



Merchants Bridge Rehab Restoring Service to Both Tracks, Supporting Increased Freight Activity Nationwide

A \$179 million project to rehabilitate Merchants Bridge in downtown St. Louis continues.

The 130-year-old rail bridge, which crosses the Mississippi River between St. Louis and Venice, IL, three miles north of Eads Bridge, is owned by the Terminal Railroad Association of St. Louis. A long list of project partners, led by the TRRA and Chicago-based Walsh Construction, are collaborating on the project. Replacing the main spans and rehabilitating the piers and east approach are major components of the work. The project commenced in July 2019 and is on track - pun intended - to complete in April 2023.

An average of 38 trains traverse the Merchants Bridge each day, carrying a total of 40 MGT (million gross tons) of freight annually. The anticipated rail tonnage is projected to increase by 49 percent by 2040. The bridge also serves as an Amtrak rail corridor.

One of the principal goals of the Merchants Bridge rehab is to enable the historic structure to facilitate two tracks' worth of freight traffic daily. According to TRRA Chief Legal Officer and Director of Corporate Affairs Asim Raza, the bridge has been functioning as a single-track structure because of load restrictions.

"The work we're doing will ensure the continued, efficient operation of the TRRA and the St. Louis gateway and will provide benefits across the nation's rail

network for the next 100 years and beyond," Raza said.

Replacing the main spans and renovating the piers - which were in place since the bridge first opened to freight traffic - is a major crux of the current project. What is significant about the current project, says Raza, is that it includes a significant amount of new construction to increase freight capacity.

Each proposed span truss of Merchants Bridge weighs 4,387 tons (8.8 million pounds), according to Vic Daiber, project manager and construction engineer for TRRA. The heaviest single member (or piece) of the project is the center bottom chord (the portion of the truss extending from end to end), which weighs 65.4 tons and is 74 feet, 6 inches long.

Rob Neville, assistant project manager for Walsh Construction, said each of the bridge's three spans contains approximately 120 loads of steel and 145,000 bolts.

"There are many construction-related challenges associated with rehabbing an historic bridge of this magnitude," said Walsh Construction Senior Project Manager Dan Sieve. "One involves coordination and permitting as we build within the St. Louis Harbor on the Mississippi River. Coordination efforts include those with the U.S. Army Corps of Engineers, the U.S. Coast Guard and the River Industry Action Committee (an association of companies and organizations that are stakeholders in the commercial industry on the inland waters of the Mississippi River). Coordinating daily river traffic in the primary and secondary river channels also requires tight logistics and constant monitoring of the river levels."

Building a project within the footprint of the existing Merchants Bridge also lends a layer of complexity to the job, according to Sieve. Working on a live rail line is another challenge. "This requires coordinated track outages," he said. "Twin lines have been reduced to a single track with a scheduled 5-hour daily track outage to accommodate construction." A planned 30-day rail outage will take place for each of the three 518-foot truss span replacements, as will two 24-hour river channel outages so workers can remove the old river truss spans and install the new ones. Assembling and mobilizing truss spans on barges, complete with a special lift and slide plan to remove old and install new truss spans, also requires precise on-site coordination.

Special methods for constructing coffer dams - the underwater structures used for construction or repair of the bridge's permanent dams - will be employed by the project team to build around existing bridge piers. A wall of large piles will be driven deep underwater surrounding each of the four river piers to create a dry work area in which construction of the concrete pier encasements will occur. A series of dewatering pumps will extract water from the coffer dams to keep it relatively free from river water during construction. Each of the four Merchants Bridge cofferdams measures 45x90 feet and 80 feet tall.

Encasing the existing river piers and east approach trestle to utilize the current alignment and right-of-way also adds a layer of complexity associated with this rehabilitation project, according to Daiber. Modifying and widening existing approach spans to provide a 15-foot center for rail lines - an improvement over the previous 12-foot center - and building ballasted bridge decks (versus the previous open deck with ties directly fastened to the stringers) are other facets of the construction work.

Another unique component of the project, according to Sieve, was employing a specialized heavy-lift helicopter - limited to a capacity of 18,000 pounds - to remove four 120-foot-tall steel towers from the bridge. "We had to separate each tower into three sections," Sieve said. "It took several weeks of preparation to prepare the towers for disassembly, attach rigging to them and prepare to lift them with cranes equipped with a grapple hook." Erickson Skyranes supplied and piloted the heavy-lift helicopter and The L.E. Myers Co. prepared the towers for disassembly in three sections per tower and rigged them

for the lifts. "The impressive facet of this part of the work was that we collectively completed the removal of the four towers from the bridge, totaling 12 lifts, in a four-hour period on a Saturday," Sieve said.

Other massive materials statistics associated with the Merchants Bridge rehab project (for the bridge portion specifically) are: 12,000 cubic yards of seal concrete; 2,100 linear feet of micropile; 8,750 cubic yards of structural concrete in pier encasement; 3.5 million pounds of rebar; and the removal of existing bridge spans totaling nearly 12 million pounds.

Associated with the approach work are the following materials quantities: 1.75 million pounds of steel retrofit; 50,000 square feet of MSE (mechanically stabilized earth) retaining wall panels; 36,000 cubic yards of embankment; 11,000 linear feet of auger cast piles; 3,000 linear feet of track on grade; more than 6,000 linear feet of track replacement; and approximately 4,000 cubic yards of structural concrete.

Designing and engineering components of the main span trusses and approaches and east approach encasement is TranSystems. Principal Frank Weatherford, Senior Structural Engineer Kandi Spraggs and Assistant Vice President Nick Staroski represent TranSystems' team on the Merchants Bridge rehab. A major subconsultant to TranSystems is Burns & McDonnell; the firm provided design of components of the main span trusses and main pier substructure.

"While river levels are up, we're in the process of encasing the (750-foot-long) east approach," said Spraggs. "We're constructing culverts in between steel trestles to allow river water movement during flooding. The culverts and steel trestles will be full encased with lightweight cellular concrete using MSE walls to contain the concrete. This will eliminate maintenance issues you typically see in elevated steel structures, while keeping the surcharge soil pressures minimal."

Subsurface Constructors is the auger cast pile contractor for Merchants Bridge. Lyle Simonton, engineer and director of business development, said the firm installed 156 auger cast piles, each measuring 24 inches in diameter, at a depth of 78 feet, that are supporting a load of up to 320 tons. The piles are structurally connected to a cast-in-place concrete mat which will then support the MSE retaining walls on both sides of the existing railway, as part of the track widening project.

The proposed main span trusses, according to Staroski, contain fracture-critical members. If these members would fail, it could result in catastrophic collapse of the entire span. "To provide redundancy and protect against catastrophic failure, the bottom chord members of the truss were designed as bolted built-up steel members consisting of angles and plates," he said. "This solution provides internal redundancy that a welded built-up steel member does not."

TranSystems also designed the renovation and reinforcing of the existing elevated steel DPG spans, shifting the eastbound track south by three feet to widen the clearances between Merchants Bridge's double tracks so they match the newly constructed trusses. "A major part of this project is shifting from an open-deck structure, where the track rails rest directly on ties and the ties rest directly on the beam, to a ballasted deck structure in which the ties rest on eight to 12 inches of ballast - or rock (aggregate) - placed in new plate deck pans which rest on the beams," said Staroski.

SCI Engineering Inc. is providing quality assurance testing during the construction phase. Senior Engineer Rick Mauch said the firm tests a minimum of 20 percent of all the quality control tests being performed by contractors to assure that the quality of the material incorporated during construction is within specifications.

"SCI reviews, tests, inspects and documents construction materials incorporated into the project," said Mauch, "including testing of the portion of the bridge project replacing the three main spans and encasing the existing east approach in a lightweight cellular concrete fill and MSE precast walls (with the same fill). SCI is also providing concrete testing including slump, air, temperature and casting, and curing and testing of compression test specimens. The firm will also test the aggregate base placed for the east approach and perform

some non-destructive testing on the bridge's structural steel, including the welding and bolts.

Guarantee Electrical Co. was contracted by Walsh Construction to provide temporary power for its operations throughout the project, according to Tom O'Hara, director of Guarantee Electrical's Illinois branch.

"There are tugboats parked near the bridge that required shore power," said O'Hara. "We had to construct a temporary electrical service for them."

Guarantee Electrical also built a new temporary power service to connect to Ameren's existing power infrastructure near the site. "From there, we're bringing power to the bridge itself and to (bridge) pier 4 on the Missouri side and piers 3 and 2 on the Illinois side," he said. For each pier, we have a set of lighting that illuminates the pier itself, and convenience power receptacles for the construction crews." Lighting the bridge approaches is also within the specialty subcontractor's project scope.

Guarantee Electrical is also extending power for dewatering pumps at three of the bridge's four piers.

Fall 2021 is the anticipated date for completion of the bridge substructure, according to Walsh Construction. Raza said that during the scheduled bridge closure periods, TRRA will reroute train traffic over the MacArthur Bridge in order to minimize impact on owner railroads and Amtrak.

Mary Lamie, executive vice president of multimodal enterprises for St. Louis Regional Freightway, said Merchants Bridge provides access to six of seven of the nation's Class 1 railroads and is a vital vein within the nation's manufacturing/logistics transportation infrastructure.

"Merchants Bridge is truly a critical component of our nation's supply chain network," Lamie said. "Rail in the St. Louis region is a critical facet of all modes of transportation in order to ensure competitive rates. The rehabilitated Merchants Bridge will help increase rail speed, eliminate the current clearance issues and load restrictions. This project is of national significance," she added.

Additional major project partners are: Bank of America (project financing), Thompson Coburn (legal), AON Insurance (insurance), Veritas Steel (truss fabrication), D&K Welding (rebar and partial steel work), Nicholson (micropile foundations), St. Louis Bridge Construction (approach work construction GC), Keeley and Sons (approach concrete work), PJR & Associates (approach rebar and steel work), Kelly-Hill (track work), Zoie (lightweight cellular fill installation) and Gerstener Electric (electrical conduit and navigation lighting).

Major suppliers are: Beelman Aggregates, Concrete Supply of Illinois, Breckenridge Concrete, Harris Rebar, Silver Eagle, St. Louis Screw & Bolt, Skyline Steel, Missouri Fabricators and Trinity Products.