Residential Precast / Pushing the Limits of Scale / Rethinking Reinforcement

# precast solutions®

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**ON THE COVER:**
**Precast "Pierfection":** To replace an antiquated fishing pier in Massachusetts, Scituate Concrete Products manufactured massive, 55,000-pound precast concrete pier casts. Learn more about how this project – along with another of significant size in the state – employed precast to achieve the owners' goals on page 18.

Photo courtesy of Scituate Concrete Products.

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# WHAT'S INSIDE


Photo courtesy of Scituate Concrete Products

# All Signs Point


Photo courtesy of Ed's Concrete Products

# to Precast

**With endless design options and durability, precast concrete is the optimal material for signage.**

By Mark Crawford


Photo courtesy of Ed's Concrete Products

*Ed's Concrete Products manufactured a precast sign with a design and color scheme that matched a construction firm's facility.*

A sign is more than just a locator of place – it is an art form that can convey a company's mission, theme, attitude and sense of creativity. When properly designed, signs compel people to admire their shape, color and craftsmanship. For designers, precast concrete offers a blank slate from which any conceivable sign can be created. For owners, precast offers an attractive solution that's set to withstand the test of time. Below is a sample of attractive precast signs manufactured by NPCA members.

## ED'S CONCRETE PRODUCTS – STRATFORD, ONTARIO

Prica Group, a construction management firm in Waterloo, Ontario, needed a large address sign with a design and color scheme that complemented its facility.

"The benefits of using precast concrete for signs include color and texture options, knockouts and formliners, efficiency, drag-and-drop installation and longevity with minimal maintenance," said André Timmermans, product coordinator with project precaster Ed's Concrete Products. "Design options are virtually limitless with precast, so the sign can be structural and aesthetic at the same time."

Different textures and colors used on the sign create sections that resemble natural wood and other materials. Two lifting inserts placed in the top eased placement and grouted tubes in the back secured the sign on-site. Installation, which included setting the signage, leveling and grouting the reinforcement, took only one hour.

## OLYMPIAN PRECAST – REDMOND, WASH.

Peninsula College in Port Angeles, Wash., approached Olympian Precast for a monument sign that required an integral pigment and two different finishes. Computer numerical control (CNC)-cut, high-density foam was used to form incised letters and a plastic formliner helped create the sign's varying depth recesses.

According to Olympian Precast President Clarke Jewell, the sign first went to the acid-etch area, where workers applied a finish that created a fine, sandy texture. This finish helped accentuate the crisp, clean lines created by Dayton Superior's Variable-Depth Random ABS Formliner. Acid-etching also helped highlight the dark natural sands of the Pacific Northwest.

The production team then sent the sign to the sandblast area, where the lower formliner portion was protected with plywood while the upper "smooth" portion received a light sandblast finish to provide contrasting color and texture to the formliner below.

"A sandblast finish tends to lighten the aggregate and soften the crisp lines," Jewell said.

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*(Above) Olympian Precast produced ribbed precast concrete signs for a local community's multiphase gateway project. (Left) The company also manufactured a monument sign for Peninsula College that included an integral pigment and two different finishes.*

Constructing the formwork at the edge of a casting deck to accommodate the stubbed reinforcing that was eventually cast into the footing was a challenge, he noted.

The company also undertook a multiphase gateway project for the city of Des Moines, Wash., that consisted of several precast signs made with a blend of white and gray cement as well as white aggregate and sand. The production crew applied a light sandblast finish on all exposed surfaces to highlight the light-colored aggregates in the mix.

The project architect specified organic shapes reminiscent of waves and sails for the sign to reflect the city's proximity to nearby Puget Sound. Bronze letters and sailboat shapes applied in the field after installation satisfied this need and provided an artistic flair.

The ribbed patterns unique to each of the three multiple sign pieces – as well as the overall shape changes – provided a design challenge.

"In order to accommodate the changing shapes, the ribbed patterns were first fabricated by creating a ribbed wood sheet for each one of the changing ribbed patterns," Jewell said. "We then cut the ribbed pattern to shape using a full-size AutoCAD template. Each ribbed shape was then laid into the overall mold."

## SANDERSON CONCRETE – SURREY, BRITISH COLUMBIA

When Stewart Bulk Terminals, a private port in British Columbia, contacted Sanderson Concrete for a sign in a remote area almost 1,000 miles away, Jan Antorp, president, knew it would be challenging.

"Everything was done remotely," he said. "We never saw the site, the client never came to the plant. From start to finish, we were able to create a sign from the initial sketch and letterhead the client sent us."

The 10-foot-wide, 5-foot-tall, 6-inch-thick sign included cast-in conduit to accommodate lighting support arms. Sanderson Concrete custom-fabricated the sign in its in-house fab shop and then powder-coated the arms. The conduit cast into the sign was precisely placed to match the conduit in the existing on-site walls.

The letters were created based on an old letterhead.

"Our foam supplier researched the historic font, duplicated the arch in the logo and cut the letters that we set into the formwork," Arntorp said.

After casting, the finishing crew painted the inset letters in black.

Officials with Stewart Bulk Terminals were pleased with the result.


Photo courtesy of Sanderson Concrete

*Sanderson Concrete created the font for the Stewart Bulk Terminals sign based on an old letterhead.*

"The client was looking for a permanent sign rather than a wood or plastic sign," Antorp said. "Precast construction provided an attractive, durable sign that was installed seamlessly and will last for generations."

## CUZ CONCRETE PRODUCTS – ARLINGTON, WASH.

The city of Arlington contracted Cuz Concrete Products to manufacture four concrete signs for specific entrances and exits into town on major roadways. All four 15-foot-by-9-foot signs present a "rolling hill" look, each with a different wildlife theme (blue heron, eagle, salmon and deer). A major challenge involved coordinating proper insert placement for the bronze wildlife images, which a local company designed.

"Precast was ideal for this project," said Aaron Zachry, vice president of sales for Cuz Concrete Products. "Not only does precast provide excellent longevity at low cost, it also gave us considerable artistic freedom. We worked closely with the local arts council and provided some creative input, which was very rewarding."


Photo courtesy of Sanderson Concrete


Photo courtesy of Cuz Concrete Products

*Cuz Concrete Products produced four precast signs with a "rolling hill" look and varying wildlife themes.*

Other communities took notice – after seeing the signs, the neighboring town of Marysville hired Cuz Concrete to manufacture a 14-foot-by-8-foot welcome sign for the roundabout on the main highway entering town.

## PRECAST IS PERFECT

Precast concrete is the ideal building material for signs. Not only is it highly durable and cost-effective, but it also allows for more design freedom. As a result, precast signs can integrate various shapes, colors and textures, as well as other materials like embedded electric lines and lights.

Ed's Concrete Products has manufactured signs for more than a decade and each year, according to Timmermans, the projects become more detailed and complex.

"With CNC routers and stencil cutters, mold-making capabilities are endless with what you cast into a piece of concrete," he said. "We recently quoted a job that had 12-foot-high, stand-alone letters as the welcome sign for a city. We are hoping it will come to fruition as we always like a challenge and showing the industry what can be done with precast concrete." PS

*Mark Crawford is a Madison, Wis.-based freelance writer who specializes in science, technology and manufacturing.*

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-Jerry Rubbo, Achen Gardner Construction


# The Business Case for Engineered Precast Concrete Walls

Photo courtesy of Superior Walls

# Precast concrete's **many advantages** make it the **ideal solution** for residential construction.

By Sam Rashkin

***Editor's Note: This is a modified version of an article that originally appeared on Builder's website.[1]***


*Precast concrete is resource-efficient, using up to 75% less concrete than a conventional foundation.*

I decided to take a hard look at a compelling option most commonly used for basements, but also well-suited for above-grade walls – engineered precast concrete. With this technology, off-site production facilities pour concrete into forms configured to detailed construction plans.

One of the most popular manufacturers for residential construction of this type is Superior Walls. Their forms result in a concrete wall configuration that includes a thin profile top bond beam, less than 2-inch-thick exterior skin and ribs two feet on center. Extruded polystyrene rigid insulation is bonded to the panels between the ribs, and the top bond beam and ribs are faced with 1 inch of expanded polystyrene. Thus, the system effectively includes a complete thermal break. Additional insulation can be installed in the space between the ribs for a higher R-value, where desired. The front edge of the expanded polystyrene ribs is faced with galvanized metal studs for directly installing a finished wall and the ribs are pre-drilled for wiring and plumbing. The total wall thickness is 10 1/4 inch.

Completed wall panels are installed in the field with cranes directly on a gravel bed without the need for a footing. Once installed, the panels are effectively bonded together for greater strength than a conventional concrete foundation, even though the system is so resource-efficient it can use up to 75% less concrete than a conventional foundation. A typical precast foundation can be installed in one day.


Photo courtesy of Superior Walls

## PRECAST'S MANY ADVANTAGES

Concrete represents a complete platform change from traditional wood framing. This is significant because as a construction material, wood burns incredibly easily, rots when wet, serves as food for insects, has poor dimensional stability, offers minimal impact resistance and provides no thermal storage capacity. In contrast, concrete is noncombustible, moisture-resistant, insect-resistant, impact-resistant, dimensionally stable and has excellent thermal storage capabilities. However, one key challenge with precast wall systems is that on-site workers must be skilled and held accountable for perfectly level grades. Consider the following impressive benefits:

### CONSTRUCTION

- Faster construction time
- Fewer tools for assembly
- Substantially reduced subcontractor work (such as integrated framing, chases, insulation, air sealing)
- Substantially less waste
- Superior dimensional accuracy helps ensure better quality fit, finish and trim
- Smaller heating and cooling systems due to substantially reduced loads and outstanding control of mean radiant temperatures
- Year-round construction, since precast concrete can be installed in cold weather

### PERFORMANCE

- Strength (effective bond beam results in added strength)
- Disaster-resistance: impact, water, wind and fire
- Moisture protection (5,000-psi precast concrete is nearly waterproof compared to more porous 2,500-psi concrete used in conventional foundations)
- Drainage (the absence of a footing provides a clear path for sub-slab moisture to the foundation drain)
- Sound mitigation
- Energy performance: minimal thermal bridging, insulation installation quality (no gaps, voids, compression) and an inherently airtight assembly
- Moisture storage to buffer the home from moisture-related issues
- Resource efficiency requiring substantially less concrete for foundation
- Space savings (finished basements with conventional foundations also need a framed assembly and air space that can add approximately 6 inches around the perimeter, consuming about 80 square feet of space in a 1,500-square-foot plan)

I'm interested in the possibility of also using precast panels for the slab, with the flat exterior skin facing the ground. I understand this would have to be engineered for necessary lateral support, but this innovation would add impressive benefits. First, it would


*Faster construction time, reduced waste and enhanced disaster-resistance are just a few of precast concrete's advantages in residential applications.*

eliminate virtually all limitations for winter construction by allowing all foundation work – walls and floor – to be installed in cold temperatures. Second, it would eliminate the complications and labor associated with installing rigid insulation under the slab. And most importantly, it would result in a diaphragm floor in the basement, where a typical oriented strand board or other sheathing is fastened to the metal studs covering the ribs. This would enable the basement to feel just like an above-grade floor. In other words, you would be building true lower levels rather than basements. And the gap between the subfloor and rigid insulation could be used as valuable space for wiring and plumbing.

Although this alternative technology offers an impressive list of advantages and has been around a very long time, the market share remains low. But that may be starting to change. Kiere DeGrandchamp, president of High Performance Homes, was convinced to give precast technology a try. He switched in the middle of development to a precast concrete foundation for his homes at The Links at Gettysburg in Gettysburg, Pa. When we discussed his experience following initial installation, he admitted there were some bumps getting past a few learning curve issues, especially since the project entailed a relatively complex design and site. However, he loved the substantially improved results and knows the next endeavor will be significantly easier. He is not turning back.

I am not associated with or financially linked to any product, technology, builder or manufacturer. I'm simply a long-time industry observer asking tough questions regarding why so many compelling new technology solutions – like precast concrete – are so slow to be embraced when they offer so many solutions and benefits to the housing industry. **PS**

*Sam Rashkin is the chief architect of the Building Technologies Office for the U.S. Department of Energy. He has earned a national reputation for his work leading housing programs that have resulted in more than 1 million certified high-performance homes. He is the author of "Retooling the U.S. Housing Industry: How It Got Here, Why It's Broken, and How to Fix it." Learn more about Sam at samrashkin.com.*

**Endnotes**

[1] builderonline.com/building/structure-durability/gray-matter-platform-performance_o


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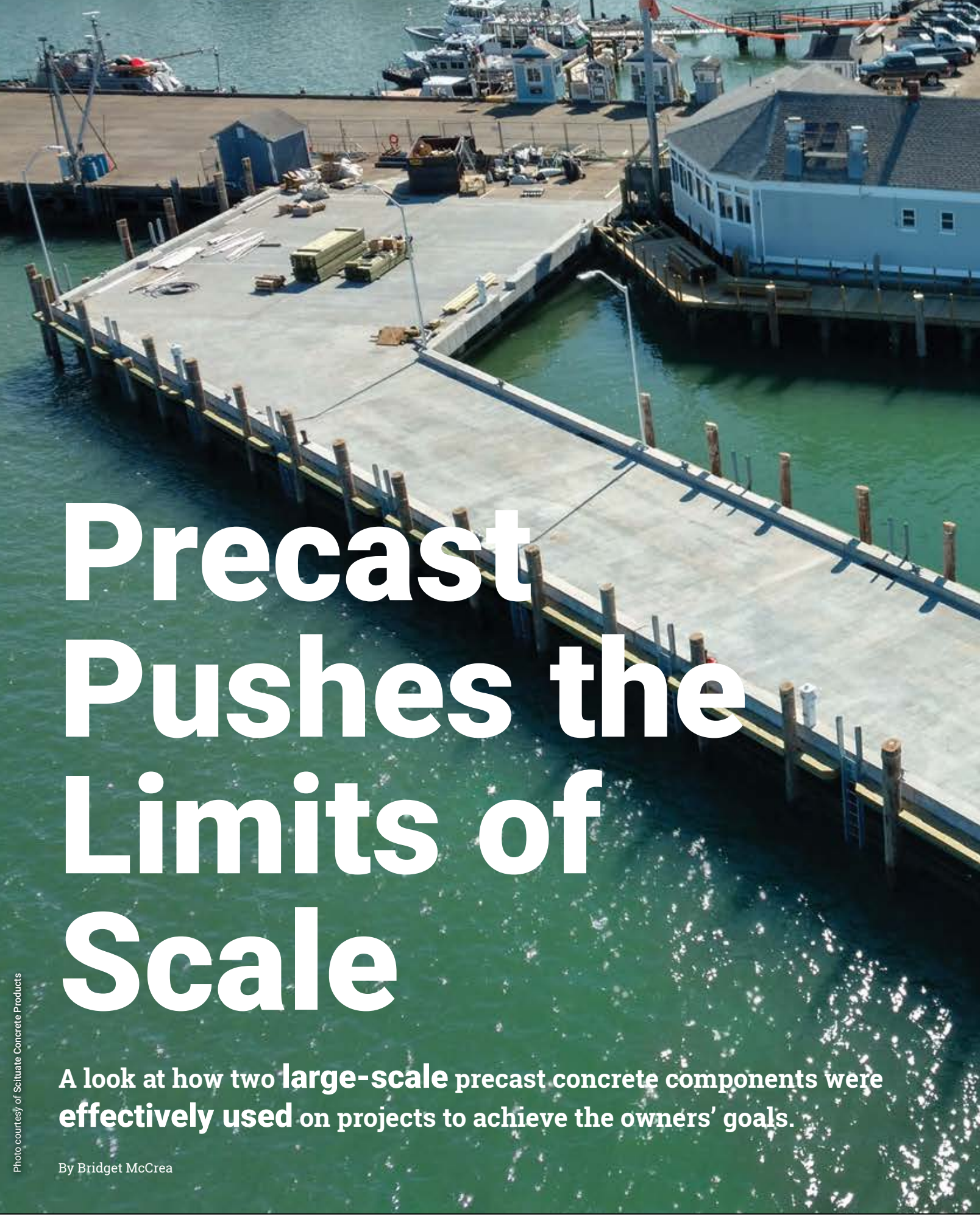


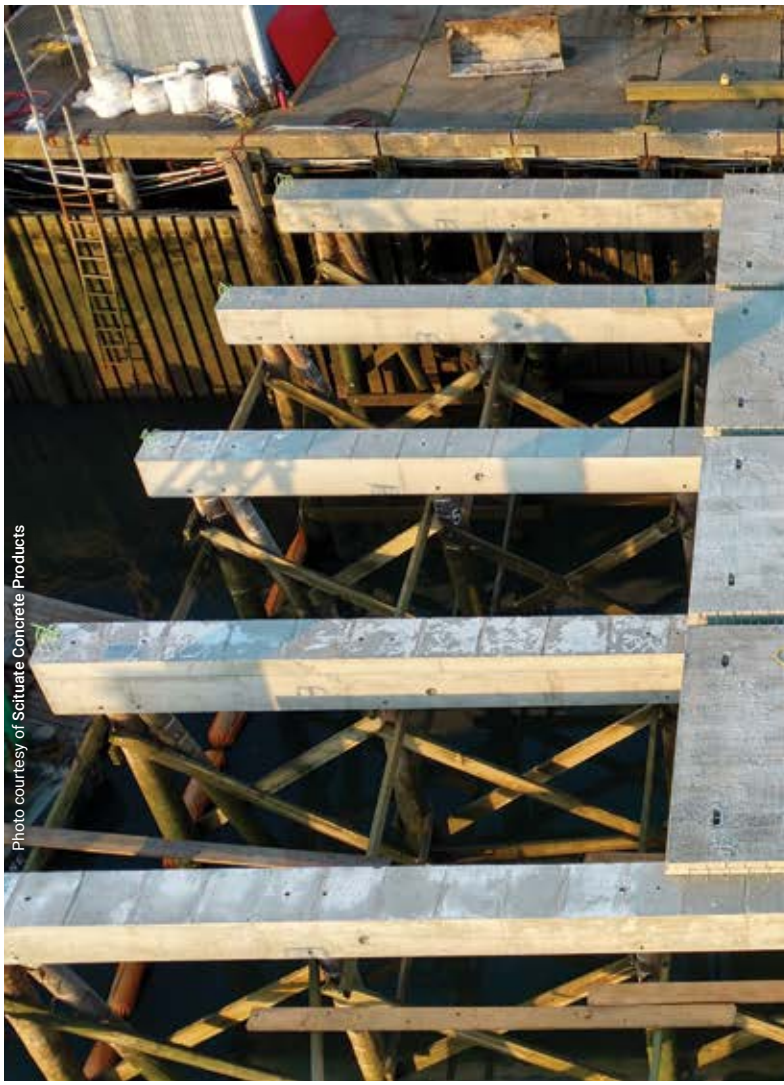
# Precast Pushes the Limits of Scale

**A look at how two large-scale precast concrete components were effectively used on projects to achieve the owners' goals.**

By Bridget McCrea

Photo courtesy of Scituate Concrete Products






*For a wharf replacement project in Plymouth, Mass., Scituate Concrete Products manufactured six massive, 55,000-pound precast beams along with numerous smaller precast slabs and pieces.*

Large-scale construction projects mean increased stakes for all parties involved. From research to design, build-out and beyond, every decision is magnified. The foundation from which these decisions are made for architects, engineers and contractors is the choice of which building material to employ. With its flexibility, durability and ease of installation, precast concrete has proven successful on a wide variety of projects, as the examples below illustrate.

## WHARF REPLACEMENT IN MASSACHUSETTS

When the town of Plymouth, Mass., set out to replace an antiquated commercial fishing pier with a newer, larger structure, it was doing more than just replacing the existing 7,780-square-foot "T Wharf" pier. It was building a stronger, sturdier structure that was more than twice the size (18,360 square feet) of its predecessor, and, in the process, helping area businesses and protecting its resources.

"This is the single most important project we've had on the harbor in quite some time," said David Gould, the town's director of marine and environmental affairs.[1]

According to Gould, the new pier also improves Plymouth's existing lobster and groundfish industries as well as emerging ones, such as shellfish aquaculture. In addition, the new facility includes amenities and services for visiting boaters and creates a more aesthetically pleasing waterfront for the thousands of tourists who visit every year.

What most of those tourists won't realize is the important role that precast concrete played in the pier renovation project, officially known as the "Wharf Replacement Project Phase One for the Town of Plymouth." Phase two is being scheduled for a future date. The long, linear portion of the pier is comprised of six 60-foot-by-2-foot-by-3-foot solid precast beams called pier casts, each of which weighs 55,000 pounds.

## A TEAM EFFORT

Produced by Scituate Concrete Products of Marshfield, Mass., the massive precast pieces required special attention and handling, both on the manufacturing side and during delivery and installation.

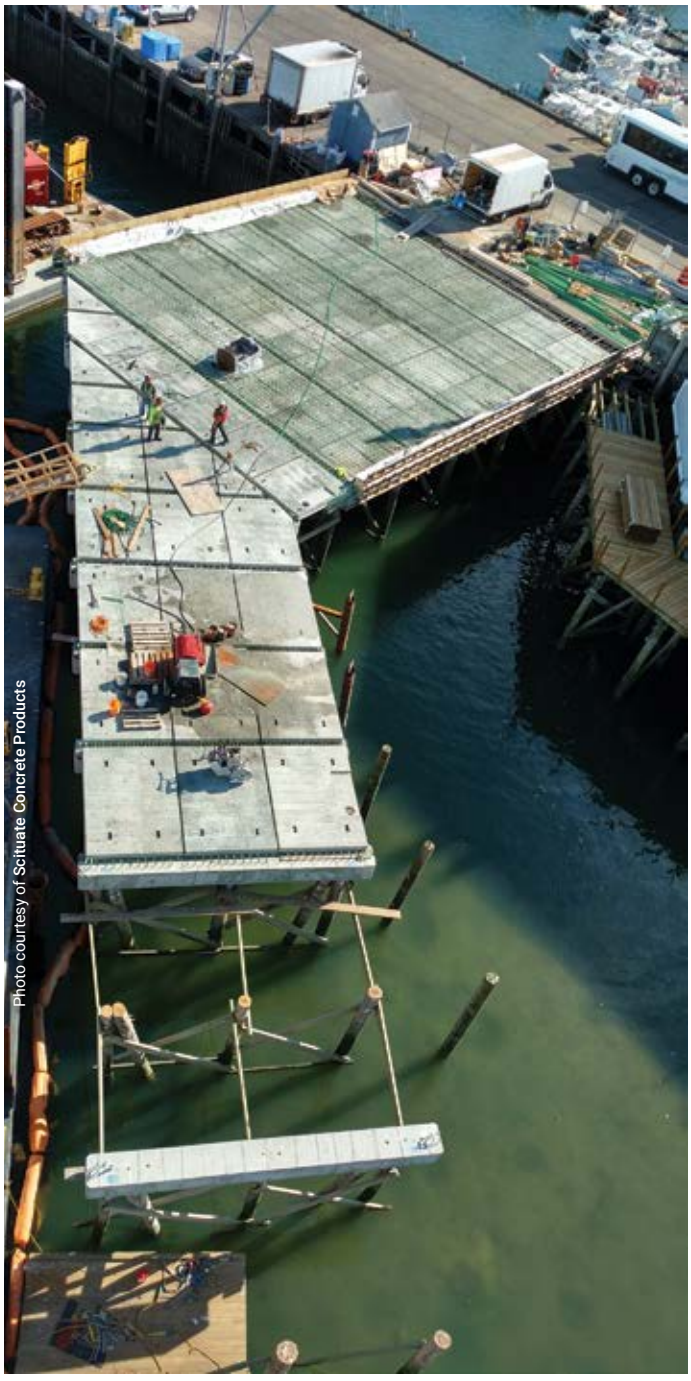


Photo courtesy of Scituate Concrete Products

"This was one of the longest pieces of precast we've ever manufactured," said CJ Scott, production manager. "We had to come up with a heavy-duty rigging solution that incorporated longer spreader bars and a few other elements."

The project also included numerous smaller precast slabs and pieces. Scott said the pieces were made in Scituate's new 60,000-square-foot plant. The company worked with site and utility construction firm Robert B. Our Co. Inc. and project engineer Bourne Consulting Engineering to design the new structure.

Once completed, each of the 55,000-pound beams had to be shipped to New Bedford and then placed on a barge to be delivered to the project site in Plymouth. To transport the huge beams, Scituate hired a specialized hauling company that offered an extendable trailer. The logistics were complicated, said Scott, and required Scituate to deliver them to a port that was roughly an hour away from its plant, even though Plymouth is just 20 minutes away.

"We've done pier casts and handled complicated logistics in the past, but nothing of this magnitude," Scott said.

During the production phase, Scituate added a corrosion inhibitor to the mix to ensure that the final product would be able to stand up to the marine environment where it would be installed. The precaster also developed a custom wood and steel mold that it used to fabricate the products.

"We had some issues in the beginning with the pressures from the concrete being exerted on the forms," Scott noted. "The first ones we poured required some adjustments to compensate for the pressure being exerted and the sheer amount of concrete being poured in a single pour."

Photo courtesy of Scituate Concrete Products

*The precast concrete substructure, which includes the massive pier casts, supports the wharf's decking.*

The products were then cured in the form for about five days, and were covered in wet burlap to ensure the right level of moisture content.

## MEETING AND EXCEEDING EXPECTATIONS

Despite the atypical requirements of the project, Scott said it went very well from start to finish, and that it exceeded his early expectations. He also noted that the design process took slightly longer than anticipated, but the extra time allowed the engineer, contractor and Scituate to iron out the details.

"Once we got the project into production, we stayed on pace in terms of the installation and transport [timelines]," he said. "We had no hiccups or bumps."

At the job site, he said all the massive precast pieces lined up with all the piers, which had been pre-installed. Coming off this successful project, Scott said Scituate now has the confidence to work on even more large-scale precast projects in the future.

"To evolve as a company and as an industry, sometimes you have to push the limits," said Scott, who advised engineers and precasters to work together to put a spotlight on precast concrete's key strengths and attributes on large projects such as this one. "Because the products are made in a controlled environment and in a certified plant, engineers are guaranteed that the products will be made to their specs and standards."

## PRECAST ENABLES RAPID DAM CONSTRUCTION

Elsewhere in the state, and armed with a $1.7-million grant from the U.S. Department of Energy, Bill French of Billerica, Mass.-based French Development Enterprises LLC set out to create a dam that incorporates non-traditional construction methods with off-site manufacturing and on-site installation. Calling his development "The French Dam," he wanted to make the entire dam production and installation process both "just-in-time" and weather-independent.

FDE's patented technology for rapid dam construction was also funded through the Massachusetts Clean Energy Center.



The 24-foot-long, 16-foot-high prototype was designed by GEI Consultants of Woburn, Mass., and Oldcastle Precast of Littleton, Colo. It comprises six 27,000-pound precast concrete 8-foot-by-8-foot-by-8-foot blocks interconnected with each other, forming one monolithic structure. A modular precast impoundment for construction and retrofit of hydroelectric dams, water control systems and powerhouses, the product was assembled on-site in less than four hours, even with a heavy rainstorm occurring during installation.

"Building on Massachusetts' long history of innovation, this investment advances inventive technologies and strengthens renewable energy infrastructure that powers the Commonwealth with clean resources such as hydropower," said MassCEC Interim CEO Stephen Pike.2 "By modernizing our energy infrastructure, we are capitalizing on investments that produce cost reductions and economic growth to benefit residents across Massachusetts."

## PRECAST: THE MATERIAL OF CHOICE

Bob Kramer, Oldcastle's vice president of marketing and product development, said French approached his team with the idea of using precast modular components to build hydroelectric dams. Kramer added that French wanted to build a prototype to commercialize the concept. Oldcastle served as a design-manufacturing partner on the project.


Photo courtesy of Oldcastle Precast

*"The French Dam" includes six 27,000-pound precast concrete blocks interconnected to form a 24-foot-long, 16-foot-high monolithic structure.*

Working with a civil design consultant, a dam expert and other members of FDE's cross-functional team, Oldcastle spent about a year developing the dam prototype and experimenting with different manufacturing, assembly and connection iterations.

"The main driver was how to manufacture and create mechanical connections that would be suitable in the environment of what's known as a small head dam," Kramer said. "So that's what the team did."

For example, one condition of the federal grant dictated the manufacture and assembly of the modules in a way that would ensure watertightness and the ability to withstand the hydrostatic pressures. This was in addition to being able to unbolt, remove and replace a piece, if necessary.

"Collectively, we created a design and were successful in building up a prototype that satisfied the requirements of the federal grant," Kramer said.

## DAM OF THE FUTURE?

In total, Oldcastle produced six modules. All were of identical dimensions inside and out and manufactured from rigid steel forms to extremely tight manufacturing tolerances. The specifications weren't unusual for the precaster, although Kramer said that if the dams were to be commercialized at some point – and then scaled up to make fully assembled, working dams – the project magnitude would increase exponentially.

"The product could be used to replace existing spillways, and would be particularly useful for municipal-owned dams that have fallen into disrepair," said Kramer, noting that there are more

than 80,000 non-electric-producing dams in the U.S. "These need to be retrofitted with a quick-fix, low-cost, high-impact solution." PS

*Bridget McCrea is a freelance writer who covers manufacturing, industry and technology. She is a winner of the Florida Magazine Association's Gold Award for best trade-technical feature statewide.*

**Endnotes**

1 bostonglobe.com/metro/regionals/south/2016/09/13/plymouth-new-pier-may-ready-year-end/6kvpdrWYYJgVwQ8PyfLwIN/story.html

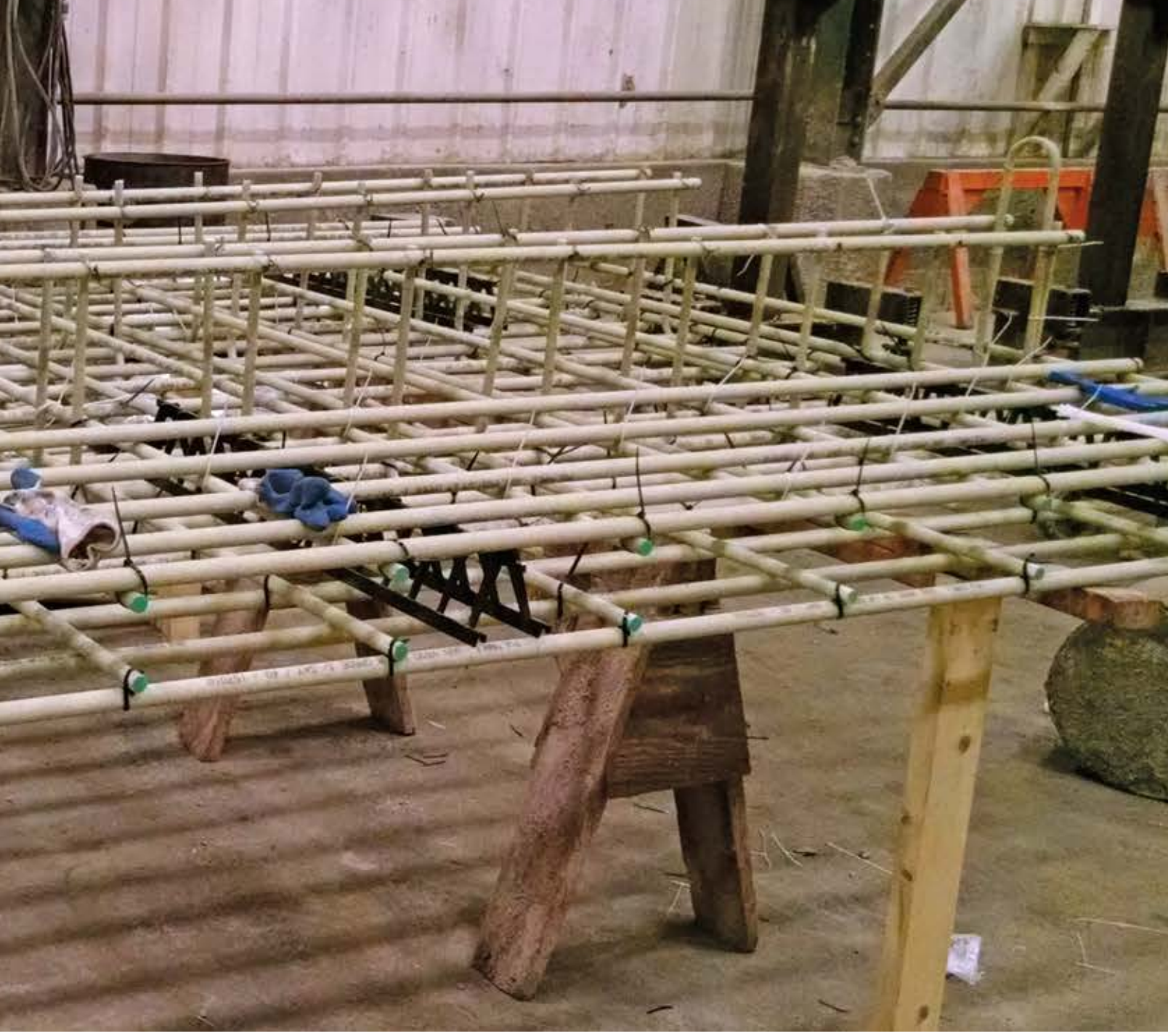
2 csengineermag.com/prototype-of-modular-precast-french-dam-completed/




*Members of the project team hope to commercialize the dam and scale up for real-world implementation in the future.*

Photo courtesy of Fort Miller and Sold by ALP Supply

# Rethinking Reinforcem



# ent

## **Alternative reinforcement** technologies **create opportunities** for precasters and specifiers.

By Shari Held


Photo courtesy of Dalmaray Concrete Products

*By using steel fibers in their mix, Dalmaray Concrete Products was able to reduce production time on precast electrical vaults for a Google Data Center project.*

Steel rebar and welded wire have long been the standard for reinforcing concrete structures. But as the precast concrete and construction industries continue to evolve, so too does reinforcement technology. Alternative materials can significantly reduce or even completely replace traditional steel reinforcement for some applications – leading to a variety of benefits for manufacturers and designers.

Here's a look at how two such materials – fiber reinforcement and glass fiber reinforced polymer rebar – compare to traditional reinforcement, along with projects in which precasters used them to achieve success.

## STEEL FIBER

Precast concrete manufacturers have used fiber reinforcement in their products for decades. But in recent years, fiber technology has advanced significantly. As a result, precasters have steadily increased their adoption of fibers, which can provide enhanced strength, durability and impermeability for their products. Despite these advantages, precasters must consider many factors when deciding whether to incorporate fibers in their mix designs.

Fibers vary in shape and size, which can affect the manufacturing process. Additionally, with a wide range of options to choose from – including steel, nylon, polypropylene, fiberglass, acrylic and polyvinyl alcohol – precasters must ensure the fibers will be uniformly distributed in the mix and serve as an optimal solution, which can prove difficult. Despite the recent advancements made, most fibers are still primarily used to complement primary reinforcing and control early age cracking. Using fibers to replace primary reinforcing is possible in certain instances, but such an application must be performed with extreme caution. The design should be approved by an engineer and performance tests should be conducted.

Steel fiber is one popular choice among precasters, particularly because of its ability to mitigate cracking. These fibers, which are generally made from carbon or stainless steel, are produced in varying geometries by manufacturers. Helix Steel of Ann Arbor, Mich., produces its solution – Twisted Steel Micro Rebar (TSMR) – from cold-drawn, high-tensile (246 ksi) carbon steel wire cut into pieces measuring from 1/2 inch to 2 inches in length and 1/2 millimeter to 4/5 millimeter wide. It can be distributed uniformly throughout the concrete mix with proper batching and mixing practices. Higher fiber count may permit broader distribution of fiber reinforcement throughout the matrix – but this can cause slump and workability loss that may make it harder to place. Still, using TSMR makes the concrete more ductile and less prone to cracking.

"Even if it (the concrete) does crack, the crack is then held tightly together," said Wes Dees, director of Helix Steel's Eastern region.

Precasters have been using the material as a partial replacement for traditional rebar for about 10 years – typically for septic tanks, grease interceptors, manholes, electrical vaults and drainage structures. Other uses include reinforced concrete pipe, footings, foundations, vertical walls, beams and columns, cladding, bridges and tunnels.

Dees offers precasters a test run, mixing and pouring the product at their plants and taking it out of the form the next day. In 2014, he demonstrated the product to Aaron Ausen, vice president of Janesville, Wis.-based Dalmaray Concrete Products. After trying the product, Ausen placed his first order.

## GOOGLE DATA CENTER – PRYOR, OKLA.

Dalmaray Concrete Products quickly found an opportunity to use TSMR. Wisconsin-based Faith Technologies Inc. needed a series of electrical vaults for its Google Data Center project in Pryor, Okla. Precast was chosen because speed and quality were of critical importance for the work. Also, because the project was scheduled for early spring, using cast-in-place would have been difficult.

The original project design specified #5 steel rebar hoops every 6 inches on center and vertical bars at 6 inches on center.

"That's a lot of rebar to cut, bend and tie in," Ausen said.

TSMR proved to be more efficient.

"The Helix design was better because we were able to reduce those hoops and verticals down to just hoops," Ausen said. "And those hoops were only every 12 inches on center. We were able to cut 45% of the rebar out of the equation."

Dalmaray was also able to shave about two hours off cage fabrication, taking it down to less than one hour per piece.

"That was huge when it came to labor savings," Ausen said.

In addition to time and labor savings, workers didn't have to snake 14-foot steel bars from one end of the plant to the other. That reduced risk of injury.

Since 2015, Dalmaray has produced 38 electrical vaults – each weighing approximately 43,500 pounds – for the ongoing job. The vaults range in size, with the largest boasting 6-inch-thick walls and 8-inch-thick lid sections. To date, they're the largest vaults Dalmaray has produced.

Ausen said the mix time didn't change and the precast easily met the minimum compressive strength requirement of 5,000 psi. But he admits there was a learning curve when it came to distributing the TSMR to meet the dosage criteria.

"After we got the distribution down, it was smooth sailing from then on," Ausen said. "We were able to set vaults up extremely fast, meet their deadline and produce a nice product."

The biggest challenges were keeping up with the changes involved with a design-build project more than 1,000 miles away in Oklahoma and transporting vaults via a wide-load truck.

Dalmaray now uses TSMR for manholes, septic tanks, grease interceptors and electrical vaults.

The biggest benefit Ausen sees is in labor savings – especially in its manhole risers and bases.

"We can turn product around a lot faster and reduce our costs," Ausen said. "Ultimately that leads to a better margin and more sales."

## GFRP REBAR

Glass fiber reinforced polymer rebar is formed from thousands of glass filaments saturated with liquid resin and then pulled through a heated die. It is manufactured in bars the same diameter as traditional steel rebar and reels. The material, which has a tensile strength up to 199 ksi, is increasingly being used across a wide range of precast applications in the U.S and Canada.

According to Chris Rescate, COO of Pennsylvania-based ALP Supply (formerly A.L. Patterson), GFRP rebar possesses many advantages when compared to steel rebar for precast producers.

"Coverage requirements are typically half of what they are for carbon steel, so the precast elements can be thinner but still supply continuous reinforcement," he said.

In many non-structural applications, precasters can substitute smaller GFRP rebar and still achieve steel rebar reinforcement strength goals. Additionally, GFRP rebar is non-corrosive, produces no ghosting or shadowing effect, and is non-magnetic and non-electrical.

Because GFRP rebar is about 1/4 the weight of steel rebar, it can help save on overall project costs and reduce safety risks. GFRP rebar also does not yield under stress like conventional reinforcement, which means structural analysis is conducted differently and engineers should reference ACI 440.1R-15, "Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer Bars." Additionally, bent bars must be made to order.

GFRP rebar has been used extensively on bridge decks. According to Rescate, more than 450 bridge decks in the U.S. and Canada have been built using the material.

"GFRP is another tool in the toolbox for precasters," Rescate said. "It gives them more flexibility when designing or bidding projects and allows them to compete against products they traditionally couldn't compete against."

## TAPPAN ZEE BRIDGE TOLL PLAZA – SOUTH NYACK, N.Y.

Fort Miller Co. Inc. produced specialty precast concrete pavement panels with GFRP rebar from V-ROD for a temporary E-ZPass toll plaza near the Tappan Zee Bridge in South Nyack, N.Y. Located on the west side of the Hudson River, the temporary toll plaza was to remain in service while the existing plaza was removed and reconstructed. The project included 30 panels – five for the ramp and 25 on the mainline. Following the removal of the temporary toll equipment, the GFRP-reinforced precast panels remained as a critical component of the approach to the bridge.

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*Precast panels produced with glass fiber reinforced rebar allowed the New York State Thruway Authority to accurately monitor toll plaza traffic.*

Each of the panels contains special sensors which, in tandem with cameras and other equipment, allowed the New York State Thruway Authority to accurately monitor traffic as it moved through the toll plaza. GFRP rebar was vital for the work, as it minimized potential interference in the sensor system.

"If there's anything metallic in the slabs, it can throw off the count when cars go by," said Michael Ortler, field engineer for Tappan Zee Constructors. "We wanted to avoid any interference with the toll collection system."

Due to the location of the project, this wasn't a typical pavement replacement job. Work had to be completed during night hours with live traffic in adjacent lanes. Some panels contained conduit and drainage, and sensing loops had to be installed after the panels were set.

"To try to do all that overnight in a short work window on the mainline of the New York Thruway would have been impossible without using precast," said Michael Quaid, senior project manager with Fort Miller.

And precast is more durable. According to Quaid, CALTRANS Heavy Vehicle Simulator testing on Fort Miller's precast panels ran for 1.5 years. When the repetitive loading was extrapolated, it was equivalent to a 40-year pavement life. By comparison, cast-in-place concrete with a rapid-setting, high-early-strength mix has a lifespan of up to eight years.

Fort Miller substituted V-ROD's #4, #5, #6 and #7 GFRP rebar for the typical steel rebar. Although wire ties can be used with GFRP rebar, for this application, the designers specified plastic zip ties to further reduce potential metallic interference in the slabs. That made the production work a bit more labor-intensive, but installation proceeded as planned over three months.

"It went like clockwork," Ortler said.

This specialty application doesn't happen every day. But the current emphasis on replacing the nation's infrastructure means construction like this will become more commonplace in the future.

"If the project needs to limit electro-magnetic interference and not disadvantage the public by shutting down the roads, this is a technology that can do the job," Quaid said.

## CAPABLE OF ANYTHING

While traditional reinforcement will continue to play an important role in precast projects moving forward, new technologies are shaking up the construction industry. With more options available, designers and owners who select precast concrete for their projects can tackle nearly any imaginable scenario. **PS**

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

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# Specifier Q&A

**This issue, Precast Solutions magazine sits down with Ron Wiendl of LEO A DALY to discuss his involvement with precast concrete products and projects.**


*For Wiendl, precast concrete equates with consistency, assuring him that each panel has the same high quality as the previous one.*

**Name:** Ron Wiendl

**Title:** Vice President, Director of Design

**Company:** LEO A DALY

**Professional Designations:** AIA

## Q: What is your field of focus and what particular products do you specialize in?

**A:** As a design architect for more than 20 years, I've done almost every type of building: higher education, corporate headquarters, civic centers – you name it. I would say higher education is my greatest love because it gives you the opportunity to mold young people's lives through the physical environment, creating spaces that encourage collaboration and inquiry. In all areas of design, that sense of inspiring greatness is key, regardless of building type.

## Q: What are the benefits of using precast concrete products?

**A:** When I know I am designing a building that has to be durable, precast is one of the first materials I mention to my clients. Working primarily in Florida, the climate can be very unforgiving, so the durability factor is huge. I never worry about a building done in precast – they have great thermal properties.

Consistency is another big factor. If I create a building that has a module, I know every panel has the same quality as the previous panel. On the other hand, if I have someone constructing a building on-site, I'm at the mercy of the person putting it up.

Finally, precast provides great benefits in terms of speed of erection. If you're working with a trusted fabricator who can deliver on time, it can have a dramatic effect on your ability to meet tough deadlines.


Photo courtesy of LEO A DALY

**Q: What are some unique or interesting projects on which you specified precast concrete?**

**A:** One example that shows the versatility of precast is a series of seven laboratory buildings I recently designed for a consortium of Florida state colleges. A group of colleges came to LEO A DALY wanting to create a flexible lab prototype that could be adapted quickly and economically to the different program needs and aesthetic environments within the system. Precast concrete helped us achieve this goal.

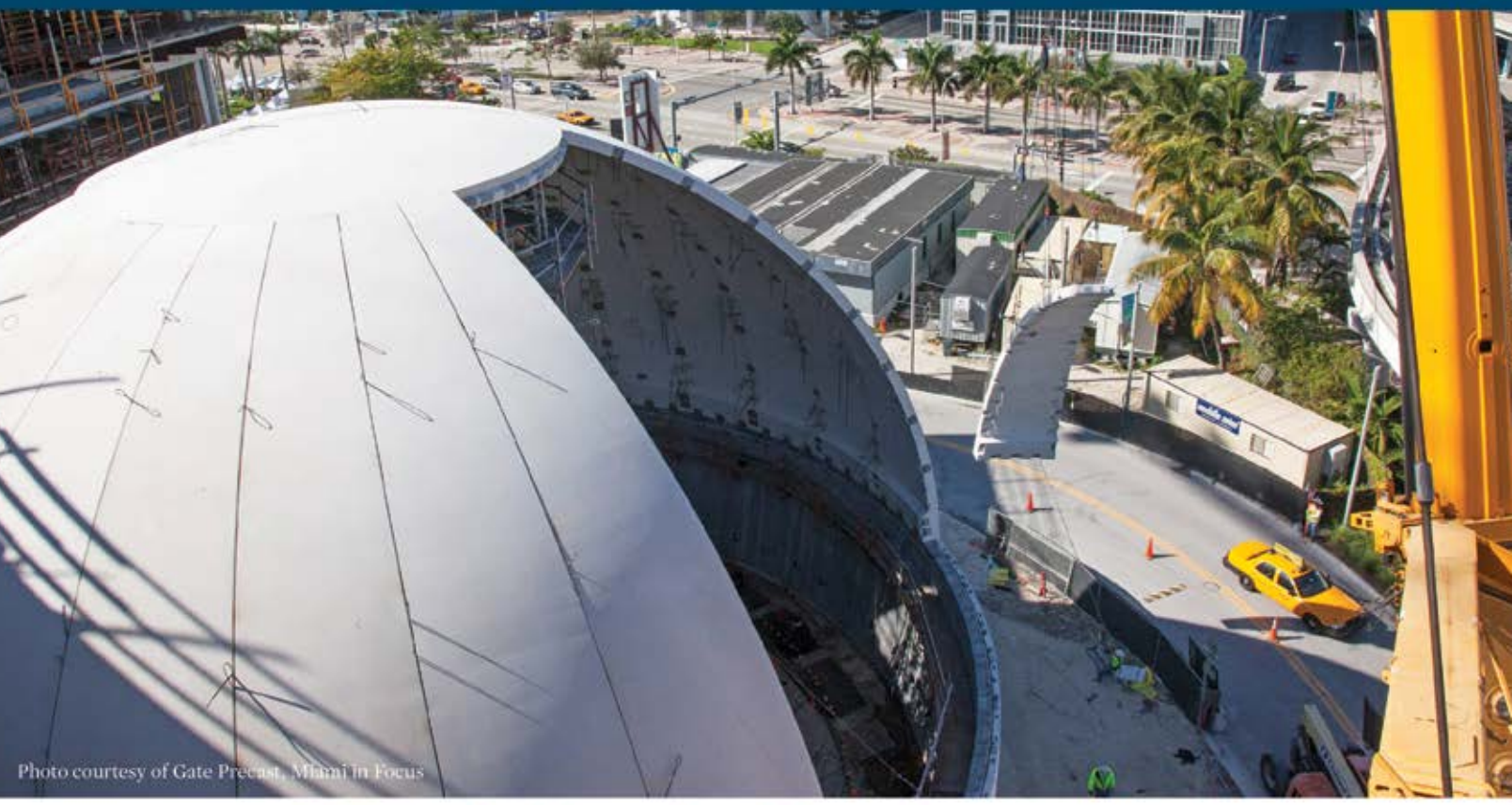
From a floorplan perspective, the seven lab buildings on seven different state college campuses are identical. What's different are the specialized interiors and engineering systems needed for the various curricula, as well as the architectural contexts of the surrounding campuses. Using precast, we could create different styles of architecture using the same basic footprint. Each building uses different embeds, tints, textures and entryway schemes to blend into the surrounding architecture. This prototype scheme gave the consortium a big cost savings in erection time and saved money that would have otherwise been spent creating distinct sets of construction documents for each one.

**Many people associate precast with warehouse boxes, but that way of thinking is outdated. Today, precast is used for high-end projects and has a certain cachet.**

**Q: How have you seen precast concrete evolve? How do you see it continuing to impact your work?**

**A:** One factor that has emerged recently is the artistry of precast. Many people associate precast with warehouse boxes, but that way of thinking is outdated. Today, precast is used for high-end projects and has a certain cachet. There's tremendous flexibility in the different looks you can achieve, and a lot of expressive ground to be explored. The only limiting factor is your imagination. Plus, down here in south Florida, it fits in really well with the Mizner-style, Mediterranean architecture that characterizes the region. PS

For more information on LEO A DALY, visit **leoadaly.com.**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