



Fisher Middle School in Greenville, S.C., features a STEAM (science, technology, engineering, arts, and math)-based curriculum. The building features a precast concrete façade with sunshades and large expanses of glass. The precast concrete panels support the oversized windows, delivering natural light into the labs and classrooms. Photo: George Spence, Metromont Corporation.

OUTLOOK ON K-12 CONSTRUCTION

Panel of experts addresses energy efficiency, safety, and speed of construction as they look to the future of this segment.

To gain perspective on how school construction is evolving, we asked a panel of experts who have been involved with thousands of school projects about the future of K-12 school construction. Our contributors:

Bill Clark, principal, Stevens & Wilkinson, Atlanta, Ga. Stevens & Wilkinson celebrates its 100th anniversary next year and the education market has been a core part of its practice since the 1950s. Clark is president of the Atlanta office and has over 37 years of architectural experience.

George Spence, sales and business development manager, Metromont Corporation, Greenville, S.C. Metromont has completed more than 100 precast concrete construction projects for schools in the last 20 years. Spence has been with Metromont for 21 years; prior to that he owned an architectural precast concrete company.

Patrick Glenn, managing principal, Glenn|Partners, Dallas, Tex. Glenn|Partners' core experience and passion is for K-12 education. Glenn has published numerous articles on school design, including "Designing Schools for a Changing Future," in the summer 2011 issue of *Ascent*, and "Integration by Compaction and Subtraction Fostering Blended Work-Sharing Environments in Next-Generation Schools," in the May 2018 issue of *School Planning & Management*.

HOW HAS K-12 SCHOOL CONSTRUCTION EVOLVED OVER THE LAST 20 YEARS?

Clark: I think we are seeing a lot more emphasis on energy efficiency. We are being smarter about project budgets as well as integrating sustainability. Going forward, classrooms and support spaces will be laid out with even more emphasis on transparency and glass. It is no longer the traditional 30-child classroom, but reflects a variety of teaching spaces that accommodate how children learn.

The structure itself has evolved from the traditional school house. In urban Atlanta, the cost of land has driven an increase in vertical construction. That changes the game. From typical load-bearing walls, we now see steel frame and some precast, which changes the dynamic. Outside of the urban core, we still see schools using brick and block. In those suburban districts, where land is relatively inexpensive, schools tend to have more traditional layout.

Spence: Although total-precast schools date back at least to the 1970s, the idea didn't catch on until about 2000. One of the factors that reintroduced precast into the K-12 market was large building programs financed by special tax referendums, creating demands for masons that could not be supported by the regional labor pools. For example, the Greenville County, S.C., school system specified that half of the schools in one of its accelerated building programs would be designed total-precast for this reason. Another important factor was the introduction of high-quality insulated wall panels, like the Carbon Cast C-Grid panel. This design allowed designers to make the walls load-bearing with an *R*-value that exceeded the energy code and could be installed with an architectural finish on the face side and hard-troweled on the back, ready to paint. A complete wall system in one unit. The availability of precast brick veneer was a plus for K-12 design because many decision-makers have a "red brick school house" mentality and want a brick finish.

Glenn: Specific to the Midwest, building codes now require schools to include tornado shelters. The 2015 IBC (International Building Code) and ICC (International Code Council Standard) 500-2014 require new K-12 construction to withstand an EF [Enhanced Fujita scale] 5 tornado (250 mph winds) if located within specific wind speed maps. Any new school has to implement this storm shelter requirement. New construction or additions also have to comply. In some municipalities, the storm shelter has to accommodate the maximum number of students on campus. There are only so many methods that you can employ to meet those requirements. Precast is one method, but most commonly we see schools using CIP [cast-in-place], CMU [concrete masonry units], or ICF [insulating concrete forms] for storm shelters. With precast construction, there are some coordination and timing challenges when it comes to the integration of building systems and infrastructure. The time needed to get these elements right in the shop is precious time needed by the contractor on-site. One other trend is buildings being healthier and a little more conscious of selecting healthy building materials. This is not new, but it is an influence, but certainly not as big of a factor as the storm shelter requirement we are seeing today.



J.J. Pearce High School in Richardson, Tex., embraces a collaborative learning environment. Photo: Glenn|Partners and Pixelhead.



In Dallas, Tex., the Alcuin School West Campus features collaborative areas distributed throughout the facility, encouraging student engagement and group projects. Photo: Glenn|Partners and Charles Davis Smith Photography.

The main interior academic corridor at Cristo Rey Dallas College Prep in Dallas, Tex., is filled with natural light through a raised roof area with north-facing clerestory windows. Photo: Glenn|Partners and Charles Davis Smith Photography.

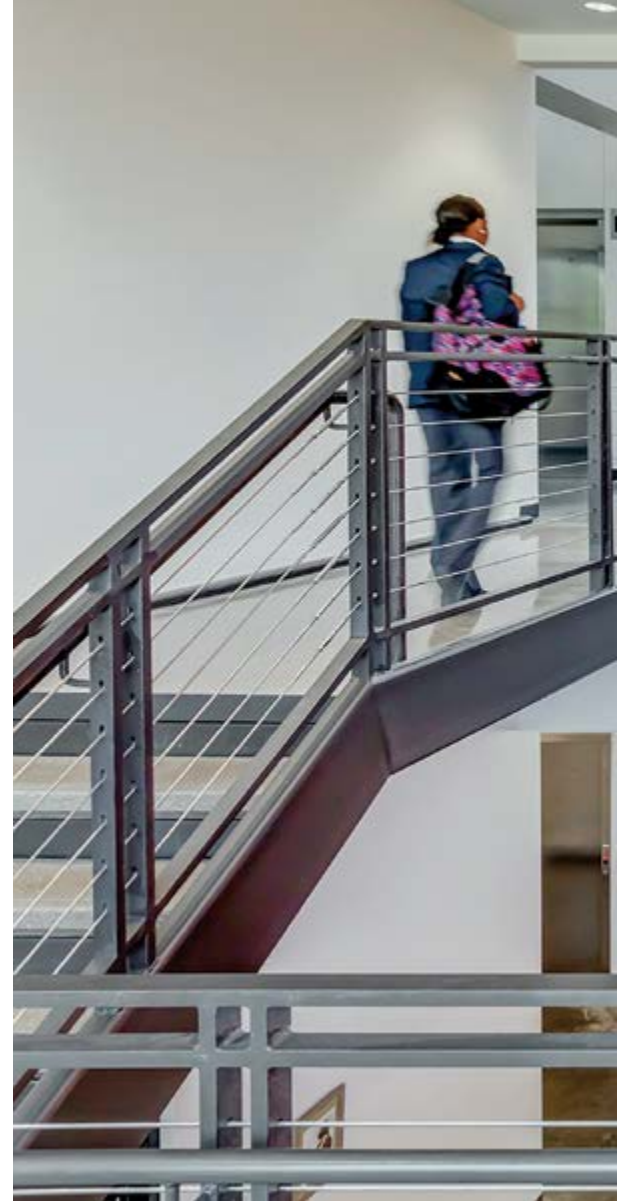
WHAT DO YOU EXPECT TO OCCUR IN THE NEXT 20 YEARS?

Clark: I would expect a continued trend toward transparency and flexible and varied learning environments. High efficiency and daylighting have proven to be positive impacts on teachers and students, which I see continuing. The whole industry is going to have to go to the next level with how we approach design and construction. With the commoditization of our services and cost/budget pressure, how can we be innovative? We need a holistic approach to the K-12 structure. When we consider a precast solution, it is not just the façade. We would like to test how a total–precast approach, including HVAC [heating, ventilation, and air conditioning] systems, can be taken to the next level. I think that is the future, and if we are not doing that we are not going to be viable.

Spence: The future for total–precast K-12 construction looks bright in the coming years. Precast will not replace traditional brick and block cavity wall construction, but it will become more popular because of reduced on-site labor, speed of construction, and its advantage of building on tight jobsites. Furthermore, precast construction is more cost-effective relative to brick and block in taller school structures. The trend in urban areas is to build multistory schools.

Glenn: It is hard to tell where school construction is headed. As a practice, our focus is primarily on the design of K-12 facilities, but we do pay attention to other markets. We are seeing a lot of design-build in other markets, but not much in the K-12 world. It might trend toward a more integrated project delivery, where you get away from traditional design-bid-build. Building information modeling (BIM), such as Revit®, also continues to play an important role in sharing models to design and build the school. Revit will continue to play a big part in school construction.

Regarding school design, we are seeing a major shift away from a typical double-loaded corridor with classrooms on either side. Open spaces are being integrated back into the classroom designs, but we are not going back to the 1970s open plan. I am seeing classrooms evolving and being designed in a slightly different way. We are seeing medium, small, and private study areas that are being integrated into the plan. Students are using those spaces to learn, collaborate, do research, and to present. Millennials have influenced the way office layout is being designed, and that will trickle down to K-12. At work we are getting away from cubicles and private offices and moving to open, huddle, and collaborative spaces. Schools are going in that same direction. Many of the tangible benefits in support of collaboration, critical thinking, knowledge share, and communication begin to cross over in similar environments for schools.



St. Mary of Carmel Catholic School in Dallas, Tex., provides a new outlook on education for pre-K through eighth-grade students. Photo: Glenn|Partners and Charles Davis Smith Photography.



The addition to Wheeler High School in Marietta, Ga., was funded by the Cobb County SPLOST (special purpose local option sales tax) program. SPLOST is an optional 1% county sales tax used to fund capital outlay projects proposed by the county. Photo: George Spence, Metromont Corporation.

HOW DOES K-12 FUNDING AFFECT CONSTRUCTION DECISIONS AND THE USE OF PRECAST CONCRETE?

Clark: If we can hang on to the 1% Georgia sales tax for education, that would be a great help. Then it is up to us to maximize the use of those funds. The fluctuating economy makes it important to be creative. Other states have more pressure to find funding, which makes it even more critical.

Spence: As mentioned above, more and more school systems are financing new construction with large five-year blocks of tax revenue voted in by local referendums. This results in five-year plans and construction cycles.

Glenn: Public schools traditionally depend on bond referendums to pay for construction. In the private school world they rely on private donations. I don't see a lot of precast in schools in the Dallas/Fort Worth area. There is so much volume of school construction around the state of Texas where architects and contractors might influence school districts to rely on fast, tried-and-true traditional design. Construction costs have almost doubled in the past few years, which causes school districts to barely keep up with the pace of those escalations. It would be a hard sell to consider a premium cost for precast concrete.

IS IT MORE DIFFICULT TO MAKE THE LIFE CYCLE COST ANALYSIS ARGUMENT?

Clark: Extremely difficult, since it is a challenge to get past first cost. Some schools recognize the importance of maintenance in their budget. Some schools have incorporated Energy Star. But some school districts can't look past first cost, given the limited funds available. We face that pressure every day.

Spence: I don't think so. The operations and facilities managers in large school systems are very sensitive to life cycle costs and generally appreciate the contributions of total-precast to reducing life cycle costs.

Glenn: We have had trouble; for example, some school districts have tried geothermal systems, which cost more up front to install, but now we are observing a struggle getting past that first up-front cost premium hurdle. It is hard to consider paying that premium. However, there are some "Robin Hood" school districts: because of their financial situation, that have to share their maintenance and operational dollars with neighboring districts. In that situation they might consider higher up-front costs to lower long-term operational and maintenance dollars that might be lost to other districts.

DOES PRECAST CONCRETE MEET RESISTANCE IN THIS SEGMENT, AND HOW CAN THAT BE OVERCOME?

Clark: Some people still have an outdated impression of precast as gray concrete for structural purposes, like a parking deck. I think that is starting to change. We have used precast in other markets that incorporated other materials cast in, like brick and stone. Opinions are changing, and some architects are ahead of the curve, while others stick to the tried and true, especially with conservative owners in the K-12 market.

Spence: There is certainly much inertia in the school system management. They are conservative and accept changes slowly. And some will never change. We'll have to wait until those guys retire. But the track record of total-precast schools over the last 20 years is impressive and most facility planners are aware of and acceptable to the idea of total-precast designs.

Glenn: I don't know how to overcome that resistance. As the marketplace slowly moves toward more collaborative design-build, then contractors and subs can bring the benefits of precast to the table. It is difficult to promote precast to the owner when we don't have extensive experience with it in K-12 or due to the higher premium in cost.

Tucker High School in Tucker, Ga., used insulated wall panels that incorporate thin brick veneer and light sandblast areas to mimic limestone. Photo: George Spence, Metromont Corporation.





At Tucker High School, the stone veneer at the bottom of the media center is granite hand-set in the precast concrete panels. Photo: George Spence, Metromont Corporation.

WHAT ROLE IS SAFETY PLAYING IN CONSTRUCTION DECISIONS, FROM STORMS TO SHOOTINGS?

Clark: It has obviously changed our approach to design and we are working with safety consultants for advice. The focus is on safe zones and hardened areas where children and faculty can go in a crisis. A lot of it is technology, and it is also reflected in the changing building codes with relation to wind loads (tornado, hurricane). When it comes to school safety, it is evolving quickly, and we need to come up with secure safe zones that serve dual purposes.

Spence: It is generally accepted that total-precast design is much more resistant to high winds (tornados, hurricanes, thunderstorms) than conventional construction, more fire-resistant, and has excellent impact resistance including for blast and gunfire. But I haven't seen many cases where these attributes were the determining factor. Some tornado-prone systems in my market area have directed portions of the campus (like gyms) to be constructed with total-precast that is designated as a "safe shelter" in case of storms.

Glenn: I think student safety is a hot topic. Most schools in Texas have secure vestibules where you check in to the office before being granted access. That thinking might be a little outdated, because you are allowing the potential intruder to get through the first set of doors. We might need to think beyond that and not permit them access to campus. Perimeter security might need to be considered rather than just the building. For example, precast bollards out front to prevent vehicles from entering, or sawtooth design footprint would minimize exposure. Designers and architects need to consider pushing intruders to the edge of the property.

WHAT ROLE IS THE LABOR SHORTAGE PLAYING IN SCHOOL CONSTRUCTION?

Clark: It does have an impact. We are seeing elevated prices because of the volume of work. Subs can pick and choose which project they would like to work on. It does put additional price pressure on school projects. GCs are on the front line, and they do their best to advise owners as to real costs.

Spence: The shortage of skilled labor, in particular masons, has had an increasing impact on the delivery system selections. Most contractors today prefer any system of construction that moves labor off the jobsite and to a plant that can operate in all weather. This message is getting through to school facility people and school designers and will result in increased demand for total-precast in the K-12 market and all other construction markets.

Glenn: I see a big labor shortage here in Texas. We have been overwhelmed with construction these past five years, and will probably continue for the next five years. Skilled labor in particular is in short supply, but there are plenty of day laborers. Perhaps the precast industry could take advantage of that lack of skilled craftsmen.



The construction team tried to minimize the impact and focused on the safety of staff and students during the construction of an addition to Wheeler High School.
Photo: George Spence, Metromont Corporation.

DO THE PARTIES (ARCHITECT, ENGINEER, GENERAL CONTRACTOR, PRECASTER) COLLABORATE ON THESE PROJECTS?

Clark: Not so much. We would love to do true integrated design delivery for K-12. The closest we get to that is CMAR (construction manager at risk). We would love to do more collaboration and design-assist with contractors and subs early on in the design process, but typically we see design-bid-build on public projects. If legislators and school districts could embrace CMAR or design-assist, we would achieve better results. In many districts, it is hard to get past that contractually.

Spence: It is always better when we all work as a team, but that's not the usual case. So, one of our marketing efforts is to educate the architects (namely with lunch-and-learn presentations) on the advantages of total-precast. And that effort extends up the line to the school system decision-makers. The contractors and engineers are usually pro-precast and help promote precast design.

Glenn: There are two main delivery methods that we see here in Texas. Fifty percent is CSP (competitive sealed proposal), which is your typical design-bid-build. The other half is CMAR. CMAR is up for debate as to whether the owner is getting the best value. CMs bring cost estimating and preconstruction services, but you take some of the competitive bidding out of the mix. The construction manager might suggest that their ability to collaborate with the design team provides an inherent cost savings. Owners could see a benefit from integrated project delivery, but architects might see a loss of control with that method. Architects don't want to give up that control, and owners like the checks and balances with the more traditional methods.