# Marines Recruit Precast

## Parris Island training facility uses total-precast concrete system to meet diverse goals

— Craig A. Shutt

*All of the precast concrete components were erected with a 300-ton crane with no difficulties and no safety problems.*

*A total-precast concrete structural system is being used to construct three formidable barracks buildings at the Marine Corps' Parris Island complex.*

Designers faced multiple challenges in creating a new barracks complex at the Marine Corps' facility at Parris Island, S.C. The buildings had to provide housing space for recruits while also meeting hurricane, seismic, and antiterrorist standards, plus meet the government's required LEED Silver rating. At the same time, the structures had to fit into the existing appearance and aesthetic specifications for the complex, which is dominated with red-brick buildings. All of this, of course, had to be accomplished on a tight schedule to ensure the facilities were ready when recruits arrived.

To achieve these goals, designers specified a total-precast concrete structural system. It consists of double tees for the floors and roof base, along with insulated load-bearing wall panels for the exterior shell. The walls had a field-applied waterproofing coating added to it as well as full-bed-depth field-applied brick to match the existing structures. Precast concrete flat slabs also were used for the breezeways and covered corridors that connect the portions of each two-module building.

The project consists of three 95,000-square-foot, three-story connected barracks that include administrative and reception areas; open squad bays; shower, toilet and laundry facilities; and electrical/mechanical rooms. The interiors of the concrete wall panels feature a smooth, steel-form finish, with no interior partitions and little drywall, mostly around mechanical rooms. Some areas were painted, while others had a ceramic-tile wainscot applied. The design is durable but remains attractive from both the exterior and interior.

### Design-Build Aids Plan

The barracks, which are to be completed and furnished by May, were undertaken as a design-build project, which the Department of Defense prefers, explains Tom Matzke, associate principal with VOA in Orlando, Fla.,

'Precast concrete offered a better approach with thermally efficient walls and a fast construction schedule.'

the architects on the project. "The military has been full force on design-build methods for 15 years. They encourage a creative approach that creates more efficient designs that can be constructed quicker."

Using this delivery format ensures both designer and contractor can leverage their unique expertise to address challenges, he explains. "It lends itself to a lot of creative structures and approaches to whatever arises. It lets us look at the entire picture and take everything into account while meeting all of the owner needs and contractors' goals."

Although some designers are wary of the levels of review and paperwork entailed in designing government projects, Matzke enjoys working with the military. "They are a very knowledgeable client," he says. "It makes the process more efficient when you are dealing with professionals. There's a definite advantage to it." (For more on working with the military, see the accompanying story on page 24.)

## Fact Sheet

**Project:** *Recruit Training Battalion Complex*

**Location:** *Parris Island, S.C.*

**Architect:** *VOA, Orlando, Fla.*

**Engineer:** *Allan and Conrad Inc., Winter Park, Fla.*

**Contractor:** *Walton Construction Co., Pensacola, Fla.*

**Owner:** *Department of Defense*

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

**Project Size:** *285,000 square feet*

**Precast Components:** *Total-precast concrete system, including load-bearing exterior walls, 24-inch-deep double tees and flat slabs*

**Project Cost:** *$80 million*

*The precast concrete panels were installed vertically, to allow one panel to span the entire three-story height.*

*Suspended drywall below the shallow depth of the precast concrete double tees provided a finished ceiling on each level.*

*The buildings were faced with full brick over insulation and a mastic coating applied to the precast concrete panels. The brick matched the brick used on nearby buildings.*

*To aid efficient bunking of recruits, interiors feature long clear spans, which were achieved with the help of 24-inch-deep double tees.*

VOA has a long history of partnering with Walton Construction Co. in Pensacola, Fla., with which the architect teamed on this design-build proposal. The two had not often used precast concrete structural systems before, however. "We brainstormed several structural systems for this project, and the total-precast concrete design proved to be the most efficient from a time standpoint."

The structural engineers also agreed with that assessment—and with the benefits of working on military projects. "We do a lot of design-build projects with the military, especially barracks, headquarters buildings, and office buildings," says Steve Shelt, vice president at Allan & Conrad Inc. in Winter Park, Fla. In some cases, especially medical facilities, the projects are bid as typical design-bid-build projects due to their complexity and equipment needs. Even in those cases, the schedule has gotten much tighter.

Material specifications vary based on the type of project, he notes. "Low-rise buildings are open to a variety of options, but we tend to find that multiple-story projects are ideal for precast concrete components." In addition to its size, the Parris Island project also had a tight timetable that was complicated by the need to establish MEP requirements early to complete the foundation plan.

## Schedule Drove Decisions

The driving force in the project was the schedule, Matzke says. VOA had used the precast concrete system on a similar project at Corpus Christie, Texas, with another contractor. "That worked very well and went together quickly, so we decided that we could use it on this project as well."

The project initially was designed with masonry blocks, but a local precaster, Metromont Corp. in Greenville, S.C., teamed up with the designer to create a precast design. "It offered a better approach with thermally efficient walls and a fast construction schedule," explains Jay Cariveau, director of business development and marketing.

A key reason for that efficiency is the single-source supplier for the full structural system, explains Matzke. "As an integral component, precast concrete provides the entire structure. It's a superior system because it's durable and flexible to allow for the designs we need, and it installs quickly."

The precast concrete structure also helped engineers meet the restrictive Anti-Terrorism/Force Protection (AT/FP) requirements for all government projects. "In many cases, if you meet construction-standoff needs with barriers, you can build any type of low-rise building with no additional blast design per se," Shelt explains. That is not the case with projects of three stories or more, requiring some consideration for AT/FP and progressive collapse factors.

For example, the effects of an explosion on a lower floor and its impact on the entire structure must be considered. It requires a change in mindset for dealing with the specifics of

the structural system. "Typically, prestressed components are reinforced for gravity loads, so they're designed to be heavy in the bottom portion, especially double-tee beams. But when planning for blast protection, we also have to design for potential increased uplift."

The requirement accounts for the force of a blast on a lower floor that could push the overhead framing upward, causing it to collapse as it falls back again. "It's a fairly significant consideration and not something that comes up when looking at wind loading or other typical forces," he says. "The biggest difference on these projects is that we are not in control of these design adjustments. We provide the criteria and then review the design in the shop drawings and make any changes then." Designers also added $1^1/_2$ times the typical topping to increase reinforcement.

The easiest way to allow for progressive collapse needs is to use the tie-force method, which defines the perimeter and internal forces that need to be considered. "The building has to be reinforced for these considerations with enough robustness to distribute the loads in case of the loss of a column or wall," says Shelt. Some of these measures have been revised since the Parris Island barracks were designed, and designers must stay current with requirements. (For more on blast considerations in military projects, see the accompanying article.)

The designers also had to account for the area being in a high seismic zone, he notes. "It mostly required us to ensure that the shear walls were tied down properly."

## Panels Set Vertically

The contractor initially intended to use the precast concrete panels in a horizontal position, with each level essentially framed separately. However, Metromont could provide a three-story-tall panel that was 12 feet wide. "It matched the double-tee configuration used for flooring, so we designed it to take advantage of that capability," says Shelt. That created narrower walls that reduced options for tying together the panels, requiring more attention to avoid uplift at the ends of the panels.

To meet these needs, Metromont supplied a bar with a plate on its end to fit into foundation excavations.

The precast concrete structural system will help achieve a Silver LEED rating in a number of ways.

The foundation pour included a metal sleeve/blockout to create a void. It was grouted and filled after the walls were erected. The bar was threaded into the precast concrete wall and dropped into the hole, after which the hole was closed. "It provided some tolerance for setting the precast, because it could be secured at varying depths," says Shelt.

That variability was necessary because the design-build nature of the project meant that foundation design had to be completed early so that the panels could be cast. That was accomplished before other architectural details were developed, Shelt notes. "Some of the details had to be massaged during the construction phase as much as possible due to adjustments that occurred after the panel design was set."

Tolerances on setting the walls were tight, agrees Matzke. "The three-story height of the panels required close coordination and good communication to ensure all of the systems were worked out before erection, because we couldn't adjust positioning on mechanicals or anything once the design was set. We planned ahead to create the penetrations where they were needed and place the shear walls so there wouldn't be any conflicts."

Having a single-source provider helped especially with the erection of the panels, says Shelt. "The single source aided calculations because we didn't have to adjust for differences between materials and how they'd interact."

The double tees were designed with a 24-inch-deep profile to reduce material needs while providing sufficient clearance on each floor. A crawl space was provided under the first floor, with a steel truss and metal roof installed above the double-tee components on the top floor. Flooring was adjusted with the use of topping to offset the camber provided in the double tees. The components were erected with a 300-ton crane with no difficulties and no safety problems.

Once the walls were erected, mastic was applied to the concrete, with insulation laid over the panels. Then full brick veneer was field installed. The designers considered thin-brick insets into the precast panels, which could have alleviated some of the concerns for laying the brick as a final step, but the specifications called for precisely full-bed-depth, field-applied brick.

## LEED Silver Rating Met

The precast concrete design helped the project meet the LEED Silver requirements demanded of all military projects, notes Matzke. "It helped in a number of ways, especially due to its recyclability and use of recycled steel, as well as by the proximity of the precast plant to the project." It also helped with energy efficiency due to its thermal mass and the addition of insulation in the barracks walls.

The project features a number of other sustainable-design concepts, including a full solar photovoltaic system to aid with operational electrical needs and a full solar hot-water system to ensure there is always hot water for showers. The solar panels are installed adjacent to the buildings to provide maximum exposure.

"The Department of Defense is working toward sustainable design wherever they can," Matzke says. "They have really stepped up their use and are encouraging it in every project, including geothermal and solar applications."

VOA also is using precast concrete in more projects, including one currently being designed with a total-precast concrete system for a border-patrol station in Kingsville, Texas. The material's use with military projects also will grow, as more projects show the benefits that can be offered.

"Allowing us to create a total-precast concrete system for this installation was a huge move for the Marines," says Metromont's Cariveau. "Precast concrete was not the designated material in the design specifications. But they allowed us to improve on the existing design while meeting the performance specifications. The scope was for the use of 'hardened materials,' and we could work with that to create a better environment." ■

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