

Quick RECOVERY

After designing a total-precast concrete high school, designers used lessons learned there to build a second facility in rapid order after a nearby school burned to the ground, displacing 1600 students

— **Craig Shutt**

Administrators in the Guilford County School district in Greensboro, N.C., had evaluated earlier K-12 schools built with precast concrete architectural panels and framing systems, so they decided to use them on their new high school. That decision paid dividends when another high school in the district burned down, allowing the first school's design to be quickly adapted and constructed to replace the destroyed facility.

For the first school, 1600-student Northern Guilford High School, the key factors in the use of the precast concrete system were energy efficiency, aesthetics, and, most importantly, schedule. "No question, one of the major drivers was schedule and lack of availability of masonry labor," says Robbie Ferris, CEO of SfL+a Architects in Raleigh, N.C., the architectural firm on both projects.

The precast concrete wall panels were designed as insulated, load-bearing panels faced with inset brick. This approach provided a variety of benefits in one panelized system. It also kept prices low by minimizing costs and issues compared to steel framing. "The design produced major savings over the volatile steel prices

NORTHERN GUILFORD HIGH SCHOOL

LOCATION

Greensboro, N.C.

PROJECT TYPE

K-12 school

SIZE

270,568 ft² (for 1600 students)

COST

\$37.9 million

DESIGNER

SfL+a, Raleigh, N.C.

OWNER

Guilford County School District,
Greensboro, N.C.

STRUCTURAL ENGINEER

Fleming & Associates, Fayetteville, N.C.

CONTRACTOR

Barnhill Contracting Co.,
Rocky Mount, N.C.

PCI-CERTIFIED PRECAST PRODUCER

Tindall Corporation, Spartanburg, N.C.

PRECAST COMPONENTS

Double tees, architectural insulated
wall panels, rectangle beams, L beams,
columns, and flat slabs



at the time,” Ferris says. There was concern that steel specified in the designs could skyrocket in price when materials were purchased later, creating budget overruns. Precast concrete provided steady, secure pricing for a material that could be erected quickly in a panelized system.

The two-story, 270,568-ft² school features a large central atrium that serves as a gathering point, a single point of entry to control security, and an auxiliary gymnasium. Classrooms, administrative offices, a computer lab, rooms for career technical education classes, and a dance studio flow off one side of the atrium, while the main gym, a 700-seat auditorium, and a dining area are adjacent to the atrium on the other side.

PRECAST EXPERIENCE

Along with its design concept, SfL+a brought to the project its long experience with designing K-12 schools with precast concrete, having designed the well-known Jack Britt High School in Fayetteville, N.C., in 1996. In that case, Cumberland County Schools wanted a design that provided a contemporary, high-tech appearance that was respectful of academic traditions. SfL+a specified precast concrete panels with inset thin brick, satisfying administrators’ request for a masonry building while resolving other challenges.



SfL+a’s 1996 design for the Jack Britt High School in Fayetteville, N.C., represented one of the first in the region to use inset thin brick in insulated precast concrete panels. The design garnered positive attention and made precast concrete a strong choice for school façades in the area. Photos: SfL+a.

The design became an obvious choice for the school as material options were reviewed, Ferris notes. A lot of construction activity was taking place at nearby Fort Bragg, sucking up most of the masonry materials and labor in the area. “Costs were getting very high and the schedule wouldn’t allow for using masons for all the brickwork. We realized early on that precast concrete was the only material that would be able to meet our schedule.”

The panels provided accenting details that could not have been achieved with concrete block and brick cavity walls, Ferris says. The design and attention to detail won accolades, including in the Architectural Portfolio and PCI Design Awards competitions, and from *American School & University* magazine.

That project, one of the first schools in the region to combine insulated panels with inset brick, garnered positive attention and made precast concrete a strong choice for school façades in the area, Ferris says. “It was really successful and has been incredible from a maintenance standpoint ever since,” he says. “There have been no problems at all. That’s something administrators all over the region have noted.”

Then, in the early 2000s, several additional large, total–precast concrete high schools were built around Greenville, S.C., and Charlotte, N.C. “The availability of local precast fabricators, speed of delivery, and quality of finished product established the precast framing solution as a tested and proven building system for large high school projects,” says Stefan Ely, sales engineer for Tindall Corporation, the precast concrete producer of the components for both schools.

SfL+a had also designed several additional schools with precast concrete framing systems, including East and West Bladen High

‘It was really successful and has been incredible from a maintenance standpoint.’

An aggressive schedule and a shortage of masonry labor led designers of the 1600-student Northern Guilford High School to specify insulated, load-bearing precast concrete panels faced with inset brick to clad the building. The panels also provided a hedge against volatile steel prices and provided a low-maintenance panelized system. Photo: Tindall Corp.





The two-story, 270,568-ft² school features a large central atrium that serves as a gathering point for student activities. Photos: Tindall Corp.

Schools in Elizabethtown, N.C. Administrators had local examples to review and liked the range of benefits the precast concrete design offered, including aesthetics, speed of construction, energy efficiency, and cost efficiency.

"One of the reasons they selected us to build the Northern Guilford High School was our experience with precast concrete," Ferris says. "They had seen the results, and they knew the schedule wouldn't be a problem for that approach."

SfL+a went through the proposal process with precast concrete designs to show. "They liked our approach and experience with the material. We didn't need to sell them on it." SfL+a worked with Barnhill Contracting Co. as the general contractor, while Tindall provided design-assist input and fabricated the components.

"Northern was delivered through a traditional design-bid-build method," says Ely. "We provided assistance for the design and budgeting as the project developed, prior to formal bidding. The Carolinas were rapidly growing, and there was a push to build many new schools."

ENERGY-EFFICIENT PANELS

A key benefit administrators liked was the energy efficiency that was inherent in the precast concrete and how it could be designed to enhance those benefits. The insulated sandwich wall panels were cast with 5 in. of insulation with a 4-in.-thick interior structural wythe and a 3-in.-thick exterior architectural wythe. The insulation was installed in two layers of 2 and 3 in.

"The double-insulation wythe allowed for continuous insulation of one wythe with local/spot interruption of other wythes at haunches to

support double tees with flat slabs at corridor floors," explains Ely. Adds Ferris, "The panels created a superior thermal envelope to a brick-and-block design, with continuous insulation."

Truss wire girders were used to connect the two insulation wythes. "The insulation type and thickness were selected to meet the overall assembly *R*-value, after consideration of any thermal losses associated with the truss girders," Ely adds.

The insulated precast concrete walls provide more reliable protection than cavity walls, too. "Cavity walls can leak, which becomes nearly impossible to fix with a brick façade," Ferris says. "The precast concrete sandwich wall panels are a panelized system that is predictable, and joints are easy to check. We've seen cavity walls that leak or allow air in at window joints, which creates problems."

A key concern is the joint where the wall meets the roof, he notes. "It's very common for that joint to leak in steel-frame buildings, requiring callbacks. With precast concrete, it's virtually impossible. The building is tied together so tightly and everything is sealed up. It creates a great building."

In addition, the inherent mass of the concrete in the walls, flooring, and roof absorbs heat and releases it slowly, creating thermal efficiencies that reduce heating, ventilation, and air conditioning (HVAC) load and provide better thermal performance. "The concrete reduces thermal demand by storing the energy for later use." The insulation provided an *R*-value in excess of *R*-19, providing a highly efficient thermal envelope.

PRECAST SCOPE EXPANDED

Initially, designers intended to use precast concrete only for the exterior insulated wall panels. But as Tindall worked with the designers on a design-assist basis through design development, that expanded. "We were able to provide a level of comfort and confidence that showed SfL+a that a total-precast framing solution would work well for this project."

The total-precast concrete framing system provided long-span clearances that added flexibility, especially in designing the central atrium. The school features an "H plan" layout that eases circulation and reduces the amount of unprogrammed space.



Eastern Guilford features inset brick on its exterior with some additional accents, along with large windows that take advantage of daylighting to save energy costs. Photos: SFL+a.

EASTERN GUILFORD HIGH SCHOOL

LOCATION

Gibsonville, N.C.

PROJECT TYPE

K-12 school

SIZE

273,195 ft² (for 1200 students)

COST

\$35.02 million

DESIGNER

SFL+a, Raleigh, N.C.

OWNER

Guilford County School District, Greensboro, N.C.

STRUCTURAL ENGINEER

Fleming & Associates, Fayetteville, N.C.

CONTRACTOR

Barnhill Contracting Co., Rocky Mount, N.C.

PCI-CERTIFIED PRECAST PRODUCER

Tindall Corporation, Spartanburg, N.C.

PRECAST COMPONENTS

Double tees, architectural insulated wall panels, rectangle beams, L beams, columns, and flat slabs

The classroom wings consist of a central corridor with double-loaded classrooms on each side. All corridor walls and some classroom demising walls were cast with solid concrete, Ely says. Classroom floor framing used double tees with flat slabs at corridor floors. "The shallow, flat-slab corridor floors allowed for greater clear height to route HVAC, electrical, plumbing, telecom and other services."

It also added versatility by expanding aesthetic options. "The use of precast concrete for interior walls allowed us to do things that added value to the appearance," Ferris says. "We really don't like the aesthetic provided by concrete block, as it makes the school look like a prison. With precast concrete, we could get a smooth finish and add some reveals and wonderful patterning that we usually can't provide. It really added interest and created a great aesthetic to the corridors." The walls were painted in various colors to add further appeal after installation.

With all the hard-wall construction and no exposed electrical conduit in the finished spaces, designers had to create a variety of electrical embeds in the precast concrete drawings. Tindall closely coordinated with the electrical designer and subcontractor, and provided space in its plant for the electrical contractor to install embedded items such as electrical boxes and conduit prior to delivery to the site, speeding up construction.

Blockouts for mechanical ducting and telecommunications cabling were also coordinated in advance and provided in the precast concrete corridor walls to allow the supply runs to reach the classrooms on the other side of the corridor walls. Those activities further aided the expedited schedule and eased the mechanical, electrical, and plumbing installation after the precast concrete frame was in place.

EASTERN GUILFORD RESURRECTION

The finished school was well-received and was at the top of administrators' minds when Eastern Guilford High School, constructed in the 1950s, was destroyed by a fire that broke out in one of the chemistry lab offices. Immediately, officials contacted SFL+a and transferred teachers and students to nearby schools to finish the school year.

Over the summer, the school set up a temporary "modular village" on the site to house the 1200 students while the building was demolished and a new high school was designed and constructed. Obviously, speed was of the absolute essence in building the new school.

Speed was of the essence when the original Eastern Guilford High School, constructed in the 1950s, was destroyed by a fire. The construction manager used the all-precaster design for Northern Guilford to build the new high school on a very aggressive schedule. Photo: SFL+a.





The total-precast concrete framing system allows long expanses and strong structural support for the atrium, which reflects the design used on the earlier Northern Guilford school. Photos: SFL+a.

'The school district wanted this school back in operation as quickly as possible.'

The project was undertaken with Barnhill Contracting on a construction manager at risk (CMAR) basis, giving the contractor significant involvement in the design prior to bid. That change in project delivery approach from the Northern Guilford High School allowed Barnhill to pick up the earlier design and tweak it quickly for the new location.

"The school district wanted this school back in operation as quickly as possible," Ely says. Administrators gave designers 24 months to design, build, and open the school. "It was very important to the district to expedite the schedule to return a sense of normalcy to the students."

The decision to replicate the earlier school with some modifications became critical to meeting that aggressive schedule. "The selection of a precast structural system was a key to responding to that challenge," Ely says. "The architect and construction manager were selected and worked closely together with us from the earliest design phases to design the building and structure so we could begin the fabrication of the precast panels for the structure as quickly as possible."

"We were able to use the Northern Guilford drawings with a few tweaks and begin casting components very quickly," says Ferris. "The permitting process was the biggest obstacle, so we wanted as many parts moving while that progressed as we could get."

ENERGY EFFICIENCY STRESSED

The new school, finished just two years after the first, incorporated more elements with high-energy efficiency, including the most advanced lighting control systems available, water-conservation equipment, and energy-conservation products. Although neither school was submitted for LEED certification, Eastern Guilford upgraded the sustainability approach of the earlier school, which followed LEED silver sustainability standards.

Eastern focused added attention on maximizing daylighting techniques. The school is situated from north to south with straight north-south corridors. Classrooms make use of daylighting, with special skylights in the north- and south-facing classrooms.

Both schools put extra emphasis on security, with straight, clear corridors making everything visible. “It’s very easy to control and lock down if needed,” Ferris says. Arriving traffic is funneled to a locked entrance that leads to a secure vestibule with access to administrative offices. “Our designs were based on what we did originally at the Jack Britt High School,” he says. “It provided a very effective approach that we could duplicate.”

“The challenges were not astronomical from a production standpoint,” Ely agrees. “It was standard work for us, with two layers of insulation, truss-wire wythe connectors, thin brick, and a custom mix with light and medium sandblast.”

As with Northern, the new building features inset brick on its exterior. The amount was even increased from the Northern design, as budget restraints then had precluded its more liberal use. Eastern added brick accents above and below paired windows, in addition to large panels of brick on accent walls.

“We could add some brick accents that aided the appearance,” Ferris says. “We liked the look of the precast concrete, but we wanted to include more brick to soften the appearance and add that traditional school look. Eastern strikes a nice balance that creates a warm look, but they both operate well.”

Building Eastern was more complicated than Northern, which had been planned and had an open, accessible site. Eastern was built as rapidly as possible on the site of the original school while temporary



The Eastern Guilford High School design allowed more thin brick to be inset into panels than at Northern Guilford, providing more accents and a warmer appearance.

buildings were located around the construction. “There was a lot going on at the site,” says Ferris. “It was a confined area to work in.”

The precast concrete erection was sequenced such that areas with intensive mechanical and electrical systems were erected first and quickly dried in, Ely says. This allowed mechanical and electrical trades to start work quickly and accelerate the schedule beyond what was already provided by the precast concrete fabrication while site work progressed.

The result was an extremely successful project that met its schedule and its budget. “The school district was delighted, and the student population was very proud of their new school,” Ely says. “Designing the system with precast concrete provided for design flexibility, year-round construction, environmentally friendly materials, and creative architectural design elements.”

Ferris agrees, noting that SfL+a has gone on to use its precast concrete design experience for other schools. “We’re using precast in all sorts of additional ways now with school projects, including hollow-core for flooring and roofing, so we can run ductwork through the voids. It’s a very versatile material that helps in a variety of ways to meet challenges in aesthetics, schedule, energy efficiency, and tight budgets.”

The total–precast concrete structural framing system allowed Eastern Guilford High School to be erected quickly, helping to meet an aggressive schedule after the original building was destroyed. Photo: Tindall Corp.

