Steel Bridge NEWS
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Recycling and reusing parts of an old bridge means everybody wins.

Just Like New

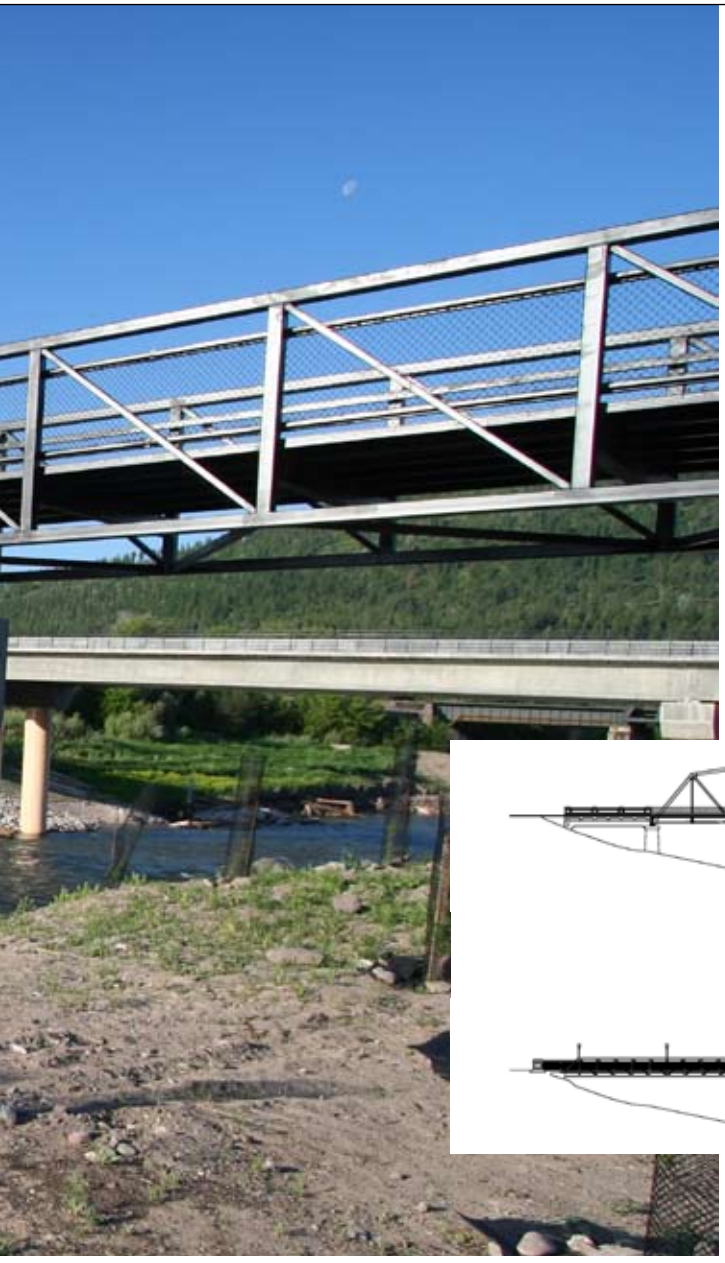
BY BRAD MILLER, P.E.

THE BLACK BRIDGE near Milltown and Bonner, Mont., was reconstructed in 2008, but not in the ordinary way. The old bridge was a four-span pedestrian bridge with two steel Pratt truss spans and a short concrete approach span on each end. The new bridge has all new foundations, a much longer center span and new prefabricated steel approach spans. Splitting one old truss span near mid-span and adding new truss bays enabled lengthening the center span and avoided impending foundation problems. The truss lengthening was made possible, from an engineering standpoint, by removing the heavy, old concrete deck and installing a new lightweight timber deck.

Project Development and Engineering

The old Black Bridge, located five miles east of Missoula, Mont., was constructed in 1921 over the Milltown Reservoir, part of the Blackfoot River near its confluence with the Clark Fork River. In recent years it has been open to only pedestrian traffic. With the removal of the 100-year-old Milltown Dam as part of a superfund clean-up site, and the loss of the reservoir behind it, the 85-year-old Black Bridge, would be subjected to swifter stream action and scour than it was originally designed for. The Blackfoot River channel was expected to degrade 12 ft or more in the area of the bridge, undermining the center pier that was founded on relatively shallow spread footings. There also were two old piers from a previous bridge that obstructed the channel contributing even more to potential scour. An alternate study was performed and the decision was made to replace the structure with a new pedestrian bridge.

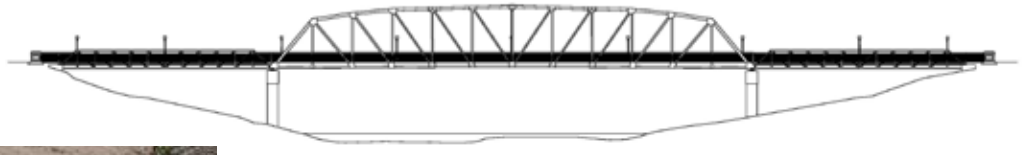
The citizens of nearby Milltown and Bonner, already sore from



Above: Before, two 166.5-ft spans and four piers in the water.

Left: After, one 222-ft span on new piers on the banks.

The original bridge built in 1921 had two 166-ft-long truss spans with short approach spans.



In 2008 the bridge was reconstructed. One truss span was lengthened to 222 ft using parts from the second truss as well as new components, and new approach spans were added.

losing their historic dam and other significant structures, formed a Save Our Bridge (SOB) committee and won support from Missoula County to save a significant portion of the existing truss spans. Tim Elsea, Missoula County Engineer, worked closely with HDR Engineering to achieve this goal while satisfying the roughly 230-ft main span length dictated by environmental constraints. HDR determined that it could incorporate one of the truss spans into the new bridge by lengthening it to 222 ft, sufficiently close to the environmental requirement for the main span, by reducing the dead load imposed on the truss. This was done by replacing the heavy concrete deck with a lightweight timber deck.

HDR bridge engineers analyzed the lengthened truss model and determined that this was a viable option but would cost significantly more than an all-new bridge. Missoula County opted to

Brad Miller, P.E., is a senior bridge project manager and professional associate with HDR Engineering Inc., Missoula, Mont.

New HSS2×2×3/16 supports running longitudinally between the stringers stiffen the new wooden deck, enabling multiple 2-in. by 8-in. planks to carry the single-wheel loads from emergency and maintenance vehicles.

go with the lengthened salvaged truss span and the final bridge design was modified to include this concept. Pleased by the outcome, the citizens of Milltown and Bonner amended the "Save Our Bridge" sign that had been installed on the old bridge to read "Saved Our Bridge."

The original Pratt truss consisted of nine 18.5-ft truss panels with an 8- to 10-in.-thick concrete deck. By replacing the heavy concrete with a lightweight wood deck, three additional truss panels could be inserted into the center of the bridge, lengthening it from 166.5 ft to 222 ft. The lengthened truss was completely re-evaluated for pedestrian, emergency, and maintenance loads as well as seismic and wind loads.

Reducing the dead load was done primarily by replacing the concrete deck with a 1.5-in. timber deck using long-lasting Ipe hardwood, also referred to as ironwood. Eliminating the cantilevered sidewalk on the downstream side of the bridge, which was used when the bridge served as a highway bridge, and narrowing the deck width inside the truss from 19.5 ft to 16 ft reduced the dead load even more. The net reduction in dead load was about 2,500 lb/ft of truss after taking into account the weight of lateral bracing added due to the increase in truss span and to offset the bracing component lost in removing the concrete deck, as well as miscellaneous steel added in the deck and rail system.

An ironwood deck, which does not require chemical preservative treatment, was selected instead of a treated wood deck because this bridge reconstruction project was part of a large superfund clean-up effort and the agencies involved were very sensitive to possible environmental concerns resulting from the use of treated wood over water. This was more of a preference than a real issue since treated wood over water is still acceptable if properly designed and installed.

The final bridge configuration consists of a new 98-ft-long prefabricated steel truss approach span at each end of the refurbished center truss span. The main truss span is wider than the approach spans and offers special overlooks for fishing and recreation. Portions of the unused second span were used to replace damaged parts on the reconstructed span and old steel stringers were incorporated into the new center portion. All the steel was painted black to match the original color of the bridge.

The final structure has an entirely new substructure consisting of concrete drilled shafts at the abutments and piers. Each pier consists of two 5-ft diameter drilled shafts extending approximately 43 ft below the ground line. Each abutment has two 2-ft diameter drilled shafts extending 22 ft below the base of concrete cap. The old truss span was removed and re-installed using a work bridge and heavy moving equipment. MSC

Owner
Missoula County, Mont.

Structural Engineer
HDR Engineering Inc., Missoula, Mont.

Steel Fabricator
Roscoe Steel, Missoula, Mont. (AISC Member)

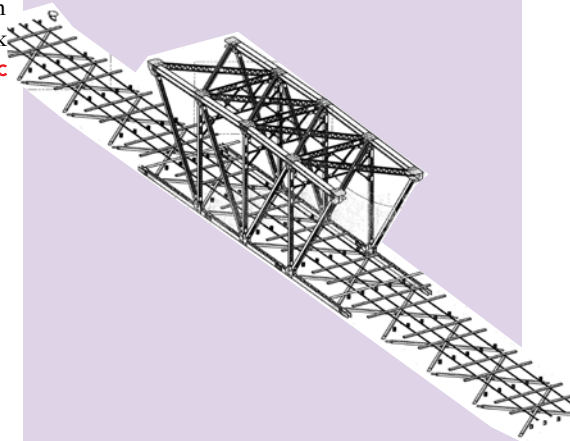
Steel Fabricator – Approach Spans
CONTECH Bridge Solutions Inc., Fort Payne, Ala. (AISC/NSBA Member)

General Contractor
Frontier West LLC, Missoula, Mont.

Returning to the Scene

Roscoe Steel had its beginnings in the Minneapolis-based Security Bridge Company, the general contractor for the Black Bridge in 1921. The area manager for security was W.P. Roscoe, Sr. who went on to found W.P. Roscoe Co. (a bridge contracting firm whose history spanned from 1923 to 1974). His son W.P. Roscoe, Jr. started Roscoe Steel & Culvert Company, Inc. in 1953 and subsequently his grandson, Jim Roscoe, bought control of that company in 1975.

For the Black Bridge reconstruction project, Roscoe Steel developed a 3D CAD model of the lengthened portion of the truss along with other new members in order to ensure the correct dimensions of new truss elements and bolted connections.



One old truss span was removed to the river bank for reconstruction, where it was split apart and new steel added to lengthen the span. Steel from the second truss span was used to replace damaged parts and steel stringers were used in the added truss bays.

The old steel of the existing truss was cleaned by 5,000-psi water jetting with a roto-tip nozzle. Cleaning water and paint debris were collected, filtered and recycled. The reconstructed truss, along with the new approach spans, were painted semi-gloss black using a three-coat moisture cure urethane paint system supplied by Wasser.