HIGH Steel News

Information from
High Steel Structures LLC

Summer 2016

High Steel Completes First In-House Metalized Girders for New York Projects

The use of metalizing is heating up in the bridge industry. Since January of 2014, High Steel has bid upon 32 bridge projects with metalized superstructure components. Half of these projects are located in New York State, with the rest being spread throughout the Northeast, Delaware and New Jersey. In comparison, the previous two years, 2012-2013, yielded only 10 projects specifying metalizing.

A major tool in the fight against costly corrosion, metalizing effectively increases the life of bridges through a process using an electric arc spray gun to apply a thermal spray of molten zinc or zinc/aluminum alloy to steel superstructure members, providing a protective coating. The 85/15 Zinc/Aluminum wire is preferred by owners versus the 99% zinc wire because it is more chloride resistant. Metalizing is a rugged coating, so damage due to handling is minimized.

Prior to 2015, High Steel would outsource the metalizing process for these jobs, often setting up temporary areas at its fabrication facilities for the subcontractors to work. In mid-2014, a decision was made to invest in equipment, chambers and staff at the company's Williamsport, PA fabrication plant to provide metalizing capabilities in house. Embracing the industry's demand for metalized coatings has yielded results.

The first two projects, which were fabricated and shipped in mid-2015, were both New York State Thruway Authority projects, the Cleveland Drive Overpass, in Erie County and Interchange 36, in Onondaga County. Both projects are being built by Cold Spring Construction Co., Inc. For the Thruway, metalizing represents a sound solution in the fight against corrosion. We approached engineers from the Thruway to share with our readers a case study detailing how they came to the decision to specify metalizing, and what it means for their bridge replacement plan moving forward:

Metalized Structural Steel Specified for New Bridge Construction on the New York State Thruway

Each year, a team of Thruway Authority employees, including structural engineers, project scoping engineers, and bridge maintenance engineers travel the full length of the Thruway looking at bridges coming up in the program, and others with particular issues as indicated by Thruway's divisional bridge maintenance engineers.

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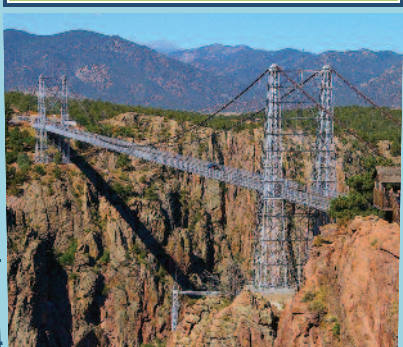
FAMOUS BRIDGES



Royal Gorge Bridge

Cañon City, Colorado

Scared of heights? Vertigo sufferers might want to avoid Royal Gorge Bridge, which has a deck height of 955 feet. From 1929 to 2001, this towering bridge was the highest in the world. It was surpassed by the Liuguanghe Bridge in China, but it's still the highest in the U.S. This steel-based bridge with wooden planks spans the Arkansas River and is part of Royal Gorge Bridge and Park, a 360-acre amusement park.

Message from the President

Jeff Sterner, President and COO of High Industries Inc.

Bringing the Most Advanced Steel Bridge Fabrication Technology into the Future

The continual development of new technology has impacted all businesses. I'm old enough to remember when a facsimile machine was a revolutionary advancement, allowing the rapid transmission of a paper document over the phone lines instead of traditional mail or overnight delivery service. My first job coming out of college was for a major oil company, and there was a typing pool where we sent all of our hand-written letters. Letters were typed using carbon paper to make duplicate copies. Then we got our first copy machine! We were so happy to be working for such a progressive company!

The steel fabrication business has changed dramatically in the plant, as well as the office, over the past decades. Massive amounts of data are created using computer systems to represent the project. Drawings can be helpful, but our operation depends on "data" to describe the structure, plan our fabrication, and coordinate our efforts. This data also feeds CNC machines that burn, drill, machine, and weld steel components with superior speed and accuracy. It also integrates with the financial management of a project, enabling us to track progress, pay our bills, and invoice our customers.

While we are proud to have the most advanced steel bridge fabrication facility in this country, modern CNC tools and computer systems still do not fabricate a bridge; people do! Even with all of this new technology, or perhaps because of it, fabricating steel bridges is complex work. It takes years for the typical new coworker at High Steel Structures to learn the trade and hone their skills to the point where they are a major contributor. I am poignantly aware of this fact because High Steel Structures continues to grow and add new coworkers. It is a challenge to keep all aspects of this business running smoothly while we are dedicating some of our resources to teaching and training new coworkers. So we are focusing on ways to modernize our training efforts to be more effective at developing the necessary skills of our workforce. Education

and training methods have also evolved with modern technology, and we are evolving to incorporate more of the most modern and proven effective techniques into our programs.

We do all of this at High Steel Structures because we are committed to being a leader; today, and for decades more to come.

Steel Coatings

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

Steel rusts and concrete cracks… These are the two "truths" of the materials that dominate bridge superstructure composition. Obviously, I am not a credible source to discuss concrete's shortcomings (trust me, steel is far superior!) so I'll go right to steel.

For many decades the steel industry has sought to minimize the product's weakness to rust thereby losing gauge and strength. Paint systems have evolved from lead based systems to those of today that employ a zinc rich primer, epoxy second coat and urethane top coat. The steel industry has developed weathering type steels whose metallurgical makeup allows the steel to rust in such a way that it forms a patina on top of the steel protecting it from further rusting. Hot-dip galvanizing is another method where the steel is submerged in a bath of molten zinc. And finally, metalizing of steel is gaining popularity whereby zinc wire is fed into an arc making it liquid and an air blast propels it onto the steel where it immediately bonds and cools.

I will discuss each of the above pointing to their strengths/weaknesses and their relative costs.

Weathering steel is available in both 50 and 70 grades the latter being denoted as High Performance Steel. As stated earlier, the metallurgical makeup of the steel allows the steel to rust in such a manner that it forms a protective patina on top of the steel. In most benign natural environments it provides very good protection and the steel enjoys a very long life. In environments where the steel remains wet or exposure to chlorides is common, weathering steel has been known to continue rusting and would not be the material of choice. Weathering steel would be the most cost effective option of those being discussed.

Today's three coat paint systems are far superior to those of the past. The evolution to a zinc rich primer, epoxy second coat and urethane top coat has dramatically increased the effective life of these coatings. An added benefit of this coating option is aesthetics in that the urethane topcoat can come in nearly any color you can imagine. One weakness of paint systems is that handling damage can occur during the bridge construction requiring field painting touchup. A three coat paint system will be more costly than going the weathering steel route but will have significant advantages in difficult environments.

The galvanizing of steel is a process where the steel is dipped into a tub of molten zinc. The zinc has more of a bonding action to the steel versus paint which is a coating. This corrosion-resistant zinc prevents corrosive substances from reaching the underlying steel. The zinc also serves as a sacrificial anode

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Carrying the Torch: Upholding the Skills of our Predecessors in the Fabrication Assembly – Part 2

By **Robert A. Cisneros, P.E.,** Chief Engineer High Steel Structures

In part 1 of this series, we explored some of the lessons that we've learned at High Steel in the value of pre-assembly. When is it needed? When can it (and when should it not) substitute for actual assembly? How much assembly is needed?

The following case study explores the trial assembly of a moderate span, skewed and curved multi-girder bridge.

Case Study #3. Mohawk Valley Gateway Overlook – The Proper Extent of Trial Assembly

Heavier than the typical pedestrian bridge, with a lovely haunched girder vertical profile and a pronounced architectural horizontal curvature, the Mohawk Valley Gateway Overlook (MVGO) Pedestrian Bridge is a park-like structure that links both halves of the City of Amsterdam, NY across the historic Erie Canal (river portion).

This structure resonates well with a tenet of our company's mission statement (the High Philosophy), which is "to contribute to a world of beauty, prosperity and peace."

Furthermore, it invokes the roots of modern North American Civil Engineering. For most mid-nineteenth century American civil engineers and surveyors had either been trained by the canal's Chief Engineer, Benjamin Wright, or by someone who had worked for him during construction of "Clinton's Ditch", the canal that was once considered an eighth wonder of the world.

For this project, the New York State Thruway Authority & Canal Corporation specified steel dead load deflection checks at the fabricator's facility in addition to the usual field erection and slab formwork checks. This provided a valuable opportunity to evaluate three-dimensional geometry and crossframe detailing for intended erected position relative to recent advances in the industry literature regarding analysis and construction engineering for bridge curvature and skew, including NCHRP Report 725, the AASHTO/NSBA Standard G13.1 (Bridge Analysis), and AISC's "Skewed and Curved Steel I-Girder Bridge Fit."

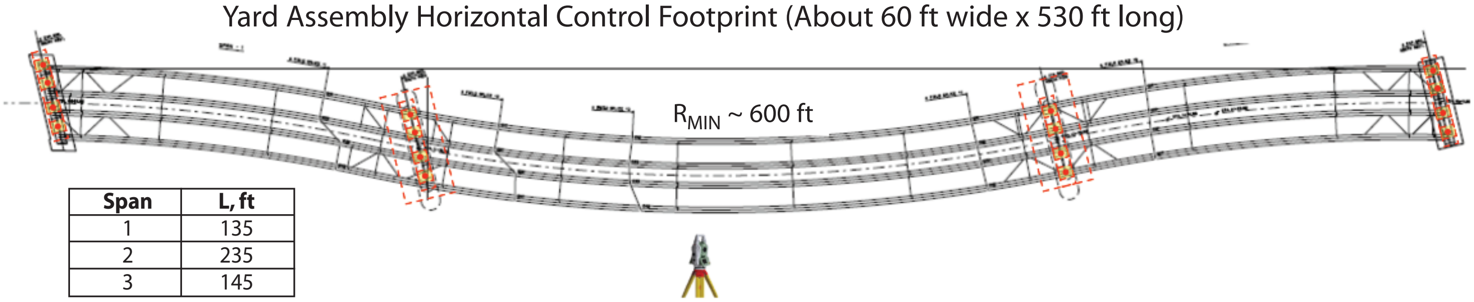
Girders were fabricated using full-sized, numerically controlled methods as if the structure were to be check-assembled only (single of four completed girder lines), but due to the requirement for dead-load assembly, sub-sized holes were used at the field splice connections (see Figure 1). Crossframes and diaphragms were fabricated using full-sized hole procedures except at the skewed/curved pier assemblies with their tightly-radiused overlook belvederes (see figure 2).

The structure was progressively assembled from abutment to abutment at High Steel's yard during winter, and adjusted to a best no-load fit condition. Holes were reamed at field splices and the overlook structure framing. The bridge was then trial-loaded with the falsework removed and measured. With owner acceptance of slight variances from the theoretical camber profile, the bridge superstructure was dismantled and shipped to the Amsterdam, New York jobsite (see figure 3).

In the field, approach spans were erected first, followed by "drop-in" installation of the closure (keystone) piece using a falsework within the canal for the main span during the spring construction season. (See figure 4 which compares yard and field erection sequences).

This provided a long-sought opportunity for the author to observe and measure the effects of erection method and season on bridge horizontal control and vertical profile (inspired by earlier, pioneering works on the subject from Linzell et al, Cozy et al). Both bridge assemblies exhibited similar torsional behaviors (outside girders tending to run slightly low, and inboard portions of the curves slightly arched within each span). Good overall correlation between Shop & Field steel dead load deflections (about ½" to 3/4" maximum deflection variance between the two assemblies at 0.4L1, 0.5L2 & 0.6L3).

Erection was completed, and the bridge design provided sufficient *continued on page 4*



Span	L, ft
1	135
2	235
3	145

The New NY Bridge Towers Over the Hudson

One of the largest bridge construction projects in the world is taking shape high above the Hudson River. By the end of 2018, the 96-foot wide two-span bridge held up by cable stays connected to 419-ft tall pylons will replace the current Tappan Zee Bridge. The new structure, which will connect Tarrytown on the east side of the Hudson River with Nyack on the west, will carry eight lanes of traffic. When its new twin structure is done, each bridge will carry four lanes of traffic, with the northern bridge also featuring lanes for pedestrians and bicycle traffic.

At High Steel Structures, the project is beginning to wind up. According to Project Manager Ken Glidden, shipping is about half-way through for S-1130405 (Unit 7W). That should be complete by the end of June. Then there is just S-1130409 (Unit 2E) & S-1130410 (Unit 1E) remaining for fabrication and painting, which will progress from summer through the end of October. These will begin shipping in October 2016 into December. Then there is a short break in shipping to the job site, before the remaining pieces are delivered in June 2017.

Photo Credit: New York State Thruway Authority

In all, High Steel's part of the project is comprised of 10 of these superstructure "units," each made of multiple spans; the largest units have five spans of 350' each; others have fewer spans of 350' or less. The long spans are designed with girders, cross frames and sub-stringers, while the shorter spans have just girders and cross frames. The main girders are 12 feet deep, and the stringers are three feet deep. This design was chosen by HDR to minimize impact on the bridge's foundations.

In 2017, the High Steel News will feature expanded coverage of this milestone project, which is the largest in the company's history.

Tech Talk - Carrying the Torch: Upholding the Skills of our Predecessors in the Fabrication Assembly- Part 2 *continued from page 3*

allowance for the relatively minor variances measured, resulting in visually pleasing horizontal and vertical lines without abrupt kinks in curvature. As of the writing of this case study, the deck is placed; parapets, special tree plantings & a lovely, winding pedestrian path are being construction.

This structure is the subject of a technical paper that has been presented to the 2016 World Steel Bridge Symposium, which provides architectural & historical considerations, a more in-depth discussion of modeling, assembly and measuring methods, as well as a visual tour enhanced by the erector's drone technology. It hopes to inspire appreciation of how park-like structures can be used to offset the inadvertent municipal divisions that occasionally result from past, major infrastructure works. *continued on back page*

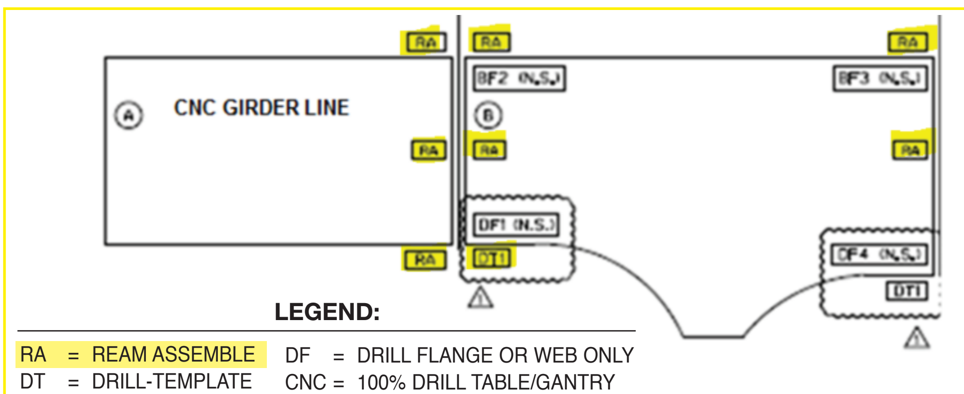


Figure 1

Figure 2

Figure 3

High Steel Completes First In-House Metalized Girders for New York Projects continued from page 1

On one such trip in 2011, it was discovered that the protective patina on overhead bridges with weathering steel were failing. This phenomenon was recorded, monitored closely and studied over the next two years. It appeared to be happening primarily in the Thruway's Syracuse and Buffalo Divisions, where heavy road salt usage is required during the winter and where there is a high volume of high speed truck traffic.

New overhead bridges with vertical clearance of 14'- 6" (former minimum) up to 17'- 6" were experiencing the same type of failure. It was determined that the high velocity salt spray coming off these trucks and impacting the girders was too corrosive an environment for the use of weathering steel. Various options were considered for new structures, including a four coat paint system and shop metalizing. Paint systems were discounted due to concern about the corrosive environment in these areas.

In reviewing the current condition of test shop metalized structural steel starting in the late 1990s through the early 2000s, it was shown to be performing very well with only a minimal amount of metalizing failure and no measurable structural steel deterioration. It should also be noted that these earlier versions of metalizing did not incorporate a finish sealer coat, which is used to protect the zinc material from reacting to corrosives. Due to these results, the Thruway Authority decided to use a shop-applied zinc based metalizing system on all structural steel for bridge replacement projects starting in 2014. Five of these were constructed in the Buffalo Division and one in the Syracuse Division

Two of these projects include Cleveland Drive (a local urban road over the Thruway mainline) in Buffalo, NY and the Interchange 36 bridge (over the Thruway mainline) in Syracuse, NY. Cleveland Drive is a 220' single span Rigid Frame bridge, 60' wide, incorporating 1.84 million pounds of metalized structural steel. Interchange 36 is a 100'-83' two-span continuous bridge, 71' wide, fixed at the median pier and expanding in both directions over the abutments (jointless bridge). This bridge incorporates 611,000 pounds of metalized structural steel. The metalizing system used is an 85/15 zinc/aluminum specification developed by the Thruway Authority for shop application with assistance from industry specialists and within the guidelines set forth in NACE NO 12 AWS C2.23 SSPC-CS 23.00.

As the Thruway Authority moves forward with metalizing, engineers will continue to monitor new bridges for any potential corrosion issues that may arise and it will utilize the metalizing technique where it can mitigate future problems.

Is Metalizing Right for Your Next Project?

The use of road salts is widespread across many project owners in areas that share similar climate challenges to those encountered by the New York State Thruway. In these conditions the service life of shop metalizing is expected to substantially exceed the service life of weathering steel or a painted structure; therefore, the use of metalized coatings may be of interest to these owners.

While metalizing comes at a premium cost, it may be money well spent in the right environment. The metalized coating with a sealer coat is an average 42 cent premium versus unpainted weathering steel.

Owners and designers interested in exploring the use of metalizing are encouraged to contact High Steel with questions or requests for budget pricing.

Steel Coatings continued from page 2

so that if the coating is scratched the exposed steel will still be protected by the remaining zinc. The life expectancy of this will be superior to paint but it comes at a cost. Galvanizing requires transportation to and from the galvanizer which is costly. Galvanizing tanks are generally under 55 feet long which limits even double dipped steel pieces to 80 to 90 feet depending on steel member depth. Also, due to the exposure of heat in the molten zinc bath, sweep and camber of the steel member can be affected. The bottom line is that galvanizing is significantly more costly than paint.

Metalizing of steel has risen in popularity among owners recently due to its inherent strengths in harsh conditions. Metalizing is a process whereby a metal wire is fed into an arc making the wire a liquid and an air blast then propels it onto the steel where it immediately bonds and cools. The wire used on bridge steel is generally 85% zinc and 15% aluminum. 99% zinc wire is available but does not provide as much chloric protection as 85/15. Metalizing does require unique blasting material that delivers a much deeper anchor tooth profile. It is a cold process so movement of the steel due to heat is not an issue. There are no size limitations other than the booth size the applicator employs. Generally about the same cost as galvanizing we find that the best combination economically is to metalize the main members and galvanize secondary pieces such as crossframes, diaphragms, etc.

This is obviously a cliff note version of what could be a more detailed description of these coating options. We have prepared an hour long presentation for bridge owners that dives more deeply into this subject with special emphasis on metalizing and the cost premiums for each alternative. If your team is interested in hearing this presentation please feel free to contact me at sbussanmas@high.net.

Recent Contracts Awarded

SR15 Sect 88A, CSVT River Bridge
Union County, PA
Trumbull Corporation
12,160 Tons

I-895 / Patapsco River Flats
Baltimore and Anne Arundel Cos., MD
McLean Contracting Company
2,459 Tons

BNSF Bridge 369.9, Project MG07030
Jackson County, MO
OCCI Engineering Contractors Inc.
1,363 Tons

US 301 – SR 896 to US1, SEC 1A
New Castle County, DE
Tutor Perini Corporation
1,327 Tons

GSP P300.229, Interchange 125 Improvements
Middlesex County, NJ
A.Servidone, Inc. / B.Anthony Const. Corp. JV
1,159 Tons

Margiotti Bridge
Jefferson County, PA
Glenn O. Hawbaker, Inc.
840 Tons

I-295 Southbound Reconstruction Project
New Castle, DE
Mumford & Miller Concrete, Inc.
756 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

In This Issue

Tech Talk - *continued from page 4*

For Part III: In our next installment, we discuss how we applied some lessons learned to long-span girder systems and cable-stayed suspension bridge assemblies.

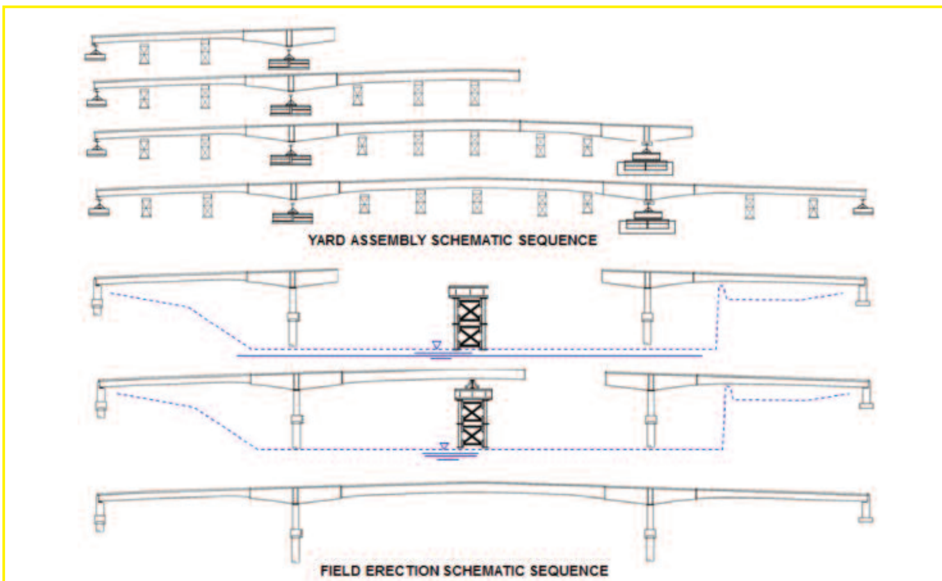

Figure 4

The Project Team for this unique structure was as follows:

Owner:	New York State Thruway and Canal Authority	**Erector:**	D.A. Collins Companies
Designer:	Amman & Whitney (Architectural Drawings by Saratoga Associates)	**Fabricator:**	High Steel Structures LLC
Contractor:	Kubricky Construction Corporation	**Structural Steel Detailer:**	Lancaster Country Drafting Services