

Precast Helps Dorm Exceed Expectations

Insulated panels provide speed, durability, and aesthetics—and offer significantly improved energy efficiency as a bonus

— Craig A. Shutt

Dormitories create a unique combination of design challenges, as they not only require typical housing needs but also must absolutely, positively meet their deadline and provide even higher durability than typical rental units. These needs were met at the University Commons student housing at Georgia State University in downtown Atlanta with the help of architectural precast concrete insulated sandwich wall panels. They not only provided speed, durability, and the desired strong, permanent appearance but helped reduce energy costs by more than 33%.

University Commons, the largest pri-

vately funded student-housing complex in the country, consists of four buildings ranging from eight to 14 stories tall and housing 2,000 students. This massive structure, containing 778,000 square feet of floor space, was clad with precast concrete panels containing 2-inch interior and 3-inch exterior architectural wythes of concrete, sandwiching 4 inches of continuous insulation and carbon-fiber connectors. The interior wythe of concrete also served as the finish face. The panels were anchored to a cast-in-place concrete post-tensioned frame.

A variety of requirements led the de-

sign team to precast concrete panels, says Dale McClain, principal at Niles Bolton Associates, the architectural firm on the project. The original plan was to use precast concrete panels at the base and steel framing with brick veneer above. But the steel and brick veneer proved costly and time-consuming. "The project ran into trouble when we priced these out, because we had a fixed budget, fixed project scope, and fixed delivery date. It created real challenges," he explains.

Officials at Hardin Construction Co., the general contractor, suggested the precast concrete design. "We under-



Georgia State's University Commons 2000-bed residential hall features insulated precast concrete wall panels that provided a strong, permanent appearance, allowed the building to be completed earlier than scheduled, saved \$1 million in construction costs and maximized energy savings over the building's life. All photos courtesy of Metromont Corp..

stood the technology, but we'd used it only on smaller, one- and two-story projects," says Robert Kochansky, senior manager at Hardin. "We worked closely with the precaster during the conceptual stages and throughout construction to coordinate drawings to ensure accuracy."

"It was a new concept for us on this type of project," says McClain. "It appealed to us because we could do away with so much labor and material, especially the intensive brickwork that would be needed. That was going to be expensive." Designers reviewed the concepts and consulted with the precaster on a regular basis as it was considered. "We had to be sure we could stand behind it so we could recommend it to the client," he says.

In addition to the savings in time and money, administrators like the appearance the panels provided, says Paul Morgan, vice president at Ambling University Development Group, the project's developer. "They wanted a durable appearance that provided a sense of permanence. That was important on a high-profile, high-rise building like this."

Speed Was Key

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Speed was a key factor for both the university and the developer, McClain notes. "We were looking for ways to save dollars anywhere we could while meeting the tight deadline that was set. The precast concrete panels ensured we could get the building dried in quickly, which was a great way to accelerate the schedule. Once the panels were installed and connected, we could start working to put in finishes, much earlier than with other systems."

Meeting the schedule was critical, he stresses. "There were huge dam-



One of the administration's goals for University Commons was to create a durable structure that projected an image of permanence. That was put to the test in 2008 when a tornado hit downtown Atlanta, leaving the building unscathed while damaging others nearby.



The interior wythe of concrete on the sandwich wall panels serve as the building's interior wall surface. Windows were framed out and prepped at the plant so windows could be popped into place at the site and erected intact, saving time.



The building sits on a four-story cast-in-place parking structure on a sloping grade. The general contractor worked closely with the precaster to ensure the foundations matched perfectly, allowing the walls to be erected quickly.

PROJECT SPOTLIGHT

University Commons, Georgia State University

Location: Atlanta

Project Type: Dormitory

Size: 778,000 square feet

Cost: \$165 million

Designer: Niles Bolton Associates, Atlanta

Owner: Ambling University Development Group, Atlanta

Structural Engineer: Browder + LeGuizamon and Associates, Atlanta

Contractor: Hardin Construction Co., Atlanta

PCI-Certified Precaster: Metromont, Hiram, Ga.

Precast Components: 2500 insulated sandwich wall panels with expanded polystyrene insulation and carbon-fiber connectors



Three finishes were used on the precast concrete panels, comprising a white sandblast finish across the top of the majority of the buildings; a buff sandblasted finish below that on the bulk of the buildings; and inset thin bricks, used at pedestrian level.

ages incurred if delivery dates weren't met." University dormitories are unique in their need for scheduling, he notes. "They're a real phenomenon. Students show up to move in within a small time frame, and they all arrive at once. You can't be finishing one part of it while another opens, which you can sometimes do with other types of housing."

The precast system helped ensure the schedule demands were met, but also offered other advantages, he adds. "We liked what the general contractor showed us with savings in metal, back-up studs, drywall, and other materials. We also liked that we could use the interior face of the concrete as the interior side of the exterior walls, which meant as soon as it was in place, we could paint it and have durable interior walls."

Enclosing the building offered more than quick access for interior trades, adds McClain. "With other systems, buildings stay open longer, which leaves them susceptible to taking on water. A big advantage to enclosing the project quickly that's often overlooked

is that you don't have to deal with a lot of moisture in the building as it's being built."

The rapid speed of construction was aided by preparing openings for fenes-

'With other systems, buildings stay open longer, which leaves them susceptible to taking on water.'

tration. The windows were blocked out and framing anchors were installed at the plant, so when the panels arrived at the site, the windows could be popped into place and erected. "It worked very smoothly," says McClain.

Long-term maintenance also was a key concern, McClain says. "Administrators were focused on creating as low-maintenance a façade as possible. Universities have so few funds to maintain buildings in the way that they'd like

to, especially large, complicated buildings like this one."

The precast concrete panels offered significant benefits over brick in that regard, he explains. "It greatly reduced the number of joints and changed the types of sealants that we'd need to use. The high-quality sealants and caulk we could use and the small amounts we'd need for maintenance were major selling points for the precast system." The panels also reduce the risk of mildew that could develop in the cavity of a traditional metal stud-framed wall with fiberglass insulation and drywall, as concrete's inorganic composition won't support mold growth, and the panels are impervious to exterior water penetration.

Multiple Finishes Used

The building features embedded thin brick on the first level and two textured finishes on upper levels. "The university wanted to warm up the building's base for visitors and pedestrians," McClain says. "They originally asked us to use field-laid brick, but we found that the embedded thin brick in precast concrete panels provided a better option. It worked great. It provided a sense of warmth and comfort at street level and set the building off while providing a low-budget approach."

"The inlaid brick looked fantastic," says Hardin's Kochansky. The panels went up quickly, and the brick was "as clean as a whistle," thanks to the face of the brick being coated with wax before being installed face down in a casting bed. Only a power-washing at the factory was needed to clean the panels prior to transporting them, he notes.

A white sandblast finish was used across the top of the majority of the connected buildings, while a buff sandblasted finish was used below. "We wanted to reduce the visual scale of the project with color and projections," McClain explains. A variety of six-foot setbacks along the faces of the structure create smaller building segments that help minimize its massive scale. A courtyard at the center of the building was designed to allow daylight to penetrate into the residential units throughout the buildings, helping to reduce lighting needs.

The interior side of the panels re-

ceived a hard-troweled finish and was painted. "These walls really should have no maintenance needs," McClain says. Paul Morgan, vice president of the project's developer, Ambling University Development Group, notes that saving the drywall and other materials needed to insulate and fur out the walls provided a significant cost and time savings.

High Energy Efficiency

With all these benefits provided, administrators were especially pleased to find they had achieved significant long-term advantages through energy savings along the way. "Maximized energy efficiency wasn't as much a part of the motive for using the precast concrete panels as speed and appearance," Morgan says. "But as we put them together, we discovered we could achieve high insulation values. And the performance has exceeded expectations. There is excellent energy efficiency and no thermal loss."

In-field application of construction products often can create different realities than thermal calculations may anticipate, McClain says. Initially, when we considered using metal studs and brick veneer, designers calculated a theoretical R-18 wall value. However, because the insulation would have to be installed between the metal studs, thermal breaks would occur frequently along the building's face. As a result, the R-18 theoretical rating actually provided the wall with an effective R 7.1 value (per ASHRAE).

The precast concrete wall system featured continuous insulation held in place between two wythes of concrete using low-conductive carbon mesh to connect the wythes. These connectors and the continuous layer of insulation eliminated thermal bridging between the exterior and interior concrete walls. The insulated precast concrete panels provided an effective, or performance value, of R-13.8.

"This was a dramatic improvement in the efficiency that we could achieve that wasn't planned in the initial proposal," McClain notes. In fact, once the precast concrete wall's effective R-value was determined, the designers went back through the project and adjusted assumptions. As a result, the HVAC system was downsized due to

the higher energy efficiency provided. "We went back through everything once we realized how effective the insulation would be for the building," says McClain.

The improvement in energy efficiency not only saved initial equipment costs of approximately \$750,000, but will continue throughout the building's service life, resulting in much lower life-cycle costs through reduced energy consumption. The results surpassed even the calculations for what the improved efficiency could provide. Estimators had forecast an energy cost of \$1.24 million during the first year of operation. In actuality, the cost was \$838,000, 33% less. During its second year of operation, actual energy operating costs were even lower, at \$750,000, 40% less than expected.

"That's a significant savings that will continue to help the operating budget," says Morgan. "We were very pleased to find that there would be substantial energy savings over time in addition to the first-cost savings that the panels provided. We'll definitely use this system on other projects in the future."

Erection in 10 Months

The panels' erection process moved quickly, with several crews working concurrently on different sections of the buildings. The 2500 panels were erected in 10 months using tower

Infrared thermal-imaging studies of University Commons show the high efficiency of the precast concrete panels, with a consistent low-heat green throughout. Red spots are lights and bathroom vents.



cranes. The erection was done at night, allowing the tower cranes to be used by other crews during the day to move materials into position. This also alleviated congestion at the downtown site while the erection proceeded.

The panels were staged in a parking lot across the street and brought to the site for erection as needed. "By doing it at night, we were able to eliminate a lot of coordination issues," says Kochansky. The panels were erected for each building segment, moving one floor at a time and connecting the panels column-to-column. Each of the buildings was finished ahead of their anticipated schedule, ranging from 2 to 45 days early.



The four buildings making up the complex were designed to create a large courtyard at their center to help pull daylight into all of the housing units, brightening the spaces and saving on lighting costs.



The buildings were erected one at a time, using several cranes. The erection proceeded at night, with each of the buildings completed in less time than scheduled. The project was completed six months earlier than estimated.

"It was a very fast system," he says. "All that was needed was a fire stop and closure plate once the panel was in place." They were caulked tightly, with crews moving quickly, he adds. "They didn't wait for the final weld, they just kept moving to the next panels to caulk. They were chasing the crane around the building really closely. It was incredible to see."

The buildings sit on a four-story, 780-space underground cast-in-place concrete parking structure, which required close coordination for foundations, he notes. The site drops down toward the back, creating different grades across the site. "We did an extensive review of shop drawings to ensure everything was accurate prior to placement," he says.

The result is a dramatic building with significant cost and times savings. McClain estimates that the precast concrete panels saved \$1 million in costs compared to the brick and steel alternative, not including the additional long-term energy cost savings. The panels also reduced the project's schedule by six months, providing plenty of time for interior trades to prepare for students' arrival.

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Withstands Tornado

Another advantage of the precast panels became evident in March 2008, when a tornado hit downtown Atlanta. The storm did significant damage to many major downtown buildings, including tearing off part of the roof of the Georgia Dome. The nearby Omni Hotel was evacuated after many of its windows were blown out, as were windows in many other high-rises. But the University Commons building suffered no damage.

McClain says. "The building held up extremely well." Morgan agrees. "The precast concrete panels performed excellently at high wind loads, especially on a high-rise building like this. It withstood the storm beautifully."

The building also has revitalized the area, especially with the inclusion of 18,000 square feet of retail space on the southwest corner. The space has been used for an ancillary dining room, health center, campus police station, and several shops. At the time, the building was separated from the campus by several blocks, but that real estate has since been purchased by the university for use as administrative buildings, creating a closer connection between University Commons and the campus.

"It's a close part of the campus now, and it's great to see," McClain says. "That part of downtown was not especially active before, and this has really added activity and energy to the area."

Students agree that their dorm rates highly. In 2011, University Commons was named "Best Overall Dorm in the

Country" by the website CampusSplash.com, which provides high-school and college students with news about college life. The building also was ranked fourth on the site's list of "Best 14 Dorms" based on 7100 reviews.

"Our vision has always been to provide students with premiere housing on our campus," says Dr. Marilyn De LaRoche, director of student housing for Georgia State University. "Students who like their residence hall's environment graduate at higher rates, have higher grade-point averages, and are more connected with their university community."

The design and construction team also have strong feelings for their work. McClain proposed this design for another recent student-housing project where speed was a critical factor. "Speed was the key driver for us on University Commons, and the energy benefits we received, which weren't even on our radar as we began the project, provided a strong added benefit."

Kochansky agrees. "This was the first and only project I've done this way, and I'd like to do more," he says. "It was a great project. After we finished it, I had PPD—post project depression." **A**

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The residential building includes 18,000 square feet of retail space, helping to bring activity to the area at all hours. The dorm has been rated one of the best in the country by students.