Clean Rivers for D.C. / Building an Entire City with Precast / Precast Gives a Dam

precast solutions

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ON THE COVER:
Welcome Home: How do you quickly construct quality homes for more than half a million people? Build an entirely new city with precast concrete. Learn more about how a variety of precast products are helping alleviate Iraq's housing problem on page 18.

Photo courtesy of Elematic.

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Photo courtesy of Elematic

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Going Big

Precast plant manufactures massive catch basin for one of the largest private development projects in the country.

By Shari Held

Photo courtesy of Coastal Precast Inc.

Photo courtesy of Coastal Precast Inc.

Coastal Precast's 55,000-pound catch basin required the use of 200 form panels for the inner and outer core.

Sometimes a leap of faith pays big dividends. That's exactly what happened for Eunice, La.-based Coastal Precast Inc.

In 2012, South African chemical company Sasol Ltd. announced plans to build an $11 billion petrochemical complex near its Lake Charles, La., facility.[1] At the time, Coastal Precast's business was only four years old. But Terry Brown, president and owner, treated Sasol's announcement as an incentive to build a larger facility in anticipation of the work and the doors it could open.

"We started preparing in advance so we could handle the workload," Brown said. "And it all worked out according to plan."

With prolonged heavy rainfall and severe flooding being common in southern Louisiana, a crucial piece of infrastructure for the Sasol expansion was an extensive underground drainage system. The goal was for a series of catch basins to control the excess water, allowing the new plant to remain in production during torrential periods of rain.

In April 2016, James Construction Group, one of the major contractors on the job, awarded Coastal Precast – a Louisiana Department of Transportation approved and National Precast Concrete Association certified plant – a contract to manufacture a 55,000-pound precast concrete catch basin for Sasol.

"This catch basin was one of the top 10 biggest ones out of the hundreds that we have on our scope of work for the project," said Paul Redmon, estimator/project manager for James Construction Group. "It's a pretty significant piece of the drainage system for the project."

GEARING UP FOR THE CHALLENGE

"We laughed, we high-fived, we celebrated," Brown said. "Then we geared up our equipment."

Prior to this project, the largest catch basin Coastal Precast had manufactured weighed 11 tons. Preparing to manufacture a 27.5-ton catch basin that measured 10-foot-by-14-foot inside dimension required serious planning.

"When you go from 20,000 pounds to 55,000 pounds, the whole ballgame changes," said Rob Ellifrits, plant manager. "It took a lot of planning and a lot of preparation to come up with a game plan."

It also took a capital investment. Coastal Precast purchased Symons Steel-Ply forming systems in a variety of sizes for the job.

"They're safer to use because you can carry one 2-foot-by-5-foot form that weighs 10 pounds compared to an aluminum or steel form that could weigh from 100 to 200 pounds," Ellifrits said.

GETTING DOWN TO BUSINESS

After considering several different approaches to manufacturing the catch basin, Coastal Precast opted to pour one big slab for the floor of the structure. They reinforced it with two layers of continuous, heavy-duty rebar cage on 4-inch centers for additional stability. Waterstop and Xypex waterproofing was applied at the intersection of the joint of the wall and the base slab.

The specifications called for the concrete to test at 4,500 psi at 28 days, but Coastal Precast used a modified self-consolidating

concrete mix that reached 7,326 psi at 28 days. The company also exceeded requirements for aggregate moisture and surface resistivity testing.

Coastal Precast used up to 200 form panels for the inner and outer core of the catch basin. Setting up the wall panel took a little more than a week. Once in place, workers attached the wall panels to the slab and poured them.

CALCULATING PERFECTION

Coastal Precast constructed the catch basin at the end of its facility, where there is an overhead opening. That opening was just large enough to accommodate a 120-ton crane that would lift the catch basin and place it onto a heavy hauler positioned directly underneath.

Precisely calculating the lift points on the catch basin was critical to safe positioning and transport. Get them right, and you get a straight pick. Get them wrong, and it's a 55,000-pound disaster. Ellifrits got it right, and the crane lift was perfectly level.

"When it gets down to game time and everything works as it's supposed to, it's such a relief," Brown said.

In May 2016, Coastal Precast shipped the catch basin to the site. However, the installation was delayed several times.

Southern Louisiana is known for heavy rains and flooding, and the spring brought heavier, more relentless rain than usual. Slick, wet conditions made it difficult for equipment to maneuver and the excavations for the catch basins had to constantly be pumped out.

When Coastal Precast got the green light, Brown, Ellifrits and the sales team from sister company Coastal Culvert & Supply were there to assist.

"They've been great to work with," Redmon said. "Everything we've asked them to produce, they've produced. And they produced it on time. Vendors like Coastal have made it a lot easier to deal with such a large project."

ENJOYING SUCCESS

The chance Coastal Precast took on the Sasol project continues to pay off. The company now has orders to manufacture 30,000- and 40,000-pound catch basins.

"It just opened up the door," Ellifrits said. PS

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

Endnotes

[1] theadvocate.com/baton_rouge/news/business/article_ee27ebd4-b3e6-5b13-8f7a-ba50845f73e7.html

Clean Rivers fo Washington, D

Thousands of precast concrete tunnel segments help reduce combined sewer overflows in nation's capital.

By Bridget McCrea

Photo courtesy of Traylor Brothers

Washington, D.C.'s Clean Rivers Project will annually reduce combined sewer overflows by 96%.

Introduced in 2005, the Clean Rivers Project in Washington, D.C., is a massive infrastructure endeavor focused on reducing combined sewer overflows into the district's waterways. The project, managed by the District of Columbia Water & Sewer Company, also known as DC Water, is designed to capture and clean water during heavy rainfalls. Once completed, it will reduce CSOs annually by 96% throughout the system.

The first major component of the work was the construction of the 24,200-foot-long Blue Plains Tunnel. As the largest of four major tunnels to minimize CSOs into the Potomac and Anacostia Rivers, the work – led by a joint venture consisting of Traylor Brothers, Skanska and Jay Dee – included tunneling four, 150-foot-deep shafts up to 25 feet in diameter. The entire tunnel was lined with precast concrete.

PRECAST: THE NATURAL CHOICE

The Blue Plains Tunnel work was awarded to Traylor-Technopref. According to Bryce Scofield, P.E., project manager for Traylor Precast, the project's engineers specified precast as the material of choice for the tunnel lining.

"It was soft ground, so there was no way to do an open-face cut, CM tunneling or any other type of tunneling," he said. "It had to be a tunnel boring machine, which naturally lends itself to using concrete-reinforced liners."

The nearly 25,000-foot-long, single-bore tunnel was made using an earth pressure balance tunnel boring machine that requires precast concrete tunnel liners. Each liner has a 23-foot interior diameter and is 14 inches thick and 6 feet long.

Photo courtesy of Traylor Brothers

Lady Bird, the tunnel boring machine used on the project, mined and constructed a 4.5-mile-long tunnel in 23 months.

A SUCCESSFUL OUTCOME

For the Blue Plains Tunnel project, the precaster produced 4,030 rings comprising 28,200 total segments of steel-fiber reinforced precast concrete. Scofield said the use of steel fibers affected the design approach.

"We got involved somewhat with the design and specifying just how much fiber would be required to achieve the required flexural strength for the tunnel lining," he said. "We had to come up with a system that would deliver the loose fibers to the mix in a very well-distributed manner."

Technopref's Louis Charette said the project kicked off in 2012 and that the precaster completed casting in April 2014. Lady Bird, the TBM, mined and constructed the 4.5-mile-long tunnel in 23 months. Half of the tunneling was predominantly in Potomac clay, which can be stiff and sticky, but was well suited for earth pressure balance technology.

Now completed, the Blue Plains Tunnel collects sewage and mitigates water runoff during storm events.

"This is a terrific milestone for DC Water's Clean Rivers Project," said DC Water CEO and General Manager George S. Hawkins.[1] "We are fortunate that the tunneling went so smoothly, finishing on time and on budget, and I applaud our DC Water staff as well as Traylor/Skanska/Jay Dee and everyone else who took part in this successful dig." **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] tunnelingonline.com/tbm-emerges-completing-blue-plains-tunnel-dc-water

Progressive En
Afoot on Canad
Pedestrian Brid

A little-known bridge design makes a big difference for the city of Edmonton.

By Kirk Stelsel

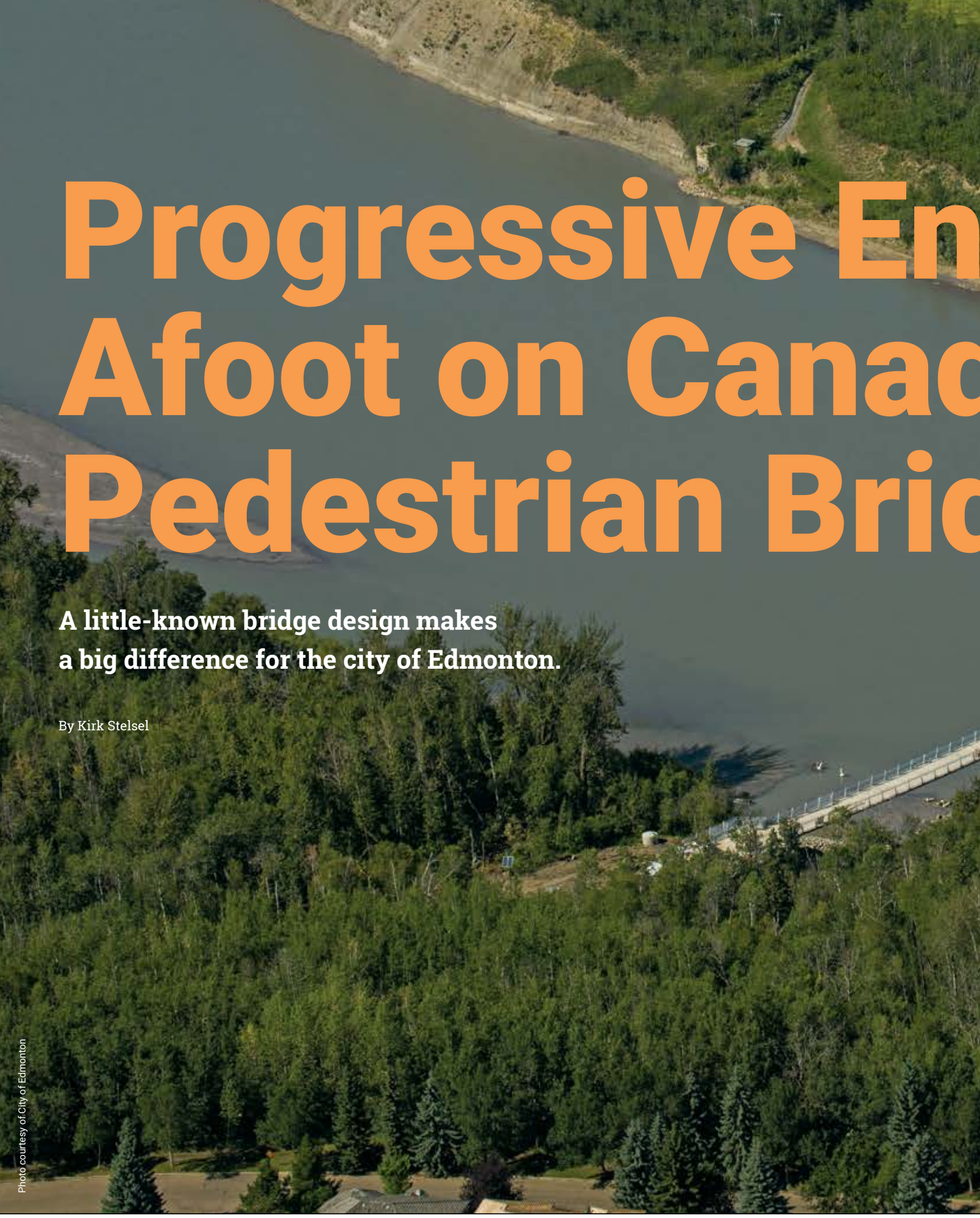

Photo courtesy of City of Edmonton

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Terwillegar Park's new stressed-ribbon bridge is comprised of 86 precast concrete deck panels.

Each of the precast panels was cast to slope toward the middle and needed to meet extremely small tolerances.

Terwillegar Park in Edmonton, Alberta, is a haven for the city's outdoor enthusiasts and those who just want to spend a little time in nature. The park boasts a large off-leash area for dog owners; plenty of space and trails for cycling, running or cross-country skiing; and a launch point for the North Saskatchewan River.

One thing lacking, however, was a link between the park and the land on the north side of the river. To remedy that, the city built the Terwillegar Park Footbridge.

To maintain the pristine natural surroundings, the city of Edmonton selected a unique and rarely used bridge design. The stressed-ribbon bridge design uses steel cables suspended across the river between abutments to hold precast concrete panels that form the decking. The result is a form factor that resembles a rope bridge with natural slack on either side of two piers in the middle of the river.

"The concept design showed the least impact to the river valley and least imposing visual impact using an elegant and exciting shape with the efficiency and durability of precast/prestressed concrete," said Allan Bartman, general supervisor for the city of Edmonton. "In addition to having the lowest cost and shortest schedule, the stressed-ribbon design, in public consultation meetings, was found to gain the highest approval and generated the most excitement due to its pleasing form."

The entire deck of the stressed-ribbon bridge was post-tensioned.

NO EASY FEAT

The city engaged Armtec, a precast manufacturer headquartered in Concord, Ontario, with a location in Edmonton, during the preliminary and design stages of the project. The result is a bridge comprised of 86 precast concrete deck panels. Each panel is cast with a trough where the panel sits on top of the 162 individual steel cables, which was no easy feat.

"The internal forming of the deck panel troughs presented some challenges," said James Siffledeen, business development manager with Armtec. "The trough formwork had to accommodate hundreds of individual projecting dowels as well as create a shear keyway while still being removable in daily casting without binding or damaging the trough region. Armtec's Production and Formwork Team carried out trials in order to create the ideal forming shape and stripping process."

Each panel was cast to slope toward the middle and needed to meet extremely small tolerances. A second consideration was a required minimum "aging" time of 180 days before post-tensioning the entire bridge structure. Armtec worked with the general contractor to develop a casting and off-site storage plan to achieve these requirements. The precaster manufactured the panels with high performance concrete and moist cured them in accordance with Alberta Transportation specifications to ensure a long life cycle.

Once the precast deck panels were in place, suspended over the river by the cables and stainless steel pins, the contractor joined all three elements through closure pours. Then, the entire deck was post-tensioned. The resulting deck is only 18.3 inches thick, which allows for a mostly unobstructed view of the surrounding natural beauty. Thanks to on-time delivery of the precast panels and proper planning, construction of the bridge remained on time and on budget.

A RARE SIGHT

Now completed, the Terwillegar Park Footbridge is 860 feet long. It is only the second stressed-ribbon bridge to be completed in Canada and ranks as the second-longest in the world, standing only behind a bridge traversing Lake Hodges in San Diego County, Calif. The rarity of these bridges results from a number of factors.

"Stressed ribbons are a relatively new prestressed and post-tensioned concrete concept that is not well known," Bartman said. "It is also challenging to design and requires more specialized analysis and design capabilities than typical girder or truss bridges."

Bartman and his colleagues were happy with the use of precast and the unique design. They found the option to be the clear choice and one that received a very positive response in the public consultation meetings. Siffledeen was also pleased with the production process.

"It was smooth due to the front-end work and mockups carried out by Armtec's team," he said. "This verified that the formwork and casting process provided the specific sculptured shape of the precast panels and achieved the extremely tight placing and finishing tolerances of both the concrete and embedded steel and hardware."

The bridge now stands as one more example of how precast concrete can enhance the world's infrastructure while minimizing the effects on natural surroundings. PS

Kirk Stelsel is NPCA's director of communication and marketing.

Photo courtesy of Kentucky River Authority

Precast Gives a Dam

Interlocking precast concrete blocks support important infrastructure upgrade along the Kentucky River.

By Mark Crawford

Located along the Kentucky River just outside Lexington, Ky., Lock and Dam No. 9 was constructed from 1901 to 1903. Completion of the structure resulted in a 19-mile-long body of water that has provided drinking water to the city of Lexington for more than a century. The dam has been renovated several times over its history, most recently from 1993 to 1995.

Due to steady population growth and the continued deterioration of the existing structures, the Kentucky River Authority decided to renovate the 14 locks and dams along the river. The goal was to increase longevity and storage volume and meet projected long-term water supply needs for the region.

The reconstruction of Lock and Dam No. 9 was performed from 2007 to 2010, and precast concrete was an important part of the work. C.J. Mahan of Columbus, Ohio, served as the general contractor on the $15-million project and Oldcastle Precast of Lexington manufactured the precast concrete.

Workers interlocked modular precast concrete components together to create an armoring system for the dam.

PRECAST MEETS THE CHALLENGE

Plans called for replacing the existing dam and raising the pool elevation. Stantec Consulting Services of Lexington conducted a flood study of the river and a structural analysis of the lock and dam components. After reviewing the data, the company recommended building a new dam immediately upstream from the existing structure. The new dam design consisted of eight steel sheet pile circular cells with 7-inch steel sheet pile connector cells. The cells were filled with concrete produced by a batch plant set up near the site.

Each cylinder was 52 feet in diameter and built directly in front of the old Lock and Dam No. 9. Officials decided not to build a lock in the new dam because of the cost. However, a cylinder was placed directly in front of the old lock. It can be removed and replaced with a new lock should the need arise.

The increased fall distance in the emergency spillway created concerns about erosion of both the spillway bank and the base of the dam itself.

"Structural solutions included scour-and-slope protections and a conveyance system to transfer water from upper to lower pools in times of drought," said Daniel Gilbert, the Stantec Consulting Services resident engineer on the project.

Due to the challenges of the river site – which frequently floods – precast concrete elements were selected to reinforce the areas of concern. In-the-wet placement, which consisted of placing precast in the wet river areas, was used where possible to reduce costs, risks, project duration and environmental impacts.

"We used a slope block and a toe block," Gilbert said. "Precast blocks were used to armor the slope downstream of the dam and provide toe protection at the new dam to armor against scour from the new dam structure."

The blocks were designed to be interlocking, in part because of equipment restrictions on the river. Smaller modular precast pieces were interlocked together to create the armoring system. Tight tolerances were required for both in-the-wet and in-the-dry placements. The interlocking nature of the blocks, however, provided some extra ability to adjust and accommodate existing conditions.

"The use of these elements provided the mass and protection against scour in an economical manner," Gilbert added. "The precast toe block elements were installed and then concreted in place to further lock them together, which was a highly effective solution."

A TEAM EFFORT

According to Jeff McKinley, general manager of the Oldcastle Precast Lexington plant, Oldcastle worked with the Army Corps of Engineers to develop the block design. Kay and Kay Contracting in London, Ky., fabricated special molds to create the custom interlocking shapes designed by the project engineers. The project required 113 precast pieces weighing 26,000 pounds each – a total of 1,500 tons.

"A key consideration in designing the molds was being certain that the pick points were located correctly so that when the blocks were lifted and set into place they were balanced and level," McKinley said. "Also, because of tight access conditions, the blocks were designed to maximize delivery on flatbed trucks, so overwide permits would not be needed."

Upon completion of the new dam, portions of the existing lock and dam were demolished. The lock gates were removed and preserved on site for their historical significance. **PS**

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

Photo courtesy of Elematic

Dream Big

The world's largest precast plant is helping to build a new city from the ground up.

By Shari Held

Photo courtesy of Elematic

Like a beacon of hope, the pristine precast concrete towers of Bismayah, Iraq, rise more than 100 feet out of the desert six miles southeast of Baghdad. The new city, roughly the size of 3,425 football fields, will contain a central business district surrounded by 834 U-shaped apartment towers, schools and social amenities. It will provide a new start for 600,000 Iraqis.

To say Iraq has an acute housing shortage is an understatement. The country is about 2/3 the size of Texas, but has a population of 38 million compared to about 28 million for Texas.[1] Baghdad, Iraq's largest city, is home to 9 million people. In Baghdad's most populated neighborhoods, it's common for 31 people to live in a one-bathroom home intended for use by a single family.[2]

South Korean engineering and construction firm Hanwha E&C was awarded the massive task of planning, designing and producing 100,000 apartments in just five years. They then had to determine how to get the job done.

"In the beginning, we naturally thought of using more traditional construction methods, but we changed to a precast method to shorten the construction time and reduce the workforce," said Jae Hyuk Choi, a Hanwha structural engineer for the project.

To facilitate an uninterrupted supply of materials, Hanwha constructed a base camp and plant complex near the site. Hanwha built 14 factories, turning to Elematic of Akaa, Finland, to create the three core facilities that compose the precast plant.

SETTING THE FOUNDATION FOR MASS PRODUCTION

Elematic broke ground for the precast plant in 2012.

"The big challenge was how we could design and supply the plant in the 24 months that were given us," said Ismo Kallio, Elematic product director for walls.

Elematic determined the capacity of the precast factory based on the number and types of elements to be cast and the timeframe in which the elements needed to be manufactured. They used that information to develop the layout of each plant.

The gargantuan plant contains more than 7 million square feet. It consists of a hollowcore plant, a battery mold plant and a sandwich plant, each with its own dedicated batching plant and automated concrete transportation system.

"Our company structure is flexible and we can quickly increase our production capacity," Kallio said. "It also helps that our production lines are based on standard equipment that we have

The battery mold plant houses 18 precast concrete stair molds.

Each of the towers is constructed with 58 precast concrete staircases.

Safety and security of all manufacturing processes are ensured thanks to a computer control system.

designed and built many times. If we had to make all this starting from zero, we never could have made it in 20 months."

The hollowcore plant produces the prestressed floor slabs and roofs for the apartments. It houses 32 parallel casting beds and eight extruders. Casting a bed takes about two hours. Six hollow cores within each slab decrease the overall weight of the slabs without sacrificing strength.

The battery mold plant produces the interior walls and staircases. It contains three battery molds with 12 casting cells each and two battery molds with 20 casting cells each. It also contains 18 stair molds.

The sandwich plant produces the external precast walls, which are injected with Styrofoam insulation. It contains 300 custom-made circulating flat tables for the four circulating wall lines and four 10-level high curing chambers.

A computer control system ensures the safety and security of manufacturing processes across all plants.

BISMAYAH BY THE NUMBERS

To make it all happen, Hanwha sent a team of 300 managers and engineers to Bismayah on 30-month long assignments. An additional 300 Korean subcontractors and hundreds of Bangladeshi workers are also involved.

It takes 1,050 wall elements, 1,316 prestressed hollowcore slabs,

The three core production facilities contain more than 7 million square feet.

More than 1,000 hollowcore slabs are installed in each tower.

Photo courtesy of Elematic

When the project is complete, it will provide housing for more than half a million Iraqis.

196 parapets and 58 staircases to construct one tower. That translates to nearly 140,000 cubic feet of concrete, 213 tons of steel rebar and approximately 44 tons of prestressed strands for the hollowcore slabs. Typically, Hanwha stockpiles elements for a dozen towers – more than 31,000 elements. In total, the three plants use 78,000 tons of cement annually.

The number of precast elements produced each month is mind-boggling: 13,182 for the sandwich plant, 6,396 for the battery mold plant and 18,252 for the hollowcore plant. These figures represent only 1/4 of what the operation is capable of producing.

"According to the initial plan, we were supposed to make precast products for 20,000 housing units per year, but for external reasons we had to downsize to 5,000 housing units per year," Choi said.

As of September 2016, Choi said Hanwha had cast 12% of all the precast elements and completed 87 of the 834 towers.

What has Hanwha learned from this project so far? "With careful plans and excellent production machinery, nothing's impossible," Choi said. **PS**

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


Photo courtesy of Elematic

Endnotes

1 worldpopulationreview.com

2 pri.org/stories/2010-10-15/baghdads-housing-crisis

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Remaking Histo

Historic bridge in New York is reconstructed in three months with precast c

By Mark Crawford

Whiteface Mountain, located in Wilmington, N.Y., is a year-round tourist destination popular among outdoor enthusiasts. The area rose to prominence throughout the second half of the 1930s and the 1940s thanks in part to completion of the Whiteface Mountain Veterans Memorial Highway in 1935, which was initiated under then-New York State Governor Franklin D. Roosevelt. To reach the mountain, visitors access a bridge completed that same year as they cross over the Ausable River on State Route 86. Today, the bridge carries about 2,000 vehicles per day over the river.

After exceeding its useful service life, the bridge was targeted for replacement in 2015. The new design is very similar to the old, but also includes decorative lighting and widened shoulders for safer bicycle use. Overhead utility lines on and near the bridge were also relocated. Because the bridge is the key approach to Wilmington and Whiteface Mountain, the New York State Department of Transportation sought to complete the project as quickly as possible, minimizing inconvenience to residents and disruption of tourist traffic. To meet these needs, they turned to precast concrete.

"With the project location only two miles from Whiteface Mountain, winter can start at in late November and continue through April," said Daniel Logel, a bridge consultant with Contech Engineered Solutions in Orchard Park. "The only way to get the structure built in such a short window of time was through the use of precast arch elements."

ADVANTAGE PRECAST

Logel helped the engineering team work through the unique design challenges of the project to build the most cost-effective structure. After consulting with Thomas Hoffman, who at the time was a NYSDOT Region 1 structures engineer, the team selected a BEBO precast bridge system. The project's precaster, LHV Precast in Kingston, N.Y., manufactured twin 70-foot precast arch spans for the bridge replacement, with an overall length of 146 feet.

Hoffman indicated there were additional site factors that led to the decision to use precast components. First, there was no room for a temporary bridge on the site, so the project had to be completed during March, April and May. Plus, at an elevation of 1,100 feet in the Adirondack Mountains, cold weather can prevail into late spring.

"The subsurface showed the soil was littered with 5-foot boulders, so micropiles would have been the only option," Hoffman said. "An additional wrinkle was that, after the original

LHV Precast manufactured twin 70-foot precast arch spans for the bridge replacement, with an overall length of 146 feet.

Construction of the new bridge took about three months to complete.

bridge was constructed almost in the dry, a dam was constructed downstream. That made the existing footing 19 feet below ordinary water.

"Therefore, we decided to reuse the portions of the substructures below the waterline that had not been subject to freeze-thaw."

GETTING IT DONE

The clock started ticking in March 2015, when Tioga Construction of Schuyler, N.Y., shut down the bridge and began demolition of the 80-year-old structure. Total construction – including demolition of the existing structure, placement of footings, precast, parapets, backfill, pavement and lighting – took a little more than three months to complete.

According to Logel, LHV Precast manufactured 28 arch pieces and 16 sections of parapet wall that had a formliner finish on the outside face and a stamped formliner finish on the inside face of the headwalls. The walls were stained to look like the natural stone of the region.

NEED FOR SPEED

Perhaps the most important consideration in selecting precast for the job was the need for speed – not only to minimize inconvenience, but also because an Ironman competition was scheduled to cross the bridge in July 2015. Detours and delays were held to a minimum and the bridge was completed well in advance of the race.

"Faced with a three-mile detour, weather concerns and the need to maintain the historic look of the bridge, precast arch elements were selected as the material of choice for the new structure," said Jim Willis, vice president of production and dispatch for LHV Precast. "The accelerated schedule afforded by the use of precast concrete was much appreciated by those who were inconvenienced by the construction activities." **PS**

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

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A Different Kind of Bridge

Precast arches create a one-of-a-kind park along 100 acres of Tulsa, Okla., waterfront.

By Shari Held

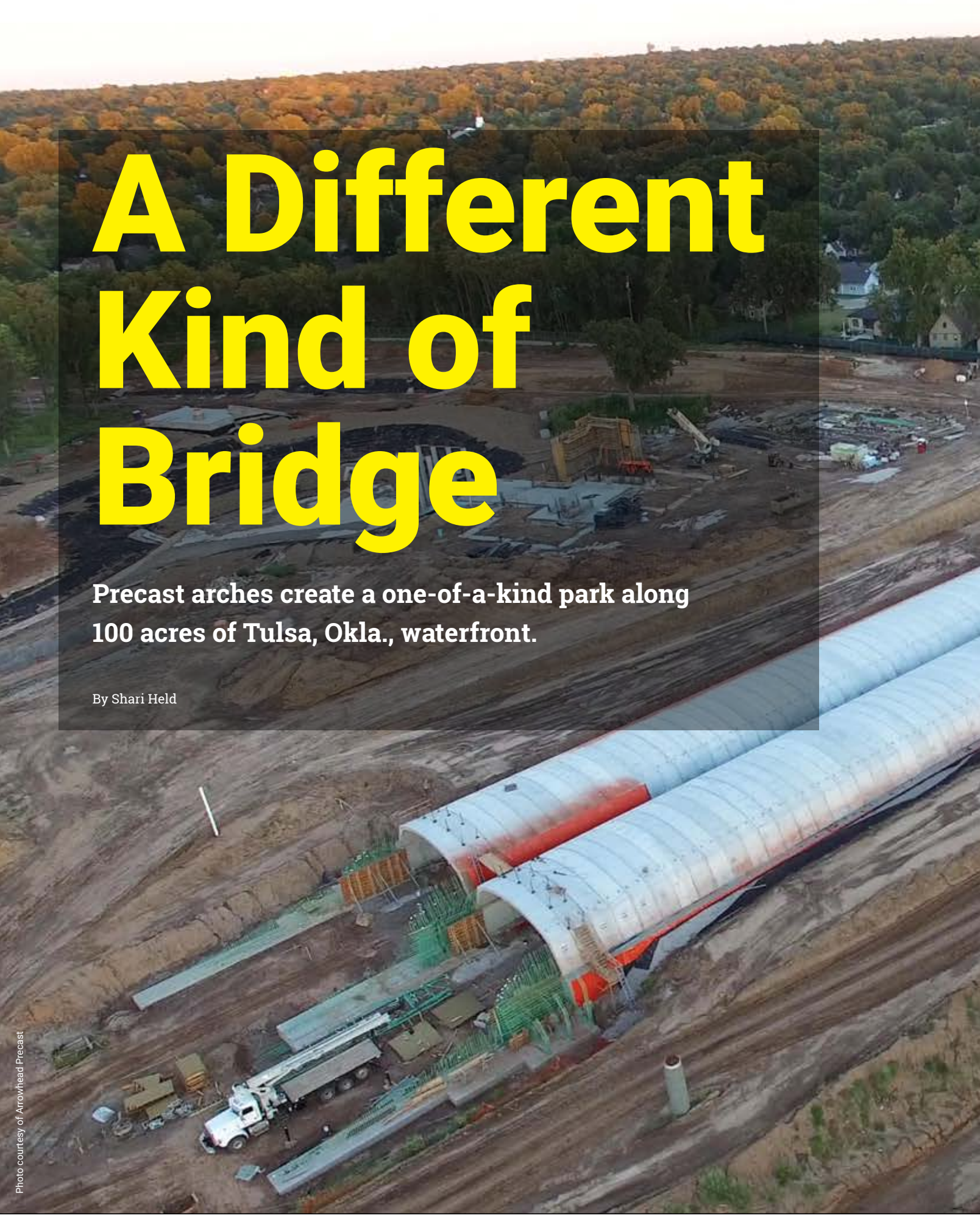

Photo courtesy of Arrowhead Precast

Photo courtesy of Arrowhead Precast

Arrowhead Precast manufactured 5,300 tons of precast concrete for A Gathering Place for Tulsa.

A $350 million donation from the George Kaiser Family Foundation – the largest private gift to a public park in U.S. history – promises to make A Gathering Place for Tulsa one of Oklahoma's top attractions. Once it's completed in late 2017, the park is anticipated to draw 1 million people each year.

Designed by New York-based architectural firm Michael Van Valkenburgh Associates, the new park will feature a five-acre playground, lodge, boathouse, pond, sports courts, nature trails, gardens, concert lawns and more.

Crucial to the park's infrastructure are the new land bridges. They rise 20 feet above the two twin-cell precast concrete traffic tunnels on Riverside Drive, one of Tulsa's main thoroughfares.

The top of each land bridge will be covered with up to 14 feet of fill that will support trees, landscaping and park structures. This will create a safe and scenic pedestrian park experience while allowing an uninterrupted flow of vehicular traffic below. It's the perfect balance of practicality and aesthetics.

"The utilization of land bridges is really what makes this park, because it allows people to get down to the Arkansas River safely – something that couldn't be done before," said Dan Logel, bridge consultant for the state of New York at Contech Engineered Solutions.

Precast concrete played a major role in making it all happen.

HIGH QUALITY, LOW COST

Contech worked with the New York City office of infrastructure solutions firm HNTB Corp. to develop a structure that could bear the weight of the fill as well as park structures and landscaping.

The biggest challenge was coming up with a cost-efficient design, and precast was a more cost-effective solution than cast-in-place. Producing cast-in-place elements would have required a new setup for every component. That would not only be more costly, but also more time-consuming.

"By using precast, workers were able to set a component every 30 minutes from the time it arrived on site," said Ryan Davis, sales and marketing manager for Arrowhead Precast, which produced the components.

Precast also allowed for a higher quality end product.

"With precast, you're able to do quality control on every load of concrete used," Logel said. "NPCA certification is one of our standards for becoming part of our producer network. Quality is what we live by and NPCA has provided a forum to evaluate that."

A LOGISTICAL CHALLENGE

Contech worked with Arrowhead Precast, which it had previously partnered with on local department of transportation and county projects, to produce the precast components for the project.

Overall, Arrowhead Precast produced 5,300 tons of precast to create the 196 CON/SPAN arch units for the two land bridges. Each arch weighs 27 tons and has a span of 42 feet.

"We manufactured and stored the units so that we could quickly ship them," said Brad Davis, general manager for Arrowhead Precast. "It's been a great team effort to meet the project's demanding schedule."

Arrowhead Precast poured self-consolidating concrete into vertical forms to help eliminate bug holes, honeycombing and other imperfections in the panels. The company produced two precast arch units per day.

"We prefer SCC so we don't have to use the vibrators to consolidate the concrete around the rebar," said Cecil Casinger, technical operations manager for Arrowhead Precast. "It flows better and actually speeds up production."

The biggest challenge for Arrowhead Precast, which is located about 30 minutes from the job site in Broken Arrow, was transporting the components in a timely fashion. Since on-site workers could set a component every 30 minutes, Arrowhead Precast had to preload multiple trucks the night before. Once those were unloaded, they'd return for more.

"Once the site started taking them, we did 24 loads per day," Casinger said.

A WIN-WIN FOR EVERYONE

Both Contech and Arrowhead Precast are grateful the project used local materials and labor to boost the local economy and that the park will provide a much-needed resource for the community and beyond.

"I take a lot of pride in this project," Brad said. "Twenty or 30 years from now we'll be able to look at it and know it was something we were instrumental in creating." PS

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

Under the Boardwalk

Photo courtesy of EnCon

In November 2014, Mother Nature took a nasty swipe at Des Moines, Wash., whipping up a powerful storm that inflicted wide-ranging damage along the city's coastline. The community of Redondo was hit particularly hard. There, the storm destroyed a much-loved wooden boardwalk, forcing officials to close it for nearly two years.

This year, the community will once again be able to enjoy the waterfront walking and biking trail thanks to a $4.7 million investment from city, state and federal sources. The rebuilt structure includes a precast concrete deck with a wood-stamp finish, stainless steel cable railing and low-level deck surface illumination, all positioned on top of the previous structure's pile encapsulation.

WANTED: BETTER LONGEVITY AND RESILIENCY

Andrew Merges, the city's transportation engineer, says the city worked with a design consultant that proposed an all-precast structure to replace the wooden structure. Working with EnCon Washington LLC, the city came up with a design that would fit its budget and aesthetic requirements.

"The project morphed from a wooden boardwalk into a concrete structure that would offer more longevity and resiliency against future storm events," Merges said.

In an effort to replicate the existing structure's wooden finish, Merges said EnCon proposed a few different precast samples in a variety of patterns.

"Both politically speaking and from a community perspective, EnCon sold the vision of creating a concrete product that possessed the aesthetics of real wood," he said. "After seeing that, we were sold on the idea of using precast."

Kirk Buhne, director of business development for EnCon, said his firm got involved with the project when the city's design engineers called for help. The engineers wanted a structure that would stand up to "wave action" while also providing the same level of aesthetics of the previous structure.

"They talked to me about the boardwalk's legacy and how people didn't really want it to change or go away," said Buhne, who helped quell the aesthetic concerns. "So we produced some samples with formliners and various stains to come up with a look that went over well."

West Coast city reconstructs popular boardwalk with resilient precast concrete.

By Bridget McCrea

Photo courtesy of EnCon

PRECAST TAKES CENTER STAGE

During the material selection phase, Merges said his team also realized that construction sequencing would be difficult to achieve with cast-in-place concrete because of the tidal influences at the project site.

"One of the main reasons why we went to precast was because we needed a product that could be installed easily to accommodate the incoming and outgoing tides," he explained. "We didn't want any water intrusion into the product."

From a structural standpoint, Buhne said precast exceeded the city's needs for a product with a longer life cycle than had been used on the previous structure.

"This is a pretty important project for the area and surrounding communities," said Buhne, who is particularly enthused by the high visibility of the EnCon project. "Our employees don't always get to see and enjoy the fruits of their labors, but in this case all of their hard work is right there in front of their eyes. That's pretty neat."

600 PEDESTRIANS PER HOUR

Roughly 1/2-mile long, the boardwalk – built by Stellar J. Corp. – incorporates 153 precast crossbeams that are approximately 8 feet long and 2 1/2 feet wide. The structure also includes 162 precast deck panels, which rest on the crossbeams, that are approximately 8 feet long and 15 feet wide. To install the precast crossbeams and panels, the contractor used anchor rods placed into the existing seawall and piles.

According to Merges, the new boardwalk was completed without any major challenges. It opened to the public in October and will once again host roughly 600 pedestrians per hour (average usage during "peak" hours).

"It's a focal point that draws a lot of people from the surrounding areas and is a very important part of the area infrastructure," he said. "And thanks to this contract, the project also provided quite a few jobs this past construction season, so it's a real win-win for our area." 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.

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