kept the appearance simple," Moller says of the panel designs. "We wanted to have the building's massing reflect its composition of precast concrete and not hide its function."

Adds Heldenfels, "The fully integrated design-build approach led to a very energy-efficient building that was constructed at a rapid pace, yet it will maintain its durability for an extended lifecycle. All of the precast components were perfectly suited for the needs, and by taking an integrated approach to the design, cost savings were realized in both the design and construction."

### **Air Force Sensors Lab**

The versatility of architectural precast concrete panels can be seen in the range of expression they provided for drastically different buildings at the Wright Patterson Air Force Base

in Dayton, Ohio. A total of 113,000 square feet of precast concrete wall panels were used in the project, which includes a 56,000-square-foot, four-story office building and two connecting indoor/outdoor range buildings containing 19,000 and 23,000 square feet, where sensitive equipment is tested.

"Precast concrete panels were used to provide architectural compatibility with other structures in the complex," explains Emersion Design's Cheng. "The existing buildings had a specific 1960s character that consisted of precast concrete panels, and the base officials wanted to extend that character and ensure the new buildings created an enhanced but coherent campus with the existing buildings." That appearance featured horizontal reveals and protrusions that new panels could replicate easily.

Precast's capabilities came into play due to the dissimilarities in the buildings' uses, he explains. "The range buildings are windowless and internally focused, with a crisp functional appearance to them, whereas the office building is a high-tech facility for researchers that serves as a new gateway to the campus and required a high profile. Precast concrete allowed us to meet the needs of both ends of that spectrum in this one project."

'Precast concrete panels were used to provide architectural compatibility with other structures in the complex.'

Achieving the specific look for the office building required a careful balance, he notes. "The command headquarters needed to have an elevated design statement, but, as a publicly financed building, it couldn't look frivolous or extravagant. It had to convey strength and stability while also projecting an image of sophistication and contemporary dynamics to represent the type of work done here. Precast concrete offered a lot of advantages in balancing those needs."

The panels feature two face mixes and two finishes, with acid etching

and exposed-aggregate designs to create contrast. The headquarters building also required insulated sandwich wall panels, which included C-Grid carbon-fiber wythe connectors, according to Dwayne Robinson, project manager at High Concrete Inc. in Denver, Pa. The connective system provides a non-corrosive, non-thermally conductive connection and has a higher tensile strength than steel, he says.

### **Precast Aided Schedule**

Using precast concrete on the project also helped meet the construction schedule, which was tight, adds Chuck Cheadle, project manager for Butt Construction Co. in Dayton. "The panels could be installed quickly, and since there are no other construction materials on the exterior, they could be erected and the windows installed on the office portion quickly. That meant we were done with the exterior and could move inside."

The panels also were less dependent on weather conditions than other types of structural systems, he says. "They go up quickly regardless of the weather. We could erect them in any weather, which we needed on this project."

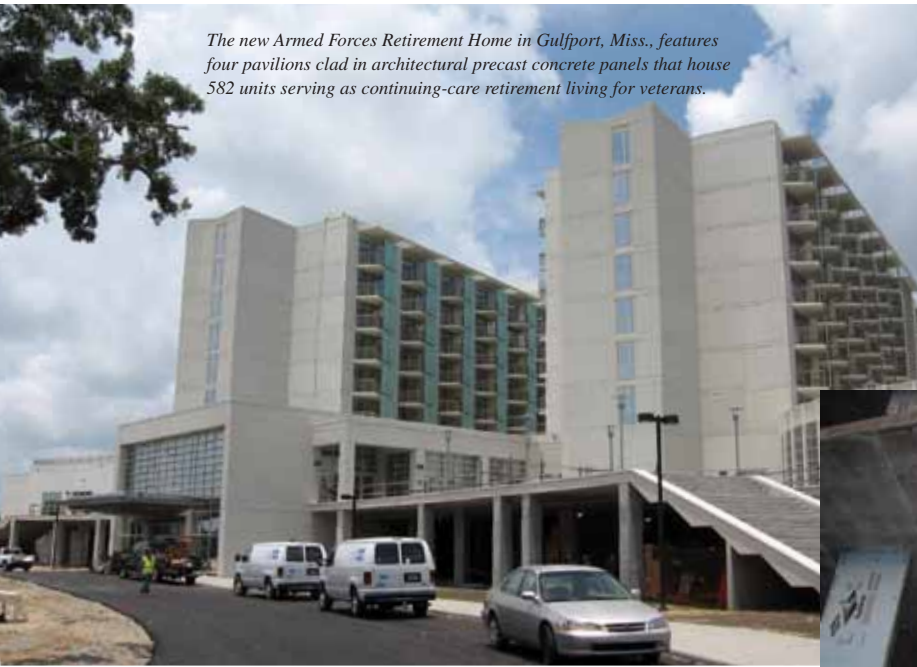
The panels on one of the ranges were erected in a vertical fashion, covering the 70-foot height quickly. The ranges feature smooth textures on the interior, while the office complex was furred out, insulated, and finished with drywall to provide a traditional office appearance.

Butt Construction has worked on a number of projects that featured precast concrete panels in addition to the \$50 million sensors-lab project, Cheadle says. Those include construction of offices and lab space for the 711<sup>th</sup> Human Performance Wing that is now under construction at the base. That \$200 million project also features architectural precast concrete panels, with construction to be completed in March. To date, the project has been running ahead of schedule.

### **Armed Forces Retirement Home**

After living and working in and around many precast concrete buildings during their military service, it only makes sense that military personnel would continue to be around the material after they retire. The new Armed Forces Retirement Home in Gulfport, Miss., allows that to happen and will help ensure it remains

*The new Armed Forces Retirement Home in Gulfport, Miss., features four pavilions clad in architectural precast concrete panels that house 582 units serving as continuing-care retirement living for veterans.*



Moisture penetration in the wake of Hurricane Katrina focused attention on the connection system.



*Architectural precast concrete wall panels at the new Armed Forces Retirement Home were designed to fit snugly around balconies and other projections. The design is the first along the Mississippi coast designed to withstand winds of more than 200 mph in a Category 5 hurricane.*

### Fact Sheet

**Project:** Armed Forces Retirement Home

**Location:** Gulfport, Miss.

**Architect:** URS Corp., New York

**Contractor:** W. G. Yates & Sons Construction Co., Philadelphia, Miss.

**Owner:** General Services Administration, Washington, D.C.

**Precaster:** Tindall Corp., Mississippi Division, Biloxi, Miss.

**Project Size:** 660,000 square feet

**Precast Components:** 1,075 architectural wall panels

**Project Cost:** \$193 million

serviceable for many decades. The project replaces a center severely damaged by Hurricane Katrina that ultimately was demolished in 2007.

The center features four pavilions rising from the main floor, with a parking level on the ground floor. A waterfront landscaped green area with walking paths, bicycle trail, reflecting, and swimming pool surround the 660,000-square-foot main building, which provides 582 units as continuing-care retirement living for veterans. The complex was clad with architectural precast concrete wall panels, consisting of 1,075 white panels with minimal color variations. The panels, averaging 15 feet tall, 8 feet wide, and 6 inches deep, feature architectural reveals and a medium sandblast. The design was created to achieve LEED Gold certification and withstand winds of more than 200 mph in a Category 5 hurricane, the first structure

built on the Mississippi coast to meet that standard.

To achieve that status required overcoming several key obstacles, according to Alex Guthrie, engineering manager at Tindall Corp.'s Mississippi Division in Biloxi, Miss. "Several post-Katrina construction projects using conventional wall-panel mounting methods had experienced water penetration," he explains. "That concern, plus the massive number of post-tensioned tendons used in the cast-in-place framing system, necessitated the development of a novel system for the cladding-hanging connections."

Working with architect Igor Labuda of URS Corp in Washington, D.C., the precaster designed connections to fix the panels to the roof slab or the bearing point of the balcony's edge and ensured that no penetrations could compromise the waterproofing barrier placed in the cavity of the build-

ing envelope. "Tindall took extensive efforts to use the outline of what we needed to achieve and developed an extremely effective system."

About 95% of the panels were erected with four tower cranes, requiring the panels to be designed below a maximum weight to ensure they did not exceed the maximum capacity of two different crane arc charts.

These projects from around the country, providing a variety of functions and levels of security, give an indication of ways that precast concrete is being used in military construction today. Its use no doubt will continue to grow as more design-build options open and designers become more aware of the options and capabilities for using both total-precast concrete and architectural precast concrete wall panels.



## Precast Aids the Parking Wars

Benefits in durability, speed of construction, and ability to replicate a variety of aesthetic needs have made precast concrete a popular choice for a range of military campuses.

The Veterans Administration in particular has used precast concrete for a number of parking structures. In Florida alone, the VA has four projects under way using precast concrete components.

In Tampa, work is under way on a 493,000-square-foot, six-story structure for the James A. Haley Veterans Administration campus, adding space for 1,500 cars. The precast concrete components, provided by Coreslab Structures (TAMPA) Inc., comprise double tees, flat slabs, conventional inverted tee beams, and perimeter spandrel beams and columns. Open precast concrete lite walls were used in ramp areas.

Precast concrete was chosen for the project due to its speed of erection, says John Ashby, senior project architect for HDR in Tampa, the architect of record. "They had a very tight time frame for construction, and precast concrete could best meet that schedule and ensure the project was completed in time."

The structure, which began construction last September and is scheduled to be completed in September 2011, is being built over a dry storm-retention pond, which drains storm water for approximately half of the campus. "It's an excellent site

location for the parking structure," notes Ashby. "Parking garages usually are built on the site of existing surface parking, so those spaces are lost during construction. This will add completely new parking."

Even so, constructing it over the retention pond added challenges. Flat precast concrete slabs were installed on the first floor, after vibro-compacting the soil. This created an 8-foot "crawl space" beneath the first parking level to provide a cover for the retention pond below. "It didn't change our design or the construction, except for having to elevate the first level above the crawl space," Ashby says.

The parking space is needed both because current demand frequently reaches capacity and also because a Polytrauma center is being built nearby. Scheduled for completion by the end of 2012, that 160,000-square-foot building also features precast concrete architectural panels as its cladding. The parking structure's spandrels will be painted after completion to match the design for the new center. Plans for a walkway connecting the parking structure to the center also are being discussed.

"HDR has done a lot of projects with the military, including a number of precast concrete parking structures," Ashby says. Coreslab also is providing components for a project still in the design stage at the Bay Pines VA facility in St. Petersburg. The parking structure will be four or five levels with approximately 205,000

square feet for at least 500 cars.

Meanwhile, Metromont Corp. in Bartow, Fla., is providing components for a five-story precast concrete parking structure for 660 cars at the Malcolm Randall VA Medical Center in Gainesville, Fla. The 224,815-square-foot project features a modular design using a total-precast concrete structural system.

Another VA project currently completing construction involves two eight-level, 515,500-square-foot parking structures at the new VA Medical Center in Orlando. The \$656 million state-of-the-art medical complex will include a 134-bed hospital, a 120-bed community living center, a 60-bed domiciliary, an outpatient clinic, and a veterans benefits mini service center. The structures will provide parking for 1,300 cars.

Precast concrete components for the two parking structures comprise wall panels, lite panels, double tees, columns, inverted tee beams, spandrels, and column covers. The spandrels will be finished with a light sandblast, while the column covers will receive an acid etching. Erection was completed by mid-December, and the structures are expected to be open in February, according to Brandy Combs, senior project manager at Durastress Inc. in Leesburg, Fla., which provided the precast concrete components. ■

**For more information on these or other projects, visit [www.pci.org/ascnt](http://www.pci.org/ascnt)**

*This rendering of the new precast concrete parking structure at the James A. Haley Veterans Administration facility in Tampa, Fla., shows tall vertical elements that will help visitors locate the parking facility upon arrival. Horizontal elements will shade the entries and carry through as design elements in the rest of the construction project.*



*Erection was completed in December on two eight-level, 1,300-car parking structures at the new Veterans Administration Medical Center in Orlando. The exterior finish includes a light sandblast on upper levels with an acid etching to achieve a different texture on column covers.*