Maine bridge achieves long-term resilience with precast concrete

In southeast Maine, the Blue Hill Falls Bridge in Blue Hill, Maine, has served travelers for nearly a century. Historically, the bridge has long served as an inspiration for artists; more recently, it has been a destination for kayakers and wake boarders because it spans a reversing waterfall with standing waves and tidal cycles of 10 ft (3 m) or more. Through time, the bridge has also become an icon for the local community, but after decades of use, it was in dire need of replacement. The Maine Department of Transportation (MaineDOT), in conjunction with an advisory committee, decided to replace the arched structure with a precast, prestressed concrete girder bridge.

To support the long-term resilience of the structure and another century of operation, many precast concrete components were specified in the design, including 16 approach beams, 5 prestressed concrete northeast bulb tee (NEBT) girders, and 8 arched fascia panels. The bridge was also raised 4 ft (1.2 m) to enhance strength and accommodate rising sea levels.

The use of accelerated bridge construction methods was critical to the project's success, which, along with the use of precast concrete, expedited the timeline. With this approach, disruptions for commuters were limited. Waste and environmental impact were also reduced compared with more traditional bridge-building methods.

"By fabricating the precast elements off-site, material waste and pollution were minimized," says Joe Carrara, president of the project precast concrete manufacturer, J. P. Carrara & Sons. "The shorter construction timeline also reduced the project's overall carbon footprint."

Off-site fabrication of the precast concrete elements allowed for more precise manufacturing, further supporting the bridge's rapid assembly and ability to safely serve the public. In addition, although some admirers of the Blue Hill Falls Bridge were reluctant to see the historic structure replaced, the design team seamlessly integrated granite-stone masonry pieces from the original bridge, serving as a lasting tribute to the past.

The Blue Hill Falls Bridge's location above saltwater necessitated the manufacture of the precast concrete components with a long-term service life in mind. To withstand the corrosive effects of the water, the J. P. Carrara & Sons team incorporated a range of high-strength materials, including stainless steel prestressing strands, grade 100 reinforcing bar, and 10,000 psi (69 MPa) concrete. The enhanced structural integrity resulting from use of these products not only equates to a longer lifespan for the bridge but also fewer maintenance requirements and reduced upkeep costs.

"Through leveraging precast and accelerated bridge construction, the Blue Hill Falls Bridge replacement project successfully addressed existing structural deficiencies, improved public safety, and provided a durable infrastructure solution for the public," Carrara says.

—Mason Nichols

J. P. Carrara & Sons supplied saltwater-resistant precast concrete products for the Blue Hill Falls Bridge replacement in Blue Hill, Maine, which also incorporated granite stone masonry pieces from the previous bridge. Courtesy of Cianbro.

Precast concrete modernizes important New York bridge

Bridges are essential for navigating New York City's boroughs. And while most of New York's iconic bridges are known as thoroughfares for vehicular traffic, they also serve as connection points for pedestrians and cyclists. The Robert F. Kennedy (RFK) Bridge, which links Manhattan, Queens, and the Bronx, is a 2780 ft (848 m) long bridge that required significant upgrades to help meet the city's demanding transportation needs. The Metropolitan Transit Authority (MTA), in partnership with the Walsh Construction Group, Fort Miller Precast, and engineering firm COWI, delivered a precast concrete solution with multiple product types along with ultra-high performance concrete (UHPC).

Officials with MTA sought a design for the RFK Bridge that would provide more suitable access for its pedestrian and cyclist users. The project site was extremely tight and situated in a high-density area, making access extremely difficult for all parties involved. These issues were alleviated by installing a variety of precast concrete components, including deck panels, ramp panels, piers and pier extensions, and architectural retaining walls.

"Walsh Construction chose precast concrete components over cast-in-place wherever practical to achieve an accelerated schedule and reduce the time impact on this project," says Joshua French, vice president of estimating, sales, and marketing for the Fort Miller Co. "Precast also reduced the amount of traffic coming into and leaving the project site. This was a huge benefit due to the difficult access and the limited amount of space available."

The bridge's location and changes in elevation required an innovative switchback design. To accomplish this, precast concrete pier extensions were attached to the side of the existing cast-in-place highway bridge piers using UHPC. By using UHPC, faster installation was achieved and the need for elaborate formwork and scaffolding at the project site was eliminated. The precast concrete deck panels also leveraged UHPC. Color matching was used to provide seamless transitions from panel to panel across the deck. Closer to the ground, architectural precast concrete retaining wall panels were installed. These were backfilled and topped with precast concrete ramp panels, also joined via color-matched UHPC field-cast connections.

Despite minimal available space, the project team leveraged precast concrete to deliver and stage the deck elements needed for the work. This led to a shortened construction timeline while also removing the labor costs associated with forming and reinforcing bar placement. Using precast concrete shaved about three months off the construction schedule.

"This project brings the RFK Bridge's original structure and access up to modern ADA standards while more efficiently and safely connecting Manhattan and Randall's Island," French says.

—Mason Nichols

Walsh Construction Group, Fort Miller Precast, and engineering firm COWI delivered a precast concrete solution with multiple product types, including ultra-high performance concrete, in the Metropolitan Transit Authority's new Robert F. Kennedy Bridge, which links Manhattan, Queens, and the Bronx. Courtesy of Vic Perry.