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ON THE COVER:

Concrete Canvas: What do you get when you combine photoengraved precast concrete panels with stills from a 1901 Thomas Edison film? A stunning student residence at McGill University in downtown Montreal. Learn more about the manufacturing process and the local history that inspired the work by reading the story on page 18. Photo courtesy of Marc Cramer.

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Ballast-ing Away Flotation

A graphic of a water splash, showing droplets and ripples, positioned below the main title and above the subtitle.

Avoid flotation issues with foresight and a powerful buoyancy calculator.

By Phillip Cutler, P.E. and Kayla Hanson





Flotation calculations for the Upham Woods project in Wisconsin required more than 52,000 pounds of ballast be added to the tank.

Out of sight, out of mind.

It's a popular expression used in situations where a troublesome issue or cause for concern can be ignored because it can't be seen. But abiding by such logic in the construction industry is a dangerous game.

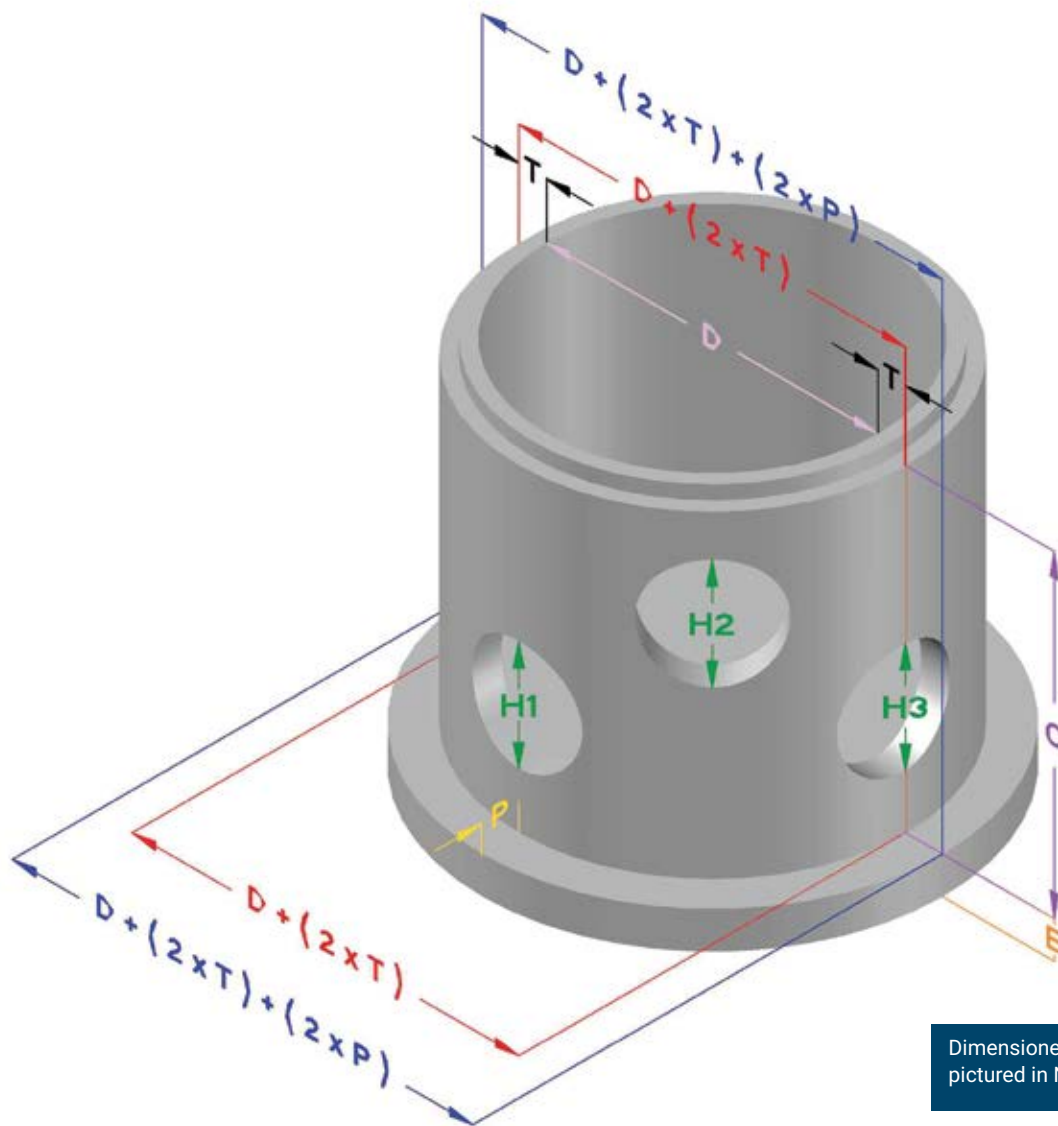
When a structure is buried underground, adverse conditions can create difficulties for designers, contractors and precast manufacturers. For example, the buoyancy or uplift force on any structure boils down to the weight of fluid displaced by the structure. Many below-grade precast concrete structures installed near a high water table face the hidden challenges of buoyancy. If these challenges are not taken into account, flotation can occur, meaning bad news for the project.

Thankfully, these potential issues can be avoided with a little planning and the help of the National Precast Concrete Association's buoyancy calculator.

BIG TANK, BIGGER BALLAST

A building expansion project for the Upham Woods Outdoor Learning Center in Wisconsin Dells, Wis., called for a large aerobic treatment system to handle the property's wastewater. Project plans specified a multi-tank precast concrete solution. Wieser Concrete Products of Portage, Wis., secured the work.

"The project presented many challenges, including the high seasonal groundwater in some of the tank locations," said Vice President Mark Wieser. "One of the most severe locations involved



Dimensioned manhole base section as pictured in NPCA buoyancy calculator.

a tank that was 20 feet long, 12 feet wide and just over 9 feet deep. We had only 2 feet of soil cover on the top of the tank and the seasonal distance to groundwater was only 1 foot.”

When facing difficult site challenges due to high seasonal water tables, designers commonly consider buoyancy or flotation calculations as part of the project details. These calculations are not difficult to make as long as the structure and site parameters are known.

“Flotation calculations for the tank at Upham Woods required more than 52,000 pounds be added to the tank,” Wieser said. “The challenge with adding this much weight is where to put it and how to attach it to the tank.”

COUNTERACTING BUOYANCY

If a high water table exists, flotation can occur when the tank in question is pumped. To prevent this, ballast can be added to the product. Typically, the amount is equal to or slightly greater than the weight required to equal the buoyancy force when the structure is empty, plus a marginal factor of safety. Although the factor of safety varies slightly, a good general rule of thumb is 1.1 times the calculated uplift force. For severe or continuous cases, a factor as high as 1.25 may be considered.

There are as many ways to add ballast to a structure as there are design possibilities for that structure. Sometimes weight is added by attaching a concrete anchor system with cabling. In most cases, this method requires additional site excavation. Another



Upham Woods project in Wisconsin Dells, Wis.

approach is to design the structure with additional depth and fill the void with concrete to achieve the desired weight. Adding ballast this way increases impact to the site by requiring a much deeper excavation and would only be considered if minimal weight is needed.

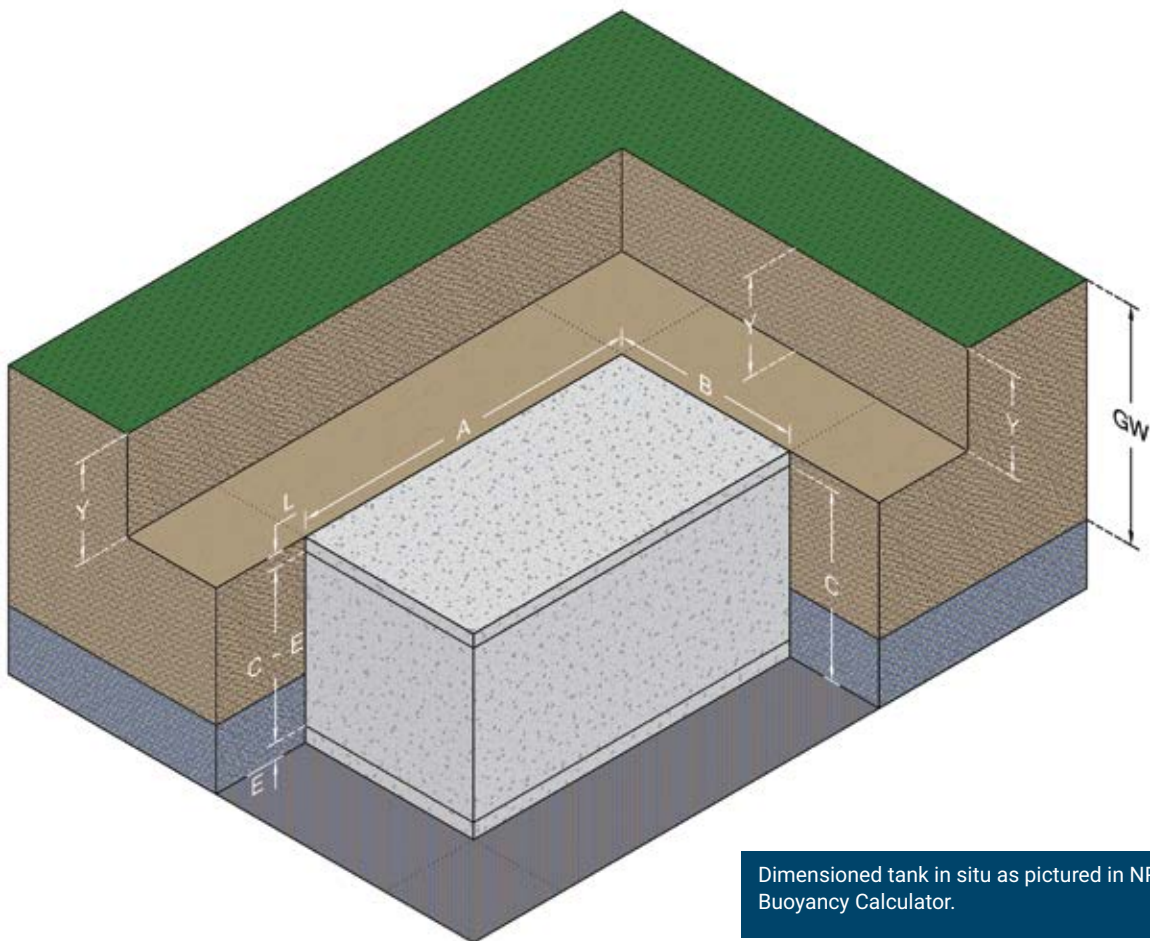
A more common solution is to add an extension at the base slab, much like a footer. Doing so takes advantage of the additional concrete that forms the extension as well as the weight of the saturated soil bearing directly above it. Wieser Concrete Products adopted this method for their Upham Woods project.

“The outside of our tank had exterior ribs on it, so we placed 13 cubic yards of concrete along the sides, on top of the ribs,” Wieser said. “This created a shoulder all the way around the tank, providing additional protection against flotation.”

TOOLS AND RESOURCES

Scouring the Internet for reference material about buoyancy can be frustrating. NPCA has developed a series of resources to help simplify the process.

- The **Buoyancy White Paper** provides you with an all-inclusive, step-by-step resource on buoyancy as it relates to precast concrete structures. The White Paper includes multiple examples detailing calculations and solution methods.



Dimensioned tank in situ as pictured in NPCA's Buoyancy Calculator.

Download the Buoyancy White Paper at precast.org/buoyancy.

- NPCA's newly revised **Buoyancy Calculator** offers designers, engineers and precast manufacturers a tool to determine a number of parameters related to buoyancy and flotation. The calculator allows input of structure parameters and site conditions for both round and rectangular structures. These values are used to calculate uplift forces and the amount of ballast required to counteract buoyancy issues. Download the Buoyancy Calculator and the Buoyancy Soil Values References Sheet at precast.org/buoyancy.

If you have any questions, please contact Phillip Cutler, P.E., at pcutler@precast.org or (800) 366-7731. **PS**

Phillip Cutler, P.E., is NPCA's director of quality assurance programs.

Kayla Hanson is a technical services engineer with NPCA.

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An aerial photograph of a rural landscape. The foreground shows a green field with a small farmstead including a white house and a barn. A road runs diagonally across the middle of the image. In the background, there are more fields, trees, and a distant town under a clear blue sky.

Ahead of the Game

Civil engineering students at Purdue University make the most of a senior design course – and a little precast concrete – to hone their skills before graduation.

By Mason Nichols and
Sue McCraven



Purdue University civil engineering graduate Ryan Martin.



A group of students at Purdue University attend a CE498 presentation.

Ask any civil engineering student how he or she is feeling and you'll likely hear "tired" or "worn out." Obtaining a bachelor's degree in civil engineering is a difficult task, and every student must put in a massive amount of work to be successful.

For students at Purdue University's Lyles School of Civil Engineering in West Lafayette, Ind., the situation is no different. Over the course of four years, students take classes covering topics such as transportation, structures and everything in between to prepare them for the complexities of being a modern civil engineer. All of these experiences ultimately lead to the capstone design course, CE498, which requires students to put their accrued abilities to the test in a real-world application. In many cases – including the one outlined below – precast concrete is an important part of the equation.

INVALUABLE EXPERIENCE

Although several instructors at Purdue teach CE498, Robert B. Jacko, Ph.D., P.E. and professor of civil engineering, has been a mainstay since the 1970s. Initially, he taught the course only when called upon to do so. However, since 2000, he has taught CE498 every semester.

According to Jacko, one of the most important benefits of CE498 is the experience students receive working with engineering firms. "I usually pick a project that is allied with a large consulting firm like HNTB or CH2M HILL," he said. "I'm very proud of the fact that we partner with firms that have real projects."

Over the years, students have worked on many different projects, including a windmill farm, a soccer field and a college

basketball arena, among others. No matter the project, student input is vital, and municipalities often choose plans designed in the course for real-world implementation.

To simulate the experiences students will face in the workforce, Jacko places them into teams. Each team appoints a project manager and assistant project manager who meet with Jacko throughout the course of the semester. During meetings, the parties discuss human resources, technical problems and anything else that may arise. The goal is to place students in situations they will face when working on team-based projects within engineering firms or government agencies.

For many students, including Ryan Martin, a recent Purdue graduate and current civil engineer with The Burke Group in Chicago, CE498 is a difficult – but extremely rewarding – course.

"Engineering students spend most of their time in a lecture or lab; we write a report or take a test and then the course is over," he said. "With the senior design course, students are forced to come up with their own solutions. There's no right answer."

Despite the challenges, Martin said CE498 helped sharpen many of his skills, including public speaking, group work and time management.

A PRECAST SOLUTION IN INDIANA

For the fall 2014 semester, Jacko collaborated with the Indiana Department of Transportation to secure work on the rehabilitation of a 21-mile section of roadway stretching from Martinsville to Bloomington, Ind. The project will upgrade parts of State Road 37 in Indiana to highway standards, extending Interstate 69.



Sections of State Road 37 in Indiana will be converted to highway standards, extending Interstate 69.

Setting up CE498 for the project worked extremely well thanks to INDOT's classification of six subsections along the roadway.

Jacko divided the class into groups of six or seven and assigned each team to a subsection. Students were required to design an intersection containing an overpass, paying specific attention to issues such as drainage, pavement design, lighting, pedestrians and more.

"It's quite comprehensive when you do an interstate like this," Jacko said. "It gets extremely real-life for the students. Those are just some of the beauties of the course."

The groups selected precast concrete box culverts as the material of choice for their underpass designs. According to Jacko, this was the best decision.

"The labor costs to form up culverts on site would be silly," he said. "With the kind of culverts they're using, why wouldn't you? The pieces can be brought to the site in an efficient manner and can be installed fairly quickly in an effective fashion."

Jacko added that although students generally specify precast concrete for roadway work in CE498, he sees great potential for additional uses in other upcoming projects.

READY FOR ANYTHING

More than anything else, students taking CE498 at Purdue benefit from the invaluable experience that comes with working on real, tangible projects. Armed with sharply refined skills and knowledge of the advantages of precast concrete products, students can enter the workforce confident in their ability to engineer solutions to any project, no matter what the challenges may be. **PS**

Mason Nichols is the managing editor of Precast Solutions magazine and is NPCA's external communication and marketing manager.

Sue McCraven is a civil and environmental engineer.

Photo Credits:

Pages 11-12 – Indiana Department of Transportation

Page 12, Right – Robert Jacko

Page 13 – I-69 Development Partner Team



Right time

An overburdened highway is renewed with the help of precast concrete products.

By Kirk Stelsel

Have you ever gone on a once-in-a-lifetime road trip with friends? Do you have a favorite childhood memory of a family vacation that started with everyone piling in the car?

It's easy to get nostalgic thinking about memories that include friends or family, a vehicle and the open road. Some highways, like Route 66 and the Pacific Coast Highway, are so iconic that they have become an important part of American culture.

But there's another side to highways ... the stressful side. A lot has changed since the Lincoln Highway became the first transcontinental highway more than a century ago. Populations have grown and overall traffic has increased tremendously. Some once-efficient roadways – the same open roads memories are made of – have become burdened with traffic far exceeding the confines of their original design parameters.

ing the Way



The interchanges in the Hamilton County portion of the U.S. 31 project replace intersections that used to be regulated by traffic signals.



A precast sound wall was installed along an extension of Illinois Street, which parallels U.S. 31 to the west.

However, one stretch of highway in Indiana is receiving new life. The Indiana Department of Transportation has infused U.S. 31, which connects traffic from Alabama to Michigan, with a \$350 million upgrade to bring it to freeway standards north of Indianapolis. It's no surprise that the backbone of the project is precast concrete.

A ROADWAY REVIVED

The primary goals of the U.S. 31 project, which was first covered in the Winter 2013 issue of *Precast Solutions*, are to maintain traffic flow and improve safety. The highway shoots north out of Indianapolis through Hamilton County. There, it cuts through suburban hubs that were once small communities surrounded by farmland. The city of Carmel, for example, had a population of 6,691 in 1970, which has now swelled to an estimated 85,927.¹ The overall project stretches all the way to South Bend in northern Indiana.

In Hamilton County, precast concrete manufacturers delivered countless manholes, catch basins, three- and four-sided structures, underground utility structures and pipe sections. This underground infrastructure creates the skeleton for the roadway. Above grade, work continues but traffic signals are now gone,

replaced by modern interchanges. Automobiles sweep safely and seamlessly on and off the highway onto ramps designed to mimic Indiana's famous limestone outcroppings. The look comes from a formliner finish on precast mechanically stabilized earth panels manufactured by Sanders Pre-Cast Concrete Systems in Whitestown, Ind.

Bridges carrying traffic east and west over the highway have been largely constructed using precast/prestressed beams. Stress-Con Industries of Shelby Township, Mich., supplied 134 beams for 10 bridges, with the largest beam weighing 130,000 pounds. The beams achieved 7,000 psi compressive strength in 28 days and provided the DOT with faster installation, cost savings and reduced lifetime maintenance. These bridges, along with the ramps, eliminate long lines that in the past would accumulate during rush hour for east-west traffic, separating those vehicles completely from the heavy north-south traffic. When all sections of the project are completed, the estimated travel time between Indianapolis and South Bend will decrease by 30 minutes.

According to Jason Rowley, project manager at CHA and design manager of the U.S. 31 project for the past six years, workers completed a tremendous amount in 2014. Seven interchanges are now open, three are 50% complete and the remaining two are at



Prestressed beams and precast MSE wall panels were used for this underpass that eliminated a traffic signal on U.S. 31.

15%. The interchanges have kick-started the heart of a roadway that once beat proudly but over time has slowed to a near halt during high-traffic hours.

“Hundreds of designers and contractors have contributed to this very successful project,” Rowley said. “It’s impossible to mention everyone and every company. This was an amazing team effort.”

Complementing the major work on the interchanges, smaller projects such as roundabouts and road extensions are in progress or have been completed to the east and west of the highway. At one site, an extension of Illinois Street – which parallels U.S. 31 to the west – the work included installation of a sound wall. The Verti-Crete wall, manufactured by Norwalk Concrete Industries in Norwalk, Ohio, features a stone finish. It provides an aesthetically pleasing way to reduce road noise for an existing neighborhood. Overall, workers installed 2,300 linear feet of sound wall posts, panels and caps in just eight days. To the east of the highway, construction crews are widening Main Street, which leads to Carmel’s Arts & Design District. The work includes installing new underground infrastructure such as precast pipe, inlets, catch basins and manholes.

The combination of durability, ease of installation and beauty

of precast concrete products met the wide range of needs the engineers and planners faced. Rowley has seen a tremendous amount of precast concrete products delivered and installed on the roadway over the years.

“Without precast products, this project would have been much more expensive and it could not have been built as quickly,” he said. “Having the precast industry experts designing their products also increases quality and adds efficiencies into the construction process. Construction time savings also reduce the impacts to businesses, the traveling public and the environment, resulting in improved air and water quality.” **PS**

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

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Pages 14-15 – Jason Rowley

Pages 16 and 17 – NPCA

(Endnotes)

¹ New population estimate according to the latest Census data available at <http://census.gov>.



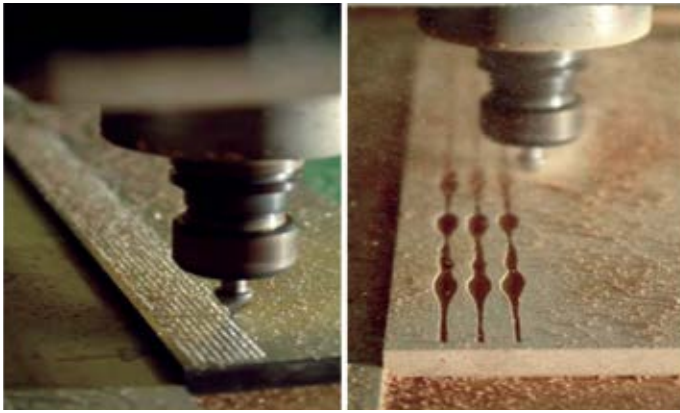


256

Shades of Gray

Precast concrete student housing in a historic Montreal, Quebec, neighborhood infuses modern design with local history.

By Deborah Huso



A computer numerical control milling machine creates a variety of subtle grooves which ultimately display the selected image.

The urban landscape is bleached white with snow. Shadowy horses pull carts of similarly shadowy men, whose wispy breath is exhaled in the cold. Steam rises from fire engines as they make their way through downtown Montreal. It's 1901, and American inventor Thomas Edison is capturing the scene in scratchy black-and-white film as firefighters roll past to battle blazes in the city.

It has been more than a century since Edison immortalized those firefighters in his film "Montreal Fire Department on Runners," but the scene still plays out again and again on the bustling University Street. Architects recently put the finishing touches on the Edison Residence, an airy 30-room building with communal living spaces just outside the gates of McGill University. The residence's precast concrete façade is finished with stills from Edison's film that appear to move depending on the angle an individual takes when viewing the building. The technique, called photoengraving, was made possible by RECKLI, a Germany-based rubber formliner manufacturer and one of several photoengraving formliner producers throughout the world.

BRINGING PRECAST TO LIFE

The site of the Edison Residence had been vacant for more than 50 years after a fire demolished the site's original stone house. But this was prime real estate in a historic Montreal neighborhood, and the location's easy access to the McGill campus made it perfect for student housing.

Tasked with the building project, KANVA, a Montreal architecture firm known for its unique approach to storytelling through design, faced a few limitations.

"Given its location in a heritage zone, the building was required to have a masonry façade," said Katrine Rivard, one of the project architects. "But we knew the building design needed to be cutting edge and push architectural boundaries – a laboratory for experimentation. And given our restriction on using masonry, concrete was a good compromise to fit within our material limitations while enabling extensive possibilities."

KANVA selected square, 10-and-a-half-foot precast concrete



The finished precast concrete panel can display 256 shades of gray, allowing any image to be produced.

panels with insulation sandwiched in the middle. The outer surfaces serve as the photoengraving's canvas, while the other side functions as the residence's inner walls with a uniform finish applied. According to Rivard, no additional elements needed to be added post-installation. Designers also chose the panels for their ability to endure the freeze/thaw cycle of Montreal's harsh springs and for the zero maintenance necessary post-construction.

Most importantly, Rami Bebawi, KANVA cofounder and partner, said the photoengraving of the precast concrete offered "the possibility of bringing to life what is traditionally considered a more neutral material."

ETCHING HISTORY INTO PRECAST CONCRETE

To set the process in motion, architects at KANVA first chose images to extract from Edison's film. Rivard said the most dynamic sequences made the cut. According to Bebawi, choosing the stills was a challenging process.

"Selecting images carries a greater responsibility with respect to displayed content and storytelling," he said. "Unlike digital billboards that readily offer the possibility of ever-changing imagery, photoengraving remains permanent, and thus, depicting images involves considerations in terms of pertinence and social context."



The image appears to move based on the viewer's vantage point, pace and lighting conditions.

Once KANVA selected stills, they were shipped overseas. A group of KANVA architects next traveled to Herne, Germany, to gain a solid understanding of the entire photoengraving process.

The following is a step-by-step look at how the photoengraving formliners are created according to Bruce MacPherson, marketing director for Nawkaw/U.S. Formliner, the North American RECKLI supplier:

- The manufacturer scans film images into a computer and “digitizes and optimizes” them for reproduction.
- The computer separates color tones into 256 shades of gray, essentially creating a digital photo negative.
- The computer generates a machining file from the identified gray values. The file includes milling commands for a computer numerical control milling machine.
- The milling commands tell the CNC machine how to engrave the photograph onto a model. Commands include a variety of subtle grooves that vary in texture from fine to coarse in order to create the different shades of gray first identified from the separated color tones.
- The CNC machine then draws the image onto a concrete milling model.

- The polyurethane formliners are poured over the finished milling model. The rubber formliner is a negative, so when the precast concrete panels are poured into the grooved formliners, the final image is a positive.

“RECKLI uses rubber molds to add flexibility and preserve intricate details of the photoengraving,” MacPherson said.

Once created, the liners were shipped to Montreal precast concrete manufacturer Saramac to handle pouring. During the pouring process, site workers added in extras, including “spacers for joints and embedded elements like insulation and metal connectors,” Bebawi said.

A crane fastened the panels to the structural slab with large metal brackets and all joints between panels were filled with silicone. Within five days, builders had put together the structure’s façade. As a finishing touch, they applied Faceal Oleo HD, a protective outer seal that safeguards the building from the elements and helps preserve the façade’s appearance.

MOVING PICTURES

Pedestrians tend to pause as they come upon the Edison Residence. Based on the vantage point, pace and lighting, the images on each panel appear to move.



"Because the image is engraved into the concrete, it is dependent on a light source to cast shadows," MacPherson said. "This is why people claim the image moves or changes – it truly does."

"There's no question that this is a very eye-catching technique. But it's also a zero-maintenance way to permanently add intrinsic aesthetics to any concrete structure."

While there are other types of photoengraving using colored aggregates and dyes, the process is a relatively new technology. In 2008, Quebec City's Promenade Samuel-De Champlain constructed concrete walls with engraved scenes. It was the first project where the technique was used in North America.

"The Edison Residence is the second project and the first building [in North America] using this technology that we're aware of," Rivard said.

As Bebawi explained, with new technology comes growing pains.

"It was a major challenge coordinating all the openings and elements embedded within the concrete pour while trying to maintain a continuous façade image," he said.

But, he added, with the gained experience from this project, in the future, "we'd try to optimize the modular system to facilitate production and installation while maintaining a non-repetitive façade pattern."

It's a technique KANVA plans on continuing to explore in the future – a way to incorporate fresh, unexpected ideas into hardy, cost-effective precast concrete.

"The process enabled extensive possibilities and experimentation," Rivard said. "The technology allowed the historic site to tell a story, uniting old and new in a unique, unprecedented way." **PS**

Deborah Huso is a freelance writer specializing in construction, real estate, finance and agriculture.

Photo Credits:

Pages 18-19 – Marc Cramer

Page 20, Left – Reckli

Page 20-21, Center – NPCA

Pages 21, Right – NPCA

Pages 22 – NPCA

Page 23 – Marc Cramer



For the Edison Residence, using precast concrete offered “the possibility of bringing to life what is traditionally considered a more neutral material.”



Speaking in



A centuries-old design principle reduces the need for added reinforcement in precast concrete manhole cones.

By Eric Carleton, P.E.

Precast concrete manholes have been a critical component of our infrastructure for decades. They provide relatively maintenance-free access for workers, are strong enough to withstand soil loads at great depths, offer long lifespans and can be manufactured in an almost endless array of sizes and configurations.

Manhole cones provide a transition from larger diameter risers to smaller diameter risers. The majority of cones are used at the top of manholes to provide a transition from the 48 inch-diameter riser to a smaller access hole provided by the frame and

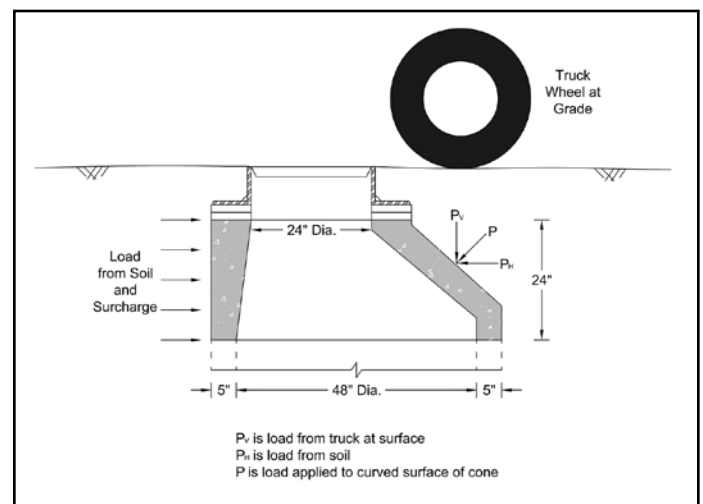


Figure 1

cover at grade (Figure 1). Designers must understand the arch action concept to feel comfortable that compression forces – not reinforcing steel in tension – will resist loads from the soil. Below, concepts enabling designers to create structurally sound, cost-efficient reducing cones are described.

MAKING GRADE

The most common reducing cone is used at grade, just below the frame and cover. Cones are produced in two shapes – concentric and eccentric. With a concentric design, the top access

Cone

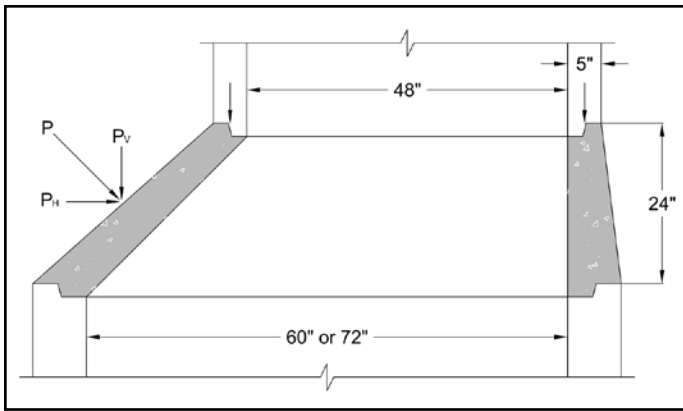


Figure 2

hole is placed at the middle of the manhole, requiring a portable ladder for access. In an eccentric design, the top access hole is placed to one side, where permanent rungs provide interior access. Both designs require the same engineering principles.

Here, we will concentrate on the eccentric cone seen in Figure 1. Figure 2 depicts a typical eccentric cone used deeper below grade for transition from a 60 inch diameter or 72 inch diameter riser to a 48-inch riser. Making the transition between two different size risers can also be accomplished with a flat reducing slab. However, reinforcing steel is required to resist tensile forces.

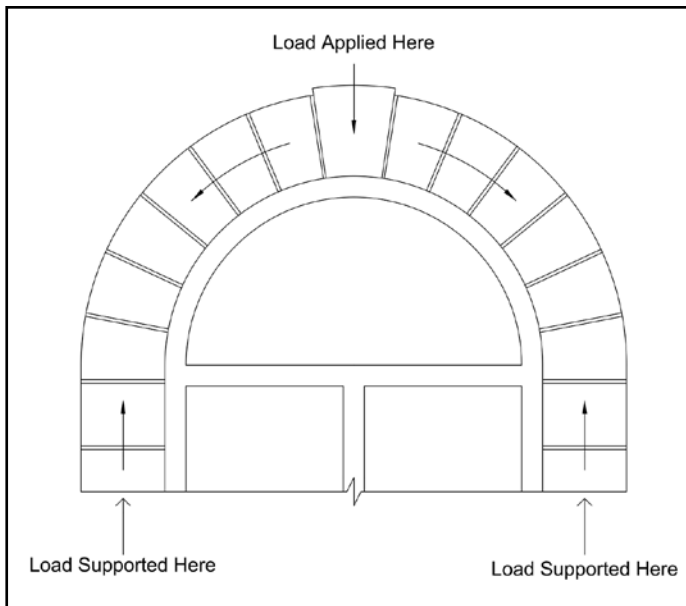


Figure 3

ARCHETYPAL DESIGN PROPERTIES

Cones rely heavily on the concept of arch design. Arches have been used for centuries in masonry construction because vertical loads are transmitted to supports via compression (Figure 3). The arch provides a big advantage for concrete, which has very little tension capacity compared to its great compression capacity. Examples of arch design can be seen in lintels above windows and

in bridges built by the railroad industry in the 19th century, many of which are still in operation.

Today, some smaller diameter circular concrete pipe is made and successfully installed without reinforcing steel because of the load transfer ability of the arch. A 48-inch diameter riser with a 5-inch thick wall made with 4,000-psi concrete is strong enough to withstand soil loads 500 feet below grade without reinforcing steel thanks to arch design. The load is transmitted via arch action as a compressive force to the walls at the centerline of the manhole and

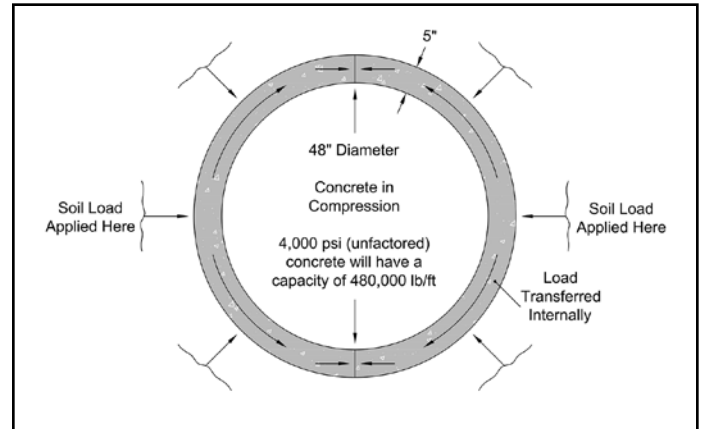


Figure 4

resisted by an equal soil load from the opposite direction (Figure 4). As a result, some manhole standards – including ASTM C478 – do not require tensile or shear steel in the barrel sections. In fact, for 48-inch diameter manholes, only minimal hoop steel in the top and bottom is required for resisting stresses experienced during handling.

TRANSFORMATIVE PROPERTIES

With an eccentric cone design, one wall is vertical and resists loads in the same manner as the risers that support the cone. The opposite wall is sloped to make the conversion from large diameter to small diameter. This geometry is where confusion on assumptions for design comes into play.

Taller cones with large openings will have a sloped wall that is almost vertical. In that instance, it's obvious the compressive arch action will work. However, design of cones where the slope is more severe is not as obvious. One such case is a 24-inch-high eccentric cone reducing 24 inches in diameter, creating a 45 degree wall slope (Figure 5).

For this type of slope, consider Beam A in Figure 6. In an eccentric cone, this beam is not independent and not supported at each end. Instead, it is supported along the side of the beam for the entire length. And, most importantly, if we look at the cross sections in Figure 6, the beam is in fact curved as an arch where the load is transferred to the continuous supports on each side. Resistance (R) will be large, as it is with a 4-foot diameter riser.

In an eccentric cone, the concrete is arched, with strength dependent on the compression capacity where the arch meets the

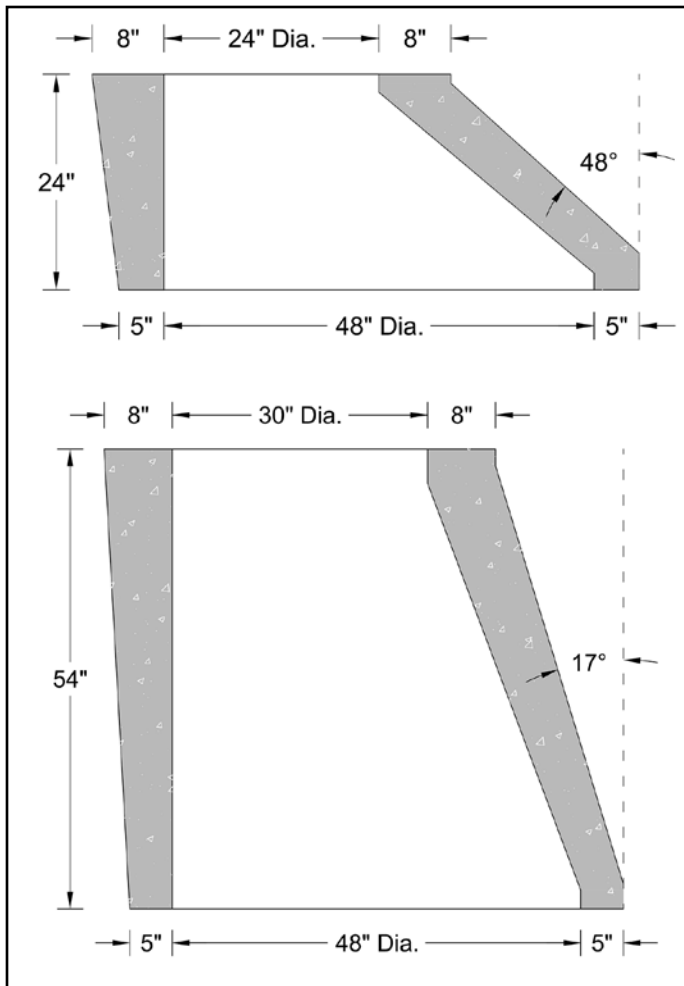


Figure 5

remainder of the cone. In a 1-foot length of a 12-inch wide beam as shown in Figure 6, the compressive strength of 4,000-psi concrete with wall thickness equal to 6 inches results in support for the beam of:

$$R = 4,000 \text{ psi} \times 12 \text{ inch} \times 6 \text{ inch} = 288,000 \text{ pounds.}$$

Since R exists on each side of the beam, the total resisting capacity is 576,000 pounds. Thus, the load can be as much as 576,000 pounds per square foot. If a factor of safety of two is applied, the load can be as much as 288,000 pounds per square foot, more than enough to resist loads from trucks traveling 60 mph. This capacity is available without the use of reinforcing steel.

LONG-STANDING SUCCESS

Both concentric and eccentric cones have been produced and successfully used for more than 40 years. Success is based on the fact that concrete in compression can handle heavy loads. Additionally, reducer cones are simply arches that transfer loads to supports via compression without the need for reinforcing steel in tension. To check with local precast concrete manufacturers regarding the specific availability of precast concrete manhole

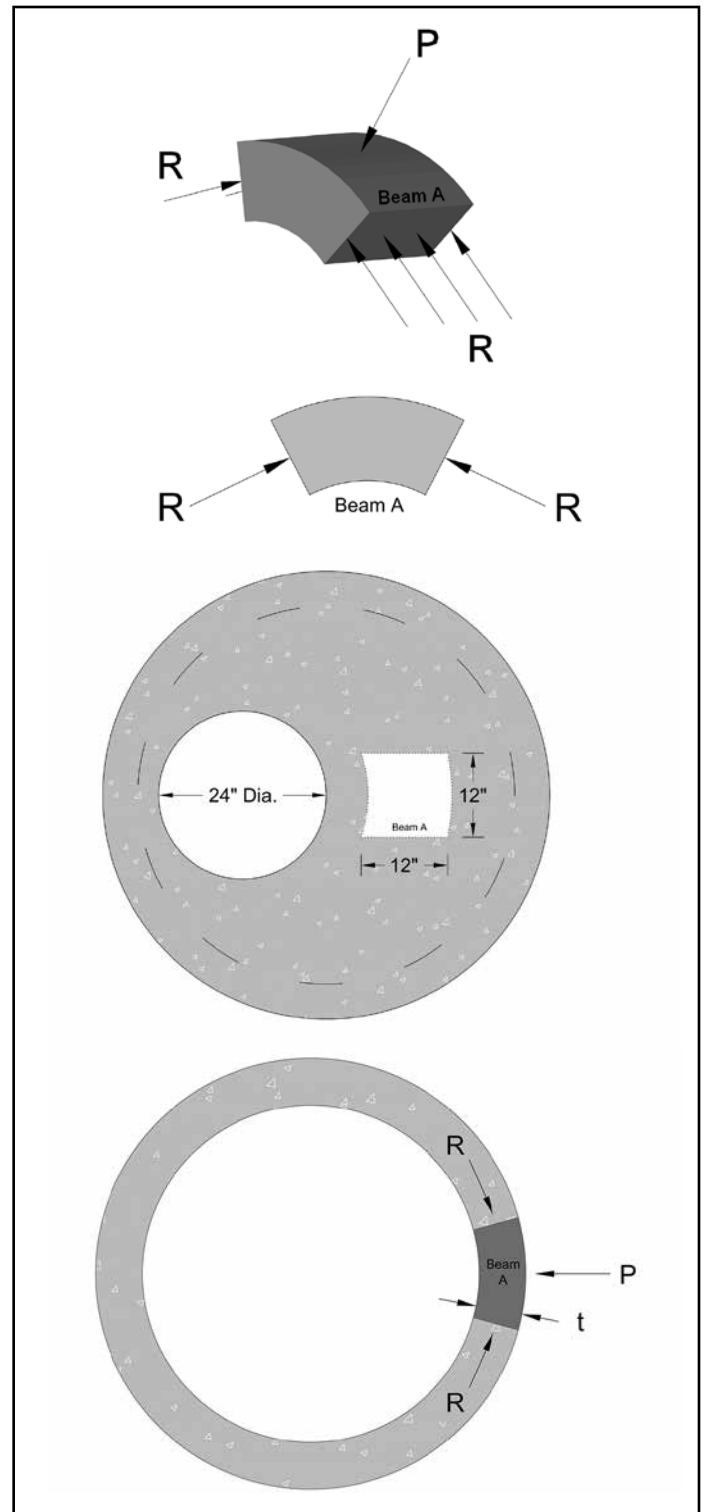


Figure 6

sections and geometry for your area, visit precast.org/find. **PS**

Eric Carleton, P.E., is NPCA's vice president of Technical Services. A special thanks goes to Gary Munkelt, P.E., for his consultation on this article.

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NPCA

Creative Use of Precast Awards

The National Precast Concrete Association's Creative Use of Precast (CUP) Awards competition recognizes innovative applications of precast concrete in two categories: above-ground and underground. An independent panel of industry experts served as judges, and awards were presented during The Precast Show 2015 in Orlando. For complete descriptions of this year's winning projects, please visit precast.org/cup2015.

ABOVE-GROUND CATEGORY

FIRST PLACE

Universal Precast Concrete Inc.

(universalprecast.com)

Project: Baseball Glove

Location: Maidu Regional Park, Roseville, Calif.

TAKE ME OUT TO THE PLAYGROUND

From the sound of a bat crushing a fastball to the sight of a star player racing toward home, there's nothing quite like an experience at the ballpark. Thanks to some well-coordinated planning and a little ingenuity, a larger-than-life precast concrete

baseball glove is bringing that experience out of the stadium and onto the playground.

To create the unique, 8,500-pound piece, Universal Precast Concrete manufactured a complex mold complete with the intricate stitching patterns typically found on a baseball and baseball glove. The complex curvature of the pieces meant the mold had to be fabricated with precise detail at all angles. Created in two parts, the ball and glove were cast with insets, allowing them to attach seamlessly. After casting, workers grinded the glove to hide the seams made by the mold, then stained and painted the piece. The baseball glove doubles as a playground climber and centerpiece for a California park, where it inspires the imagination of the children who play with it each day.





SECOND PLACE

StructureCast

(structurecast.com)

Project: Stress Ribbon Bridge

Location: Santa Cruz, Calif.



A RIBBON RUNS THROUGH IT

More than just a precast concrete bike path, the Broadway-Brommer Multiuse Project maximizes opportunities to educate, inform and inspire users of the Santa Cruz Arana Gulch and its resources. A key component of this pedestrian corridor that runs through an environmentally sensitive area is a 340-foot stress ribbon bridge.

With a goal of causing no environmental harm to the upland vegetation, StructureCast provided a no-impact solution. The company cast 32 precast concrete panels to compose the decking of the pedestrian bridge. After cable ribbons were strung across the gulch and attached to abutments on each side, installers placed

each panel on the cable ribbon and slid them across the gulch one panel at a time.

Using this innovative technique and precast concrete decking, installation of the panels took just five days to complete, far less than the two to three months needed to erect a steel or cast-in-place structure. Using a precast design wasn't just the best low-impact environmental solution; the deck panels are engineered to withstand 100-year storm flow events, providing an optimal resilient solution as well.



THIRD PLACE

Hy-Grade Precast Concrete

(hygradeprecast.com)

Project: Custom Precast Concrete Washroom

Location: St. Catharines, Ontario

FORM MEETS FUNCTION IN PARK UTILITY BUILDING

What happens when a block-and-wood washroom in a public park looks woefully outdated next to the modern additions around it, including a new \$20 million aquatic center? It's replaced by a durable, visually-appealing custom precast concrete washroom.

Situated in the heart of St. Catharines, Ontario, Lester B. Pearson Park is a community focal point. With a revitalization project breathing new life into the 27-acre park, visitor numbers spiked. As a result, the local recreation department wanted to continue rehabilitation by replacing a dated restroom facility with a new, modern structure. Looking to neighboring communities, city officials noticed several municipalities had replaced old block-and-wood washrooms with precast buildings, so the city approached Hy-Grade Precast Concrete requesting a signature design.

Hy-Grade's team worked with the city on several concepts, landing on a challenging but dynamic design that included an unconventional footprint with a pitched roof featuring compound joints. Using 3-D modeling, the precaster ensured the compound angles at the roof joints would precisely match. Hy-Grade also worked closely with the plumber and electrician to preform openings and penetrations for the fixtures, eliminating the need to core drill holes on site.

Each panel has four different finishes and includes fine details

around openings. After curing, all panels received a stain finish to match the city's desired color scheme. Hy-Grade also designed and supplied custom columns and a steel structure to support the large roof overhang. Installers completed assembly of the seven exterior wall panels, eight interior partitions and four roof slabs in just five days. Hy-Grade's innovative design and precision production emphasize the amazing versatility of precast concrete in a building that will serve the community for many years.

HONORABLE MENTION

Bethlehem Precast Inc. (bethlehemprecast.com)

Project: Vertical Circulation

Location: Babylon, N.Y.

HONORABLE MENTION

Leesburg Concrete Co. Inc.

(leesburgconcrete.com)

Project: Boat Ramp Restroom

Location: Astatula, Fla.

HONORABLE MENTION

Olympian Precast Inc. (olymprecast.com)

Project: University Village South Building

Location: Seattle, Wash.

HONORABLE MENTION

Universal Precast Concrete Inc.

(universalprecast.com)

Project: Shipwreck

Location: Storybook Woods Park, Elk Grove, Calif.





UNDERGROUND CATEGORY

FIRST PLACE

Sherman-Dixie Concrete Industries

(shermamdixie.com)

Project: Brooks Run Modular Arch Span

Location: Highway 61, Bullitt County, Ky.

NO DETOURS

When a road widening project called for a new bridge to be built in Kentucky, precast concrete's structural and cost benefits offered the most viable solution. Due to Federal Emergency Management Agency flood map restrictions, the bridge required a complicated "no rise" hydraulic design. Additionally, the design called for 23 feet of backfill from the top of the arch to the top of the road, a significant dead load for a 46-foot span. Sherman-Dixie provided the solution with its ECO-SPAN Versa Series Multiple Radius Arch.

The modular precast components worked well with the phased construction plan, which minimized traffic impact and eliminated costly and inconvenient detours. The existing bridge remained in service during the first phase while more than half of the new bridge was constructed. During the second phase, the work crew installed 24 of the 36 precast arch sections and traffic was shifted to the new bridge. The old bridge was then demolished and replaced by the remaining 12 arch sections. Some of the project's many improvements include a wider road, a clear span opening that will minimize future maintenance and a higher roadway elevation. Overall, this precast solution demonstrates the enormous benefits of precast to all departments of transportation involved in accelerated bridge construction.



SECOND PLACE

StructureCast (structurecast.com)

Project: Trash Trapper

Location: Los Angeles County, Calif.

CLEANING UP A POLLUTED WATERWAY

Surrounded by refineries and busy streets, Harbor City's Machado Lake in Los Angeles appears from a distance to be an unexpected metropolitan oasis. But get a little closer and the trash

is hard to miss. To clean the polluted water bodies, the Los Angeles County Department of Public Works researched possibilities and settled on a precast concrete design to enhance the lake, dispose of contaminated sediments and protect wildlife.

The city selected StructureCast to manufacture a precast concrete trash-trapping net and bypass structure system across the flood control area. The Wilmington Drain Project called for 11 trash trap chambers designed by general contractor Fresh Creek Technologies, each about 15 feet tall by 7 feet wide by 8 feet deep. In addition, the project called for one 12-foot-wide bypass structure and one 8-foot-wide bypass structure.

While StructureCast worked for almost four years with Fresh Creek Technologies to design and engineer the project, when it was time to cast the structures, time was of the essence. Delivery took place within 40 days of approved shop drawings and installation took just five days. It is estimated that it would have taken more than twice as long to cast the structures in place. The end result was a happy customer, repeat business and a clean water solution for Los Angeles.



THIRD PLACE

Cape Fear Precast LLC (capefearprecast.com)

Project: Aircraft-Rated Precast Infrastructure

Location: Marine Corps Air Station, Jacksonville, N.C.

PRECAST WITH MILITARY PRECISION

The P-705 Project was a partnership between Cape Fear Precast and a local contractor to expand the maintenance facility for the MV-22 Osprey aircraft. Cape Fear supplied dozens of aircraft-rated drop inlets, underground rainwater harvesting vaults, utility vaults, pump stations and sewer manholes for the expansion. By completion date, the precaster made 100 deliveries to the project.

According to Cape Fear, manufacturing the aircraft-rated, heavily reinforced box culvert was not complicated. Additionally, precast concrete was the obvious choice for the project, as the contractor saw no way that casting the structure on site could meet the aggressive timeline.

For Cape Fear, it was a matter of ramping up and pouring. The company started with all-new panel forms and poured six units a day. Time constraints prevented pre-fabricated wire mesh from being an option, but Cape Fear worked with its suppliers to develop new procedures for cage forming that enabled the individual mats to be preassembled and tied before the inner cores were set up.

Thanks to the use of precast, Cape Fear was able to successfully meet the project deadline. Overall, the company manufactured 150 units in just 25 days.

HONORABLE MENTION

Atlantic Precast Concrete Inc.

(atlanticconcrete.com)

Project: Princeton University Box Culvert

Location: U.S. Route 1, Princeton University Campus, N.J.

HONORABLE MENTION

Knights Precast (knightscompanies.com)

Project: Massive Stormwater Tunnel Cover

Location: Charleston, S.C.

HONORABLE MENTION

Piranha Pipe & Precast (piranhapipe.com)

Project: Park Diversion Structure

Location: Sacramento, Calif.

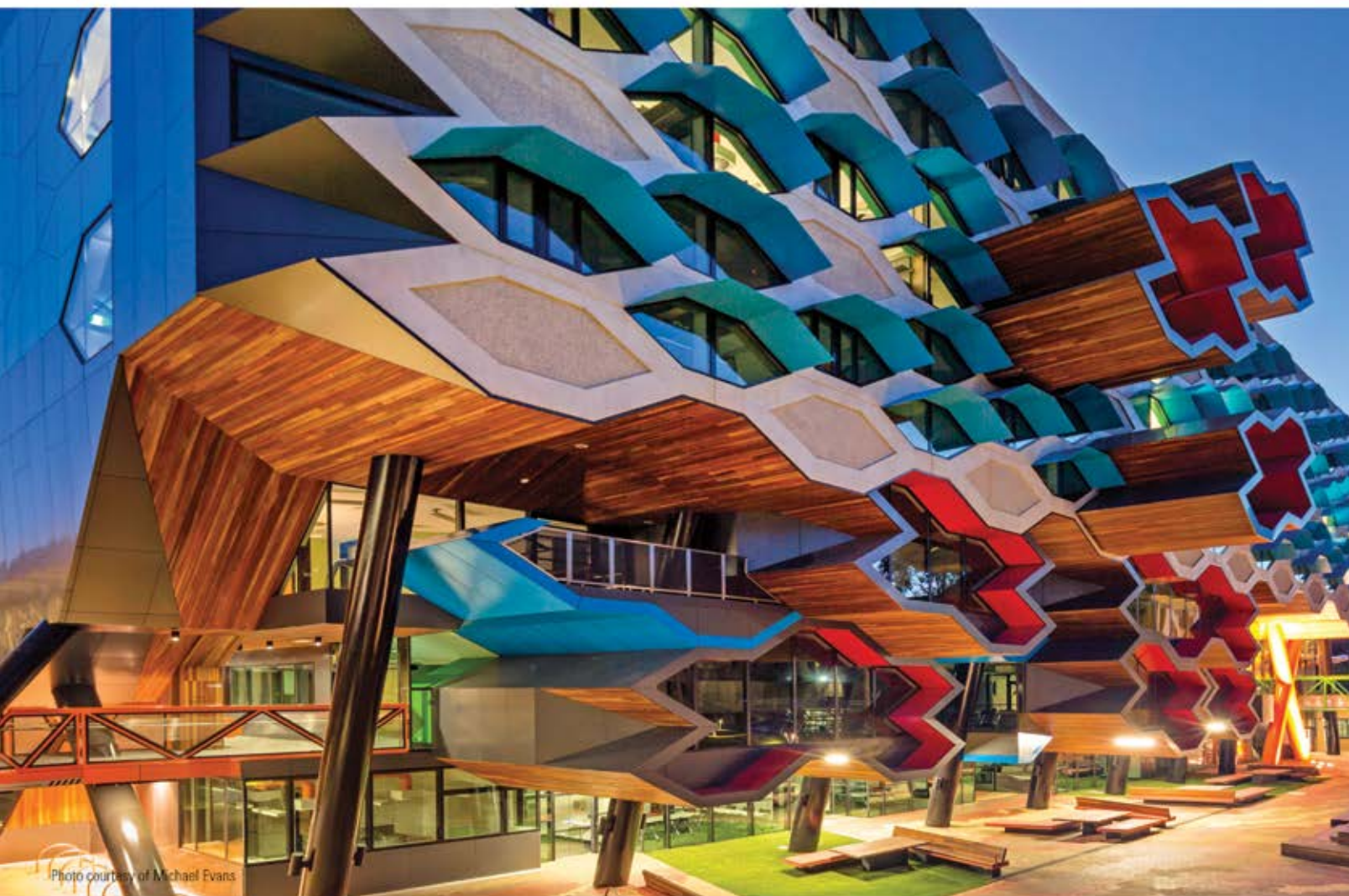


Photo courtesy of Michael Evans

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