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PCI DESIGN AWARDS

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The PCI Design Awards is not just looking for design excellence, but also for projects displaying outstanding use of precast concrete. PCI looks for projects that push the envelope and advance the precast concrete industry.

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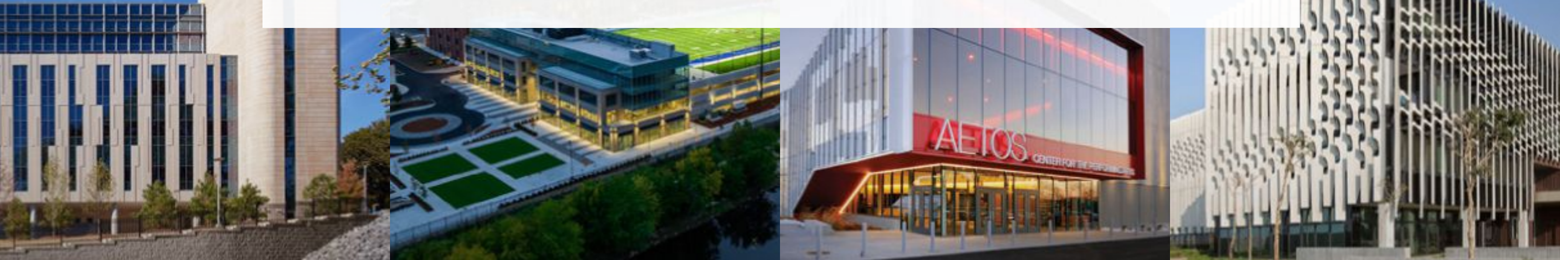

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2024 PCI Design Awards

TRANSPORTATION AWARDS

Mason Nichols is a Grand Rapids, Mich.-based writer and editor who has covered the precast concrete industry since 2013.

TRANSPORTATION AWARDS JURY

JAMIE FARRIS

Jamie F. Farris, PE, is the deputy director of the Texas Department of Transportation (TxDOT) Bridge Division. She assists in overseeing operations that include program and project development; structural and geotechnical design; plan development; plans, specifications, and estimates review; safety inspection; and bridge construction and maintenance statewide support. Farris has a BS in architectural engineering and an MS in civil engineering from the University of Texas at Austin and has been a registered engineer in Texas since 2004. She has a broad range of experience, including designing and rehabilitating concrete and steel bridges, serving as a project manager, writing TxDOT guidelines and manuals, serving as an advisor on research projects, developing the TxDOT Transportation Asset Management Plan, serving on national technical committees, analyzing proposed legislation affecting bridges, and providing technical assistance for design-build projects.

REGGIE HOLT

Reggie Holt, PE, is a senior bridge engineer and the concrete bridge specialist for the Federal Highway Administration (FHWA) Office of Bridges and Structures at FHWA headquarters in Washington, D.C. He is responsible for national policy and guidance on bridge design and analysis. Prior to his current position with FHWA, Holt worked for 15 years for the bridge design consultant T. Y. Lin International, where he designed and managed multiple complex concrete bridge structures.

Holt has a bachelor of science and a masters of science degree in civil engineering from the University of Maryland. He is a registered professional engineer and member of multiple technical committees, including ex-officio for the American Association of State Highway and Transportation Officials (AASHTO) T-10 Committee on Concrete Design; the Post-Tensioning Institute (PTI) Post-Tensioned Bridge, Grouting, and Cable Stay Bridge committees; and the PTI/American Segmental Bridge Institute Grouted Post-tensioning Committee. In addition, Holt has served on multiple research technical review panels, blue ribbon panels, and expert task groups throughout his career.

STEPHEN J. SEGUIRANT

Stephen J. Seguirant, PE, FACI, FPCI, is vice president and director of engineering for Concrete Technology Corporation (CTC) in Tacoma, Wash. He began his career at CTC in 1979 as a project engineer. He has held various posts at CTC, including project manager, chief project manager, and vice president and director of project management and quality assurance. He earned his BS in civil engineering from St. Martin's College in Lacey, Wash., and his MS in civil engineering from the University of Washington, Seattle. He is a registered civil engineer in Washington state.

Seguirant serves on PCI's Research and Development and Transportation Activities councils, and he is a member of PCI's Bridges and Prestressed Concrete Piling committees. He is also a member of the American Concrete Institute (ACI) Committee 318 and was chair of ACI 318 Subcommittee G, Precast and Prestressed Concrete, for the 2014 and 2019 code cycles. He is also a member of ACI/PCI Committee 319. Seguirant is a fellow of PCI and ACI. He was principal author of Chapter 3, "Fabrication and Construction," of the *PCI Bridge Design Manual*.

Seguirant has won numerous awards from PCI and the American Society of Civil Engineers for articles in the *PCI Journal*, and he was named among the eight Technology and Materials Innovators in the American Road & Transportation Builders Association's list of America's Top 100 Private Sector Transportation Design and Construction Professionals of the 20th Century. He was also the recipient of PCI's Norman L. Scott Professional Engineer Award in 2014 and ACI's Robert F. Mast Award in 2023.

Bridge with a Main Span up to 75 Feet

PROJECT TEAM

Owner: Pennsylvania Department of Transportation District 6, King of Prussia, Pa.

PCI-Certified Precast Concrete Producer: PennStress, a division of MacInnis Group, LLC, Roaring Spring, Pa.

Engineer of Record: Michael Baker International, Harrisburg, Pa.

General Contractor: Neshaminy Constructors, Huntingdon Valley, Pa.

Project Cost: $4.5 million ($770,000 for the precast concrete)

Project Size: 2872 ft²

GIRARD AVENUE OVER CSX

PHILADELPHIA, PENNSYLVANIA

A tight construction timeline and a unique location necessitated an innovative design approach for a short-span bridge replacement project on West Girard Avenue in Philadelphia, Pa. The bridge is located in a busy area of the city, adjacent to the Philadelphia Zoo and over a CSX freight railroad carrying more than 20 trains per day. Sandwiched between on- and off-ramps for Interstate 76, the bridge supports four lanes of vehicular traffic and includes two trolley tracks and two pedestrian sidewalks. Given the project's location and the high volume of traffic flowing through the area, officials with the Pennsylvania Department of Transportation District 6 sought a building material that could be installed with speed and efficiency, while minimizing disruption to the public. PennStress of Roaring Spring, Pa., in partnership with engineer of record Michael Baker International of Harrisburg, Pa., and the rest of the project team successfully designed, manufactured, and installed a variety of precast concrete components for the structure.

COMPLEX SITE, INNOVATIVE SOLUTION

Given the complexity of the site, which also includes water lines, electrical ducts, and other utilities, a major goal for the project was to replace the bridge's superstructure during two short construction stages, all while maintaining two lanes of

"This bridge replacement project utilized precast components to address multiple project constraints, which included tight site conditions with utilities [and] heavily traveled roadway that needed to maintain two traffic lanes. A precast deck beam component called the NEXT D beam met these constraints."

—Reggie Holt, Federal Highway Administration

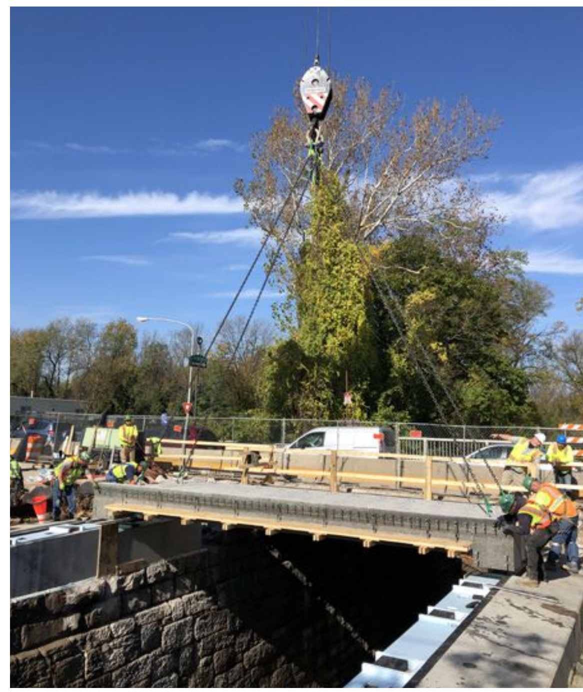
traffic and one sidewalk on West Girard Avenue. The project team chose NEXT D precast concrete beams for the bridge deck, which, in addition to saving critical time over a cast-in-place deck solution, met the limited vertical clearance requirements generated by the bridge's location over the railroad. Crews installed three 8.5-ft-wide and seven 10-ft-wide NEXT D beams. The different beam widths were needed to match the existing bridge's out-to-out. Each of the NEXT D beams was designed with a nonstandard height to achieve the vertical clearance needed.

As the project progressed, opportunities to integrate other precast concrete solutions arose. For example, curbs and exterior barriers were integrated into the precast concrete beams to serve as a formwork for the sidewalks.

"This allowed for the barriers to arrive to the project site with the architectural details already in place," said Audrey Corrado, PE, senior associate and bridge department manager with Michael Baker International. "In turn, construction time was even further reduced, ultimately allowing the bridge to reopen more quickly."

Precast concrete beam placement took place throughout stages 2 and 4 of the seven-stage project. Initial construction involved installing a precast concrete plank beam outside the limits of the out-to-out to support a new water line. Once this was completed, NEXT D beams were set in stage 2, which consisted of removing the existing south half of the bridge and the top courses of the masonry stone abutments and installing precast concrete abutment caps along with four of the NEXT D beams. Ultra-high-performance concrete (UHPC) closure pours were leveraged between the abutment caps and the beams. Stage 4 followed the same approach as stage 2 and was performed on the north half of the existing superstructure with five NEXT D beams. Together, these stages were finished in just two weeks, far less than the six-month timeline that would have been required if alternative materials and construction methods were used.

Replacing a deficient structure in an urban environment is no small task, but thanks to the use of precast concrete, the many stakeholders involved experienced minimal disruptions and the result is a positive outcome for all.



Photos: Michael Kovacs, Michael Baker International and Tony Canuso, Neshaminy Constructors Inc.

KEY PROJECT ATTRIBUTES

- **Located on a tight urban site adjacent to the Philadelphia Zoo, the Girard Avenue over CSX project replaced a short-span bridge superstructure in just two weeks.**
- **Throughout the project, traffic flow was maintained with minimal detour time. Utilities remained in service throughout the work.**
- **NEXT D precast concrete beams, along with other precast concrete products such as abutment caps, made the project possible.**

PROJECT AND PRECAST CONCRETE SCOPE

- **Ten NEXT D beams were installed on the project. Three were 8.5 ft wide and seven were 10 ft wide. The varying widths were used to match the existing bridge's out-to-out.**
- **Precast concrete beam installation took place in 2022 in two separate stages, November 2 to November 7 and November 8 to November 14.**

Bridge with a Main Span from 76-200 Feet

PROJECT TEAM

Owner: Maryland Transportation Authority, Baltimore, Md.

PCI-Certified Precast Concrete Producer: Coastal Precast Systems, Chesapeake, Va., and Cape Charles, Va.

Engineer of Record: AECOM, Glen Allen, Va.

General Contractor: Skanska USA Civil SE, Vienna, Va.

Project Cost: $463 million ($31.5 million for the precast concrete)

Project Size: 608,170 ft²

HARRY NICE/MIDDLETON BRIDGE

NEWBURG, MARYLAND

By the mid-2010s, it was apparent that the original Harry W. Nice Memorial/Senator Thomas "Mac" Middleton Bridge (Nice-Middleton Bridge), which was built in 1940 as a key gateway connecting Virginia and Maryland, did not meet the needs of modern motorists. Therefore, the decision was made to replace the existing 1.9-mile, two-lane undivided bridge with a new, 61-ft-wide bridge featuring 12-ft-wide lanes along with a center median and shoulders to increase traffic capacity, improve safety, and facilitate access for maintenance and wide-load vehicles. When designing and erecting the new structure, the talented project team used many precast concrete components as part of the strategy for success.

A COST-EFFECTIVE AND STATE-OF-THE-ART DESIGN

In addition to increased capacity for vehicular traffic, the $463 million new bridge features a navigational vertical clearance of 135 ft, enabling large ships traveling the Potomac River to pass under the structure. Additionally, according to Kenneth V. Butler, PE, senior vice president and director of complex bridge practice with project engineer of record AECOM, more gradual vertical grades on the new Nice-Middleton Bridge allow vehicles to maintain a safe, consistent speed—and offers several other advantages.

"The innovative bridge design incorporated efficient and cost-effective span lengths, structural performance, constructability, and maintainability considerations that saved on project costs for the Maryland Transportation Authority

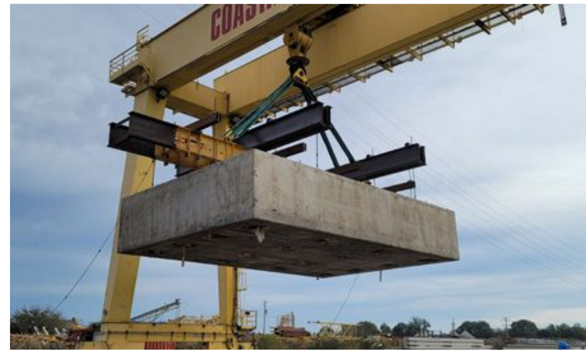
> *"This project is a great example of comprehensively looking at a project from all angles. The design team delivered a design that was based on cost effectiveness, structural performance, constructability, maintainability, as well as inspect ability."*
> **—Jamie Farris, Texas Department of Transportation**

while improving aesthetics and lowering long-term maintenance costs," he said.

This design cost-effectively balanced the number of spans used against the number of supporting piers and leveraged a combination of prestressed concrete girders in the low- and high-level approach spans with long-span, haunched steel girders over the main channel. Coastal Precast Systems of Chesapeake, Va., manufactured the project's various precast concrete products, which included girders, massive piles, and more. The bridge's substructure and foundations vary from pile bents to concrete columns and caps on waterline footings. Deep foundations were made possible using 36- and 66-in. prestressed concrete piles with lengths up to 190 ft. All the precast concrete elements specified for the project were designed to provide a simple and repetitive structure, which increased construction efficiency so that the design and construction could be completed within two years from notice of award.

The project featured many innovative uses of precast concrete. Coastal Precast Systems manufactured the 66-in. cylinder piles with carbon-fiber prestressing strands, precast concrete drainage troughs that were installed beneath modular expansion joints, and precast concrete foundation frames dubbed "bathtubs." Building information modeling (BIM) also played a significant part in the effort, with the team leveraging BIM approaches and technology to identify elements of the bridge that could be designed as precast concrete pieces. Ultimately, the use of precast concrete enhanced the project's safety, as many of the components could be produced in a controlled, off-site environment and then delivered to the site, where workers could complete repetitive installation tasks on the ground. Alternatively, cast-in-place concrete construction would have situated workers at varying heights over water, resulting in a more complex installation process, greater safety risks for workers, and likely a longer timeline that would have further inconvenienced the public.

"The new Nice-Middleton Bridge offers a 100-year service life and is a benchmark to the start of a new era for the southern Potomac area of Maryland and Virginia," Butler said. "The bridge reduces life-cycle costs through state-of-the-art design details and durable material selection while providing a structure that is easily accessible for future inspections and maintenance."



Photos: SCM Project Images.

KEY PROJECT ATTRIBUTES

- **The original Harry W. Nice Memorial/Senator Thomas "Mac" Middleton Bridge (Nice-Middleton Bridge), built in 1940 and supporting just two lanes of traffic, was replaced with a structure that can accommodate four 12-ft-wide lanes, shoulders, and a center median.**
- **The new, 1.9-mile bridge is 61 ft wide. It has a navigational vertical clearance of 135 ft, enabling large ships traveling the Potomac River below to pass through.**
- **Thanks to the use of precast concrete products, Nice-Middleton Bridge boasts a 100-year service life, making it a reliable connection point between Virginia and Maryland for years to come.**

PROJECT AND PRECAST CONCRETE SCOPE

- **Both 36- and 66-in. prestressed concrete piles reinforced with carbon-fiber strands were installed on the project. The piles are up to 190 ft in length.**
- **A massive project in scale, the new Nice-Middleton Bridge encompasses more than 600,000 ft^2 and cost more than \$463 million to construct.**
- **Due in part to the use of precast concrete products, the bridge opened to traffic two months ahead of schedule.**

Rehabilitated Bridge

PROJECT TEAM

Owner: Pennsylvania Department of Transportation District 11, Bridgeville, Pa.

PCI-Certified Precast Concrete Producer: Brayman Precast, LLC, Saxonburg, Pa.

Precast Concrete Specialty Engineer: Wilden Enterprises, Inc., Northern Pines, N.C.

Engineer of Record: SAI Consulting Engineers, Inc., Pittsburgh, Pa.

General Contractor: Allison Park Contractors, Gibsonia, Pa.

Project Cost: $7.7 million ($2 million for structure rehabilitation, including $840,000 for the precast concrete)

Project Size: 648 ft^2

ALMONO ABC WIDENING OF I-376 WESTBOUND BRIDGE

PITTSBURGH, PENNSYLVANIA

Completed in just 15 days, the widening of a bridge on westbound Interstate 376 (I-376) in Pittsburgh, Pa., was accomplished with a winning combination of ultra-high-performance concrete (UHPC), multiple precast concrete products, and accelerated bridge construction (ABC) methods. This important work was generated out of necessity—the redevelopment of a former brownfield in the area was projected to increase daily traffic on the bridge's off ramp from 55,000 vehicles to 65,000 vehicles, exacerbating a preexisting issue with stopped motorists on the structure.

The project, which would reduce the three existing lanes down to two during construction, needed to be completed quickly, as it would temporarily cause even more congestion in the area. The team, which included Brayman Precast of Saxonburg, Pa., local engineering firm SAI Consulting Engineers, and the Pennsylvania Department of Transportation, met the project's tight timeline thanks in large part to the precast concrete components specified, which included foundations supported by drilled micropiles, substructure stem and backwall elements, and deck panels.

AS EASY AS ABC

With speed and efficiency being key considerations for the project, the ABC approach rose to the top. Jake Daugherty, quality control manager with Brayman Precast, noted that the significantly reduced construction time associated with ABC leads to a variety of other positive outcomes, including

"This rehabilitation project involved widening an existing bridge on a very busy freeway. The substructure had to be changed to accommodate the widening, and it just couldn't be extended as is."
—Stephen J. Seguirant, Concrete Technology Corporation

Photos: *SAI Consulting Engineers, Inc.*

improved safety and fewer hazards for the public, who would otherwise face complex and lengthy road closures and delays.

"ABC also decreases the risk of weather-related impacts, since the precast concrete elements are cast indoors in a temperature-controlled plant, ensuring enhanced quality control," Daugherty said. "Fewer road closures and traffic delays are also good for the environment, as there is less idle time for cars in traffic jams."

Jason DeFlitch, PE, DBIA, project manager for SAI Consulting Engineers, agreed with Kemper, noting that because the precast concrete elements for the bridge substructure could be erected ahead of the interstate closure for superstructure work, significant time was shaved off the construction schedule. Compared with a cast-in-place concrete project, using precast concrete and ABC methods reduced the overall project time from 45 days to just 15.

"Precast construction overcame all project challenges, including maintaining two lanes of traffic on I-376 westbound at all times, limiting lane restrictions on adjacent facilities, minimizing utility impacts, and increasing safety," DeFlitch said. "Minimal crews were needed for construction, and the duration of the proximity of those crews to live traffic was limited."

The installation of the micropiles and precast concrete substructure elements was completed during weekend closures of the road below the bridge, along with various ramps to and from the interstate. Superstructure widening included a partial removal of a portion of the existing bridge deck, erection of a new girder on substructure extensions, placement of precast concrete deck panels that connected to the existing deck with a longitudinal UHPC closure pour, transverse UHPC pours between adjacent precast deck panels, and placement of precast concrete approach and moment slabs. Overall, the project deployed 27 yd^3 of UHPC and $840,000 in precast concrete products, leading to a solution that not only mitigates traffic in the area but also leverages innovative construction methods to enhance safety.

"Widening this westbound bridge on I-376 represents a significant infrastructure improvement that positively impacts the community," Daugherty said. "Widening and elongating the exit ramp results in a more gradual, smoother exit from the highway, making the driving experience safer for motorists and reducing congestion."

KEY PROJECT ATTRIBUTES

- **By taking advantage of accelerated bridge construction methods and precast concrete products, the project team successfully widened a busy westbound bridge on I-376 in Pittsburgh, Pa., in just 15 days.**
- **The work widened and lengthened the deceleration/exit lane, which had been experiencing significant congestion due to the redevelopment of a former brownfield in the area.**
- **Throughout the entire project, only one lane remained closed, minimizing disruption for motorists.**

PROJECT AND PRECAST CONCRETE SCOPE

- **Precast concrete included both substructure and superstructure elements, costing $840,000 and representing nearly half of the amount spent for overall structure rehabilitation.**
- **One lane of the interstate bridge was closed from June 10 to June 25, 2022, for placing the precast concrete deck panel and installing precast concrete approach and moment slabs.**
- **Selecting a precast concrete solution over cast-in-place concrete for the bridge deck shaved 30 days off the construction timeline.**

International Transportation Structure

PROJECT TEAM

Owner: Bonus Essential Sdn Bhd, Kuala Lumpur, Malaysia

Precast Concrete Producer and Precast Concrete Specialty Engineer: Dura Technology Sdn Bhd, Chemor, Perak, Malaysia

Engineer of Record: VED Engineer Sdn Bhd, Selangor, Malaysia

Structural Engineer of Record: Concrete Technology Consult Sdn Bhd, Perak, Malaysia

General Contractor: Dura Construction Sdn Bhd, Perak, Malaysia

Project Cost: $20 million ($5 million for the precast concrete)

Project Size: 126,090 ft²

LANGAT RIVER BRIDGE

BANTING, SELANGOR, MALAYSIA

Spanning more than 1600 ft, a new bridge in Malaysia constructed from precast ultra-high-performance concrete (UHPC) is an impressive feat of engineering, epitomizing the innovation and resilience that precast concrete makes possible. The bridge consists of 15 spans, including two abutments and 14 piers, with one span crossing the Langat River. While the original propose was for a bridge with a structural steel plate girder system, the team at Dura Technology Sdn Bhd (Dura) worked with the project owner to convert the approach to UHPC U-girders and a cast-in-place concrete deck. Switching the design to a precast concrete solution provided a wide variety of advantages, including lower costs, a faster construction schedule, long-term durability, and more.

A RECORD-SETTING APPROACH

Contractors built the bridge in a 1000-acre industrial park—one of the largest in the area. Its construction not only solves local traffic congestion but also encourages further development inside the park, which could lead to new businesses and work opportunities for those living in the area.

All of this was made possible thanks to nine record-setting U-girders measuring 344.5 ft in length and weighing 440 tons. Each of the U-girders was manufactured using UHPC and required 220 yd^3 of concrete. A special technique was deployed in the precast concrete producer's plant to ensure perfect alignment and match cast segments, with lengths

> *"This record setting span was made achievable due to the use of ultra-high-performance concrete or UHPC. UHPC greatly reduced the girder cross section and superstructure weight, as well as provide superior mechanical properties for the concrete."*
> **—Reggie Holt, Federal Highway Administration**

between 21 and 26.2 ft. A long bed was used to cast every other segment along the length. Then, gaps between segments were filled in, achieving the alignment needed. The concrete for each segment also had to be placed continuously, necessitating the use of a large, 15-yd^3 mixer.

According to Yen Lei Voo, Dura CEO, the precast concrete UHPC design brought a significant number of advantages to the project. "The cost of the precast solution was 30% less than that of the steel originally planned," he said. "Additionally, precast concrete helped avoid supply-chain issues while also taking advantage of sourcing locally produced raw materials. We were also able to increase safety by avoiding the need for skilled workers to weld and bolt structural steel at high elevations."

UHPC has become increasingly popular for infrastructure projects. The material is recognized as sustainable and durable, leading to shorter construction schedules, extended service life, and minimized maintenance requirements. These attributes, when combined with the general advantages that precast concrete products provide, made the U-girders the perfect solution for the project. "UHPC is expected to be in service for several hundred years with little associated maintenance costs," Voo said. "When compared to structural steel, the need for frequent painting is also eliminated."

Despite the difficulties associated with installing massive components and the bridge being on a 44-degree skew, the team was able to erect one precast UHPC girder in less than two hours using a single launching operation. The U-girders consists of two webs, each 6 in. thick, and a bottom flange with a thickness of 9 in. U-girders were post-tensioned using seven bonded tendons in the bottom flange with 37-in.-diameter strands. Each U-girder top bulb girder includes one 13-strand tendon. This arrangement guarantees compression across the joints after transfer and for service loading. All tendons were stressed to up to 80% of their breaking load.

Overcoming several obstacles, including difficult installation conditions, massive size considerations, and even a pandemic, this record-setting precast UHPC bridge will serve the industrial park where it is located—and the surrounding community—for years to come.

Photos: DURA.

KEY PROJECT ATTRIBUTES

- **A new bridge spanning the Langat River in Malaysia was constructed using a combination of precast concrete and cast-in-place concrete to serve a 1000-acre industrial park.**
- **Dura Technology Sdn Bhd (Dura) worked with the project owner to convert the design from a structural steel plate girder system to a precast concrete U-girder system leveraging UHPC.**
- **Switching to UHPC lowered costs, reduced time spent on the project, and offers long-term benefits for the industrial park and surrounding area.**

PROJECT AND PRECAST CONCRETE SCOPE

- **Nine record-setting U-girders measuring 344.5 ft in length and weighing 440 tons were installed as part of the project.**
- **The project team leveraged post-tensioning methods to guarantee compression across the joints after transfer and for service loading.**
- **Of the overall project cost ($20 million), 25% ($5 million) was dedicated to the precast UHPC components.**

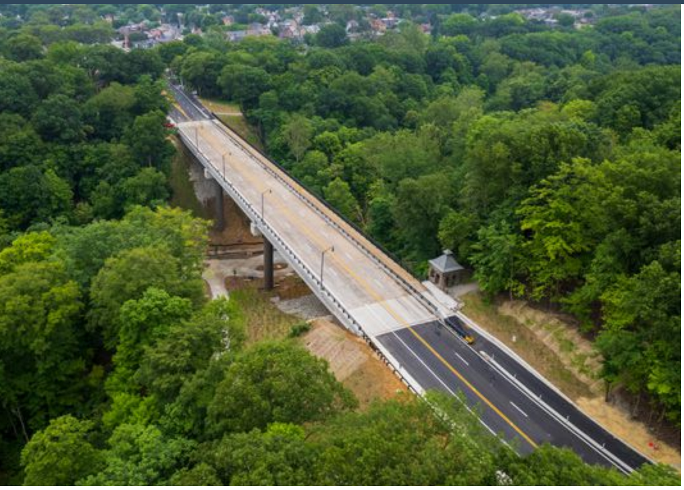


Photo: Swank Co.

PROJECT TEAM

Owners: City Of Pittsburgh, Pittsburgh, Pa.; Pennsylvania Department of Transportation District 11, Bridgeville, Pa.

PCI-Certified Precast Concrete Producer: PennStress, a division of MacInnis Group, LLC, Roaring Spring, Pa.

Engineer of Record: HDR, Pittsburgh, Pa.

General Contractor: Swank Construction Co., LLC, New Kensington, Pa.

Project Cost: $22 million

Project Size: 29,440 ft^2

KEY PROJECT ATTRIBUTES

- **Prestressed concrete beams were selected as the superstructure of the new Fern Hollow Bridge after the original steel bridge collapsed in early 2022.**
- **Leveraging a precast concrete design and with an emergency proclamation in place, the project, which would typically take from four to five years, was substantially completed in less than one year.**
- **The finished bridge boasts a design life of more than 100 years.**

PROJECT AND PRECAST CONCRETE SCOPE

- **The new bridge is a three-span structure with 21 prestressed concrete 33/95.5 PA bulb-tee beams, each weighing more than 100 tons and measuring roughly 152 ft in length.**
- **Precast concrete manufacturing started on May 5, 2022, and was completed on June 3, 2022. Precast concrete erection began on July 25, 2022, and ended on August 16, 2022.**

BRIDGE WITH A MAIN SPAN FROM 76-200 FEET

FERN HOLLOW BRIDGE

PITTSBURGH, PENNSYLVANIA

In the early morning hours on January 28, 2022, Fern Hollow Bridge collapsed in Pittsburgh, Pa., sending several vehicles and a Port Authority bus into a ravine below. Thankfully, the collapse only resulted in a handful of injuries and no fatalities. However, with the route carrying more than 20,000 vehicles per day, an emergency replacement was needed to restore this critical passage for commuters. Officials with the Pennsylvania Department of Transportation (PennDOT) chose precast concrete for the new bridge, specifying a three-span structure that would use 21 prestressed concrete 33/95.5 PA bulb-tee beams, each weighing more than 100 tons and measuring roughly 152 ft in length.

FAST, DURABLE, AND SAFE

Owing to the severity of the situation and the pressing need to install a new bridge at the location, state officials approved an emergency proclamation that allowed PennDOT and the City of Pittsburgh to leverage all available powers, resources, and personnel necessary to rectify the situation. A progressive design-build delivery process was selected, which, when combined with the decision to use precast concrete, accelerated the project schedule from four to five years to just under one year. As a result, motorists could quickly resume using the route made possible by Fern Hollow Bridge, avoiding a congested detour that had added approximately 20 minutes to commute times.

Many aspects of the design of the new bridge, including the existing bridge's location, right-of-way limitations, traffic volume, and environmental and historical impact, were carefully evaluated. Key objectives included reassuring the public that the bridge would be safe and providing a structure that would reduce maintenance while providing a design to exceed the American Association of State Highway and Transportation Officials' minimum 75-year design life. The high-quality prestressed beams selected for the project helped address all these considerations.

PennStress of Roaring Spring, Pa., manufactured the beams efficiently, readying them for their intended use within six months of the original steel bridge's collapse. This time frame was well ahead of those for other potential superstructure options, and using an offsite fabrication process simplified concurrent work taking place at the project site.

Because the prestressed concrete beams were fabricated in a controlled environment and have protective coatings and material requirements that meet PennDOT's design manual and specifications, the prestressed beams boast a service life of more than 100 years. Thus, the new, 460-ft-long Fern Hollow Bridge will provide a secure route for commuters to navigate the busy Pittsburgh suburbs for years to come.

BRIDGE WITH A MAIN SPAN FROM 76-200 FEET

MILE LONG BRIDGE

CHICAGO, ILLINOIS

Traffic in the Chicagoland area is often heavy, with scores of commuters traversing the city's roads each day. Such is the case 20 miles southwest of downtown Chicago, where the Mile Long Bridge, a part of the Central Tri-State Tollway on Interstate 294, supports 150,000 vehicles each day. The Illinois State Toll Highway Authority, in partnership with contractor FH Paschen of Chicago and County Materials Corporation of Janesville, Wis., reconstructed two aging bridges in the corridor to accommodate increasing traffic demands, minimize maintenance, and improve safety. The project was made possible through the fabrication and installation of 523 colossal precast and prestressed concrete bridge beams.

MASSIVE SCALE, MASSIVE RESULTS

Project leaders were challenged with replacing the four-lane northbound and southbound bridges in the area with larger structures to accommodate five lanes of traffic and a flex lane in each direction. Further complicating matters was everything beneath the bridge, including two major railroads, three water sources, local roads, and a series of commercial properties. Given these conditions, unique approaches to design and construction were required. To reduce disturbance to the aquatic ecosystem near the site and meet the project's lofty goals, LHQ Tri-State Partners/H.W. Lochner Engineering of Chicago developed a solution that reduced the number of piers from 53 for each of the original bridges to 26 each for the replacement structures. This approach helped minimize the project's impact on the transportation and commercial activities taking place below the jobsite.

Precast and prestressed concrete bridge beams offered the only solution that would support the goals of the project, which included not only minimal disturbance to the area but also reduced maintenance and extended service life for the replacement bridges. County Materials Corporation manufactured 44 187-ft-long girders and 479 girders ranging in length from 127 to 170 ft. The 187-ft-long precast concrete beams are the largest prestressed concrete bridge girders produced in the region to date. Getting the girders to the project site was a challenge. The massive beams were hauled to the area on specialized trailers, with each load requiring four personal escort vehicles and two state patrol cars. Once precast concrete girders were on site, contractors used an innovative gantry system in lieu of traditional cranes to install them near the waterways. This helped allow four lanes of traffic in each direction to remain open throughout construction, mitigating potential headaches for commuters.

Thanks to the use of precast concrete, the Mile Long Bridge project offers myriad benefits to all parties involved. The durable and resilient replacement structures provide exceptional taxpayer value as they have an expected service life of 100 years, need less maintenance, and create additional lanes for traffic moving through the area each day.

Photo: *County Materials Corporation.*

PROJECT TEAM

Owner: Illinois State Toll Highway Authority, Downers Grove, Ill.

PCI-Certified Precast Concrete Producer: County Materials Corporation, Janesville, Wis.

Engineer of Record: LHQ Tri-State Partners/H.W. Lochner Engineering, Chicago, Ill.

General Contractor: FH Paschen, Chicago, Ill.

Project Cost: \$500 million (\$37 million for the precast concrete)

Project Size: 734,400 ft^2

KEY PROJECT ATTRIBUTES

- **The Mile Long Bridge project replaces aging bridges in a heavily traversed corridor with a high-performance solution using massive precast and prestressed concrete girders.**
- **A diligent and detailed engineering approach led to the development of a design that mitigated environmental effects near the worksite via an innovative gantry system used during precast concrete installation.**
- **The number of lanes in the northbound and southbound directions at the Mile Long Bridge increased from four to five, improving traffic conditions for future commuters.**

PROJECT AND PRECAST CONCRETE SCOPE

- **More than 500 massive prestressed and precast concrete bridge beams were installed, accounting for \$37 million on the \$500 million project.**
- **The PCI-certified precast concrete producer manufactured 44 187-ft-long precast concrete girders for the project along with 479 girders ranging in length from 127 to 170 ft. The 187-ft-long components are the largest prestressed concrete bridge girders produced in the region to date.**
- **Work on the project was completed in two segments. The northbound bridge was completed in 2020, and the southbound bridge was finished in 2022.**