

Innovative COLLABORATION

Meeting evolving programming needs, tight budgets, and fast schedules keeps LS3P's K-12 designs on the cutting edge of design for administrators, teachers, and students

— Craig A. Shutt





The Richland Two Institute of Innovation (R2i2) in Columbia, S.C., pulls students from five district high schools for specialized courses. LS3P incorporated some of the latest concepts in K-12 school design, including collaborative spaces, flexible classroom use, and high energy efficiency. All photos: LS3P.



Designers need to meet a wider range of challenges with K-12 schools today, as districts find better ways to reach their students with curricula suited both to their futures and to the varied ways in which they learn best. Rapidly evolving technology options, along with higher security demands and other trends, also impact concepts. LS3P meets those needs with cutting-edge designs that other designers and administrators look to adapt for their own programs.

R2i2 PULLOUT SCHOOL

The most exciting of these is the Richland Two Institute of Innovation (R2i2) in Columbia, S.C., which opened in the fall of 2016. The 215,000-ft² building pulls students from five district high schools for specialized courses. Classes focus on science, technology, engineering, and math (STEM) courses for college-prep students and specialized career and technical education (CTE) programs. The latter encompasses courses in designing apps, installing solar panels, food-truck management, robotics, and others.

A number of these classes include local business partners, such as Boeing, as well as input from the University of South Carolina and Midlands Technical College. “The goal is to expose students to every opportunity possible and give them real-world projects that help prepare them for the working world,” explains Allen Taylor, Capital Studio leader and operations and finance manager for LS3P’s Columbia office.

“We went to local businesses and asked what skills were missing from applicants they reviewed, and the school built its curriculum to include their responses. Graduates are confident they can move on to college or into jobs and be prepared.”

The school includes 185 offices for district personnel and the school board, an 800-seat conference center (often rented to community groups), and a 30,000-ft² relocated branch of the Richland County Library. The school provides class space for up to 800 students, with juniors and seniors in the district currently using the facility.

“The combination of facilities in this model is unique in the country,” says Mary Beth Sims Branham, vice president, principal, and leader of the Columbia office since it opened in 2004. “We’ve never seen anything like it.” The goal was to design a “fishbowl of learning,” in which students, administrators, community members, and business leaders share space and focus on new learning approaches.

Administrators and designers around the country haven’t seen its like, either. Many have visited to see how the spaces are used. “They want to emulate parts if not all of it,” says Taylor. “They’re intrigued by the pull-out concept and want to see if there are ideas they can incorporate into their school programs.”

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At the building's core is the Open Project Area and classrooms, including outdoor spaces with overhangs to provide weather protection. The two-story space features a flexible, durable envelope with large roll-up doors that provide access for delivery of large equipment. The space was built with a total-precast concrete structural framing system, consisting of wall panels and double tees, with a perimeter second level for more classrooms.

Precast concrete slabs created stairs at the auditorium, which also are used in projects. "We wanted to create a variety of options to match the learning techniques that students need today," says Branham.

The precast concrete design offered great flexibility, which was critical, as the designers didn't know how the spaces would be used when they planned them. "The district's vision to us didn't specify programming, as they didn't know what would be the hot topics," says Taylor. "We used precast concrete to provide a flexible infrastructure to accommodate whatever came up."

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The school includes stair systems built with precast concrete that not only provide easy access but can be incorporated into school lessons.

MORE COLLABORATION

Creating flexible spaces in which community groups can help students collaborate on projects has become a key trend with schools today, says Branham. "There is more collaborating among students and fewer times a teacher stands at the front of class lecturing to students at desks," she says. "The new model stresses open-learning areas for hands-on instruction, with more collaboration and adaptability. Each class uses different spaces geared to their lessons. That's changed the entire design concept for the school."

A key portion of the R2i2 school is the Open Project Area that focuses on science, technology, engineering, and math college-prep classes and specialized career and technical education programs. It was constructed with architectural precast concrete panels and a total-precast concrete structural framing system.



Rather than each teacher having a classroom that students visit each period, teachers have a work space and hold classes in rooms geared to their specific requirements that day, explains Marques Moore, an associate in the Charlotte, N.C., office who specializes in K-12 projects. “It’s similar to a college professor, who has his own office yet teaches in a different room.”

The spaces designed to handle these changes have necessarily evolved, too. Where once designers created large rooms with accordion-like dividers, new concepts have arisen. “We limit that approach due to the amount of annual maintenance those walls require,” Moore explains. Instead, designers created classrooms of varying sizes to allow teachers to gather several classes or teach a small group. Furniture also adapts so groupings are customized.

These collaborative approaches have been developing for a decade, Branham notes, but they don’t arise automatically. “They represent an idealistic view of how teaching should change to adapt to students, who learn in different ways, especially now that we have technologies that can aid those changes.”

Collaborative learning is gaining adherents, but there has to be buy-in from educators, says Eric Aichele, principal in LS3P’s Charleston, S.C., office and a designer on many of the firm’s K-12 school projects. “Some schools have tried it and it wasn’t successful,” he notes. In part, that happens because the facilities aren’t geared to it, which hinders teachers making it work. “You need both the teachers’ support and the facilities to make it successful.”

R2i2’s features benefit teachers, which aides learning—and helps recruitment. The school’s 800-seat conference room serves as a professional-development center for teachers, alleviating the need to rent outside spaces. “It provides an excellent recruiting tool for teachers and administrators,” says Branham. “It also attracts community and business partners, who want input with the future workforce.”

Flexibility is especially vital when addressing technology issues. “Technology is advancing faster than we can design to it,” says Moore. Often, technology packages are released no more than one year ahead of opening and often only six months. With schools often taking four or five years from design concept to grand opening, that’s the only approach that works. “We’re encouraged to wait because the technological costs go down while the systems get better.”

SPEED BECOMES ESSENTIAL

Another key trend has been the speed with which stakeholders want the schools built, which runs up against the stringent permitting process. “The bureaucratic process to get a school designed and constructed takes longer than stakeholders desire,” says Moore. “The regulatory process involves much red tape that at times results in a more aggressive construction schedule to open the school in time.”

Designers must then avoid the temptation to cut corners to meet their deadline—which is typically the new school year, which can’t be missed. “You can’t rush good design or good quality construction,” Moore stresses. “We’re tasked to be creative to meet the schedule and budget demands, be it through alternative delivery methods or innovative construction techniques. It’s an inherent challenge in public projects.”

In many cases, precast concrete architectural panels and structural framing help to meet these demands. They provide the aesthetic appearance administrators seek while providing a panelized system that encloses the building quickly while minimizing long-term maintenance needs. Off-site prefabrication allows structural systems to be cast while permitting and site work are underway, allowing the framing system to be erected as soon as possible.



The precast concrete structural system allows the Open Project Area in R2i2 to include open spaces that create large collaboration spaces and the capability to bring in large equipment for various classes, including full food trucks, manufacturing equipment, and robotics.



The total—precast concrete framing system for West Cabarrus High School in Concord, N.C., will provide open space for added flexibility in the school.

WEST CABARRUS HIGH SCHOOL

Schedule demands led LS3P architects to specify architectural precast concrete panels and a precast concrete framing system for the new West Cabarrus High School now under construction in Concord, N.C. The 300,000-ft² school, with a capacity of 1850 students, was designed with three distinct building systems, including precast concrete for the main academic building.

The school incorporates 21st-century educational models, with strategically placed collaborative learning areas, flexible classrooms, and flexible teaching stations. “This educational model aims to achieve a higher utilization rate through philosophical design principles,” Moore says.

The load-bearing precast concrete wall panels feature 4 in. of insulation sandwiched between two 3-in. concrete wythes that attach to the floor slabs and support double tees for the structural framing. “The structural characteristics are comparable to a parking deck, just a very aesthetically pleasing one,” Moore says.

LS3P chose precast concrete for the new school in response to the local labor market, he explains. “There are real labor shortages of steel erectors and masons. We knew we needed an innovative construction method to maintain the fast schedule and deliver a high-performing building. The precast concrete design achieves those goals.”

The three distinct building sections of masonry, steel, and precast concrete were erected simultaneously, with all trades working on the site at once. That also ensured the school could open even if something fell behind. “We anticipated the three-story classroom portion would go up quickly with precast concrete, so the classrooms would get dried in quickly,” he explains. “So we could be assured classes could begin even if the auditorium wasn’t completed in time.”

PRECAST’S KIT OF PARTS

Precast concrete’s flexibility as a “kit of parts” can help the pieces in the design jigsaw come together more quickly than with other materials, fitting a tight schedule. That concept helped LS3P create two high schools for the Charlotte-Mecklenburg school district in Charlotte, N.C., one after the other, two years apart. The 300,000-ft² Ardrey Kell High School came first, encompassing classrooms, science and technology labs, an auditorium, gymnasium, cafeteria, media center, and offices to serve 2000 students.



Now under construction, West Cabarrus High School in Concord, N.C., features architectural precast concrete panels and a precast concrete framing system for its classroom sections. Precast concrete’s capability to meet the project’s schedule was a key factor in its specification.

It was built with load-bearing insulated precast concrete wall panels along with double tees and flooring slabs. The panels were 11 in. thick, comprising 5 in. of insulation sandwiched between two 3-in. wythes of concrete. Typically 12 ft wide and 45 ft high, the panels feature reveals and a combination of light, medium, and heavy sandblasting finishes to provide a variety of textures. The interior wythe was provided with a smooth finish and painted.

"The district ranks among the top 20 public school districts in the country, and administrators are always looking for creative ways to meet the challenges of building new schools," explains Scott Dodrill, an architect in LS3P's Charlotte office who worked on the projects. "They knew they would need two schools in rapid succession, and they chose a precast design to help with construction speed and budgeting."

The school served as a prototype for the Mallard Creek High School, built two years later. The 306,000-ft² school includes

classrooms, offices, media center, gymnasium, practice gymnasium, and other facilities to serve 2000 students. The precast concrete-clad layout was reused in adapted form.

"We had various precast concrete rectangles that fit together in new ways to accommodate the site variances," explains

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Roger Attanasio, an architect in the Charlotte office and construction administrator for the projects. "The schools had the same requirements but needed adaptations to fit their locations. It was an interesting design challenge to put the same components together in different ways to create another efficient plan."

The second school's construction moved more efficiently thanks to lessons learned on the earlier project, he notes. "We learned

how to detail the connections and coordinate the construction on the Ardrey Kell project, so Mallard Creek came together even smoother, providing an added benefit."

LS3P's design for Ardrey Kell High School served as a prototype for other schools and was reused two years later for the Mallard Creek High School. The 306,000-ft² school, which serves 2000 students, features a precast concrete structural system with adaptations to its site.



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The interior side of load-bearing insulated precast concrete panels used on Ardrey Kell High School were cast with a smooth finish and painted after being installed.

SECURITY CONCERNS GROW

Precast concrete also is helping with another key topic for schools today: security. "Security is a hot button issue since the Sandy Hook shooting" in 2012, Moore says. "School facilities need to be aesthetically pleasing but also secure. They can't look like a prison, but they need the security of one. We need to devise ways to secure the building while giving it a welcoming appearance for students."

Precast concrete panels, used both inside and out, can help achieve that, along with new design principles, he notes. Generally, that means allowing one or two entrances with additional exit points for safety. "We often design two ways in and 15 ways out," Moore says. A typical design includes a secured vestibule as a first access point with administrative offices nearby to vet visitors.

Schools also are designed with more straight lines rather than angled corridors. "We want two administrators to be able to secure 100,000 ft² with clear sight lines and no hidden corners," he explains. That also leads to limiting interior glass, especially in classrooms, to hide occupancy. Designs also are limiting campus layouts and creating more compact, secured buildings with an interior courtyard.

BRICK APPEARANCE DOMINATES

Maintaining that welcoming appearance often results in a masonry or brick appearance which many communities associate with school buildings. "Administrators love red brick," says Moore. "It's a traditional look that people associate with a learning environment." Studies have shown that elementary school children especially expect their school to have red brick, he notes.



"Think of the Three Little Pigs: brick means safety to kids, and when you ask children to draw a school, they draw a red square with a triangular roof." At the high school level, there is more leeway to use other materials. "We like using precast concrete panels because they can provide that traditional appearance, but they also offer efficiency of design and construction."

West Cabarrus High features panels with inset thin brick as accents highlighting several finishes of buff-colored precast concrete. The other segments feature colorful metal panel insets and glass to add a high-tech appearance.

"Precast concrete is an easy sell for the exterior appearance to most administrators if we can show that it reduces costs and scheduling," says Moore. "Those are key priorities: First, does it fit the budget and meet the schedule, and then does it look like a school? If it meets all three criteria, you're golden."

Administrators want to reassure parents, students, and other stakeholders, but they also want to express that they are using contemporary teaching methods. Typically, LS3P presents three aesthetic options: a traditional look, a modern look, and a combination. "They usually choose the combination."

The precast concrete envelope added further benefits at R2i2. "We needed a durable, high-bay space, and we realized we could use precast concrete as a teaching tool as well," says Taylor. The framing is exposed, with each mechanical system color-coded to allow students to see how they run through precast concrete shear walls and other materials. "Keeping the panels exposed allows students to see the concrete and see the connections and how it all fits together."

ENERGY EFFICIENCY GROWS

Schools continue to pay attention to sustainability, both to keep budgets under control and to serve as another teaching tool for students. R2i2 not only features an array of solar panels on its roof, but it has a second array installed on the ground so students can study it more closely.

"Energy efficiency is a key goal today," says Branham. R2i2 was built in accordance with the Green Globes online assessment protocol, rating system, and guidance program. Many other schools are either certified as LEED projects or follow those guidelines.

LS3P has completed more than 14 million ft² of green projects, with a substantial percentage of its designers LEED- and/or Green Globes-accredited. The firm regularly is listed among Engineering News-Record's "Top 100 Green Design Firms."



Mallard Creek High School took the basic "rectangles" used to assemble functional areas for the earlier Ardrey Kell High School and fitted them together in a different format to meet the needs of the site.

LS3P's Strategic Expansions

LS3P was founded by Frank Lucas in a one-room office in Charleston, S.C., in 1963. The firm became Lucas & Stubbs the next year when Sidney Stubbs, a Clemson classmate, joined. Their signature project was the Municipal Auditorium & Exhibition Hall for Charleston, which they were awarded in a design competition.

By 1982, new partners comprised Vito Pascullis, Richard Powell, and Thompson E. Penny, adding their names to the firm's title. It was shortened to LS3P in 1991. In 1999, LS3P merged with TBA2 Associates in Charlotte, N.C., and in 2004, it opened an office in Columbia, S.C. In 2005, it merged with Boney Architects, with offices in Wilmington, N.C., and Raleigh, N.C. Another merger in 2011 and two more in 2016 further strengthened the firm's expertise and expanded its reach.

LS3P now has more than 300 employees in eight offices in three states. Its major practice areas comprise K-12 schools, higher education, offices, healthcare, aviation and transportation, hospitality, worship, federal projects, and residential.



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"Energy efficiency is an area that administrators are keen on attacking," says Aichele. "But it can be hard to fit it into the development budget, which is separate from the operations budget. They realize that if they spend more money early it will save them much more down the road, but those funds take away from something else." At the same time, he notes, they realize that saving money on operating funds every year means those annual funds can be shifted elsewhere, too.

"Some are more into finding ways to fit it into the budget than others, but everyone is aware of the value of not wasting energy. Energy codes force them into some parameters, and some take it further. The level of efficiency varies right now, but once new techniques become more prevalent and the benefits are seen, more districts will put money into their development budgets for it."

Another reason administrators like precast concrete panels, he notes, is because their low maintenance keeps annual budgets low. "They're very sensitive to where their operating budgets go, and they appreciate that precast concrete offers a durable material inside and out that takes little maintenance. We sometimes limit the palette we use to aid maintenance needs and save costs, but you can see the benefits that precast offers on older buildings that still look good."

Administrators also see the value in sustainable designs, Moore notes, as they can mean lower operating costs. "Schools that are more sustainable are healthier, more efficient, and more conducive to learning," says Aichele. Research shows factors such as better

indoor air quality, increased natural light, better temperature control, and improved acoustics are linked to higher student attendance and achievement. Sustainable designs can decrease operational costs, increase attendance for both students and teachers, and increase the quantity and quality of learning that takes place.

"They're tied together, but it can be difficult to get past bottom-line needs," Aichele says. LS3P designers focus especially on finding

ways to reduce HVAC needs, through insulation and other efficiencies, such as motion sensors.

"Our goal is always to avoid conditioning and lighting unoccupied space."

The Ardrey Kell Road and Mallard Creek High Schools incorporate a variety of sustainable techniques, including site design, water

efficiency, recycled materials and resource selection, daylighting efficiency, energy use and recovery, and indoor environmental quality.

Anticipating new technologies and new teaching methods will remain key challenges. But with input from all stakeholders and years of experience, LS3P is positioned to meet evolving needs. "Single-use facilities work well for some functions," says Branham. "In our rapidly changing world, however, success depends on collaboration, real-time communication, and connection. The innovative new model for educational facilities represented by R2i2 demonstrates that multidisciplinary partnerships can help us bridge academia and business, create a nexus of opportunity, serve a diverse community, and build a catalyst for meaningful change."

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