HIGH Steel News
Information from High Steel Structures LLC
Spring 2015

New Generation of Steel River Bridges Connect Southwestern Pennsylvania Communities

Southwestern Pennsylvania, with its beautiful rivers and historic manufacturing towns, is noted for its many remarkable bridges. With the Monongahela River from the south and the Allegheny River from the north joining to form the Ohio River in Pittsburgh, the area is a prime destination for bridge enthusiasts looking to visit iconic steel spans designed and built by the 19th century masters of a bygone era, with names such as John Roebling, Gustav Lindenthal, and George Farris, among others.

PennDOT has recently initiated several replacement projects for river crossings that have reached the end of their life spans, building a new generation of steel bridges designed to serve their communities for the next hundred years. High Steel Structures is currently supplying Brayman Construction Corporation with structural steel for two of these projects, the Hulton Bridge in Allegheny County and the Masontown Bridge which connects Fayette and Greene counties. Both existing structures are through truss bridges and more than 95 years old.

The final span of girders for the Hulton Bridge is strand-jacked into place

The Hulton Bridge

Located about 14 miles northeast of Pittsburgh, the Hulton Bridge spans the Allegheny River between the suburbs of Oakmont and Harmarville, Pa. The bridge is named for Jonathan Hulton, one of the first landowners in the Oakmont area in the mid-1800s. Hulton's son operated a ferry across the Allegheny River near the current bridge location. A Parker Pratt through truss, the bridge was the first river crossing bridge designed by Allegheny County and cost $306,000 to build in 1908.

Designed by a team led by Gannett Fleming, the new Hulton Bridge is being constructed directly upstream of the existing bridge and will include four, eleven-foot lanes, a four-foot median and six-foot shoulders on each side of the roadway, and a sidewalk on the downstream side of the bridge.

High Steel has fabricated an estimated 6,152 tons of steel for the project. The girders vary in shape and size with deep haunch girder sections of 21 feet over the piers. The bridge superstructure is comprised of five girder lines.

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Bridges Of The World

Dragon Bridge

Da Nang, Vietnam

Every Saturday and Sunday night a fierce dragon breathes fire in Da Nang, Vietnam. There's no reason to be afraid. It's the Cau Rong or Dragon Bridge that spans the Han River. Constructed in 2013, the 2,185-foot bridge has steel piers, girders and arches that are lit up by thousands of LED lights for a breathtaking display.

Message from the President Brian W. LaBorde

Design for Manufacturability

Designing for Manufacturability is a great concept! It optimizes the manufacturing process to assure the best quality, reliability, compliance, delivery and cost effective products to the customer.

High Steel Structures supports this concept and encourages your participation in optimizing the steel fabrication process for bridge and large scale building girders. Design engineers typically welcome any feedback from a fabricator that leads toward a common goal – an efficient steel design. There are several ways we can assist you.

1. Visit our website, www.highsteel.com, to learn some of the best practices for efficient steel design by using the information found in the Technical Resources tab, including the Technical Library, Coatings, and FAQs. You can also submit design, pricing and shipping questions about your project to us via the Designer Tools, located at the top of the right column of each page in the website.
2. Come to our Open House. In conjunction with the AISC's annual Steel Day event, High Steel hosts a free, full day Open House, including a morning of technical presentations and an afternoon tour of our fabrication facilities in Lancaster, PA. This year's event is on September 25th, and is a perfect opportunity to see first-hand how your designs are brought to life.
3. Read this newsletter's ***Tech Talk*** column, another great avenue to learn how to practice design for manufacturability. In each issue, our VP of Technical Services, Ronnie Medlock, P.E., explores various topics from welding to steel erection. Past issues can be found on our website.
4. The National Steel Bridge Alliance (www.steelbridges.org) is another great resource for the most current technical information on steel bridge design.

The most common areas of efficiency gains are in connection and weld details. For example, if fillet welds can be designed in lieu of complete joint penetration groove welds, there will be cost savings. The size and grade of plate material you select can also lead to schedule and cost savings. Complex coatings for structural steel like galvanizing and metalizing are most often overlooked. Fabricators' feedback on the application of these specific coatings can lead to properly written coating specifications that lead to efficiencies.

Projects delivered through the design-build process offer a prime opportunity to utilize the design for manufacturability

concept. A recent example is PennDOT's emergency bridge replacement of a fire damaged bridge at the I-81 Interchange in Dauphin County, PA.

Due to the tight schedule, High Steel performed the detailing of the structural steel plate and cross (box) girder shop drawings concurrently with the development of the steel design at Gannett Fleming. Our detailers, using 3D modeling, identified potential steel connection interferences early in the process. Many of the internal box diaphragm connections had tight tolerances that were identified through the 3D modeling. Our input during this phase allowed the subsequent fabrication operations to go very smoothly.

Together we make a better product!

Cost- Another Good Reason for a Steel Bridge

By **Steve Bussanmas,** Senior Vice President of Sales & Marketing

Steel has long been used as a bridge super structure material. Its many advantages include the ability to fabricate curved structures, to span very long lengths, easily inspect for the affects of aging and, should the need arise, the ability to repair and/or strengthen.

As the world economy plays out another good reason to use steel is emerging, and that is cost. For the past several years the price for raw plate steel from the mills has remained steady. The labor to fabricate that steel and the cost to deliver it has risen modestly at about the rate of inflation. Thus, the total cost on average has risen at about half the rate of inflation.

However the past six months has seen two factors affect bridge steel pricing. First, the price of raw plate steel has been coming down. With the economies cooling in Europe and China, North America is seen as the one strong economy left in the world. Sectors such as the automotive industry, rail cars and wind farms are strong, compelling European and Chinese steel companies to export large quantities of steel plate into the US market. This is driving the price of steel down.

The second factor is oil prices. The cost of transporting the raw plate to our fabrication plants and then the finished product to job sites has been positively impacted as the price of fuel has gone down. In the grand scheme of total cost this has had a relatively minor impact but the bottom line is that the overall cost is down.

An analysis we did on a job that was bid in 2012 at $1.47 per pound would today be bid at $1.37 by applying the same margin percentage as was applied originally. Bottom line is that the price for fabricated steel on average has gone down albeit a modest drop. How many other products can make that claim? I would guess that there aren't many.

Metalizing – A Growing Option for Longer Bridge Life

The next time you are at a social gathering or your local health club and someone asks you "What's hot in the bridge industry?" You can answer — ***metalizing.***

To understand why metalizing is hot, we need to consider how the bridge industry has evolved over the last 60 years. In the late 1960's and 1970's the bridge industry saw the introduction of zinc-rich coating systems. Prior to the introduction of these new coating systems, bridges were painted with lead based paint (often referred to as red lead), which was frequently applied directly over mill scale.

The use of zinc-rich coating dramatically increased a bridge's ability to resist corrosion, and as a result reduced the maintenance required and increased the bridge's life. The zinc-rich coating is part of a multi-coat paint system. A zinc-rich coating (the primer) is usually covered by an epoxy intermediate coat and a urethane top coat. According to the

Metalized knuckle girder for the Lake Champlain Bridge.

FHWA, systems with zinc-rich coating systems have "shown performance far superior to all other conventional coatings (without zinc-rich primers) tested in parallel to-date under harsh exposure conditions."

Today, many of our nation's bridges that were built prior to the use of zinc-rich coatings or the use of weathering steel are showing signs of their age. These bridges include those built during periods of great expansion, such as during President Roosevelt's public works programs in the 1930's or President Eisenhower's Federal-Aid Highway Act of 1956.

Now, as the owners of bridges are facing the need to replace and upgrade their structures, they are taking steps to increase the lives of their bridges. One of those steps is Metalizing.

Metalizing, which is a form of thermal spray, is a process in which metallic materials, such as zinc or zinc / aluminum alloy, are melted into tiny droplets and sprayed onto surfaces to produce a corrosion resistant coating. Many owners see metalizing as a coating system that provides superior protection and life.

The corrosion-resistant zinc coating prevents corrosive substances from reaching the base metal, and it is also a sacrificial anode for the exposed steel, if the zinc coating is scratched. Since metalizing is applied manually, it is recommended that a range of 8 to 20 mils is specified.

Metalizing provides a similar zinc coating to galvanizing, without the size restrictions of the molten zinc galvanizing tanks. While galvanizing is cost effective for secondary members, such as cross frames and lateral bracing, only bridges with moderate sized main members, such as truss bridges, can be fully galvanized. By pairing galvanized secondary members with metalized main members, owners can gain superior benefits for any size bridge.

Facing the pressures of tighter maintenance budgets, Federal Highway dollars restricted for construction, and drivers who want fewer maintenance delays, owners are responding by increasingly moving towards longer life / reduced maintenance bridges by specifying metalizing. By factoring the total life cycle cost of a bridge, owners are taking the longer term view and choosing to spend a little more on their coating system for the desired benefit of increased life and less maintenance.

High Steel Structures LLC, in response to demand for metalized bridges, is becoming one of only a select few bridge fabricators to offer metalized structures. In 2015, High Steel Structures will add the capability of providing metalized bridge girders directly from their fabrication facility.

While metalizing will not replace the need to apply good design practices in bridge design, such as preventing water and salts from stagnating on main members, it does offer added corrosive protection. We welcome the opportunity to discuss your project.

These painted girders were first metalized to increase service life.

Tech Talk The High Tech Corner

An NDE Revolution

By **Ronnie Medlock, P.E.,** Vice President Technical Services

Significant changes are underway in the bridge non-destructive examination (NDE) world, particularly with respect to:

- Digital radiography,
- Phased array ultrasonic testing, and
- New non-destructive testing acceptance criteria.

Here is an update on each topic.

Digital Radiography

High Steel now uses digital for most of its radiography. The Bridge Welding Code, AASHTO/AWS D1.5, does not mention "digital radiography," but this is not an impediment. Consider how digital radiography satisfies the two general requirement areas for radiography: acceptance criteria and processing.

In terms of acceptance criteria, there is simply no difference between digital radiography and film. For either type of image, the practice is the same: review the film for indications (such as slag, porosity, or lack of fusion), and if indications are present, judge them against the acceptance criteria in the code.

Processing digital radiographs is different than processing film (and much easier), but, once again, digital images are handled rather readily by the code: both film and digital images must satisfy code requirements for sensitivity. Technically, digital images must also satisfy requirements for film quality: of course, the code does not release the fabricator from satisfaction of these requirements when using digital images. Happily some of the requirements become nonsense in the digital world: no chemicals are present to result in streaks or stains, and digitals panels cannot be exposed by backscatter. Other requirements remain the same: shots must be of the proper width and scratches must not potentially obscure results.

So, digital radiography is here now, and we all benefit from the advantages: instant results; greatly reduced effort in film processing, handling, or storage; far less chance of shot quality problems; and, ultimately improved schedules and lower costs. Who among us would wish for a switch from digital photography back to film? Only a very few. And, one day (hopefully soon) we'll say the same about film radiography.

Digital RT provides immediate digital results on the shop floor.

Phased Array Ultrasonic Testing

Phased array ultrasonic testing (PAUT) is not new technology, but it is new to bridges, and it is coming to the shop soon. The joint AASHTO and AWS D1.5 committee has voted to adopt PAUT by inclusion of the technique as an appendix, with reference to the appendix from D1.5 clause six, allowing PAUT as a substitute for traditional UT. This vote is not a completion of the approval process: the PAUT ballot must still be approved at higher levels with AWS and within AASHTO, but the D1.5 committee vote is a key step, both because it is a formal approval of the method by the committee and because it establishes the way PAUT is approached within the code. In short, if the ballot is approved, then PAUT will be in the next edition of D1.5.

What is PAUT? Like traditional UT, PAUT is an NDE method that finds anomalies by sending sound through the steel and interpreting the sound reflections that bounce back. Sounds that bounce back normally indicate that the steel is clean; sounds that bounce back irregularly are an indication that the steel has a discontinuity. However, the delivery of the sound and the interpretation of the return signal can be significantly different with PAUT. Most notably, with traditional UT, the probe sends one sound signal through the steel; with PAUT, an array of probes sends many signals through the steel; the signals are pulsed in groups – hence they are "phased". Further, the signal can all be sent at the same angle (lineal scan) or at a variety of angles (sector scan). The net result is that inspection is much faster and much more thorough.

Another key difference is that PAUT can be encoded. With encoding, a device (perhaps a wheel or a string) precisely documents the location of the probe during testing, allowing correlation of the probe with the collected and stored data. This provides two advantages: first, the test data can be stored permanently, and second, the data can be evaluated at any time.

Given the flexibility and broad range of

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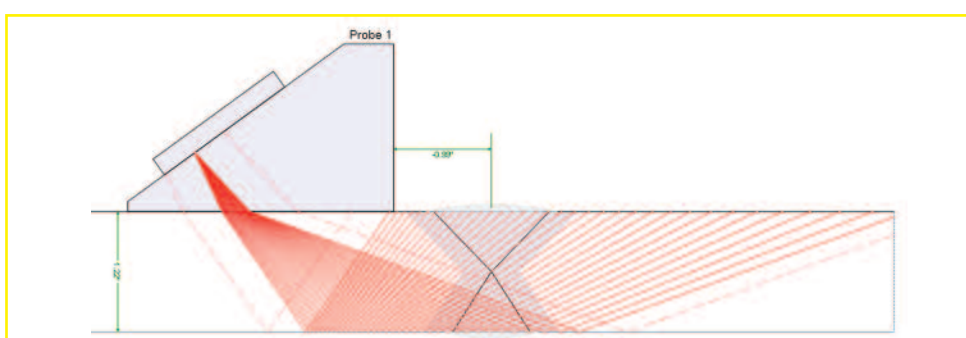

Phased array UT transmits sound at many angles.

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Because the design calls for deeper beams than can be transported to the site, various stacked girder beam sections with horizontal flange bolted splices were required to accommodate transportation to the site. Delivery restrictions required beams to be transported in various configurations (vertical, horizontal and inverted).

There were 128 beam loads and numerous miscellaneous loads transported from High Steel's Williamsport and Lancaster fabrication facilities. Ninety-five percent of the beams were reloaded on a barge and transported out to cranes waiting to hoist the beams into position.

Steel erection was completed on January 16, when the final 60-foot wide, 283-foot long, 1,200-ton section was strand jacked into position.

105 individual girder segments were already erected for spans 2-5. But the steel erection for the bridge was finished with the placement of the entire final span. This final segment erection was facilitated by subcontractor Mammoet, a company specializing in heavy lifts.

The girders were pre-assembled on Shugart barges and moved into place the night before the lift. Four 600-ton capacity strand jacks, each using 36 18mm diameter wire strands, were used to lift the segment approximately 70 feet to its final elevation.

The segment contained roughly 8,000 bolts and took crews 22 hours to safely secure. The river navigation channel was closed for less than 48 hours to allow for the prep, lifting and bolt up. Extensive survey and analysis were necessary to ensure that the segment would fit within the allowable gap, with just 1 ¾ inches of final entering clearance on each side. Construction of the bridge deck is scheduled to begin in March. The project is on track for completion in October.

The Masontown Bridge

Located about 70 miles south of the Hulton Bridge, the Masontown Bridge connects Fayette and Greene counties, carrying SR 21 over the Monongahela River and Norfolk Southern Railroad about an hour south of Pittsburgh.

Designed by SAI Consulting Engineers, this project replaces an existing eleven-span, two-lane steel truss bridge with a new 1,700 ft, four-lane, seven-span plate girder bridge. The new bridge is being constructed just north of the site of the existing bridge.

Replacing the bridge was one of the recommendations in a 2000 transportation study focusing on improvements to the Route 21 corridor between Waynesburg and Uniontown. The study cited the age and the design of the existing structure as well as the increased traffic on Route 21 as reasons for replacement. The existing bridge, which had become a bottleneck, was deemed to be inadequate in width, at only 24 feet wide with no shoulders, and was built in the early 1920s.

Brayman Construction began the first of two construction phases for the new $49.6 million bridge in 2011. Phase I was finished in August of 2014 and entailed construction of the two westbound bridge lanes. On September 27, the old bridge was imploded into the Monongahela River, making way for construction of Phase II, which is currently underway.

The new Masontown Bridge required 4,425 tons of structural steel. The first phase girders were fabricated at High Steel's Lancaster fabrication facilities, and the second phase girders were fabricated in Williamsport.

The main span is comprised of 72 girder beams that are over 14 feet deep and are built with both A709 Grade 50W and A709 Grade 70W materials. All of the main span girder beams required transportation in the horizontal position and are being erected from a barge.

Both bridge abutments and approach slabs to the main 1400 LF span over the Monongahela River were completed by the end of 2014. The approach grading work will take place in the spring, along with the bituminous paving necessary to drive on the new bridge. The project is on schedule for completion in October 2015.

The Masontown Bridge under construction.

JUST THE FACTS:

Hulton Bridge

Location:	Allegheny County, PA
Project Owner:	PennDOT District 11-0
Designer:	Gannett Fleming, Inc.
General Contractor:	Brayman Construction Corporation
Total Contractor Bid:	$64.8 Million
Total Steel Tonnage:	6,152
Material:	A572 Grade 50, Painted

Masontown Bridge

Location:	Fayette and Greene Counties, PA
Owner:	PennDOT, District 12
Designer:	SAI Consulting Engineers
General Contractor:	Brayman Construction Corporation
Total Contractor Bid:	$49.6 Million
Total Steel Tonnage:	4,425
Material:	A709 Grade 50W, A709 Grade70W

Recent Contracts Awarded

SR 6219 Sec 020B, Garrett Bridge
Somerset County, PA
Joseph B. Fay Company • 4,300 Tons

Kosciuszko Bridge Phase 1
Kings County, NY
Skanska - Kiewit - Ecco III (JV) • 2,848 Tons

I-276 / I-195 Interchange Section D10
Bucks County, PA
PKF-Mark III, Inc. • 2,647 Tons

MD 331 / Choptank River
Talbot County, MD
McLean Contracting Co. • 2,019 Tons

I-95 Ross Bridge Ramps / Aramingo Ave Interchange
Philadelphia, PA
Driscoll Construction Co, Inc. • 1,543 Tons

Garden State Parkway Interchange 36-48, MP 34.5-38.0
Atlantic County, NJ
South State, Inc. • 1,430 Tons

Flushing Town Center
New York, NY
Cives Steel Company • 572 Tons

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"Lay down a good weld and give good measure"

Sanford High 1931

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Fast Answers to Your STEEL Questions

Please address comments or requests for additional subscriptions to editor, Lisa Masters, at lmasters@high.net

HIGH Steel News

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sound sending and collecting possibilities, under D1.5 the practice of PAUT will require a "scan plan". The scan plan will define which probes and how any probes will be used, just how far the probes will be from the weld (the "offset distance"), the direction and number of scans, and how the probes will be positioned relative to the geometry of the part being examined. A scan plan will be developed for each joint to be tested; however, fabricators will be able to establish standard scan plans that can be re-used for multiple joints. In fact, in the future, fabricators will probably have a number of standard scan plans that they use for the joints that they see (like flange butt splices or box corner joints).

Phased array UT is not on the shop floor yet, but it should be here soon. Potential shop floor advantages include faster and more thorough testing, especially with respect to flaw locations, and the possibility that owners may allow substitution of PAUT for radiography.

Acceptance criteria

Soon a research project sponsored by the National Cooperative Highway Research Program (NCHRP) will be underway to re-examine acceptance criteria for steel bridge NDE. The acceptance criteria in the code today were established half a century ago and have done well to ensure superior performance of bridge welds. However, these criteria are based purely on workmanship; conversely, the research project will study how weld quality can be correlated to fitness-for-purpose, especially using advanced NDE like PAUT, and will thereby help ensure that weld discontinuities will only be repaired when necessary. This study, "Improved Non-Destructive Evaluation of Full Penetration Bridge Welds", has been funded, and NCHRP is in the process of selecting a contractor to perform the work.

Summary

Steel bridge NDE is changing for the better. Digital radiography is here, phased array UT will be here soon, and research will soon be underway to put improved rationale in place for weld evaluation and associated repairs. If you or your project are a part of High Steel, expect to participate in this revolution.