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FEATURE

PROVIDING ENGINEERED ACCESS TO CROSS THE HUDSON RIVER

Universal Manufacturing Corp., Zelienople, Pennsylvania, engineered and provided one mile of system scaffolding stair towers and fabricated custom work platforms and designed and built crane lifting rigs to help bring the "New NY Bridge" to life.

By Mike Bredl

Those who cross the Tappan Zee Bridge, 25 miles north of downtown Manhattan, New York, will notice a new structure rising from the Hudson River water just next to it. In 2013, the New York State Thruway Authority (NYSTA) awarded the contract to replace the existing Tappan Zee bridge to Tappan Zee Constructors, LLC (TZC), a design-build consortium of some of the world's best-known design, engineering, and bridge construction companies including Fluor Enterprises, Inc., American Bridge Company, Granite Construction Northeast, Inc., Traylor Bros., Inc., and designers HDR and Buckland & Taylor.

The replacement effort, called the "New NY Bridge" project, will create the longest bridge in the state of New York, crossing the Hudson River at one of its widest points. The old cantilever bridge, which currently accommodates 140,000 vehicles per day, is being replaced with a state-of-the-art, 3.1-mile long twin-span bridge. Essentially there are two new bridges, one traveling eastbound and one westbound. The new bridge is designed and being constructed to stand for the next 100 years without requiring major maintenance efforts.

This massive bridge-building undertaking requires today's most modern technology, highly skilled labor, and specialized teams performing some creative engineering feats, including the most efficient way to access the construction of the bridge safely from start to finish. Universal Manufacturing Corp., (UMC), located in Zelienople, Pennsylvania, was contracted by TZC to help achieve these goals through innovative scaffolding engineering, design, and fabrication of custom-access products to meet the project's unique specifications.

UMC worked with two different bridge engineering teams on the project, one team for the approach-span piers and one for the main-span bridge piers. Each bridge consists of 43 concrete piers, 41 approach-span piers, and two double and much taller main-span piers. Thirteen of the concrete piers were less than 45 feet in height and did not require scaffold access. The remaining 30 piers varied from 45 feet to 409 feet in height to

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allow for bridge stability and an increase in clearance for ships to pass beneath the structure. Every pier required construction access towers engineered and designed to match the contractor's specifications. TZC would specify each location of the scaffold tower on the pier base in order to match up with the openings in formwork on each pier cap. UMC then provided detailed stair-tower drawings for each pier, noting location on the pier base, tie-in specifications to the columns, and exit height of each stair tower. This design and layout process was repeated for all piers.

Limited in area to stage and assemble the stair components at the project site, the stair towers for each specified pier were assembled by crews up river; the crews matched the numbered engineered drawings provided by UMC. The stair towers were then craned onto a barge using lifting rigs provided by UMC, transported by barge to the construction site, and lifted in place by crane using the same lifting rigs. Each lifting rig was a steel-beam, single-lift, bridle unit that attached to each coupling pin to allow for consistent, safe lifting.

The focal points of the iconic cable-stay main-span structure are the four pairs of outwardly leaning pylon towers located at the two main-span piers. The overall height of each concrete pylon tower is 409 feet, and each splays outwards at a constant angle of 5 degrees, presenting unique engineering challenges for providing a safe and reliable means of access. TZC's access requirement for the 409 feet was to build a 290-foot stair tower, which would lead to a crossover truss connecting the two pylon towers, and two additional 120-foot stair towers supported on a platform anchored to the concrete pylon at the crossover elevation. Challenged with engineering a construction stair tower 290-feet tall that would support its own weight and meet the capacity requirements of the customer, UMC developed a hybrid system scaffold/shoring frame. The hybrid frame worked with all system scaffold components and was used from the base of the 290-foot tower to approximately 119 feet, at which point standard system-scaffold stair-tower construction was used for the remaining 171 feet. All scaffolding for the main-span piers was designed to follow climbing concrete jump forms – as the forms climbed up the tower facilitating rebar operations and placing concrete, additional scaffold access was barged to the piers and craned into place.

Scaffold tie-in plans and product were provided for all stair towers with the 290-foot towers presenting the largest challenge. Due to the fact that the main span pylon towers were outwardly leaning, the 290-foot stair towers had to be positioned at a diagonal from a corner of the pylon tower and far enough from the pylon to allow for access to the climbing concrete jump forms. Placement of the construction stair towers at this location had stairs at some locations as far as 10 feet from the pylon corner with 20-foot-long multiple tie configurations at each point. The construction stair towers had to be engineered to withstand wind of 115 mph.

"UMC collaborated with our engineering team to find the safest, most efficient, and most economical means of access for our construction crews to get to work every day," said TZC Professional Engineer Andre Markarian. "There are many scaffolding companies we could have purchased scaffolding from. UMC is different because their engineering team provided the continuous support we needed."

In addition to engineering custom stair towers, UMC designed and fabricated various custom staging platforms for this project. Pre-cast staging was designed and installed over the top of the pier caps to allow for access around the perimeter of all pre-cast pier caps. Grout platforms were also designed in the same manner to allow access to the pre-cast tubs where additional grout needed to be placed. Each of these one-piece platforms provided a safe work platform that was craned into place using custom-fabricated lifting units.

"The cap and grout platforms were very useful and efficient to install and remove throughout the construction of the bridge," said TZC Professional Engineer Joseph Rynn. "Universal did a great job designing these for us."

UMC has been a pioneer in providing quality steel scaffolding shoring and custom fabricated access equipment for more than 85 years. "This project required many hours of innovative engineering work because of the complexity of the structure, says UMC Sales and Marketing Manager, Mike Bredl. "It was great to be challenged by Tappan Zee Constructors and truly showcase our scaffold engineering and custom fabricating capabilities." •

About the Author

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