Student Residences Open Door to Partnerships

Total precast concrete structure helps Montclair State dormitory finish ahead of schedule and on budget, providing prototype for public-private partnerships in New Jersey

— Craig A. Shutt

In 2009, the New Jersey legislature passed the Economic Stimulus Act that allowed public organizations to work with private groups to develop projects that benefited both parties. One of the first projects to take advantage of the law was the $132-million Heights residence hall at Montclair University in Montclair, N.J. The two-building, 565,000-square-foot project used a total-precast concrete structural solution to overcome extraordinary site conditions and pursue LEED Silver certification while coming in ahead of schedule and on budget.

The complex consists of four residence towers rising six to eight stories. The large facility provides 1,009 dormitory suites with individual bathrooms and vanities, as well as amenities such as common areas, laundry rooms, multi-purpose rooms, and study rooms. Each building has a two-story common area, with one of the buildings housing a 25,000-square-foot cafeteria with five menu stations.

The project took advantage of the new public-private partnership law, which provided the framework for

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This aerial view shows how the new residence halls at Montclair State University were offset to better align with the topography, reduce the scale of the project and provide a variety of scenic views from the rooms. The foreground halls are located behind the red-roofed recreation center and are connected by the new cafeteria space.

Capstone Development Partners to collaborate with the university on its first such project. Under the agreement, the university provided the land while Capstone's development team financed, designed, built, and manages the project. After 30 years, ownership shifts to the university.

Capstone advised the university while the legislature was considering the bill and then was contacted by administrators when it released its RFP on the project, explains Bruce McKee, Capstone principal. Interestingly, the university suggested five alternative sites for the housing complex, but Capstone proposed another.

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PROJECT SPOTLIGHT

Montclair University Residence Hall

Location: *Montclair, N.J.*

Project Type: *University dormitories*

Size: *565,000 square feet*

Cost: *$132 million*

Architect of Record: *Paulus, Sokolowski & Sartor, Architecture & Engineering, Warren, N.J.*

Design Architect: *Design Collective Inc., Baltimore, Md.*

Owner: *Capstone Development, Birmingham, Ala.*

Structural Engineer: *PS&S, Warren, N.J.*

Design-Build Contractor: *Terminal Construction Corp., Wood Ridge, N.J.*

PCI-Certified Precaster: *High Concrete Group LLC, Springboro, Ohio and Denver, Pa.*

Precast Components: *Precast concrete load-bearing insulated sandwich wall panels, hollow-core plank*

Difficult, Rocky Site

"We visited the sites with our design and construction team and ultimately proposed modifying and expanding one of the sites," he explains. The suggested site was over a former large quarry with uneven, rocky topography. "Our plan was to create a number of smaller structures that could respond to the extreme topography in an organic way and produce a repetitive design that still tied very closely to the institution's architectural style. It helped with constructability while adding site-planning interest and helped create the 'village' feel we were looking to create."

Terminal Construction Corp. of Wood Ridge, N.J., was selected to head the design-build team. The team used an eight-month preconstruction planning process to plot out design, material choices, and procedures before the project began. That time paid off, as the original tight 15-month construction schedule was able to be condensed to 13 months, ensuring completion well ahead of the school's opening for the 2011 fall semester.

"It was a difficult site and an aggressive schedule, with a lot of program challenges," says Bruce Corke, project manager at Paulus, Sokolowski & Sartor, Architecture & Engineering in Warren, N.J., which served as architect of record. "It was designed and built very quickly, with a lot of the configuration and layout dictated by what the site would allow us to do." Design Collective Inc. in Baltimore served as design architect.

Total Precast Solution

The total-precast concrete structural solution consisted of load-bearing precast concrete wall panels and hollow-core floor planks. The wall panels feature two wythes of concrete, a three-inch outer layer and a five-inch inner layer, sandwiching three inches of rigid-foam insulation. The layers are secured with proprietary carbon-fiber shear trusses to minimize thermal transfer while transferring shear forces between the layers.

This approach makes the panels fully structurally composite, with both the inside and outside layers handling wind and seismic loads. The thicker inner layer supports gravity loads and provides a smooth, durable finished interior surface that withstands abuse. The concrete's two layers of thermal mass and interior insulation provided a uniform R value of 15.

"The project's timeline needed the

The first level of the dormitory buildings feature a beige tint and reveals that add interest at the pedestrian level.

'Precast concrete provided the structural frame, the thermally insulated envelope, the architectural appearance and the fire rating all in one piece.'

innovation of precast concrete walls," states George Stankiewicz, project engineer for Terminal Construction. "Using the load-bearing insulated panels ensured the project's wall system was complete once it was assembled. And the insulating R-value of the skin contributed to the structure's energy efficiency in a single application."

Fabricating precast concrete components offsite also sped up construction, as considerable foundation work was needed, according to Glenn Kustera, structural engineer for PS&S. "At this old quarry site, the remaining rock levels varied in depth greatly over the site," he explains. During excavation, crews would suddenly be stopped by a 20-foot vertical wall of rock. As a result, to accommodate the varying rock heights, foundations ranged from walls supported by continuous stepped-strip footings to grade beams supported by piers and isolated spread footings. Precast concrete bearing walls were placed on the cast-in-place walls or grade beams.

"Coming out of the ground on this project was very interesting," Kustera says. "Each time a new rock height was uncovered, we had to modify the foundations on the fly. The goal was to take this curveball and create uniform footings, so the precaster could complete his shop drawings and cast panels based on the knowledge that certain footing conditions would be created, no matter how we reached that condition."

Construction maneuverability was complicated further by steep grades and existing buildings around the site, including a recreational center and parking structure, along with a steep cliff to the east. The buildings are located along campus circulation paths to the main academic buildings and the recreation center.

"The wing configuration of the structures came from the nature of the topography," Corke explains. "Precast concrete was decided on early in the process due to its capabilities to be cast off-site while foundation work was done, speeding construction, and also because it lends itself well to replicating housing units. The spans it can provide establish parameters that work well for hotels and dormitories."

Wings Offset

The wings were offset in order to reduce the massive structures' scale and to vary the perspective from the rooms. "We wanted to add creativity to the design by providing angles that created different views from rooms and add visual interest outside," Corke says. "The breakdown into separate wings worked very well with the surrounding roads and topography."

The buildings were organized around central common cores with wings or residential suites radiating from the cores. "This design provides efficient circulation as well as close supervision of residents," Stankiewicz explains. The common core offers basics of residential life, including mail services, lounges, TV and meeting rooms, study rooms, kitchenettes and vending machines, and laundry rooms. Offices have been provided in each building, as well as apartments for Capstone's staff, who reside on campus year round. The dorm suites are located in towers between six and eight stories tall, depending on site grades.

The towers were designed with shear walls on the short sides of the buildings, which bear the brunt of the wind loads, Kustera notes. The buildings sit on top of the first ridge of the Watchung Mountains, several hundred feet up. "The wind loads can be 80% higher at that location than in other, lower portions of the campus," he explains. "So those shear walls have to work pretty hard."

The precast panels and plank also provided all of the fire resistance required to meet the building code, Kustera adds. "Their inherent composition met the code automatically, eliminating that concern. Precast concrete provided the structural frame, the thermally insulated envelope, the architectural appearance and the fire rating all in one piece. It's a very efficient system."

Mission Style Created

The finishes of the precast concrete panels were designed to complement the Mission Style design featured throughout the campus. The bright-white concrete mix on upper floors contrasts with beige coloring and reveals used on the first level to replicate the look of stone blocks.

Windows featured frames that jut out several inches to create depth. Ledges at the first and top floors, along with higher towers at the entries, provide more visual interest. Red accents were created as a contrast, including the clay-tile roof on the cafeteria, aluminum tower caps and gutters, and red steel building railings and pergola.

Mock-ups of the different elements were created and reviewed by the designer and developer, Stankiewicz says. "Once accepted, the suite design allowed for repetitiveness in assembly, so the learning curve decreased rapidly. Punch list items were managed and kept to a minimum."

"Designing the building into wings helped make the Mission Style architecture more prominent," Corke says. "All of the elements, both horizontal and vertical details, help reduce the scale of this major project. And the wings provide scenic views of the mountains."

Erected Simultaneously

Once the foundations were set, High Concrete Group delivered more than 1,650 wall panels and 4,500 hollow-core floor planks. "The delivery of all the pieces was flawless," Stankiewicz says. Two lattice cranes assembled the pieces with continuous operation, each working on a dormitory complex. At some point, crews were shifted from one site to the other to keep progress moving.

"The goal was to ensure we had a weather-tight building in place before winter hit, and we achieved that," Stankiewicz says. With erection beginning in July 2010, the building was completely enclosed early in November, when interior trades began work that continued through the winter. The precast concrete erection took 100 days to complete. "Manufacturing the concrete components off site saved so much time," Corke agrees.

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The repetitive nature of casting the components also helped the schedule, notes McKee. "There was a demanding schedule to achieve dry-in quickly so interior trades could get to work," he explains. "That goal fit well with precast concrete's strengths. Its repetition allowed pieces to be cast and delivered quickly. It helped with the schedule, the architectural character, and the quality that we wanted to achieve."

The erection, and in fact the entire construction process, moved smoothly, he adds. "The only real surprises we had were outside the project, in terms of some permitting snags and such," he says. "The rest went extremely well."

LEED Certification

At press time, the project had been submitted for LEED certification, with the anticipation of a Silver rating and the possibility of Gold. LEED certification was necessary to satisfy requirements of the private-public partnership guidelines. A range of efficient elements were included to achieve that goal.

The precast concrete components aided certification by providing high energy efficiency in the building shell, regionally manufacturing the materials, using recycled materials, and other factors. Site use also was enhanced by reclaiming a former parking lot for higher-density use. Nearly 90% of construction debris was diverted from landfills. Water efficiency, landscaping, and other site activities also were included.

An Energy Star-rated high-albedo EPDM roofing membrane was installed to cover nearly 75% of all roofing area, reducing the heat island effect and the amount of energy needed to cool the buildings. Wood-based materials were certified by the Forest Stewardship Council to ensure integrity for the forest ecosystem.

The mechanical system provides 750 tons of cooling through water-source heat pumps in each suite. Individual thermal-comfort controls provide ongoing accountability of building energy usage. The mechanical system uses enhanced LEED commissioning to ensure indoor air quality during construction, while upgraded refrigerant management provides zero use of CFC refrigerants.

To allow for the increased capacity to the campus infrastructure, a sanitary-pump station and nearly three miles of gravity sewer lines were woven through the residential streets of the city. "Roadways, parking lots, hardscape, landscaping, fire service, and stormwater management all contributed to permanently altering the campus and its lifestyle," says Stankiewicz,

The result is a dramatic addition to the campus that maximizes space and created a complex that fits organically into its surroundings. Administrators allowed students to select names for each of the wings through voting, increasing their ownership of the project and giving them additional pride in the place they call home while at college.

"The character of the site created a challenging project," says McKee. "But the solution also led to creating the architectural style that we wanted and provided a lot of the strong identity that the project ended up with." ■

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