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Sustainability, Resiliency and the Precast Advantage

Demand for green and resilient building is on the rise in the U.S. – and that's **good news** for precasters.

By Shari Held

The Latitude luxury apartment complex in Arlington, Va., earned LEED Gold certification.



Photo credit: Les Timmerstein

Resiliency is not just a buzzword anymore; it's becoming a requirement in sustainable building design. And precast concrete is proving to be the material of choice because it offers long-term protection and resistance against the natural forces – such as storms and floods, hurricanes, tornadoes and high-winds – that plague the U.S. frequently.

For instance, the U.S. Green Building Council's 2018 World Green Building Trends report shows 13% of U.S. responders expect the majority of their upcoming projects will be green. And 50% of them believe the top demand will come from the green existing building/retrofits sector.¹

The USGBC also recently reported a 19% growth in LEED-certified residential (including multi-family residences) building since 2017. LEED-certified residences use 20% to 30% less energy,² and reducing energy consumption is the top environmental reason responders cited for building green.¹

“The most important reason to build sustainably is we have limited natural resources. We can't build things that will need to be replaced frequently. That's an unsustainable model.”

– Chris Grogan, *Smith-Midland Corp.*

The National Precast Concrete Association has reported on numerous projects that have obtained or are applying for LEED Gold certification and the numbers are growing. For example, Amesbury, Mass.-based Shea Concrete Products recently moved into a new 13,000-square-foot office, built primarily with precast. The company cited sustainability as a main incentive of precast and is working on obtaining LEED Gold certification. Two other projects that already attained LEED Gold are the MGM National Harbor hotel and casino in Maryland with 300,000 square feet of precast concrete and the Statue of Liberty Museum which features precast structural and exterior walls.

Here's another example of sustainable building practices in action.

LATITUDE LUXURY APARTMENTS

From the beginning, this 12-story, mixed-use high-rise in Arlington, Va., was on track for LEED Gold. Its building envelope of high-strength architectural precast concrete played a significant role in making that a reality.

“The most important reason to build sustainably is we have limited natural resources,” said Chris Grogan, business development manager for Va.-based Smith-Midland Corp., which designed, fabricated and erected the architectural precast panels for the job. “We can't build things that will need to be replaced frequently. That's an unsustainable model.”

Precast concrete was always part of the plan. The reflective, white precast panels on the building's

Smith-Midland Corp. manufactured 70,000 square feet of acid-wash finished architectural precast panels.



Photo provided by Smith-Midland Corp.

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*Gregg Jacobson, General Manager
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"Everybody worked together to achieve LEED Gold. This was definitely a design-assist job. Every job has challenges, but solutions are available as long as you spend the time to dissect them and come up with a solution as a team."

– Chris Grogan, *Smith-Midland Corp.*

facade minimize the urban heat island effect. Precast concrete's high thermal mass keeps the interior cool during the heat of the day. This makes the building more energy-efficient, so HVAC requirements are reduced. In addition, precast concrete is durable, has a long life cycle and is low maintenance.

"Using precast also minimizes or eliminates construction waste because most of the work is in plant-controlled conditions that are designed efficiently to minimize waste both at the plant, and by default, in the field," Grogan said.

Efficiencies in the fabrication phase

The concrete mix design originally called for using pigments. Later, the design team opted to use all natural materials. Smith-Midland was challenged to maintain a uniform color for the white acid-finish panels without using pigments.

"It required a lot of planning and a lot of different material selections to achieve it," Grogan said.

Recycled local materials were used in the concrete mix which also

helped the project earn LEED credits.

Smith-Midland fabricated 70,000 square feet of acid-wash finished, high-strength, architectural precast concrete from March to August 2015. The 746 panels included 25 different configurations, with the largest piece weighing 18,600 pounds.

Another challenge was to make the forming process at the plant efficient. Grogan said it took some ingenuity, but Smith-Midland was able to minimize the formwork and maximize what the architect wanted to achieve with the building.

Workaround for lost time

Installation also proved difficult since some panels had to be installed under slabs that were already in place.

“From a design perspective, this job was very complex,” Grogan said.

In addition, access was an issue in this heavily traveled urban environment. A staging yard near the job site was used to stockpile several loads for emergency use when weather conditions prevented trucks from delivering.

High winds interrupted the installation initially, forcing Smith-Midland to use two tower cranes simultaneously to get back on schedule. Workers set



The high-thermal mass precast concrete wall panels absorb heat during the day, and then slowly release heat as temperatures drop at night.

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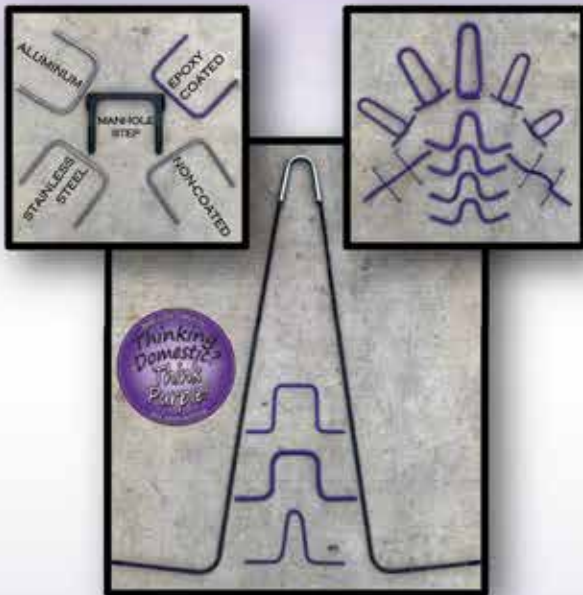
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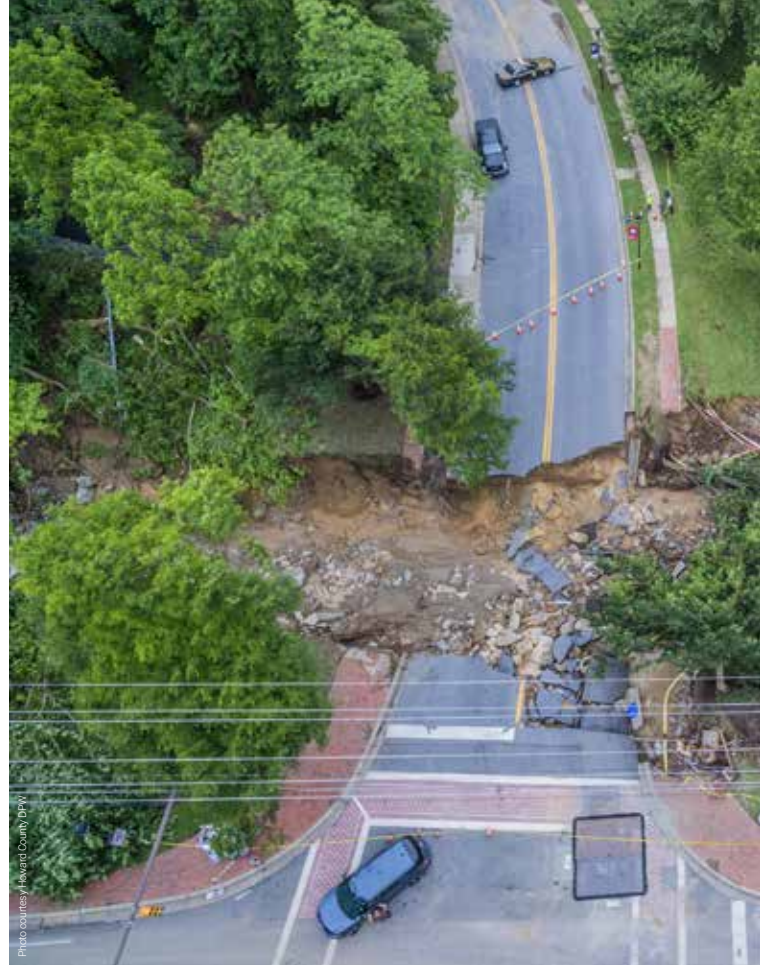


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Flooding caused a large portion of Ellicott Mills roadway to wash away after an aluminum culvert installed beneath it failed.

a precast panel with the first crane, then repeated the process with the second crane. The strategy worked.

Sustainability: A win for everyone

"Everybody worked together to achieve LEED Gold," Grogan said. "This was definitely a design-assist job. Every job has challenges, but solutions are available as long as you spend the time to dissect them and come up with a solution as a team."

Grogan believes sustainable building practices start in the precaster's own plant. Precasters constantly need to look for improvements, whether it's shaving off time, using less material or making a process more cost-effective. Then they need to promote those efficiencies and show customers how that will benefit them.

"It's a win-win on the cost side when you are sustainable in your own plant," Grogan said. "It does transfer into the building design and also into what the customer pays down the road, especially in back-end costs."

RESILIENT BUILDING PRACTICES

One definition of resiliency is the ability to avoid damage, or to absorb or withstand major damage. With extreme weather producing catastrophic results in recent years, building for resiliency is becoming a necessity. In 2018 alone, insured losses due to natural disasters in the U.S. was \$52 billion.³

Communities now realize they must create resilient buildings and infrastructure if they are going to survive. Key attributes of resiliency include longevity, sustainability, durability, robustness and resistance



“The question was, do you put in another 10-foot-by-15-foot culvert or do you design for your ultimate need? And we designed for our ultimate need. A culvert of this magnitude is going to last the community much longer.”

– Greg Ouimette, *Oldcastle Infrastructure*

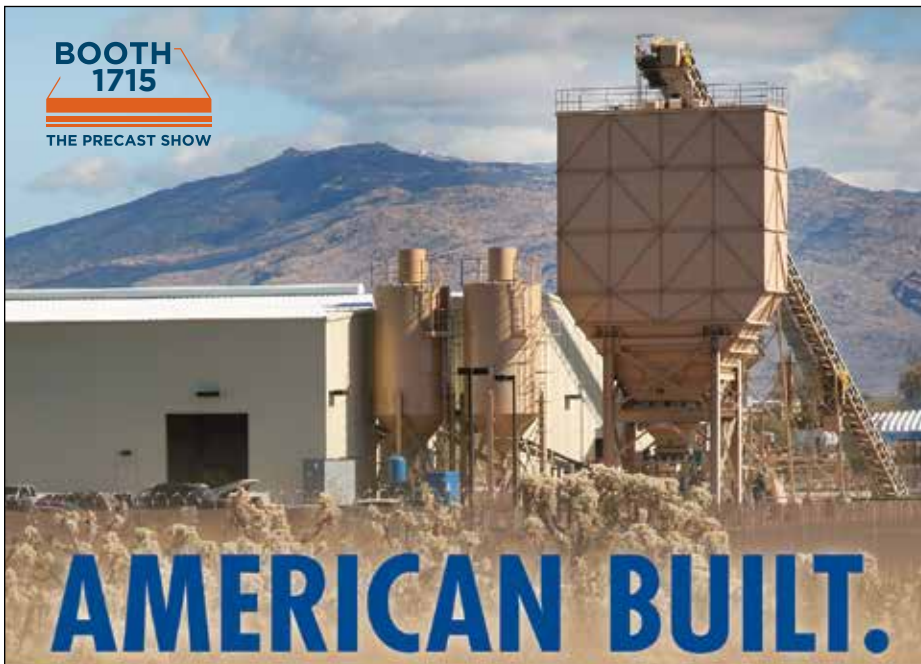
to disasters.⁴ When it comes to achieving resiliency, building or rebuilding with precast concrete fits the bill.

“Ellicott City is the perfect example of this,” said Greg Ouimette, business development manager for the North Region for Atlanta, Ga.-based Oldcastle Infrastructure.

Historic Ellicott City, Md., is located in Howard County near the area where four river branches converge to join the Patapsco River. In 2016, a 1,000-year flood hit the city with devastating results. The city had barely recovered when torrential rainfall in May 2018 produced a second 1,000-year flood. This time, a 50-year-old, 400-foot-by-15-foot-by-10-foot corrugated aluminum culvert near the intersection of Ellicott Mills Drive and Main Street failed. As a result, a large section of Ellicott Mills Drive, the city’s main emergency route out of town, washed away.

“We had an inspection regimen, but it’s very difficult to see inside the pipe to assess its condition,” said John Seefried, P.E., deputy chief, bureau of engineering for the Howard County Department of Public Works. “We weren’t aware of any defects because they were hidden under a foot or so of sediment and the constant flow of the stream.”

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Decision time

The first decision the city made was choosing what material should be used for the replacement culvert. Corrugated metal and aluminum were considered but rejected in favor of reinforced precast concrete. Precast concrete doesn't corrode, and it has a potential life cycle of 100-plus years. The forward-thinking city also planned for the future by replacing the old culvert with a culvert large enough to survive the ravages of another 1,000-year flood.

"The question was, do you put in another 10-foot-by-15-foot culvert or do you design for your ultimate need?" Seefried said. "And we designed for our ultimate need. A culvert of this magnitude is going to last the community much longer."

Meeting a tight schedule

Oldcastle Infrastructure engineered a 130-foot-by-24-foot-by-13-foot, clamshell-style box culvert for Ellicott City. The walls measure 1 foot thick and the top and bottom slabs, 1 foot 10-inches. It took 57 pieces, each weighing 23 tons, to produce the oversized culvert.

The biggest challenge during the fabrication process was the tight schedule. Oldcastle Infrastructure had to produce the material in only six weeks. That meant devoting more resources to the project and holding suppliers of the special-order, epoxy-coated steel to a deadline.

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– Greg Ouimette, *Oldcastle Infrastructure*

The design for the high-strength concrete mix called for 5,000 psi, but Oldcastle Infrastructure overdesigned the mix, so 28-day breaks were well above the required compressive strength.

“That made it stronger, and it set up a lot faster,” Ouimette said. “We could move the pieces with less chance of them breaking or chipping. We were really looking for a fail-safe product, and we got it.”

Going underground

Oldcastle Infrastructure actually beat the six-week deadline and began delivering the pieces one at a time to the job site. Worcester, Pa.-based general contractor Allan Myers installed the precast clamshell culvert. Limited access was the only hitch in the installation process. To place the pieces at the correct depth from a distance, a larger crane was procured. Once the pieces were in place, it was just a matter of tightening the cast-in bolts to pull the top and bottom pieces together.

One issue with installing a significantly larger culvert is the increased flow would cause flooding downstream. That was remedied by adding restrictive walls at the



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Photo provided by Oldcastle Infrastructure

The new precast concrete culvert installed at Ellicott Mills Drive weighs 23 tons and is 140 feet long, 24 feet wide and 13 feet high.

front of the culvert to control flow volume. For now, the structures immediately downstream receive the hydraulic equivalent of the output of the older culvert. Future plans call for replacing those structures with tunnels that can accept the capacity of the new culvert. When that happens, the walls will be removed.

A job well done

Ellicott Mills Drive was back in service in April 2019, and the area downstream of the culvert was opened shortly after Labor Day.

“It all went down flawlessly,” Ouimette said. “I’ve been in this industry for 31 years, and I’ve never seen two companies, meaning Oldcastle Infrastructure and Allan Myers, work closer together. It was a really great project.”

For Seefried, the bottom line was this, “We built it stronger and better than it was.” **PI**

Shari Held is an Indianapolis, Ind.-based freelance writer who has covered the construction industry for more than 10 years.

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