



Rehabilitating and beautifying an aging bridge

Engineering evaluation identified the most critical repairs to save the 107-year-old Market Street Bridge.

By Kari Moosmann

Throughout the country, communities are challenged with rehabilitating and replacing deteriorating bridges. The cities of Follansbee, Wellsburg, and Weirton in Brooke County, W.V., recently worked with the West Virginia Department of Transportation (WVDOT) to save a bridge. They have long been connected by three bridges over the Ohio River to the city of Steubenville, Ohio. In early 2009, the Ohio Department of Transportation decided to close the Fort Steuben Bridge, leaving only two bridges. Although the Veterans Memorial Bridge can handle most of the traffic demand and heavy loads, the Market Street Bridge also serves as a vital link for commuters, light commercial traffic, and emergency vehicles.

When local community leaders learned that the bridge might be closed, they reacted quickly by contacting officials at the WVDOT who could make decisions to save the bridge. After careful evaluation, the decision was made to invest in a rehabilitation project to preserve the structure, at least until a new bridge could be constructed. Bridge designers from Burgess & Niple took on the challenge to evaluate the most critical needs and design repairs to rehabilitate the Market Street Bridge in a very aggressive timeframe. Completion of design work for the 107-year old structure was accelerated to position the project to receive American Recovery & Reinvestment Act (ARRA) funding.

Recently, Matthew Lewellyn, P.E., M.ASCE, project manager at Burgess & Niple in Parkersburg, W.V., and David Whited, project manager at the WVDOT in Charleston, W.V., discussed the success of the recent rehabilitation of the Market Street Bridge and its positive impact on the surrounding community.

What is the history behind the Market Street Bridge?

Lewellyn: The Market Street Bridge was built in 1904 to transport workers from their homes in Ohio to the tin mill in West Virginia. There have been several modifications over the years. One of the more significant changes was the replacement of the stiffening truss in 1941. Also, decorative finials were removed from the towers and plates were added to the columns, which modernized the bridge, taking away its look of a delicate, riveted and laced structure. Famous bridge engineer D.B. Steinmen later inspected and repaired the bridge.

Whited: It also went from a trolley structure (its original purpose) to a vehicular toll bridge at that point.



The Market Street Bridge rehabilitation transformed a tired, aging structure into an icon for the surrounding communities.

Project info

Bridge length: 1,794 feet

Bridge type: Three-span cable suspension

Main span length: 700 feet

Tower height: 210 feet from cut stone piers

Number of lanes: Two lanes of traffic on an open steel grid deck. A cantilevered sidewalk provides pedestrian access on the downstream side of the trusses.

Participants

Owner: West Virginia Department of Transportation

Civil, structural, and electrical engineer: Burgess & Niple, Columbus, Ohio

Construction firm: Ahern, a division of Kokosing Construction Co., South Charleston, W.V.

Construction manager: Joseph Juszczak, P.E., WVDOT District 6, Moundsville, W.V.

Painting subcontractor: Panthera

Paint supplier: Terma-Rust

Steel fabricator: Beverly Steel

Electrical subcontractor: Bayliss and Ramey

Construction inspection: WVDOT/Greenhorne & O'Mara



What were the reasons for the rehabilitation?

Lewellyn: The bridge hadn't had many repairs since the 1980s. With the open grid, the roadway salt accelerates deterioration. The necessary repairs were determined through inspection. We had seen the deterioration through the years. The ability to repair the bridge now was due to the available ARRA funds. When the nearby Fort Steuben Bridge was demolished, that put more traffic on the Market Street Bridge, and the public supported the rehabilitation.

Whited: A new bridge is being planned about 10 miles away from the Market Street Bridge, but not for at least another 10 years. We couldn't wait that long and needed the Market Street Bridge fully functioning for the public.

Who initiated the rehabilitation?

Whited: It came partly from a result of Burgess & Niple's inspection. As a result of ARRA — having the funds available — upper management made the decision to make more of a complete rehab. That's when lighting was added and a complete cleaning and painting.

Why was rehab chosen instead of building a new bridge?

Lewellyn: The funds were not available for building a new structure of this magnitude. Plus, there are environmental clearances for a new structure that take time. They needed something now.

Whited: And being a border bridge, there are agreements that would have had to be made on a new structure. It would have involved not only West Virginia's funding issues, but Ohio's as well, since they would have been a participating agency.

What were some of the major issues in the rehabilitation?

Lewellyn: With age and condition of the structure, we had to limit the amount of weight the contractor could have on the structure. The project had to keep track of the total weight of the equipment, materials, and the containment in critical work areas.

Whited: The contractor could only put up 100 feet of containment at a time due to the weight restrictions.

Lewellyn: Repairs to the suspension bridge presented unique challenges. We had to test our minds for repair solutions.

Whited: In many cases, we had to leave elements in place because we couldn't remove them.

Lewellyn: Older bridges like this have crevice corrosion, where rust occurs between two plates, and that was a concern. We wanted to stop it and control it. We used a specialized paint in conjunction with a penetrating sealer — something new we initiated that should stop the growth by wicking into the crevices. The calcium sulfonate paint stays plastic and is pliable so it can heal itself over time. The contractor had some growing pains in using it. He could paint it while it was still drying, which sped up the application process. Problems occurred when blasting in the next location; dirt and spent shot would leak through the tarps and would stick to the paint.

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Above: Specially trained Burgess & Niple engineers used rope access to inspect the towers, cables, and trusses without closing the bridge to traffic. Right: The 1,704-foot-long Market Street Bridge, shown here before rehabilitation, was constructed in 1904 and had undergone several modifications during its life but had not had many repairs since the 1980s.

Other repair work included strengthening the stiffening trusses, steel strengthening work to the main tower legs, reattaching the plates that were added in the 1940s — but with continuous welding instead of intermittent. There was lots of welding and adding plates and replacing some of the rocker post bearings. We were able to replace the rocker post bearings with more modern and maintenance-free materials.

Whited: We replaced floor beams and stringers. The deck had to be removed to replace the stringers. The approach trusses had to be strengthened to maintain their capacity. Additional uplift anchorage was added at the abutment. The area around the eyebars was concreted. Previously, they were unpainted steel going underground, so we added concrete for protection.

How was the bridge inspected?

Lewellyn: Industrial rope access was used to access the towers, cables, and trusses without closing the [bridge to] traffic. About 30 of us at Burgess & Niple are trained for rope access. When we started inspecting this bridge in 1991, we were the pioneer in using climbing to access bridges. Now, there are still only a handful of companies that are capable of completing an inspection like this. It saves the cost of renting a man lift and flagging traffic. Providing a hands-on inspection while keeping bridge users safe and on-time is our goal. It is low-impact.

Why did Burgess & Niple use inspection photographs in the plans for the structural steel repairs? How did that help?

Lewellyn: That was one of the ways we sped up the process. We would take digital photos of the problem areas. We could then insert what had to be done — our repair notations — on top of the photograph. This method reduced the drafting time for basic repairs. We still had to do some basic drafting, but some repairs, such as replacing a rivet, could be specified with a photograph without drafting the existing steel at that location. It clearly communicated what the contractor needed to do.

Everyone can understand a photograph rather than a 2D drawing. The contractor really liked this method. We get requests to do presentations on this technique. This is probably the biggest project we've used it on so far.

How was the public involved in choosing colors?

Whited: The mayors of the surrounding cities and other officials selected half a dozen different color schemes. Those color scheme options were placed on an Internet website for voting by the community. Around 10,000 votes were received on the website. This was the second time the community had participated in choosing a bridge color scheme in West Virginia. Internet voting was used for the first time on the Eugene Carter Bridge in Charleston.

What type of lighting was added to the bridge?

Lewellyn: The public asked if it could be lighted in the same way as the suspension bridge in Wheeling, W.V.

Whited: Federal funding was available to do it. The revitalized bridge paint and lighting uses a color scheme featuring the West Virginia state colors — Mountaineer Blue and Gold. The state-of-the-art decorative lighting makes the project unique. The catenary lighting defines the cables with 160 white necklace luminaries. The towers are illuminated by 60 directional floodlights, and a blue LED stripe accentuates the upper chords of the truss. The sidewalk railing was brightened with 212 fixtures.

What are some of the biggest achievements of rehabilitating this structure?

Lewellyn: The Market Street Bridge was designed in an aggressive 10-week timeframe. Repairs took two summers. It was originally let in November 2009 and the bridge opened in 2011. The rush in the schedule was meeting the deadline for the funding; we had to get the job awarded to a contractor by a certain deadline. The team was able to meet the deadlines.

Whited: The contractor was able to keep the bridge open during holidays, which made the public happy, while the work was still able to proceed.

What has been accomplished through the rehabilitation of this bridge? How did it benefit the area?

Lewellyn: [There] were three bridges. When one was closed, the public was upset. By restoring the Market Street Bridge, we not only were able to maintain both crossings on the Ohio River, but also took a dilapidated structure — an eyesore — and turned it into a nice-looking bridge. Politically, it was a success for the area. The local citizens can see wise reinvestment in their area to preserve critical infrastructure.

Whited: It really boosted quite a bit of pride in the community.

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