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SUMMER 2014



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ON THE COVER:

Lifting power: A launching gantry, capable of lifting up to 3,600 tons, positions a precast concrete segmental span for the Manhattan West Project in NYC. By using precast concrete pieces, the high-traffic rail lines located beneath the gantry can remain open, increasing efficiency and reducing construction time. Read the story on page 16. Photos courtesy of Rizzani de Eccher USA (www.rizzanideccher.com).

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Publisher:

Ty Gable

Executive Editor:

Bob Whitmore

Managing Editor:

Mason Nichols

Associate Editor:

Kirk Stelsel

Graphic Designer:

Deborah Templeton

Advertising:

Brenda C. Ibitz, Vice President of
Development & Member Services

(317) 571-9500

bibitz@precast.org

NPCA

Precast Solutions

1320 City Center Dr., Suite 200
Carmel, IN 46032

(800) 366-7731

(317) 571-9500 (International)

E-mail: npcaprecast.org



npcaprecast.org

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BY LAND OR BY SEA

Precast concrete is the material of choice for two major projects in Oklahoma and Michigan.

By Bridget McCrea

What do the U.S. Army Corps of Engineers, Tulsa District, and the Frenchtown Charter Township Resort District Authority in Monroe, Michigan, have in common? After careful review of the material options available on the market for their bridge and seawall replacement projects, both groups selected precast concrete during the engineering and design process.

BUILDING BLOCKS

In October 2013, the U.S. Army Corps of Engineers, Tulsa District, announced plans for the \$15.6 million replacement of the aging Highway 151 Bridge over Keystone Dam. Kiewit Infrastructure South Company of Omaha, Nebraska is handling the construction work and the precast concrete aspect of the project was split between two companies: Heldenfels Enterprises Inc. of San Marcos, Texas, (for the prestressed girders) and Tricon Precast Ltd. of Houston, Texas (for the post-tensioned deck panels).

By using precast concrete bridge elements, the time on site it typically takes to form and cure elements is eliminated.





The precast, prestressed and post-tensioned components help meet an aggressive timeline and make installation easier.

Elements can also be constructed simultaneously, reducing lag time waiting for one element to be completed before starting the next. That speed of construction factored into every element of the bridge, which was erected in 1964 and had reached the end of its useful life. And while the bridge isn't considered "high traffic" by DOT standards, Daniel Morales, P.E., a senior structural engineer for the Corps, says it does carry a high volume of traffic across the Keystone Dam on a daily basis. Because of this, the project was put on a tight, 13-month timeline.

"We really wanted to cut down the construction time, the down time and the amount of traffic that had



The new precast concrete seawall at Detroit Beach will replace the deteriorating structure currently in place.

to be disrupted because of the project,” Morales said. As part of that mission, he said the Corps leveraged accelerated bridge construction techniques and materials such as precast concrete. The original bridge, which was being demolished at press time, was built with steel girders. The new one will be made of precast, prestressed and/or post-tensioned pieces that will instill internal redundancies into the structure.

“That’s just one of several technical benefits that we’re gaining with the new system,” Morales said. The bridge’s position over a body of water – plus the inclement winter weather conditions that the crew had to deal with between November and April – make it a perfect backdrop for factory-poured and assembled precast pieces.

“The site is very windy, and the winter weather exacerbated those poor conditions for several months,” Morales said. “Cast-in-place would have been more difficult to manage in this setting, not to mention the additional quality control measures that we would have had to deal with versus having everything made in a controlled, lab-type environment.”

TEARING IT DOWN

Keith Rice, project engineer with the Corps, says the Keystone Dam Bridge project included the demolition of the existing steel infrastructure. “We cut down the existing pier caps right down to sound concrete,” he said. “We did that to get to the sound concrete and because the new precast girders are of a different depth than the (existing) ones.” To maintain the same height across the roadway deck, he added, precast pedestals were used to replace the pier tops (and the precast girders will be placed on top of those pedestals). The structure will also include a prefab catwalk that runs from pier to pier.

“Everything was designed to be ‘placed’ out there on the bridge once we had the original structure demolished,” Rice said, “with the thinking that the construction will go quicker and smoother as a result.” He said the project is on schedule despite a few hang-ups that were created by the cold and stormy winter season. “The freezing weather slowed us down a bit in terms of saw-cutting the concrete deck off,” Rice said, “and we had an issue with water on the roadway deck freezing up, but overall we’ve managed to stick to our original timeline.”

Morales concurs and says the team is now anticipating the arrival and installation of the precast concrete pieces. “The part of the project that I’m most anxious about is the installation of the deck panels, and we’re not quite there yet. That’s what I consider to be the biggest and most quality-control (sensitive) aspect of this development,” he said. “There has to be a lot of quality control during that stage and I’m interested to see how all of that goes.”

SHIELDED FROM LAKE ERIE

About 900 miles northeast of Tulsa, the Frenchtown Charter Township Resort District Authority has also made precast concrete its material of choice for a very important project. In the bid/award phase at press time, the project encompasses the construction of a new seawall to protect homes situated on Detroit Beach from Lake Erie’s high water. Nearly 3,400 ft in length, the new precast concrete wall (with steel soldier piles) replicates another, similar shoreline project that was completed in the area about two years ago.

According to Larry Smith, director of the Authority, the new seawall will be erected 30 in. in front of the existing structure. The latter is now

This deteriorating seawall will be replaced with a flared-top precast seawall that will repel waves.



20 years old and was put in place following a major flooding of the shoreline at the time. The new structure will be built with a flair on top to force waves to roll back, dissipate and then slow the energy of the following wave.

Smith says the 20-year-old structure is in need of replacement because the walls and other components are deteriorating. "They're in bad shape," he said. Special tax assessment district funds are being used to fund the rehabilitation project, which will cost \$6-\$7 million to complete. "Flood protection is one of the primary goals for the Frenchtown Charter Township Resort District Authority," Smith said. "The Authority has been putting seawalls up – and then replacing them and repairing them – since as far back as the 1950s."

David K. Wehner, P.E., and Christopher Zangara, P.E., both of Maumee, Ohio-based Mannick & Smith, designed the seawall and specified precast concrete as the material of choice for the new structure, which will protect a total of 4,700 ft of shoreline. One of the final steps will involve cutting down the existing steel wall while leaving the lower portion in the ground.

"Essentially, we're building a new wall in front of the existing wall, putting in the soldier pile precast concrete sections in front of it, and then filling in the space between the two walls," Smith explained. "Then the contractor cuts the existing back wall down below grade so that it's no longer visible, thus enhancing the property while preserving the surrounding earth and soil."

OUT FOR BID

Wehner says Mannick & Smith has been working with the township

for about 15 years. For the Detroit Beach seawall project, the company served as both designer and engineer – putting the job out for bid and managing the construction aspect of the development. Once the job is awarded, the contractor will subcontract the precast concrete manufacturing portion via a different bidding process.

The project is expected to take 18 months to complete. Wehner says the design team considered steel as the primary material for the new seawall, but the corrosiveness of the surrounding soil and water prompted the designers to explore alternative options. "The tiebacks are always the weakest link on steel walls. They are why the existing structure was beginning to fail," Wehner said. "There's a lot of corrosion and oxidation on the seawall that's there now – and the tiebacks are failing."

Wehner said precast concrete was selected because the 8-ft panels can be constructed in a way that creates a smooth, flush wall surface. "Precast concrete looks good and we designed it to be very buildable," he said. For example, the design is based on a self-supporting cantilever setup that requires no tiebacks or other forms of structural support. "The piles themselves go way down into the bedrock, which we'll drill down into and pin with the concrete," Wehner explained. "Then we'll put the panels on it." The project will incorporate some cast-in-place closure pours and recessed staircases, but is 95% precast.

The Authority's decision to use precast concrete to build the new seawall also aligns with a six-year-old township ordinance that enhanced the municipality's flood protection efforts. "In 2008, it was decided that anyone who wanted to repair their own walls in the area would have to use either steel or concrete," Wehner said. "Earthen materials, wood



or masonry are not allowed anymore due to a lack of durability with those options. Lake Erie gets high and the wave action is fierce. Steel or concrete are the only products we want in there."

Finally, Wehner says precast provides a level of convenience and quality that can't be replicated by cast-in-place alternatives. "The quality control is better and we can do more thorough testing," he said. Easy to ship and install, the panels will include the seawall's flair (which protrudes outward by 8 in.) in a monolithic manner. "That's an advantage when you pour precast concrete in a plant," says Wehner. "You can create any shape you want much easier than you would be able to do if you were out in the field using a cast-in-place wall."

Once the seawall project is awarded and a contractor selected, Smith expects the planning and staging process to begin right away. "We've allowed 18 months total for this project, and that timeline depends on what kind of winter we have this year," he said. "If we have a season like the one we just had, it'll probably take the full 18 months from start to finish." **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.

Photo Credits

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An example of how the new seawall will look based on a similar project in the area completed in 2012.

POSSIBILITIES IN PRECAST

Moving W



Water

There are more than 45 billion gallons of water on Earth for every one human, which is a good thing when it comes to sustaining life but a challenge when it comes to managing how and where it moves.

By Kirk Stelsel

For the next 10 seconds, close your eyes and picture yourself leisurely lounging on a veranda in an isolated tropical paradise.

Are you there? Listen to the waves crash rhythmically onto shore. Hear birds in the distance as the wind moves slowly through the trees. Take a deep breath of the crisp air carrying the scent of rain. Hear the skies open up to release a steady shower that patters off the roof and leaves around you.

Moments like that help us shed the burdens of life and give in to nature. In that moment, water was all around you – the ocean waves, the rain, and in the birds and plants. Even you yourself are about 60% water.¹

Enjoying nature, our built environment and the basic amenities we often take for granted requires movement and management of water. To do so, we have a maze of networks, and precast concrete plays a vital role.

OUT OF SIGHT, OUT OF MIND

In the tropical paradise we escaped to, we can't forget that eventually we'll come in off the porch and use running water. Evidence of humans harnessing water with concrete goes back to the Roman Empire. The Roman Aqueducts² and Cloaca Maxima³ helped carry potable water to the city and take wastewater away. Today, concrete continues to play a vital role in our water

infrastructure.

Manholes, pipe and other precast concrete products all disappear into our unseen infrastructure to meet our needs for decades to come. But precast is used even when a connection to city infrastructure is not feasible. Just southwest of Detroit in Milan, Michigan, Milan Vault provided on-site wastewater treatment tanks for a newly installed 4-H restroom and shower facility. To meet effluent regulations, a series of four 3,350 gallon precast tanks advance the treatment of the water until it's ready for the final treatment area.

According to Jed Dingens of Dingens Architects in Corunna, Michigan, using precast provided a variety of benefits including strength, durability, flexibility of design and ease of installation in a timely manner. The tanks were manufactured for 6 ft of cover with custom risers to grade with cast iron covers, and are strong enough to withstand an accidental drive-over by heavy vehicles. Customizations were a part of the plan.

"We were able to place inlet and outlet penetrations at any location they had need for," said Sam Wagner, vice president of Milan Vault. "We were also able to place access openings in any location they chose."

Sometimes, though, getting rid of the water is not the need. On a commercial and residential level, rainwater detention and



Milan Vault manufactured a series of four customized 3,350 gallon precast tanks for wastewater treatment at a 4-H facility.

retention systems give overburdened stormwater systems a break and can hold back the water for beneficial reuse (for an example, see precast.org/superbowl). In Canada, RH20 was hired to take the residential rain barrel concept to the next level for a LEED-Platinum neighborhood in Newmarket, Ontario.

The company installed underground precast rainwater harvesting systems in the fronts of 34 homes to provide water for flushing toilets and lawn irrigation. The tanks met the town's requirements to reduce household water draws by 25% and overall water discharge flows by 60%.

Listing all of the underground products that manage our water in some way would be nearly impossible due to custom products, but in almost any city you'll find grease interceptors keeping our sewers safe from greases and fats, lift stations ensuring our water gets to where it needs to go and manholes providing human access to the network. The list of custom products is limited only by a need, some imagination and a little engineering knowhow.

"I think precast is very important in the underground infrastructure of our country," Wagner said. "Concrete has a long-standing history of being a durable, economical and readily available product. It is easy to work with on site, requires little maintenance when installed correctly, and saves time and money for on-site contractors."

WATER UNDER THE BRIDGE

To get to our tropical paradise, it's very possible we crossed a bridge or two. Bridges are an integral part of our transportation network. According to the American Society of Civil Engineers (ASCE), the U.S. currently has 607,380 bridges that get us over everything from bubbling brooks to raging rivers. However, these bridges are aging. The latest ASCE report card gave U.S. bridges a C+, which is only slightly better than the paltry D+ for overall infrastructure.⁴

Replacing bridges takes time and money and snarls traffic, but those headaches can be minimized. As MassDOT found out, precast concrete bridge components install fast (visit precast.org/fast14), and less time means less on-site labor and a happier public. Whether it's precast



RH20's underground precast rainwater harvesting systems helped reduce overall water discharge flows by 60% for a neighborhood in Newmarket, Ontario.



beams and columns for larger bridges or precast culverts for short-span bridges, speed and durability make precast concrete the product of choice. This was the case in Arizona when wildfires ravaged critical wooden bridges (visit precast.org/prefast). Add in precast approach and deck slabs, headwalls, endwalls, wingwalls, parapets, retaining walls and railings and you have a complete bridge solution.

Increasing efficiency is exactly what North Carolina has set out to accomplish with the replacement of 14 aging bridges in multiple counties across the state. Due to staff reduction in recent years, the state sought the expertise of an outside engineering firm to plan and execute the bridge replacements in order to take advantage of federal funds. The bridges are express design builds that mainly consist of small stream crossings best served by precast concrete 3-sided culverts.

Cherry Precast, an NPCA member in Lewisville, North Carolina, bid the job and was awarded the contract for all 14 bridges. "Using precast, you have the option to cast all of the parts of the structure (culvert, wing wall, wing wall footers, etc.) before the

contractor moves on site," said Nelson Fulcher, vice president of Cherry Precast. "Then, once he's there, he can reduce the duration of time by removing the existing structure, pouring the new foundation and placing the new structure all within a couple of weeks. By doing so, the contractor reduces his overhead, traffic controls, erosion controls, manpower on site, etc."

CUSTOM CHANNELS

Revisiting our paradise one last time, local engineers have probably managed natural water sources in some way to make habitation possible. Custom precast concrete products enable cities to harness natural water in all sorts of ways. In California, the El Dorado Irrigation



Flume 41 near Riverton, California, now has a 100-year lifespan thanks to lightweight precast.

District needed a custom product for Flume 41, a section of a larger system that carries water down a mountainside to a power station.

The existing wooden flume had long since met its expiration date, but to replace the 584-ft section, a number of requirements had to be met. The precast sections needed to be lightweight, and the mix required a 6% air content to combat the freeze-thaw nature of the area, which sits at 3,000 ft directly above Riverton, California. At the precast plant, Universal Precast in Redding, California, the design was perfected by starting with 3-D modeling. After that, it was just a matter of getting the pieces cast and set.

"We had never done anything like this before, and this is the largest repair job that the district itself has done – so it was the first time for a lot of people," said Rick Rice, project manager with ProVen Management. "It's in a remote location, so having Universal Precast perform the work cut costs and provided better controls on batching concrete, and the wood pieces we replaced are not nearly durable enough. The precast was brilliant – everyone is extremely pleased with how the project turned out."

Now installed, the project engineer estimates Flume 41 to have a 100-year lifespan thanks to the precaster's quality control measures.



"Precast sections allowed for better mix control and for a higher-quality product than possible with on-site cast-in-place," said Dave Jermstad, principal-in-charge for the design, construction administration and quality control inspection plan for Carlton Engineering. "We have had great success with the construction and performance of the precast flume sections over the past 20 years. This includes extreme exposure and incidental rock-fall or tree-fall impacts."

Just a few states to the east in Utah, Oldcastle Precast took on a waterway restoration project of its own: the reconstruction and improvement of approximately six miles of mostly open, unlined channels that feed critical water to farmers. Prompted by a deadly landslide in 2009, the precast channel provided a complete reconfiguration of the canal.

Oldcastle supplied approximately 10,000 ft of specially designed precast concrete box culvert and pipe that was used in the upper portions of the canal. To match the canal, designers beveled the majority of the segments to curve with the existing footprint until they emerge into a 66 in. concrete pipeline. During installation, the contractor was able to average more than 15 segments a day. Once installed, it was backfilled with 6 in. of road base to provide a maintenance access road and a recreational trail.



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

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Page 14: ProVen Management

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(Endnotes)

¹ <http://water.usgs.gov/edu/>

² <http://www.history.com/news/history-lists/10-innovations-that-built-ancient-rome>

³ <http://www3.iath.virginia.edu/waters/Journal4Hopkins.pdf>

⁴ <http://www.infrastructurereportcard.org/bridges/>

⁵ <http://water.usgs.gov/edu/earthhowmuch.html>

WATER WORLD

Considering that approximately 71% of the earth's surface is covered by water and the average daily use of ground and surface water in the U.S. was around 410.6 billion gallons per day in 2005,⁵ it's no wonder we have such extensive networks to manage water. To contact a local precaster who can help you find a product suiting your water management needs, visit precast.org/find. **PS**





Manhattan West Project:

LAUNCHING PRECAST INTO SPACE

**Formidable in its mass and lifting power,
a custom-built launching gantry hoists
and precisely positions 2,400-ton precast/
post-tensioned segmental spans.**

*Editor's Note: This article is based on an interview with Andrea Travani conducted by Sue McCraven,
NPCA technical consultant.*

By Andrea Travani, P.E.

Containing a bustling population of more than 8.5 million, New York City has about 28,000 people per square mile – a concentrated, growing mass of humanity greater than that of Los Angeles and Chicago combined. NYC is home to more billionaires than anywhere else in the world. Many live part-time in luxury Manhattan apartments that can run \$50 million or more.

With buildable land scarce in NYC, the city's premier real estate developers were in search of a solution to maximize the limited space available. Looking out over the undeveloped Far West Side and the Hudson Yards District, they discovered a simple solution. All they needed to do was look up.

Enter precast concrete and the Manhattan West Project, where a huge, custom-built Launching Gantry (LG) is positioning 2,400-ton, 240-ft-long precast/post-tensioned beam spans above 15 live rail lines and their electrified power lines. These beams will support a public plaza and parking structure between two high-rise buildings.

FROM STEELY PLANS TO AN UNPRECEDENTED PRECAST SOLUTION

Brookfield Office Properties, owner and developer of the Manhattan West Project, contacted Rizzani de Eccher USA (RdE USA) seeking a solution to close a big gap in the middle of their 7-million-sq-ft development site by somehow spanning this air rift with a platform above bustling, high-traffic-volume railway tracks. Brookfield executives had observed the efficiency of the LG RdE USA used to erect haunched precast bridge segments in rebuilding the old, steel Roslyn Viaduct in Long Island, New York.

Originally, the platform design called for structural steel. After collaborating with several consultants on an innovative new concept, RdE USA presented the owners with the following alternative solution:

1. Use precast bridges to span the entire opening.
2. Erect the precast bridge segments with a custom-built overhead LG.
3. Eliminate the need to place steel columns in between the railroad tracks below.

ERECTING A MONSTER BEAM AT RECORD LENGTH

NYC is home to many brilliant engineering ideas. Fittingly, 2,400-ton segmental beams are being placed at a record length of 240 ft – during the early morning hours – all 55 ft above live tracks that run in underground tunnels to Penn Station.

Brilliant engineering ideas depend on equally innovative construction designs and tools. The success of the Manhattan West Project hinged



on two important components:

- The ability of DEAL, a subsidiary of RdE USA, to manufacture a very high-tech piece of LG equipment with the capacity to smoothly place 16 beams in position; and
- The skills of McNary Bergeron to design a precast concrete beam that could accommodate 100 tons of post-tensioning strands inside.

Comprised of 1,100 tons of steel with a capacity to lift 3,600 tons, the LG has a 90-ton winch for handling the individual segments before



they are epoxied and post-tensioned into a single, giant beam. Every component was designed and manufactured in Italy and broken down into more than 90 containers to allow oceanic transport to NYC.

Before placing the first span, some New Yorkers and other contractors were expecting a dramatic scene: perhaps loud impact noises or the thrill of precariously swinging loads. But when RdE USA erected the first beam, it was so smooth, silent and precise that many observers on site were somehow disappointed.

LAUNCHED INFRASTRUCTURE AND SAVING WITH PRECAST

The assembly process is very similar to other sequential span-by-span bridges that use an under-slung LG. Here, the difference is that a platform is being built, so there is no need for a gantry that launches from pier to pier. Rather, a machine moves sideways to place one completed bridge span adjacent to the next. This is a unique setup in Manhattan and one that could be very useful in any situation where, because of busy train tracks or roadways, urban developers are not able



to maximize all the potential real estate space.

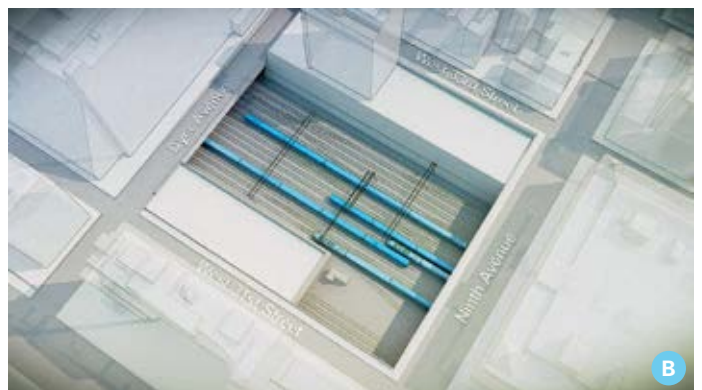
The most important feature of this type of project is early collaboration during the conceptual phase on construction alternatives that allow placement of columns, slabs, steel or segmental bridges to maximize design flexibility. In particular, solutions that use precast concrete elements speed up construction and, considering the significant labor rates, keep costs down.

The LG solution seems to have been the only economical way to develop these parcels of land. In fact, Brookfield acquired the property in the early 1980s, and it remained undeveloped for decades due to the presence of critical rail traffic.

JERSEY PRECAST SUCCEEDS AT COMPLEX BEAM GEOMETRY

Because of all the geometry control required, precasting segments such as these for the first time is not easy. As a result, RdE USA sent some of its engineers to the precast plant to work side-by-side with Jersey Precast personnel to ensure an accurate transfer of knowledge for a quality job.

McNary Bergeron designed the precast bridges. Each bridge consists of 37 to 39 match-cast segments individually trucked on site and assembled over the under-slung bed. Once the segments are epoxied, post-tensioned and grouted together, the giant beam is lifted and erected into its final position.

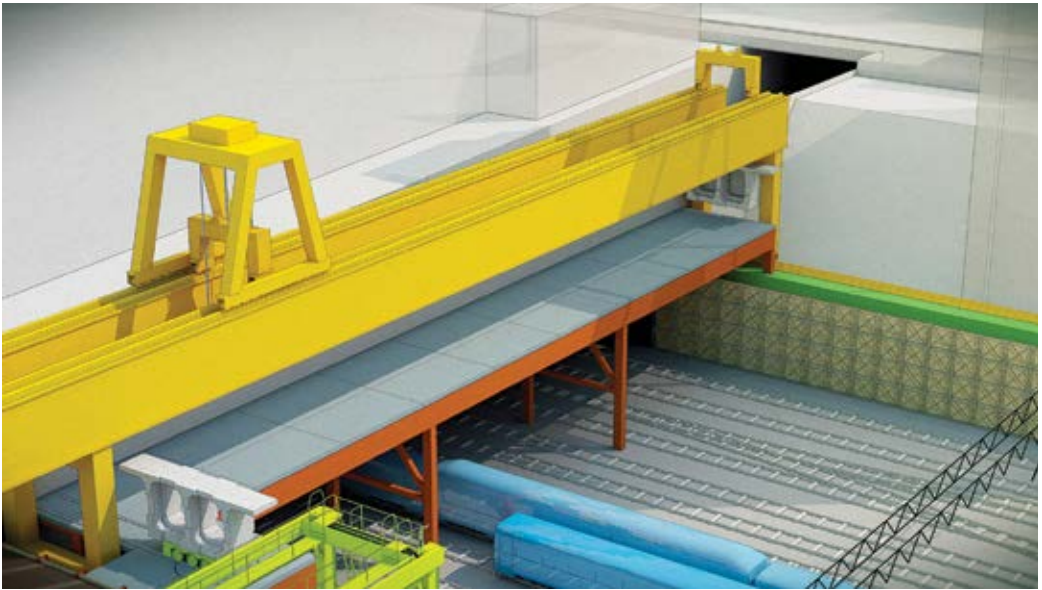


CHALLENGES FOR PLATFORM PROJECT MANAGER

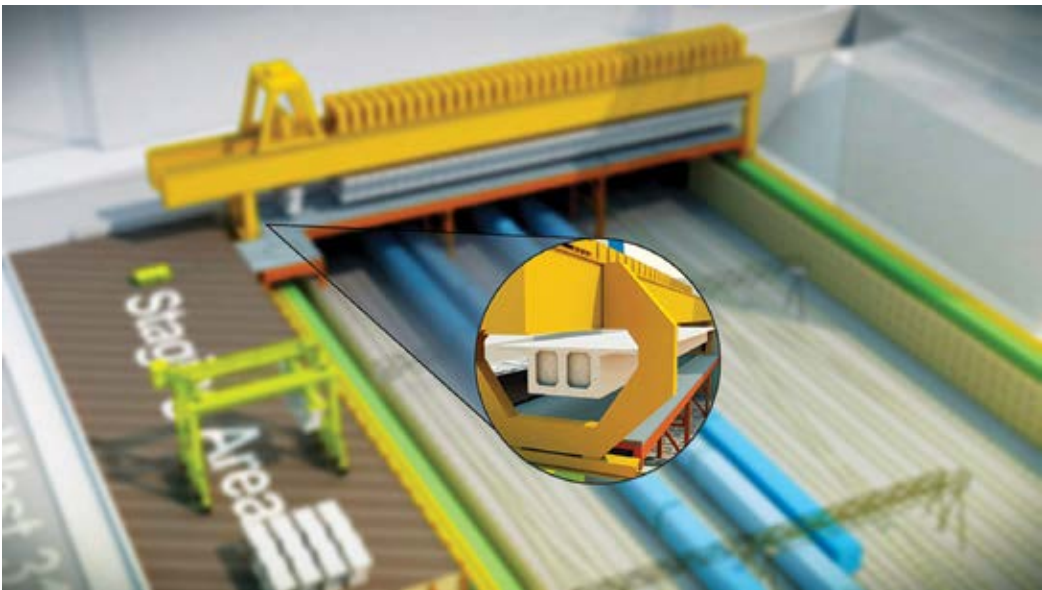
Despite the overall success of the project, there is always room for improvement. For example, the temporary post-tensioning bar configuration was a real challenge because having narrower-than-usual precast segments presented some difficulties in the installation and removal of the rods.

Another significant challenge is the engineering involved in coordinating the design of the bridges and equipment. Because this is such a unique structure, an innovative, seamless approach is required to make it work.

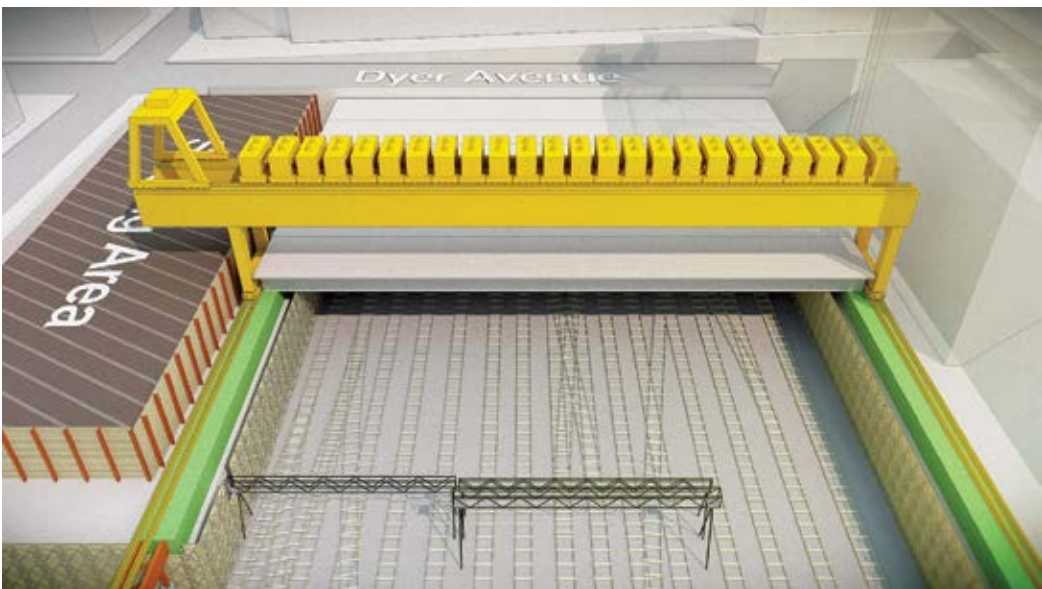
The logistics of the project are also complex, with work taking place



- ▶ The LG lifts and places each of the precast concrete segments that make up the decking.



- ▶ Once the segments are placed and connected, they are post-tensioned, creating a single bridge span.



- ▶ Each of the spans is moved from the temporary platform and into position.

 To view a complete video of the construction process, visit precast.org/launcher.

MANHATTAN WEST PRECAST PLATFORM PROJECT

Overall Project: The Manhattan West Project leverages the power of a launching gantry (LG) to produce a precast/post-tensioned platform used to support a public plaza and parking structure between two high-rise buildings.

Platform Location: The Manhattan West Project is located between Ninth and Tenth Avenues and 31st and 33rd Streets and above Amtrak rail yard with 30 tracks that lead to Penn Station, in Manhattan, New York.

Manhattan West Owner & Developer: Brookfield Office Properties, NYC

Overall Project Construction Manager: Turner Construction Co., Headquarters: NYC

Manhattan West Project Construction Manager: Rizzani de Eccher USA, Bay Harbor Islands, Florida and Pozzuolo del Friuli, Italy

Precast Platform Design Engineers: Entuitive, Toronto, Canada

Precast Post-tensioning: Tensacciai, Milano, Italy

Launcher Gantry Designer: McNary Bergeron & Associates, Old Saybrook, Connecticut and Broomfield, Colorado

Launcher Gantry Supplier: DEAL, subsidiary of RdE USA, Italy and Florida

LG Operator & Platform Erector: Metropolitan Walters LLC, New York

Precast Concrete Segments Producer: Jersey Precast, Trenton, New Jersey

Platform Bridge Bearings: Mageba, Bulach, Switzerland

Drilled Caissons & Foundation Contractor: Posillico Civil & Drilling, Farmingdale, New York

Cast-in-Place Concrete: John Civetta & Sons Inc., Bronx, NYC

Superstructure Architect: Skidmore, Owens & Merrill, Chicago, Illinois

Lessor of space over Long Island Railroad/Amtrak Yard: NYC's Metropolitan Transportation Authority



on a staging area effectively the size of a postage stamp (250 ft by 90 ft) in the middle of Manhattan. Assembling the LG meant trucking in more than 90 very large and heavy containers to a small, confined area where other contractors were also working.

RdE USA had significant interaction with SOM (the project architect) during the design phase. The most critical issues faced were related to creating openings in the platform to possibly allow future columns for the overhead buildings to touch down at the track level. The platform's design is very sophisticated and these openings were particularly daunting because of the flow of stresses on the deck.

NEW URBAN FRONTIER

Melisa Coley, Brookfield's vice president of investor relations and communications, captures the amazing potential of this remarkable



technology for major cities everywhere: "In a sense, it's kind of Manhattan's final frontier," she said.

"There'll be lots of parks, lots of amenities, and the transportation is huge being right next to Penn Station."

"This groundbreaking project is the first time that post-tensioned bridge segments have been produced locally in NYC," said Arshad Afridi, COO of Jersey Precast. "Our association with RdE USA has been a source of valuable technical expertise, support and immense mutual benefit, and will continue to open up new opportunities for both firms."

Perhaps a more important opportunity is the

yet-unimagined infrastructure potential for urban frontiers across North America. **ps**

Andrea Travani, of Rizzani de Eccher USA, is the project manager for the Manhattan West Project in NYC. With master's degrees in engineering and project management from the University of Trieste, Italy, Travani has extensive international experience in managing major transportation, bridge, rail and municipal projects, most involving specialized launching gantries.

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Andrea Travani

A photograph of a precast concrete sound wall. The wall features a textured surface that mimics natural stone, composed of various sized rectangular blocks. Vertical metal posts are spaced along the wall. The background shows green foliage.

A SOUND DECISION

Thanks to their durability, versatility and mass, precast concrete sound walls provide the best solution for noise abatement.

By Claude Goguen, P.E.

PROJECT PROFILE

Location: Interstate 20 – Columbia, South Carolina

Client: South Carolina Department of Transportation

General Contractor: Zachry Construction Corporation – San Antonio, Texas

Precaster: Cherry Precast Inc. – Rural Hall, North Carolina

Prestressed Posts: Standard Concrete Products – Savannah, Georgia

Sound Wall Consultant: JBM Solutions Inc.

Sound Absorptive Material: Durisol® by Armtec Infrastructure Inc. – Guelph, Ontario, Canada

Size: 609,000 sq. ft.

The Santa Monica Freeway in California. Interstate 75 through Atlanta. The Dan Ryan Expressway in Chicago. Perhaps these countless acres of concrete and asphalt evoke painful memories of sitting in traffic for hours.

They are a small sampling of the busiest highways in North America. The busiest is the 401 in Ontario, Canada. It widens to 22 lanes in some areas, handling about 450,000 vehicles a day. That's more than five vehicles a second. According to the FHWA, at least 13 highways in the U.S. are more than 12 lanes wide, and that number is growing. All that traffic creates a lot of noise, and managing the resulting sound is a major challenge for highway officials.

This noise affects residential homes or apartments, hospitals, schools, office buildings and nature areas. Numerous FHWA studies indicate that the most pervasive sources of noise today are those associated with transportation.¹ An effective way to address such noise is the use of precast concrete sound walls.

MASS-IVE NOISE REDUCTION

Precast concrete sound walls are noise barriers, defined as solid obstructions built to divide roadways from residential or commercial areas. Noise barriers can be constructed from earth, concrete, masonry, wood, metal or other materials, but to effectively reduce sound transmission, the chosen material must be rigid and sufficiently dense

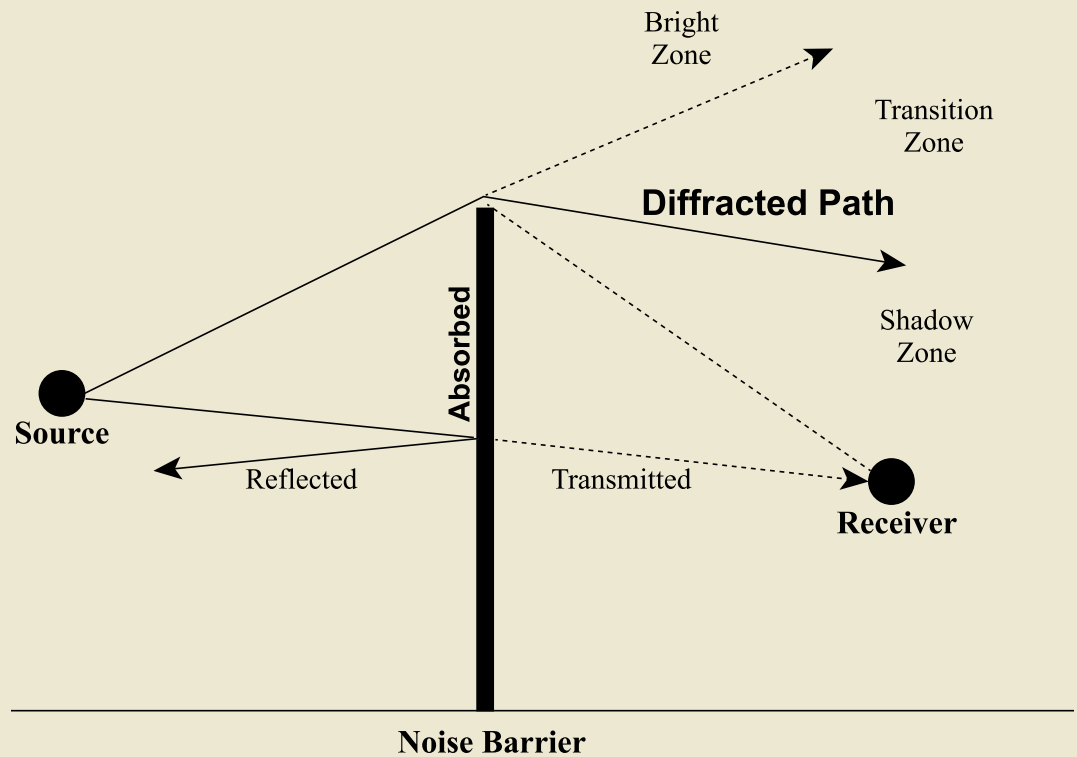


Figure 1: This diagram illustrates how diffraction affects sound.

(at least 37 lb/yd² or 20 kg/m²).

Due to its mass, precast concrete offers a perfect solution for noise abatement, capable of reducing sound penetrating through a wall by more than 80% when compared to wood or steel. Additional benefits of precast concrete sound walls, including durability, ease of installation and aesthetic versatility, make it a top choice for noise reduction on a variety of transportation projects.

Precast concrete sound walls arrive on the job site ready to be installed, significantly reducing on-site labor compared to cast-in-place applications. As a result, projects can be completed quickly, saving time and money. Further, precast concrete has a long life cycle and is very resilient in the face of high winds, fire and rising waters, making it a sustainable building choice. Precast concrete sound walls can even be manufactured to be graffiti resistant (visit precast.org/graffiti).

TO ABSORB OR TO REFLECT?

There are two types of precast concrete sound walls: absorptive and reflective. Absorptive sound walls take in sound energy while reflective sound walls push sound energy back across the source (away from the receiver) and into the atmosphere. Both types of sound walls force sound waves to take a longer path – over and around the barriers – reducing the amount of sound reaching the receiver. This is known as diffraction (Figure 1).

After passing through an absorptive precast concrete sound wall, lower amounts of sound energy remain to re-enter the environment, resulting in less noise reaching the ears of the receiver. Materials and finishes used to manufacture absorptive precast concrete sound wall

panels and posts vary, but can include:

- Sound-absorptive aggregates
- Lightweight cellular material
- Composite materials
- Acoustic facing tile
- Textured/stamped concrete surface, porous finish or stamped brick
- Fibrous materials (fiberglass, mineral wool, recycled tire rubber, or recycled wood fibers or shavings)

Unlike absorptive sound walls, reflective sound walls are not manufactured with absorptive materials or finishes. Instead, producers rely on the natural materials found in concrete to force sound back toward the source or into the atmosphere at a significantly decreased level. When properly designed, a reflective precast concrete sound wall will effectively eliminate noise at the receiving location.

SIX-MILE SILENCE

Northeast of Columbia, South Carolina, work crews recently completed the first-ever installation of an absorptive sound wall in the state. The sound wall, which was installed across a six-mile stretch of Interstate 20, is over 600,000 sq ft in length.

JBM Solutions Inc. provided the technology for the sound wall system, including the forms, tools and handling devices. On site, the company also set up a temporary plant for production of the precast concrete pieces, training the work crews and quality control staff to produce, handle, store and ship the absorptive products.



The project's precaster, Cherry Precast of Rural Hall, North Carolina, produced and shipped the absorptive panels. The precaster's crews and quality control staff paid strict attention to detail, resulting in a highly effective noise barrier solution. Out of over 5,400 precast concrete panels produced and shipped to site, none were rejected due to quality issues.

Armtec, of Guelph, Ontario, also supported the project. The company provided the equipment necessary to produce Durisol, a highly sound absorptive material consisting of specially graded wood particles bonded with cement. Wood processing equipment milled local wood chips to the desired gradation, mineralizing equipment treated the milled wood chips and a fully contained high-tech batch plant mixed the Durisol to a constant consistency.

According to Jerry McNeal, president of JBM Solutions Inc., the installed sound wall is most likely the first of many more to come in the region. Currently, several state DOTs are monitoring the project to determine the success of the system. If the wall performs as designed, North Carolina and Georgia may install their first absorptive sound walls in the near future.

PEACE AND QUIET

Noise is an undesirable byproduct of our modern ways of life. Those exposed to excessive noise levels over an extended period of time are often unaware of how it can interfere with sleep, work or recreation and in some cases even cause physical and psychological damage. Transportation noise is the most pervasive and difficult sound source to abate in society today. In an era of ever-widening highways, a concentrated effort is needed to control transportation noise using a system that is effective, durable and aesthetically pleasing. Precast concrete sound walls are the best solution capable of standing up to the challenge. **PS**

Claude Goguen, P.E., LEED AP, is NPCA's director of sustainability and technical education.

Photo Credits
Page 24, 27: JBM Solutions Inc.

(Endnotes)

¹ http://www.fhwa.dot.gov/environment/noise/noise_barriers/design_construction/keepdown.cfm




Cherry Precast, of Rural Hill, North Carolina, manufactured absorptive sound walls for Interstate 20 in South Carolina.

LIMITLES





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A photograph of a thick, light-colored wooden plank resting horizontally on a single, angled, light-colored concrete support. The background is a dark, textured wall.

A designer for a well-known Canadian concrete company finds allure and intrigue in the versatility of precast concrete products.

By Mason Nichols



What's the first adjective that pops into your mind when you think of precast concrete products?

If your answer is strong, reliable or trustworthy, you fall right in line with the many contractors, engineers and architects who have come to discover just how useful the building material can be in a vast array of projects and applications. If your answer is "sexy," then you may be one of a number of forward-thinking designers – like Carla Pienaar – who is on the cutting edge of product development and understands the seemingly endless design aesthetics that can be achieved through specifying precast concrete.

THE WINDING ROAD

Pienaar, a designer in the product development department for Barkman Concrete of Steinbach, Manitoba, has always been fascinated by homes, furniture and the possibilities created in planning spaces. Pienaar began working on her first interior design book when she was 10, a compilation filled with unique spins on design inspired by her

parents' appreciation for the unusual.

"My parents have a bit of a quirky style," Pienaar said. "They have always been interested in angled walls. So when I think back to that sketchbook and my furniture placement in my own room, I always had my bed on an angle. It was never just against the wall, but always coming out from the corner of the room."

In many ways, Pienaar's career path mirrors her first sketchbook: though filled with unconventional angles and turns, the traveler ultimately reaches the desired destination. While Pienaar initially set out to work in the marketing industry, she quickly recognized that the field wasn't a match, because it limited her imagination and stifled her creativity. "I realized that I didn't want to sit behind a computer for the rest of my life and that I really needed to do something with design, something tangible," she said.

As a result, Pienaar shifted her focus back to her original love, ultimately ending up in a master's degree program at the University of Manitoba, where she currently studies interior design, object design



An experimental bench Pienaar created combining clean lines and exposed rebar.

designer wishing to invoke myriad emotions through her work.

"The diversity of what each type of precast can instigate in someone is actually the most exciting thing for me personally as a designer," Pienaar said. "In terms of concrete, it's great because the world is your oyster."

PLAYING NICE

Over the past year, Pienaar's main focus has been on developing a new line of wet-cast site furnishings falling somewhere between Barkman's traditional exposed aggregate products and the more high-end glass fiber-reinforced concrete line. To further diversify the line, the company chose to leverage the power of mixed media, adding additional materials such as wood to the mix.

The result is a family of precast concrete benches that incorporate black locust, an insect- and rot-resistant wood that is one of the strongest domestic timbers in the U.S.¹

Pienaar noted precast's ability to "play nice" with other materials as crucial to her continued education in the field. "Again, as a designer, part of what's really interesting with precast concrete is because of its diverse applications, you're learning about all kinds of other things, including wood," she said. "Working on this particular line was a great opportunity for me to be able to use all of my different thought processes and perspectives."

NO BOUNDARIES

For a designer whose focus is the quirky and unconventional, precast concrete provides the perfect solution in an infinite number of situations. Perhaps even more importantly, it establishes a world where restrictions cease to exist. For Pienaar, using precast is design nirvana.

"The fact that there are really no boundaries is a constant source of inspiration," Pienaar said. "The diversity of materiality and applications that concrete provides means that there are many, many more years of exploration to be had with it as a material." **PS**

Mason Nichols is NPCA's external communication and marketing manager.

Photo Credit
Barkman Concrete (www.barkmanconcrete.com)

(Endnotes)

¹ <http://www.wood-database.com/lumber-identification/hardwoods/black-locust>

and landscape architecture – all while developing innovative products with Barkman Concrete.

ENDLESS POSSIBILITIES

If a career in the marketing industry suppressed Pienaar's creative juices, working as a designer for Barkman Concrete opened up a whole new world of possibilities, thanks to the flexibility and versatility of precast concrete.

"For Barkman, the bread and butter has always been paving stones, trenches and similar kinds of products," Pienaar said. "But they are interested in pushing the boundaries, trying new things and getting creative. As a designer, that's great."

Barkman Concrete supports Pienaar's creativity by encouraging "blue sky thinking," a process whereby employees generate new product ideas to spur creativity in existing lines. This approach speaks to Pienaar's innate desire to experiment with unconventional ideas. Throw precast concrete into the equation, and the result is a perfect fit for a



Photo courtesy of Gate Precast

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