The Art and Science of Hospitals

University of Kentucky Hospital uses insulated precast concrete panels to create a high-performance envelope providing energy efficiency, strong aesthetics, faster speed of construction and other benefits

— Craig A. Shutt

Hospitals today are re-examining how to create healthy environments in which patients can thrive and be treated efficiently and effectively. Building-science research and technology are providing better understanding of the materials used to construct facilities and the efficiencies they can provide, leading administrators to look for ways to save money and encourage healthy surroundings. A number of these benefits were provided at the University of Kentucky's Albert B. Chandler Hospital's Pavilion A with the help of precast concrete insulated sandwich wall panels cast with embedded thin brick.

"As the new centerpiece of the hospital, Pavilion A bridges the art and science of medicine, assuring residents access to the best care within a healing environment," explains Thomas Gormley, principal at GBBN Architects, the architect of record on the project. "The University HealthCare's Guiding Principles focus on patients, staff, students, and technology, and these were used as a basis for all design and construction decisions."

The new 1.2 million square-foot facility serves as the "front door"

The new 1.2 million square-foot Pavilion A at the Albert B. Chandler Hospital at the University of Kentucky was designed as the new entry point for the complex, connecting to three existing facilities. Precast concrete insulated sandwich panels helped the building meet a number of its goals. Photo Pease Photography, courtesy of GBBN Architects and AECOM.

to the hospital campus, Gormley explains, unifying the complex and creating a new focal point as visitors arrive. It connects to three existing facilities, including a 1,600-car parking structure. As the new hospital nexus, it needed a dramatic appearance that blended with the existing buildings on the college campus.

"The design goal was to use the facility to enhance patient and family convenience and to make the functions easily comprehensible through orientation and wayfinding and maximize clinical efficiency throughout the hospital."

That orientation began with the siting and arrangement of the major elements at the entry. The lobby connects to the existing buildings as a common point of entry. At the entrance, the circular drop-off and two-story atrium lobby orient arriving visitors and provide a link to the new and old facilities. "The new lobby helps separate the 'on-stage' and 'off-stage' activities of the medical campus."

As patients and families move into the patient tower, a sense of place and orientation is maintained by the curved central lobby. Patient rooms have separate zones for family, patient, and staff. Each zone is planned with the specific user in mind, with the rooms featuring large windows that provide natural light and views. The patient floors have decentralized team stations to allow nurses to work closer to the patients and the point of care.

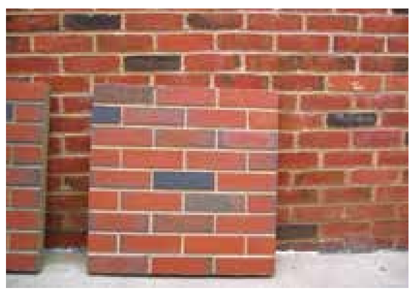
"The design and implementation of this project was a highly successful collaboration between GBBN Architects, AECOM, a fully engaged owner, and numerous engineering and specialty consultants," says Gormley.

Precast Helps Project Image

Projecting the exterior image that sets the stage for this healing environment required considerable advance planning, as administrators wanted a brick cladding with large window openings. The structural framing consists of a seven-story steel frame atop a five-story, cast-in-place concrete frame sitting on concrete piers. It was clad with insulated precast concrete panels cast with thin brick selected to complement the surrounding campus.

The precaster worked on a design-

The new pavilion connects to three adjacent buildings, including a parking structure with a similar brick exterior. Photo Pease Photography, courtesy of GBBN Architects and AECOM.



The precaster fabricated 1,758 panels using a blend of five brick colors. In all, more than 1 million pieces of brick were embedded into the panels. Photos: Gate Precast Co.

The pavilion is one of the largest capital projects the university has ever undertaken and required considerable advance planning. The precaster worked on a design-assist basis for about 1 ½ years before the project began construction, which was completed on a design-build basis. Photo Pease Photography, courtesy of GBBN Architects and AECOM.

PROJECT SPOTLIGHT

University of Kentucky Albert B. Chandler Hospital's Pavilion A

Location: Lexington, Ky.

Project Type: Hospital

Size: 1.2 million square feet

Cost: $352 million

Architect of Record: GBBN Architects, Cincinnati, Ohio

National Healthcare Design Architect: AECOM Inc. (formerly Ellerbe Becket), Minneapolis

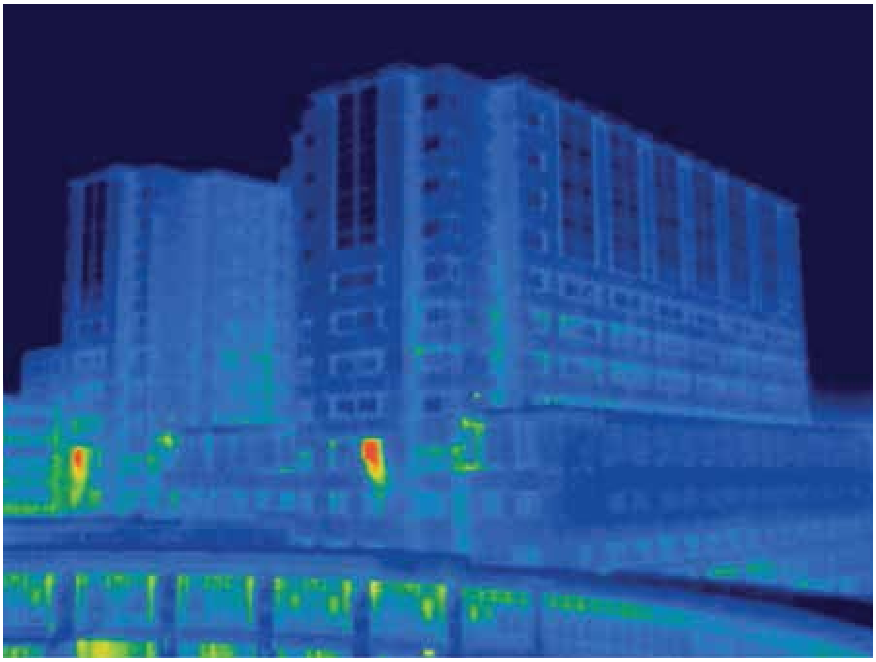
Owner: University of Kentucky, Lexington, Ky.

Structural Engineer: THP Limited Inc., Cincinnati, Ohio

Contractor: Turner Construction, Cincinnati,Ohio

PCI-Certified Precaster: Gate Precast Co., Winchester, Ky.

Precast Components: 1,758 insulated panels 9 inches thick (4-inch interior structural wythe, 2 inches of polyisocyanurate insulation, 3-inch exterior architectural wythe) in four finishes: embedded thin brick, two finishes of buff-colored limestone like texture, and a granite-like texture.



This post construction thermal image shows the uniform, continuous insulation that was achieved for the hospital, which was a key requirement. The precast concrete insulated sandwich wall panels played a key role in reaching this goal. Photo: Gate Precast Co.

assist basis for about 1 1/2 years before the project began construction, which was completed on a design-build basis. "The pavilion is one of the largest capital projects ever undertaken by the university," Gormley explains. "A lot of infrastructure relocation and improvements had to be undertaken to construct the facility."

A major concern was enclosing the entire building quickly so trades could begin work on the complicated interiors and still meet the tight time frame. "The project team was challenged early on to eliminate a year from the construction schedule," Gormley says. "The building's exterior skin was a big component of the construction's critical path, so the need to accelerate construction of it resulted in reviewing all skin options."

The team visited several precast concrete installations to evaluate options and validate that the system could achieve the project's exterior-design objectives, he explains. "Insulated precast panels were selected because they could be erected quickly and had the benefit of providing a finished exterior wall with edge-to-edge continuous insulation." Complementing the panels was a curtain wall and windows that were unitized and installed quickly in the cast openings.

"Scheduling was a key challenge and a primary reason that precast concrete panels were chosen," says Bill Sparks, chief engineer at Gate Precast Company. "If they had tried to use hand-laid brick, it would've taken forever to get it completed, and the site—at the front of the hospital—would have been disrupted for a long time with materials and scaffolding." He estimates the precast panels allowed the building to be enclosed two to three times faster than would have been possible with field laid-up brick, and without the site congestion.

Continuous Insulation Provided

One of the primary challenges addressed in the early planning was the architect's desire for a building that had continuous insulation throughout, with no cold spots created by building material techniques. "It was great to achieve the goal of having continuous insulation before it became a code requirement," Gormley says. That meant not allowing any connections to interfere with the consistency of the insulation layer.

"The need for continuous insulation was one of the biggest challenges on the project," says Sparks. The panels consist of a 3-inch front wythe of concrete, which features another 5/8-inch layer of thin brick; a middle 2 inches of polyisocyanurate insulation with ship-lapped edges, and an interior 4-inch structural wythe. The panels typically were 6'8" tall and 36 feet long. The precast envelope system has a noncomposite design, in which non-conductive fiber-composite connectors penetrate the insulation to secure the front and back wythes of concrete.

The biggest concern came with designing the load-bearing connections, as some of the panels stacked on top of others. That approach created loads up to 25 kips. The design consisted of large, thick plates from which a steel tube projected. "The panels' back face was full of concrete anchors and weldable rebar," Sparks says. "These were heavy panels, and they were heavily reinforced to provide enough support."

Prestressing Strengthens Panels

A significant aid to successfully meeting all of the panels' needs was the precaster's capability to prestress the panels. "Prestressing was a significant benefit due to the large sizes of the panels and the thinness of the wythes," Sparks says. Prestressing the panels added sufficient strength to ensure the forces created by stripping the panels from the molds would not crack them.

"The project definitely had its challenges," Sparks says. "But by prestressing the panels in the plant and with insulated and brick inlay projects under our belt, we felt prepared to meet those challenges successfully."

"The insulated system provided a very efficient wall system," Gormley says. "To not have to post-apply insulation in the interior wall assembly saved significant time and provided more uniform coverage. Additionally, with the pre-installed wall system, the owner didn't have to immediately finish floors for future expansions."

Understanding that the insulation represents a drainage plane is important when considering this type of system, Gormley notes. "How that drainage plane meets adjacent systems, such as curtain wall and window systems, and how it is properly flashed where it terminates, are important details that need to be studied," he explains. "Understanding the panelization of the precast with respect to the design intent, and

The project team was challenged early on to eliminate a year from the construction schedule.'

The brick facade features a blend of five brick colors, requiring more than 1 million pieces in all.

acceptable tolerances to achieve the design intent, are important considerations."

The panelized system provided additional benefits, he notes, including inherent mold and mildew resistance, as well as fire resistance, due to concrete's inorganic composition; minimal maintenance costs over the life of the building due to the panelized design resulting in less joints; high durability; reduced trades on site during construction; and excellent indoor air quality due to the lack of off-gassing or other chemical interactions. The insulated panels also offer noise dampening from exterior sources thanks to its high mass and elimination of air penetration.

A number of additional sustainable-design features were incorporated into the project. These broke down into five key areas:

- General planning, such as aiming for a 100-year service life and creating rooms that can be easily renovated for new purposes.
- Siting, such as ensuring access to public transportation, use of a previously developed site, and inclusion of a green roof that will reduce the heat-island effect and assist in retaining storm water.
- Energy efficiency, such as a highly efficient lighting system with motion sensors and mechanical systems with variable-speed drives.
- Material usage, such as the use of natural, recycled, and easily renewable materials with low VOC content and low-emitting adhesives, sealants, and paints.
- Indoor environmental quality, such as following a stringent air-quality plan during construction, ensuring 75% of public spaces have views outside, enhancing daylighting, and using environmentally friendly refrigerants in chillers.

"The entire project team is proud to have been able to develop these sustainable strategies within the allotted budget and the required schedule," Gormley says. "Each technique provides a return on investment that will bring real savings in the operation while providing a higher level of comfort to the patients, families and staff within the Patient Care Facility."

Precast concrete helped achieve these sustainable-design goals not only in the aforementioned benefits but by reducing construction waste and in using local products and manufacturing products locally. "We used many sustainable principles in the project, but the goal was not to seek LEED certification," Gormley says.

Inlaid Panels Pass Test

With the structural design issues worked out, designers and precaster could turn their attention to the building's aesthetics, he says. "Prior to our specifying the system, the precaster had to demonstrate how the brick-inlaid panels could achieve the look of the hand-set brick and stone used on adjacent buildings."

Gate produced numerous brick blends and mock-ups to provide the reassurances that were needed. "Providing samples is pretty typical, especially on projects of this size requiring brick blends," Sparks says. "Mock-ups are always a key component, and we went through several iterations. But there were no unusual brick lines or courses to follow, so it went smoothly."

The brick façade features a blend of five brick colors, requiring more than 1 million pieces in all. The brick panels are accented by panels in three finishes: two replicating buff limestone with a medium acid-etch finish and a third simulating field-applied granite.

The project was completed on time and on budget. "Precast concrete panels gave us the flexibility to achieve the project-schedule constraints," Gormley says. By casting the panels as site work progressed, the panels were ready for erection when the structural frame was ready and could be erected quickly. In all, 1,758 panels were cast and erected.

The hospital's podium, consisting of the lower five floors, were erected first onto a cast-in-place structure. The steel-framed tower then was clad using a tower crane. Both sections together required only 24 weeks to erect.

The result was a dramatic looking building that welcomes visitors while creating an efficient facility from both logistics and operations standpoints. "The design team's decision to integrate thin-set brick and insulation helped achieve the design objectives," says Gormley. "It seamlessly matched adjacent campus structures, formed a better thermally performing exterior skin, and was produced in an environment where quality of the construction could be better controlled and still take a significant amount of time off the project schedule."

That created a facility that sets a new standard, he adds. "This project serves as a stepping stone for any subsequent project to take a leadership role in the enhancement of our environment, stewardship in the use of facility funding, and the improved quality of life for every user."

For more information on these or other projects, visit www.pci.org/ascent.

Only 24 weeks were required to erect the entire structure, including both the podium or base section and the towers. Photo: Gate Precast Co.