

Repairs on the 75-year-old Winona Bridge in Winona, Minn., extended its service life, preserved its historical integrity and met the state's Chapter 152 Bridge Improvement Program requirements by adding internal redundancy to all fracture-critical tension members, building a parallel bridge for inbound traffic, and using the historic bridge for outbound traffic only.

PHOTO: COURTESY OF KENTZINN, MICHAEL BAKER INTERNATIONAL

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Bridges Today I

Bridging The Gap

U.S. states and sector professionals innovate to meet current needs

By Marge O'Connor

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New Techniques and Materials Extend Bridge Integrity Until Funding Improves

Our nation's bridges need attention.

Until federal funds are allocated for repairs or replacement, many states and the bridge sector are collectively finding ways to support current needs.

Data from the U.S. Federal Highway Administration's National Bridge Inventory from December 2017 revealed that 8.9% of the 615,002 U.S. highway bridges are structurally deficient. While this is lower than the 9.1% listed as structurally deficient in 2016, it does not necessarily mean that conditions are improving.

"The problem is that bridges are still getting old. The average age of the deficient bridges is 67 years, and they had a projected life of 50 years," explains Andy Herrmann, who served as president of the American Society of Civil Engineers (ASCE) in 2012 and currently oversees

ASCE's bridge chapters for its Infrastructure Report Card. He is also partner emeritus of Hardesty & Hanover, an international engineering firm headquartered in New York City.

In 2016, ASCE conducted a study of infrastructure needs, which showed that the U.S. government would invest only half of what is currently needed for infrastructure. "Transportation alone needs \$1 trillion. How many National Infrastructure Weeks will be declared before federal funding is increased?" Herrmann asks. "In the meantime, states are stepping up, with about 27 of them raising gas taxes to fund their own infrastructure needs. Our calculations show that 25 cents a gallon is needed at the federal level to make a dent in infrastructure repairs and replacement."

The bridge sector is also taking action. More projects are using building information modeling (BIM) to speed up project communication, with several states moving to make it a requirement. High-performance concrete with higher strength and durability and high-performance steel with higher strength and more ductility are also now being used.

"A new steel material that has seen some limited use is a low-grade stainless steel, designated as ASTM A709 50CR, that can be used in highly corrosive environments, such as marine, coastal and industrial sites. The Virginia Dept. of Transportation (DOT) has already used it on several bridges," says Brandon Chavel, a director of market development for the National Steel Bridge Alliance (NSBA) in Chicago.



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Some bridges have embedded sensors that allow DOTs to monitor them remotely. Existing structures can also be checked with variable-amplitude, noninvasive equipment brought to the site. “Within a few hours, the monitors give a comparison of what the bridge’s condition is and what it should be. This helps prioritize repairs based on what conditions may be close to becoming dangerous and how aging is progressing,” says Alan Jeary, partner at STRAAM Group in New York City.

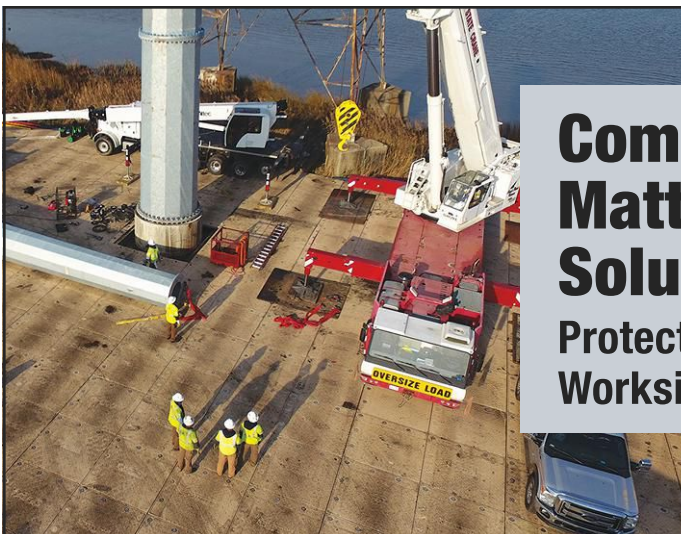
Many states and the bridge sector are finding ways to support current needs.

Bridge owners and designers are also evaluating redundancy and fracture-critical members. “In the old way of thinking, owners feared the term ‘fracture critical.’ Through research and analysis, the sector has put together specifications on how to better understand redundancy and fracture-critical members in new and existing bridges,” says Jeff Carlson, a director of market development for the NSBA.

“Purdue University has led research in redundancy and fracture-critical members,” Chavel adds. “The newest developments integrate the design, fabrication and inspection aspects of steel bridge construction. The new guide specs also promote innovative design options by removing previous constraints on designers and owners,”

The FHWA requires that DOTs perform hands-on fracture-critical inspection every two years. The new specifications allow DOTs to set reliability-based intervals, allowing a better dedication of resources.

The new guide specifications are AASHTO’s Guide Specifications for Analysis and Identification of Fracture Critical Members and System Redundant Members, and Guide Specifications for Internal Redundancy of Mechanically Fastened Steel Built-Up Members. ♦



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Bridge Contractor Honored With Safety Award

Safety is a critical part of construction, especially on complex bridgework. Recently, Trumbull Corp. of Pittsburgh received an EFCO Safety Award for its attention to safety on a dual, eight-span bridge.

The Pennsylvania Turnpike Commission named Trumbull general contractor for the I-576 Southern Beltway Section 55A-2 Project. The route crosses over U.S. 22 in Phase 1 and also connects the airport to I-79 near Canonsburg, Pa.



"The design and versatility of the EFCO forming system gave our crews the flexibility to use various fall-protection and retrieval systems during all phases of pier construction on this bridge."

—Bob Ward, Senior Site Safety Manager, Trumbull Corp.

Future phases of the project will connect the airport to the Mon-Valley and its I-43 expressway.

This section consists of a dual, eight-span bridge. Its largest structure is 115 ft tall and includes large Champaign-style pier caps. The largest of the 14 caps measures 64 ft wide and 48 ft tall with radius soffits. EFCO configured stem formwork with minimal rework during cycling using the PLATE GIRDER® and REDI-RADIUS® systems.

Trumbull Superintendent Scott Harkleroad worked closely with EFCO for a formwork solution. "For this project, EFCO provided a forming system for 14 pier caps that allowed for efficient cycle times," he says. "The caps were built and able to be cycled from cap to cap, allowing our crews to meet and exceed production times. For the larger pier caps, the pier cap formwork was designed in a manner that allowed crews to efficiently strip, reassemble and reset the formwork. The familiarity with EFCO's forming system and the design for each segment of the pier caps provided our crews with the most efficient and safe system."

EFCO has provided formwork and solutions for all eight phases of this 13-mile highway project. This award program is just one of many ways that EFCO demonstrates its commitment to safety on all work. ♦



Two New Products Improve Safety in Highway Construction Work Zones

An industry leader and global supplier of commercial highway products, Trinity Highway recently added two new products that comply with the Manual for Assessing Safety Hardware (MASH) for testing standards accepted by AASHTO and FHWA. They are the SMT™ and the SS180® M.

Both are truck/trailer-mounted attenuators (TMAs) that can be attached to the rear of a stationary or moving shadow support vehicle. The two products are tested to MASH Test Level 3 and are designed to help absorb rear-end impacts at speeds up to 62 mph (100 km/h) when impacted within MASH crash test standards.

SMT is a trailer-mounted attenuator for efficient deployment. Its system is comprised of two lightweight aluminum cartridges contained in a steel support frame. It has LED lighting, replaceable energy-absorbing cartridges, and a potentially reusable steel frame after an impact within MASH crash test standards.

The SS180 M is a truck-mounted attenuator consisting of two lightweight aluminum cartridges contained in a potentially reusable steel support frame. It is designed to help minimize damage from low-speed nuisance hits up to 6 mph.

A 180° tilt feature folds at the center to stack the two cartridge sections on top of each other. Its short height while in storage mode makes it convenient for garage storage and low over-passes. ♦



The SS180 M is shown here in both the stored and deployed positions.

PHOTOS: COURTESY OF HOPE TOLLETT, SITE-SAFE



Designing Anchor Points to Provide Suspended Access Solutions for Challenging Situations

What do you do when the anchor points for a suspended solution are not obvious? A suspended platform, which is a preferred solution for bridge access, enhances safety and environmental protection, allows multiple trades to work side-by-side with a higher degree of efficiency and keeps traffic flowing smoothly.

However, suspended access solutions require anchor points, which can be a challenge, especially on a concrete structure. Typically, securing a suspended platform involves looping chain over structural members and connecting clamps to trusses. This is not always feasible due to a bridge's design or obstructing elements.

For example, the reinforced concrete rails on California's Rocky Creek Bridge could not support a

structural load, but the bridge surface or road would. So the engineers had the contractor drill through the concrete surface and the access team drop the chain through. The suspension chain connected to a pad eye welded to the underside of a structural steel plate that fit almost flush with the road surface.

For the Caracău Viaduct railway bridge in Romania, cantilevered concrete pedestrian walkways prevented direct access to the arch workface. In this case, the concrete anchor system started with a 20-millimeter-dia threaded rod embedded into the concrete during walkway rehabilitation. The rods formed a connection for rotating suspension point assemblies.

These solutions may seem exotic, but they are just part of an average workday at BrandSafeway, an expert at securely

anchoring suspended access systems on bridges worldwide. For more information, visit www.brandsafeway.com. ♦



BrandSafeway engineered a custom anchoring system for the suspended access system used on the renovation of the Caracău Viaduct railway bridge in Romania.

PHOTO: COURTESY OF BRANDSAFWAY

P10-10' Portable Sectional Barges

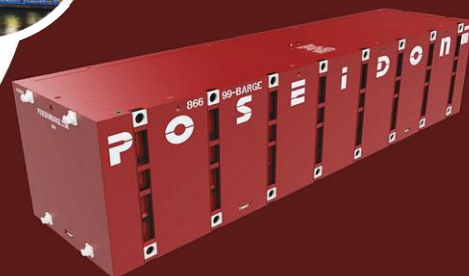
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Hopper Barges Simplify Disposal Needs for the Baudette-Rainy River Bridge Project

Replacing an existing bridge has multiple logistical challenges. A good example is the \$39.3-million replacement of the Baudette-Rainy River International Bridge that links Baudette, Minn., and Rainy River, Ontario, Canada. Lunda Construction of Black River Falls, Wis., heads up the three-year project that began in 2018.

The area's rocky terrain required drilling to safely place footers for the abutment. Lunda anticipated the great amount of spoils brought to the surface by drilling and its potential for affecting the environment, so it used sectional hoppers for disposal.

Lunda chose 50-cu-yd sectional hopper barges made by Poseidon Barge of Berne, Ind. These barges can access areas that traditional hopper barges cannot. The Poseidon barges arrive by truck, are placed in the water and assembled into a flotilla of hoppers. Lunda was able to position the hopper barges near the drilling and deposit all spoils directly into them. It proved to be an affordable solution to a problem that has plagued drillers for decades.

For additional information, visit www.poseidonbarge.com. ♦



These 50-cu-yd sectional hopper barges can be used in areas that traditional hopper barges cannot reach. They offer efficient disposal in difficult terrain usually associated with bridge construction.

PHOTO: COURTESY OF POSEIDON BARGE

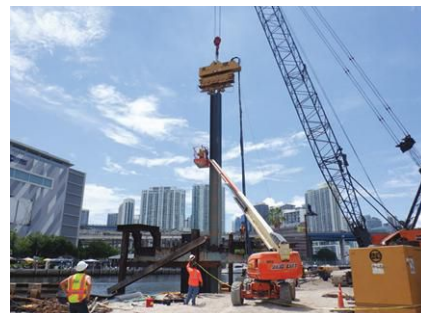
King Pile Wall Serves as Bulkhead To Bridge Communities in Miami

Built in 1929, the bascule bridge at Southwest First Street connects historic Little Havana with metropolitan Miami. The Florida Dept. of Transportation, with Hardesty & Hanover and GLF Construction, is in the process of rebuilding the bridge to allow for increased traffic, an exclusive bike lane and continuation of the Miami Riverwalk project.

GLF worked with Nucor Skyline to redesign the king pile walls. The combination walls serve as the new bulkhead wall of the bridge piers and were crucial to building new bascule piers with land access.

Utilizing pairs of W36X232 wide flange beams connected to pairs of NZ 19 sheet piles, the new design contributed significantly to the project's early phase.

With the challenging fabrication and delivery schedule maintained by Nucor Skyline, GLF completed both bulkheads within four months. This resulted in increased navigable waterway clearance from 75 ft to 150 ft for the Miami River long before initially anticipated. For more details, visit www.nucorskyline.com. ♦



Wide flange beams are driven to depth for a redesigned king pile wall.

PHOTO: COURTESY OF GLF CONSTRUCTION CORP.



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- In 2013, a storm protection plan to protect Mantoloking from storm surges, sea-level rise and shoreline erosion was developed.

SOLUTION

- In 2014, Nucor Skyline supplied 45-foot long SKZ 34 sheets, using A690 marine grade steel.
- Nucor Skyline manufactured and delivered 14,000 tons of steel using a 15 truckload-per-day rotation from June to September 2014.
- In 2015, the seawall prevented extensive storm damage from Hurricane Joaquin.

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