

**MODULAR
INFRASTRUCTURE**

VALUE ENGINEERING

When infrastructure projects find themselves in densely populated areas, or occur on a site with poor conditions, the opportunity for value engineering with precast concrete infrastructure components presents itself as a preferred solution to difficult construction issues.

To value engineer a portion of a construction project is to provide a higher quality product at similar or greater value. Precast concrete is widely accepted as a high-performance material due to its high compressive strength, controlled production practices, and stringent quality requirements.

The choice to utilize precast concrete will ultimately decrease the site times by eliminating the forming and cure times necessary with typical cast-in-place (CIP) concrete. This results in a project that is completed quicker for the owner and opened to the public

on-time and within budget. Our experienced design team can help you develop a value engineered solution for any complex CIP concrete designs a job may present.

Recent innovations in connection methods for precast elements:

- Grouted splice couplers
- Bolted connections
- Concrete closure pours
- Post-tensioning
- Welded connections



ACCELERATED BRIDGE CONSTRUCTION (ABC)

As the nation's infrastructure continues to age, the number of bridges requiring rehabilitation, repair, or total replacement continues to increase. One of the greatest concerns with bridge construction and repair is how the project will affect the surrounding community, with safety, quality of life, and economical impacts being major considerations. In densely populated areas, the effects of lane closures or complete shutdown of a bridge can result in a larger economic cost to the area than the project cost itself. This makes way for the increasingly adopted practice of Accelerated Bridge Construction (ABC).

ABC is a method of bridge construction that uses innovative planning, design, materials, and construction methods in both a safe and cost-effective way to reduce on-site time that occurs during new construction, bridge replacement, and/or rehabilitation.



*See page 16
for more info
on the
Northwestern
University
Wave Wall.*



IDOT ACCELERATED BRIDGE CONSTRUCTION

UCP was chosen to be the precast producer for IDOT's first accelerated bridge construction project over Gar Creek in Kankakee County, IL.

With UCP's long history in supplying superior precast components for owners, including full and partial depth bridge approach slabs, wingwalls, abutments, and pier caps, we were selected as fabricator for this project. Precast was the clear option over cast-in-place since the installing contractor only had a 72-hour window to completely remove and replace the single-span bridge. Even though this was the first ABC project for IDOT, it was very successful paving the way for more opportunities to utilize this method of bridge construction on future projects.

UCP's scope of work consisted of producing four precast wingwalls, two pier caps, two approach footings, and eight full-depth bridge approach slabs with integral parapets. The size and length of the pieces and the custom forming required to fabricate these structures were a few of the challenges that our highly skilled operations team overcame. The heaviest piece produced weighed nearly 78,000 lbs and spanned 39'-2". It was cast with (11) 1'-9" diameter voids on the bottom surface ranging in height from 1'-6" to 2'-0" to fit over field-driven H piles. The voids were filled with high strength grout, allowing the load from the bridge deck to be transferred deep into ground. Strict tolerances were upheld by our top-notch, in-house quality control team to ensure exact dimensions of the precast components to avoid fitup issues.



The overall goal of implementing ABC on this project was to fine tune the current system for future projects. The project was a productive learning process for everyone involved, and only the most technically inclined precaster could have fabricated or maintained the dimensional tolerances of these intricate bridge structures. With UCP's reputation for consistently meeting necessary target dates and our commitment to producing innovative and superior precast products, the decision was simple for the contractor. Utility Concrete Products welcomes the opportunity to be a part of future jobs that incorporate ABC.





PRECAST BRIDGE APPROACH SLABS

Cast-in-place bridge approaches typically settle over time resulting in a “bump” in the pavement at the bridge ends which increases road roughness, driver discomfort, accident potential and vehicle wear and damage.

To significantly reduce the local settlement before the bridge, heavily reinforced 6,000psi precast concrete approach slabs are utilized as an alternate to CIP. The precast slabs reduce settling by acting as a land bridge spanning from the approach footing or bent to the abutment. In addition to decreasing settlement, precast also saves the installing contractor time and accelerates the schedule for bridge reconstructions, provides increased durability and enhanced user comfort. Approach slabs are available as partial depth which have exposed u-bars for bonding to a CIP wearing surface or as full depth where the precast is the final driving surface.

PRECAST DECK PANELS

Forming and pouring bridge decks on site are an expensive and time-consuming process, not to mention dangerous when over live commuter traffic.

The application of precast panels for a bridge deck allows the pieces to be cast at an off-site plant in a controlled environment. Precast deck panels are thinner than a typical CIP deck but have equal or better durability and structural capacity. This is attributed to the reduced rebar clearances allowed for precast and the use of 6,000psi concrete. Connection to the supporting structure below can be achieved by several different methods including weld plates or pockets in the precast that fit over studs and get grouted in to create a composite section. With any connection details, precast significantly decreases on-site construction time.





PRECAST PAVEMENT SLABS

Busy roadways in densely populated areas can't always afford long-term lane closures for Cast-In-Place pavement repairs.

CIP repairs often result in high volumes of traffic congestion and can also impact the surrounding economy. By reducing construction related congestion, precast pavement slabs are the optimal choice. They allow the contractor to replace a section of roadway with a brief lane closure, (typically 8 hours overnight), so that it is reopened to the public for the morning rush. The top surface of the precast can either be the final driving surface or receive diamond grinding to achieve the proper final elevation.

PRECAST PIER ELEMENTS

Difficulty in forming and pouring concrete high above the ground are two of the major disadvantages of traditional CIP pier elements which include foundations, columns and caps.

Precasting these components allows for the entire bridge pier to be set in a few days with minimal crane picks. This method cuts down on overall construction time and allows the contractor to move to other phases of the bridge's construction that would have otherwise had to wait several weeks.





PRECAST BRIDGE ABUTMENTS, BACKWALLS & WINGWALLS

Bridge abutment and backwall components support the loadings of the bridge superstructure, support the bridge approaches, and retain the earth behind the beam ends.

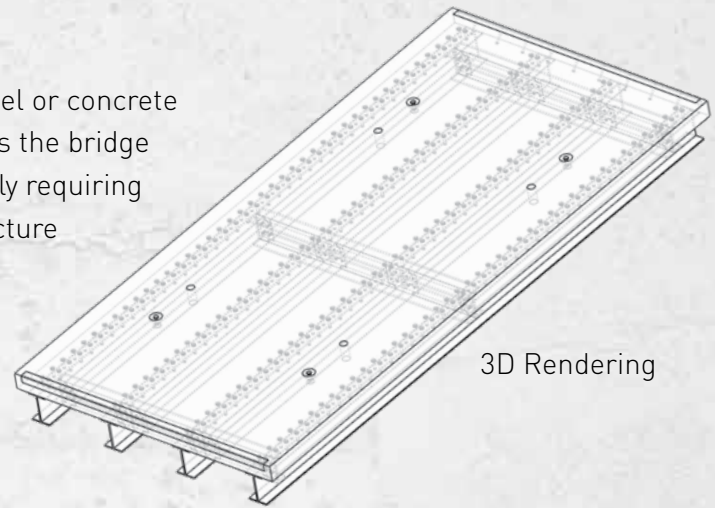


Wingwalls are adjacent to the abutment and act as small retaining walls to further support the embankment. Typical on-site CIP construction for these components is a slow process. To decrease on-site construction time, the solution is to precast these items in an off-site plant. The pieces can then be trucked to the site and quickly erected and fastened using one, or a combination, of the innovative connection options available for precast.

SUPERSTRUCTURE SYSTEMS

These systems include both the deck and primary supporting members integrated in a modular manner.

A precast deck is poured integral with the supporting steel or concrete beams at an off-site, controlled precast plant. This allows the bridge system to be transported to the site already complete only requiring erection onto the substructure elements. These substructure elements may be existing abutments/piers or newly fabricated precast elements. The prefabricated system may also include the parapet or railing such that additional on-site construction isn't required and the bridge may be operational sooner.



PRECAST MOMENT SLABS & COPINGS

Pouring these components on-site is a difficult task due to the complex forming and bracing required for the portion of the coping that overhangs the retaining wall.

They are also labor intensive due to the heavy rebar cages required to withstand the vehicular impacts on the barrier that the moment slabs support. Precast is the solution to these job-site problems. A precast coping section with exposed rebar eliminates the need to form over the side of the retaining wall and gives the contractor a ledge to setup forms on for their barrier. Rebar extends both vertically and horizontally to tie the CIP barrier and pavement/moment slab together. A precast moment slab system complete with a barrier and coping is also an option which eliminates the on-site forming altogether and significantly decreases on-site labor required.



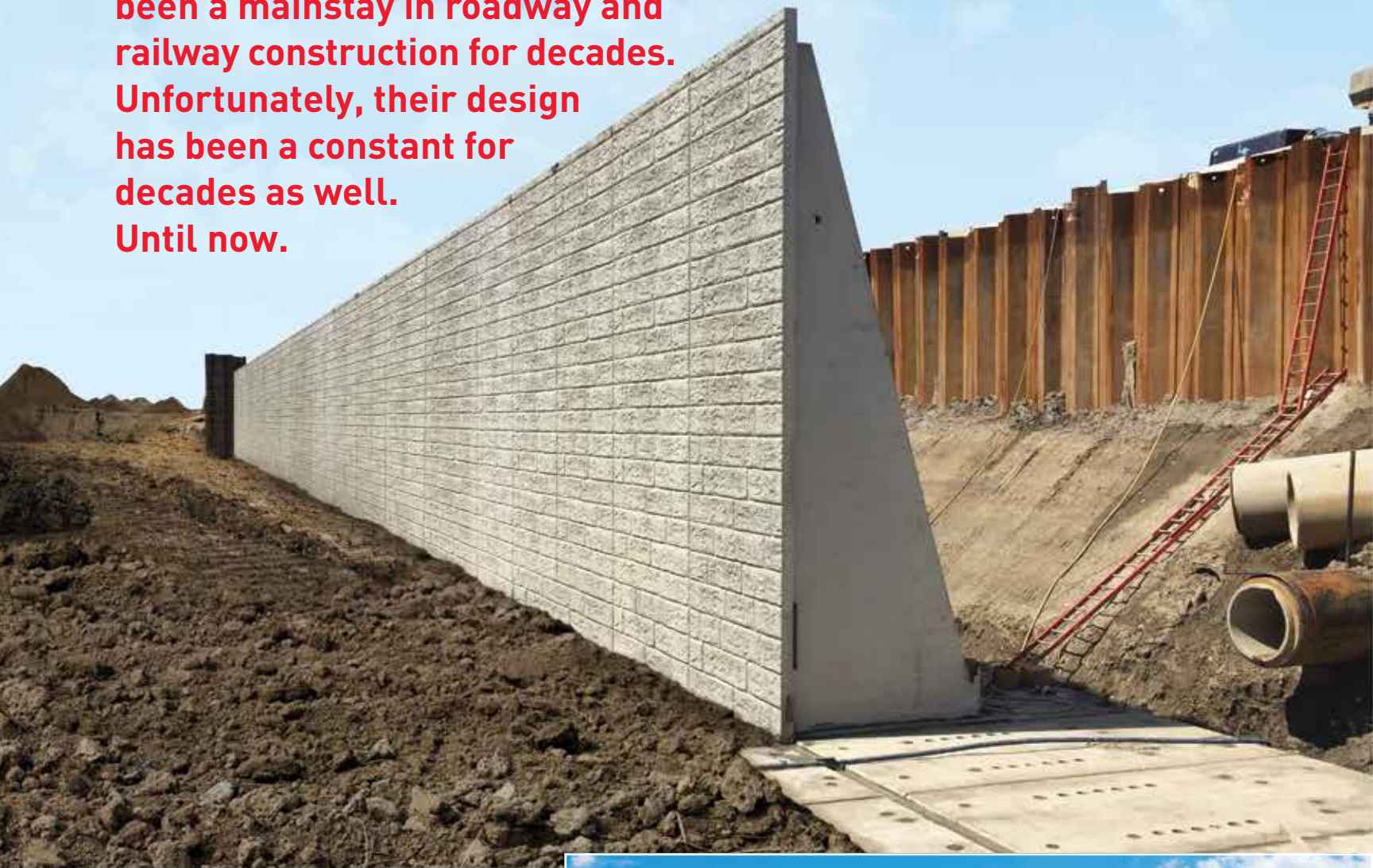
COUNTERFORT RETAINING WALL



ELEVATE
RETAINING WALLS

www.elevateinfrastructure.com

Precast concrete retaining walls have been a mainstay in roadway and railway construction for decades. Unfortunately, their design has been a constant for decades as well. Until now.



Elevate's patent-pending counterfort wall is the latest advancement in engineered solutions, designed to bring sustainability and stiffness as well as ease, safety, and speed of installation to earth retention systems. As a two-piece precast wall system, Elevate simplifies on-site installation while providing the performance required by the most demanding roadway and railway applications.





PRECAST RAIL PLATFORMS

As rail infrastructure continues to expand the need for rehabilitated and new stations continues to grow.

Forming and pouring rail platforms in-between live train traffic is not always cost-effective or practical, which is why precast is often the solution. The platform is produced off-site and trucked to the site for quick installation during brief track closures. This strategy provides minimal impact to the users and helps to speed up total completion of the project. In addition to rail platforms, precast can also be used for stairs, ramps, soundwall and any other concrete components required for the station.



PRECAST SIGN COLUMNS

Like pier elements, cast-in-place concrete columns that support overhead sign structures face similar job-site issues due to their height.

Connected to their foundation using innovative splice sleeve couplers, a precast column provides equal or better strength and durability when compared to traditional CIP construction. This method reduces job-site congestion and allows for a quick install of multiple columns in a single day.

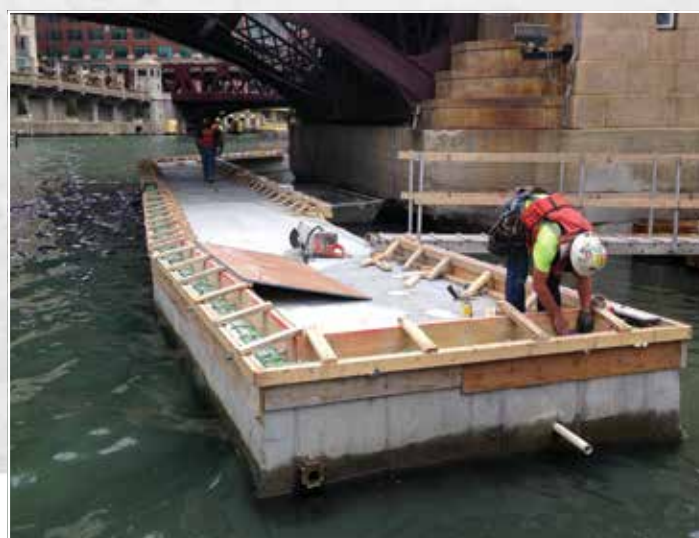




PRECAST TUBS

A perfect example of value engineering, the precast underbridge tubs were a solution to a major job-site constraint.

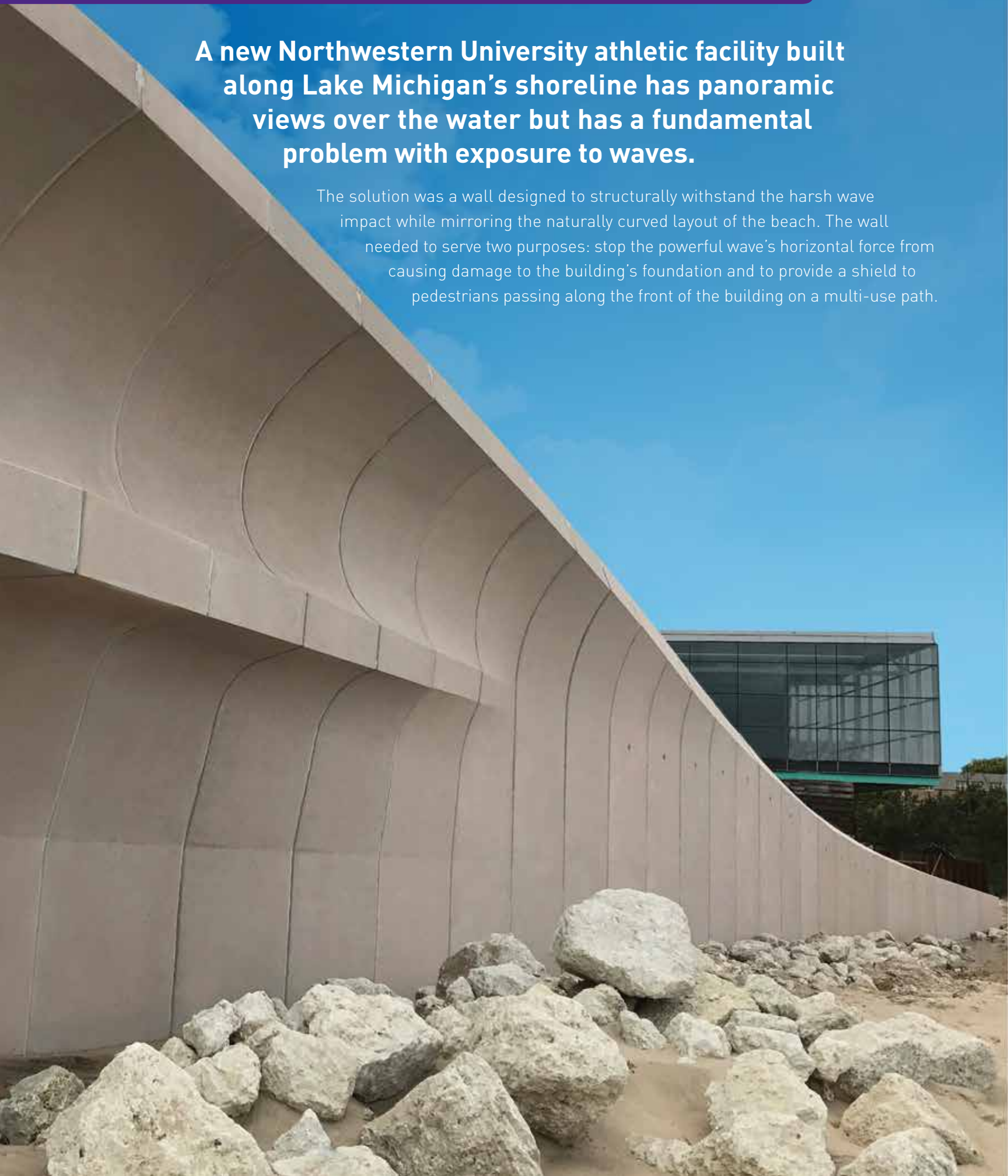
Walkways passing under bridges along the Chicago Riverwalk were originally designed to be cast-on-site in the river. Instead of figuring out a way to pour within the existing waterway the contractor turned to precast. The tub was poured in our controlled precast plant and shipped to a staging yard where it was loaded onto barges. The barges transported the tubs up the river to the site where they were set on large piers and lowered into place. Each tub was filled with a heavy rebar cage and infilled with a high strength, high performance concrete that, when complete, provided the final walking surface.



NORTHWESTERN UNIVERSITY WAVE WALL

A new Northwestern University athletic facility built along Lake Michigan's shoreline has panoramic views over the water but has a fundamental problem with exposure to waves.

The solution was a wall designed to structurally withstand the harsh wave impact while mirroring the naturally curved layout of the beach. The wall needed to serve two purposes: stop the powerful wave's horizontal force from causing damage to the building's foundation and to provide a shield to pedestrians passing along the front of the building on a multi-use path.



The architect envisioned a wall with distinct curves that replicated the appearance of a wave. To achieve an extensive wall with multiple tapering curves that included integral pigment coloring and an architectural, durable finish, the designers knew that a cast-in-place design would be nearly impossible. Something this unique needed to be built to last while aesthetically pleasing and could only be achieved in a controlled environment with precise forming. The solution was precast! Utility Concrete Products was the precaster of choice given our longstanding history of quality products and service, our top-notch engineering team's vision and expertise in the field, and our production staff and facility that is second-to-none.

Consisting of (109) 5'-0" wide segments, the wall was designed to stand at 20' tall and taper at each end where it begins to flatten, similar to a wave. The Self Consolidating Concrete mix design included Scofield SG "Sand Buff" liquid integral color which was altered to match a sample of existing building limestone. The segments were sandblasted by UCP's skilled architectural finishing team for a final product that achieved the architect's desired appearance.



Considering the powerful waves crashing against the wall and the freeze-thaw environment of Lake Michigan, designers knew that precise placement of epoxy reinforcement, embedded stainless steel angles, and hot dipped galvanized/epoxy connectors within the high strength concrete would require a precaster that had a long-standing history of top-notch performance.



The precast units sit on top of a cast-in-place knee wall that utilizes both column base connectors and splice sleeves to complete a unique connection developed specifically by UCP's engineering team for this project. Due to our design, the contractor could bolt down the wall at these shoes and continue with the installation instead of using a bracing system. The location of the connection elements was extremely critical and required a very tight tolerances. All of the segments showed up to the site and were placed with no fit-up issues, a nod to UCP's production staff and quality control department.

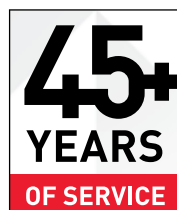
Getting the wall installed as efficiently and quickly as possible was a top priority for the contractor. The wall's location on the site made it a critical item since building erection couldn't continue until the wave wall was completed due to a tight site and the necessity for crane space.

After considerate design and coordination between all involved parties, and a quick fabrication timeline by UCP, the wave wall was erected on time, and within budget. Construction at the athletic facility continues, and is on pace to finish on time. The architect's choice to use precast to meet their vision and the contractor's choice to use Utility Concrete Products as the fabricator resulted in success on this difficult, yet rewarding project!



The use of precast concrete is an integral part of the **Accelerated Bridge Construction** (ABC) process, as it allows for the infrastructure components to be cast off-site reducing congestion, impact on motorists, total project delivery time, and improves safety on site.

UCP produces a wide range of custom structures that aid in the ABC Process. Speak to a member of the Sales Team to discuss the details of your project.



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