Making the Grade with Precast Concrete

— Anne Patterson

School projects are using precast concrete to meet tight schedules, save money and energy, and create community-pleasing looks

With school districts nationwide looking to expand, upgrade, or replace their educational facilities, administrators face challenges with budgets, timetables, and community acceptance. To meet those needs, more architects are selecting precast concrete for facade and shell requirements instead of masonry, which many schools traditionally favor.

Precast concrete offers architects, owners, and contractors a number of important benefits. Chief among them is the speed with which it can

The Academy of World Languages in Cincinnati, Ohio, uses insulated precast concrete wall panels to help the school achieve an international style that fits its language focus. Photo courtesy of McGill Smith Punshon.

Precasters' recommendations are a significant help in learning the most cost-effective ways to create desired design details.

help complete both design and construction activities in an industry where time is money.

Architects' time is reduced when they obtain input from the precast fabricators during a project's design phase, usually allowing the structural and precast design to take place simultaneously. The precasters' recommendations are a significant help in finding the most cost-effective ways to create desired design details. "Their input early on helped us control costs," says architect Marvin Coker with McMillan Smith & Partners of Spartanburg, S.C., referring to a recent high-school project in Greenville, S.C.

The need for rapid construction can be the decisive factor. Enclosing a school building with structural precast concrete sandwich wall panels speeds up the project by eliminating material needs, providing an already insulated component, and offering an interior finished wall.

An example can be seen in a recent school project in Mableton, Ga. "Thanks to precast wall panels, the school was completed in record time—a mere 14 weeks from groundbreaking to certificate of occupancy," says project architect Ron Talens with Perkins+Will Inc. in Atlanta, Ga. The precast concrete components were fabricated while the building site was being prepared. In addition to added constructability, sandwich wall panels' insulation between two wythes of concrete also provides thermal advantages, keeping schools warmer in the winter and cooler in the summer, producing energy savings.

Architects also benefit from precast concrete's design flexibility, which al-

Fact Sheet

Project: *Academy of World Languages*

Type: *Magnet elementary school*

Location: *Cincinnati, Ohio*

Designer: *McGill Smith Punshon, Cincinnati*

Engineer: *M-Engineering, Westerville, Ohio*

Contractor: *Monarch Construction, Cincinnati*

Owner: *Cincinnati Public Schools*

Precaster (wall panels): *High Concrete Group LLC, Denver, Pa.*

Precaster (interior precast concrete components): *Total Precast Solutions LLC, Fairfield, Ohio*

Size: *85,500 ft²*

Precast concrete components: *Sandwich wall panels, solid wall panels, hollowcore, interior load-bearing walls, stairs with landings*

Project cost: *$17.6 million*

Cast-in red tile on the classroom wing of the Academy of World Languages emphasizes the precast concrete panels' horizontal lines. Photo courtesy of McGill Smith Punshon.

Precast concrete insulated wall panels helped Imagine School's new Mableton, Ga., facility meet a tight deadline for the fall session. The building contains classrooms, an administration office, a media center, and a cafeteria/multipurpose room.

The precast concrete components can be fabricated while the building site is being prepared.

Fact Sheet

Project: *Imagine Schools*

Type: *Charter elementary school*

Location: *Mableton, Ga.*

Designer: *Perkins+Will, Atlanta, Ga.*

Engineer: *Uzun & Case Engineers, Atlanta*

Contractor: *Bouma Construction Co., Grand Rapids, Mich.*

Owner: *Imagine Schools School House, Arlington, S.C.*

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

Size: *41,000 ft²*

Precast concrete components: *Composite exterior wall panels*

Project cost: *$4.5 million*

lows them to create details that give a school building aesthetic appeal and help it relate to the surrounding community. "Precast provided aesthetic flexibility, giving our design team the ability to play with colors and textures," says Randy Merrill, principal with McGill Smith Punshon (MSP) in Cincinnati, Ohio. Mike Moose, design principal with Glaserworks, architects and urban designers in Cincinnati, agrees. "I've always liked precast, especially for its plasticity," he says.

Creating an International Look

The architects at MSP took advantage of precast concrete when they created the details on the Academy of World Languages, an 85,500 ft² K–8 magnet school in Cincinnati, where students learn Arabic, Russian, Japanese, and Chinese, as well as English as a second language. Their goal was to create a sleek, stylish international building that fit the school's mission, providing a welcome change from the undistinguished facility it replaced.

"We were able to obtain cost savings in precast fabrication through repetitive patterning," notes Merrill. Specifying precast concrete wall panels also enabled designers to incorporate details that contributed to the stylish look. Outside and in, the school features bright colors and dynamic patterns.

On the front facade, cast-in red tiles accentuate the structure's horizontal lines, which are enhanced by contrasting diagonal bands of sandblasted and retarded finishes. Double rows of blue tile on some classroom exteriors

emphasize the panels' vertical joints. Squares of set-in colored tile and prefinished red window frames add bright notes. The central gymnasium is clad in precast concrete panels with a retarded finish. High Concrete Group LLC, based in Denver, Pa., fabricated the precast concrete insulated sandwich wall panels in its Springboro, Ohio, plant, while Total Precast Solutions LLC in Fairfield, Ohio, supplied the interior components.

The structural panels provided additional benefits, eliminating the need for drywall and the dust associated with finishing it. "We had a clean building after enclosure," says Merrill. "The panels saved labor costs."

The school complex incorporates four building groups: the classrooms, the administration section, the library/media center, and the gym. A judicious use of scale and massing, with the bulk of the gym in the background, keeps the building's size from appearing overwhelming. In addition to the exterior precast wall panel system, precast concrete components included much of the remaining structural system, including hollow-core, interior load-bearing walls, and stairs with landings.

Competing with Masons

In Ohio, most public schools have featured block-and-brick facades because the Ohio School Facilities Commission did not approve the use of precast concrete until 2004. MSP de-

Precasters' recommendations are a significant help in learning the most cost-effective ways to create desired design details.

Fact Sheet

Project: *Fairview Clifton German Language School*

Type: *Magnet elementary school*

Location: *Cincinnati, Ohio*

Designer: *Glaserworks, Cincinnati*

Engineer: *M-Engineering Inc., Westerville, Ohio*

Contractor: *Turner Construction Co., Cincinnati*

Owner: *Cincinnati Public Schools*

Precaster (exterior wall panels): *High Concrete Group LLC, Denver, Pa.*

Precaster (interior precast concrete components): *Total Precast Solutions LLC, Fairfield, Ohio*

Size: *84,143 ft²*

Precast concrete components: *Structural sandwich wall panels, hollow-core, interior walls, stairs, beams*

Project cost: *$15.8 million*

After being erected, the precast concrete panels are braced during construction of the Fairview Clifton school. Photo courtesy of Glaserworks.

Fairview Clifton German Language School in Clifton, Ohio, features a nearly total-precast concrete structure due to the energy efficiency, speed of construction, and weather resistance that the material could provide.

Precast concrete sandwich wall panels were erected quickly at the J. L. Mann High School, helping to meet a tight budget. Photo courtesy of McMillan Smith & Partners.

Inset brick on precast concrete insulated wall panels allowed the J. L. Mann High School in Greenville, S.C., to retain a classical Southern appearance while offering 21st-century energy efficiency. Photo courtesy of McMillan Smith & Partners.

Fact Sheet

Project: *J. L. Mann High School*

Type: *Magnet high school*

Location: *Greenville, S.C.*

Designer: *McMillan Smith & Partners Architects, Spartanburg, S.C.*

Contractor: *B E & K Building Group, Greenville*

Owner: *School District of Greenville County*

Precaster: *Metromont Corp., Greenville*

Size: *248,000 ft²*

Precast concrete components: *Load-bearing wall panels and non-load-bearing wall panels*

Project cost: *$31.4 million*

signed the first total-precast elementary school in Ohio, Roberts Paideia Academy, which opened in 2007 in Cincinnati. (For details, see the Winter 2008 issue.) "I was pleased to be able to use precast again, because Roberts Academy has been a great success," says Merrill.

Another nearby example is the Fairview Clifton German Language School in Clifton, Ohio, a Cincinnati suburb. The 84,143 ft² school was constructed using almost entirely precast concrete components, except for the use of steel joists over the gym and cafeteria. The architects at Glaserworks specified precast concrete because masons in the area were busy and prices were rising.

"A precast concrete building will be more energy efficient and weather resistant than one with traditional masonry," says Glaserworks' Moose. "Additionally, by using precast, we were able to shorten the construction schedule by a month." High Concrete Group and Total Precast Solutions also supplied the precast concrete components for this project.

Enjoying an excellent scholastic reputation since its founding in 1974, the Fairview Clifton German Language School is a magnet school for 650 students in pre-K through 6th grade. It was one of the first schools in the country to immerse primary students in the German language.

Situated on a knoll, the architects designed an L-shaped facility with classical proportions, giving the building a presence appropriate to its civic importance, Moose noted. They also wanted to relate it to two other nearby buildings. A stone carriage house located at a right angle to the new school forms one side of a courtyard, while a 1905 school building is located across the street. The community plans to develop the carriage house into a cultural arts center, which will share its performance space with the school.

The school building features a one-story commons wing and a three-story classroom wing. The commons contains the gym, media center, art and music rooms, the cafeteria, and administration offices. Structural pre-

cast concrete sandwich panels designed to an 8 ft 8 in. module are used to enclose the building. The panels are 11 in. thick, with the tallest ones measuring 39 ft high. The precaster used 219 high-performance insulated wall panels.

The panels feature 2 to 2.5 in. of insulation between two concrete wythes connected with carbon-fiber trusses that transfer in-plane shear forces and allow both concrete wythes to be load bearing. The 100% structurally composite panels, which are thinner than block-and-brick and noncomposite designs, are thermally efficient and prevent thermal bridging. The insulated wall panels keep occupants comfortable year round and provide expected energy savings over the life of the school.

Three finishes were specified for the panels' exterior surfaces. Gray concrete echoes the stone on the adjacent carriage house, and yellow thin-set brick replicates the color of the brick on the nearby 1905 school building. A dark band, using a black aggregate in the concrete, anchors the building to the ground.

"The precasters were a great help during the design process," says Moose. "They assisted in the detailing of the panels, making them easy and economical to fabricate. They also produced mock-up panels to show us possible colors and finishes."

Meeting the Deadline

When faced with a tight completion deadline, designers often find that precast concrete components are the only option available. For example, block and brick were originally considered for the exterior of the new 41,000 ft² charter elementary school in Mableton, Ga., owned by Imagine Schools. The elementary school for grades K through 5 is the first phase of a master plan still under way. The new building contains classrooms, an administration office, a media center, and a cafeteria/multipurpose room.

However, during the design phase, it became apparent that school could not be finished by the deadline using these materials. Groundbreaking had taken place in May 2007, and the school had to be ready for classes in the fall. Enclosing the school with composite precast concrete wall panels made it possible to obtain a certificate of occupancy by August 1.

"One major element in expediting the erection of the building was the use of structural precast panels on the exterior," says project architect and designer Ron Talens. "The rapid erection of the wall system allowed the building to be quickly enclosed, so interior construction could take place." Typical panels, which were produced by Metromont Corp. at its Hiram, Ga., plant, are 12 ft wide by 35 ft high; the interior insulation layer provides an R-value of 11.

The precast wall panel system provided an additional benefit, notes Talens. The minimal joints in the concrete panels prevent water penetration, which is particularly important in the South. The panels also eliminated the need for drywall on the interior side, which is a potential food source for mildew and mold. Portions of the exterior walls were painted red to add visual interest, and the balance of the building was coated in white.

Quick Brick Solution

The J. L. Mann magnet high school in Greenville, S.C., offers a program concentrating on math and science and also provides an environment responsive to the district's physically handicapped students. It has enjoyed a reputation of being one of South Carolina's premier high schools, with 86% of the students advancing to college. But the existing school facility was badly outdated and overcrowded.

Before designing the new school, architects at McMillan Smith & Partners received a good deal of input from the school district and neighboring businesses and residents. The consensus was that the 248,000 ft² school for 1500 students should have a classical Southern appearance. Usually, this would lead to a brick exterior, but masonry construction was incompatible with the school's aggressive construction schedule.

> 'One major element in expediting the erection of the building was the use of structural precast panels on the exterior.'

Precast sandwich wall panels with thin-set brick contributed to the desired look while helping to speed up the building's completion, which was finished six months sooner than originally estimated. Precast concrete column covers added to the building's traditional look. Metromont also supplied the precast components for this project.

The gym and auditorium, which form the core of the building, are masonry block on a steel structure. Erected on steel framing, the precast concrete wall panels enclosing the rest of the building offer a combination of cast-in thin-brick veneer and a sandblasted pigmented concrete. Insulation is incorporated between the exterior and interior wythes of concrete. The interior concrete wythe includes cast-in conduit for wiring and a steel-trowel finish that is paint ready.

"Although the school district did not actively pursue LEED certification, an important goal of the building program was to create an energy-efficient building that would meet many of the sustainable criteria necessary for certification," says Marvin Coker, project designer and manager.

Specifying precast concrete ensured use of local and regional materials and recycled content, including brick formliners and fly ash. Specifying 5/8-in.-thick brick veneer instead of 3 5/8-in. full-brick veneer translated into an 80% reduction in energy expended for mining, kiln firing, and transportation costs. All precast concrete components were manufactured off-site in a controlled environment, resulting in less disruption on the jobsite and a minimum of waste materials.

Several of the architects who designed the schools described here indicated that LEED certification could have been fairly easily achieved because of their extensive use of precast concrete, which makes it possible to meet so many of the required criteria for a creating a green building. In one case, only more energy-efficient windows would have been needed. But school budgets usually are very tight, and the school districts involved did not want to seek such certification.

Even so, the architects were enthusiastic about the advantages precast concrete offers and see its expanded use as the wave of the future. "You can do a lot of wonderful things with precast," Merrill says. "I am looking forward to using it again soon." ■

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