

Township Road 241 Bridge (excerpt from Vern Mesler's report to the Hancock Park District)



Photo 1: TR 241 Bridge in 2008



Photo 2: TR 241 Bridge Finial



Photo 3: TR 241 Bridge Plaque

The Township Road 241 Bridge (hereafter referred to as the TR 241 Bridge) is a wrought iron Pratt through-truss spanning the Blanchard River in Hancock County, Ohio, just outside Findlay (photo 1). There is little written about this 113 year old historic bridge. It was only after standing for many decades that inspection records began to be kept. Cast iron plaques bolted to the top of the two portals have the name of the company that built the TR 241 Bridge: **1895 The Canton Bridge Co. Builders Canton Ohio** (photo 3). Along the tops of the portals on each side of the plaques are broken brackets that give evidence of cast iron portal crestings removed years ago. As with many wrought iron bridges that span one and two lane country roads throughout the United States, few records were kept or photographs taken. Rummaging through piles of old photographs and postcards in antique stores and local transportation offices, I have found that our ancestors took few photographs of their local iron truss bridge. When the one-dollar Eastman Kodak Company's Brownie was introduced in 1900, it revolutionized photography being simple to operate and inexpensive to buy. People took photographs of the horse, barn, house, front porch, and even the outhouse, but rarely was the one-dollar Brownie pointed toward the local iron truss bridge. It appears our forefathers simply looked at the local iron truss bridge as a tool to get goods and services to and from town, and when the bridge wore out, as with any tool, they replaced it with a better tool. J.A.L. Waddell, engineer and author of *De Pontibus, A Pocket-Book for Bridge Engineers* (1908), wrote in his chapter "Aesthetics in Design": *"In regard to the ornamentation of bridges by adoption of elaborately artistic approaches, ... little has yet been done in America, the reason being that any money so expended has evidently no utilitarian purpose, and consequently to the eye of the solely practical man appears to be entirely wasted."* The TR 241 Bridge was not without some ornamentation, however. At the top of each corner of the trusses, above a connection known as the hip joint, were bolted large cast iron finials (photo 2), and along the top of the portals there had been cast iron crestings. This ornamentation may not have been selected by the practical Findlay Ohio County Commissioners but may simply have been part of the bridge package from the Canton Bridge Company.

The TR 241 Bridge has an important history, but it is not written in books, newspaper articles, or seen in photographs. Its story is in the metal members that make up the bridge. This is the unwritten record of the history of the wrought iron and steel making processes and the fabrication methods used in the construction the TR 241 Bridge.

In 1891, one hundred and thirty five miles east of Findlay, the Canton Bridge Company was incorporated. Among its owners were blacksmiths. David Hammond, Vice President and later President of the Canton Bridge Company, began his career as a bridge builder in a blacksmith shop he owned. He, along with a single helper, built one of the earliest wrought iron bridges in Canton, Ohio. In 1871 Hammond was president of the Wrought Iron Bridge Company, a company with which Hancock County had dealings as early as 1873. In that year, two decades before the purchase of the TR 241 Bridge from the Canton Bridge Company, the Hancock County commissioners entered into a contract with the Wrought Iron Bridge Company to fabricate and erect a wrought iron bridge to span the Blanchard River in Findlay. Over the years, Findlay purchased many metal truss bridges from both the Wrought Iron Bridge Company and, later, the Canton Bridge Company.

The TR 241 Bridge members are made of wrought iron. In less than ten years after the bridge was erected, ninety percent of the highway bridges would be made of steel. Wrought iron is no longer produced in the United States today, and its use in major structures declined quickly after the end of the nineteenth century. A high degree of skill from many iron craftsmen was needed to produce wrought iron, and it could not compete with steel that was mass produced at low cost. The shiny black metal furniture one now sees in catalogs and home improvement stores as "wrought iron" is really wrought steel, "wrought" in the sense of being produced or shaped by beating with a hammer.

As you travel over any nineteenth century metal truss bridge, you travel a roadway that is supported by floor beams that are rarely seen. Their history is rarely known, and during most historic bridge rehabilitations the floor beams are the first historic members to be replaced by the engineer of record with modern wide flange beams (photo 9). Historic metal floor beams were either I-beams (American Standard Beams, photo 4) or a riveted assembly of plate and angle (photo 6,7,8). The floor beams of the TR 241 Bridge are I-beams with riveted end connections. The I-beam was first produced in the 1850's by Trenton Iron Company.



Photo 4: I-beam profile (American Standard Beam)

Trenton Iron Company
"Trenton's debut as a leading industrial center in the world began in 1847. In that year, Peter and Edward Cooper, James Hall and Abraham Hewitt began the Trenton Iron Company. Later, Charles Hewitt joined the company. Cooper-Hewitt's "Universal Mill", the first in America, became the first to roll wrought iron beams for fire proof buildings. It made beams for Nassau Hall, the Harper Publishing Company, Cooper Union in New York, and the dome on the Capital Building and the Treasury Building in Washington, D.C."

Mercer County website:
www.nj.gov/counties/mercerc/about/history/industrial-giant/html



Photo 5: I-beam (American Standard Beam) Speaker Road Bridge, St Clair County, Michigan



Photo 6: Riveted wrought iron floor beam, East Delhi Bridge, Washtenaw County, Michigan



Photo 7: Riveted wrought iron floor beam, Bell Road Bridge, Washtenaw County, Michigan (with good view of eye-bar above the floor beam)



Photo 8: Riveted wrought iron floor beam, Haupt Creek Bridge, Sonoma County, California



Photo 9: Wide flange beam profile (once known as Bethlehem sections)

"Farewell to a Mill That Shaped the Modern City"

(John Holusha, The New York Times, October 21, 1995)

"Henry Grey was an English-born inventor who developed a process for rolling wide-flange beams of uniform thickness in the late 1880's. But he was at first unable to persuade any American steel companies to adopt his technology directly. After a mill built in Germany and the process from it became successful, Mr. Schwab decided to get into the business. In 1907, he began building the mill. The first beam was rolled in 1908 and a new generation of skyscrapers was designed by engineers and architects who could simply specify the size of the girders they needed. They were called Bethlehem sections."

Historic metal truss bridges were either pin connected or had riveted connections. Many of the nineteenth century bridges were pin connected. One of the most significant members of a pin connected bridge is the eyebar, a tension member that was used as a diagonal and as a bottom chord (photo 7). The TR 241 Bridge is a pin connected Pratt truss with forge-welded looped wrought iron eyebars. The looped eyebar was made in the forge shop and required the most experienced craftsmen to make the forge weld. The welding heat, a red or white heat, and the type of flux are two important ingredients for making a successful forge weld. Mill scale attached to the wrought iron presents a problem because the melting temperature for mill scale is higher than the

welding temperature for making a forge weld. By the time the mill scale melts, the wrought iron is too hot for making a forge weld. Fluxes are used to lower the melting point of scale; sand and borax were commonly used.

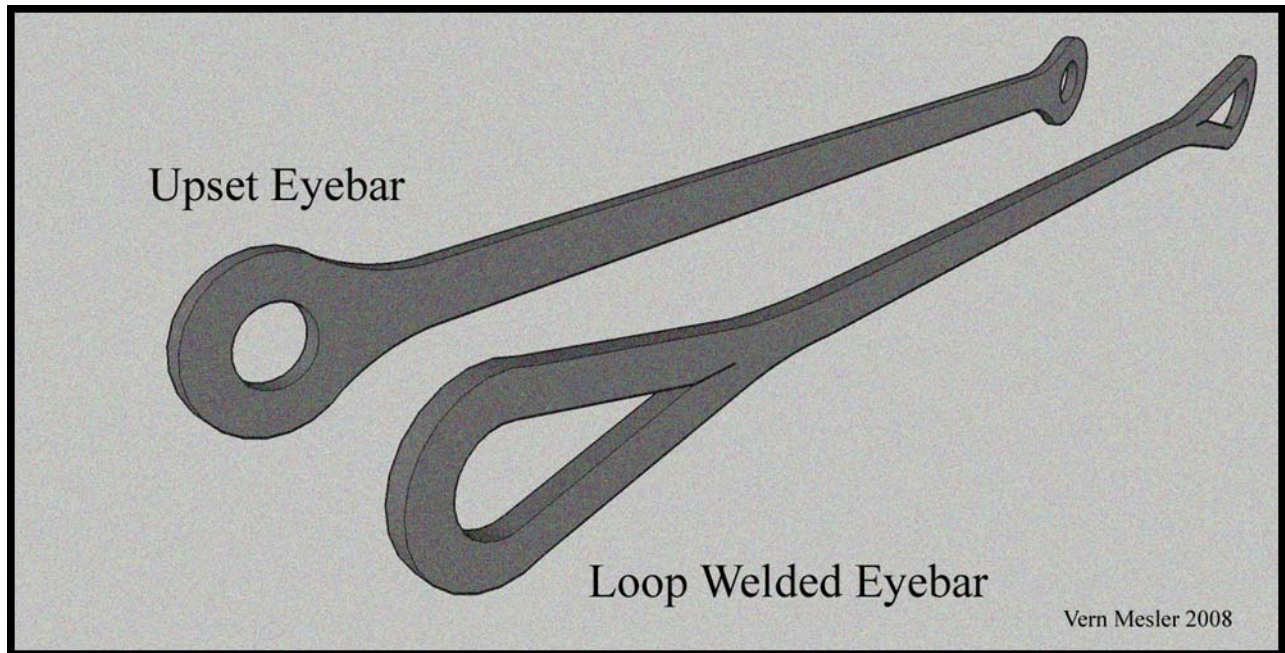


Photo 10: Eyebars

To make the loop eyes, a wrought iron bar is heated in a forge fire, then a scarf joint is hammered at the end of the heated bar and the bar is bent around a pin by means of a lever. Finally, the loop is forge welded to complete the eye (photo 11). After the blacksmith has finished forging the eyebars they are placed in a furnace for annealing, a process that eliminates internal stresses within the wrought iron. [Another method of fabricating eyebars, not used on the TR 241 Bridge, is to "upset" the hot metal through a series of dies. Upset eyebars were often used in large pin connected trusses, sometimes with eyebar heads as large as 33" in diameter, 2" thick and eyebar body 14" wide. Special heavy equipment was required to produce these eyebars, hydraulic shears for cutting bars to length, furnaces to heat the eyebar heads, and upset machines to form the eyebar heads.]



Photo 11: Forge Welding of Loop Eyebars



Photo 12: Broken forge weld from a Michigan Historic Bridge

Eyebars are a distinctive component of American pin connected bridge design. The use of eyebars and the speed of erection of a pin connected truss (photos 13,14) was considered an advantage over other bridge designs.



Photo 13: TR 241 Bridge top chord and vertical pin connection with recessed nut



Photo 14: TR 241 Bridge top chord and inclined end post pin connection with cotter key

The TR 241 Bridge was fabricated with wrought iron angles, channel, square bars and I-beams. The assemblies were riveted with wrought iron rivets. Today the electric arc welding process has replaced riveting in the fabrication of metal structures, and riveting is rarely used in metal fabrication today. At the time the TR 241 Bridge was fabricated, most of the rivets on a bridge were driven in the shop rather than in the field. The TR 241 Bridge was completely shop riveted. Field riveting was considered inferior and specifications at the time required 50% more rivets on a connection if field riveted. Six years after the TR 241 Bridge was erected, Joseph Boyer patented the Boyer long stroke pneumatic hammer (photo 15) and made it possible to field rivet successfully.

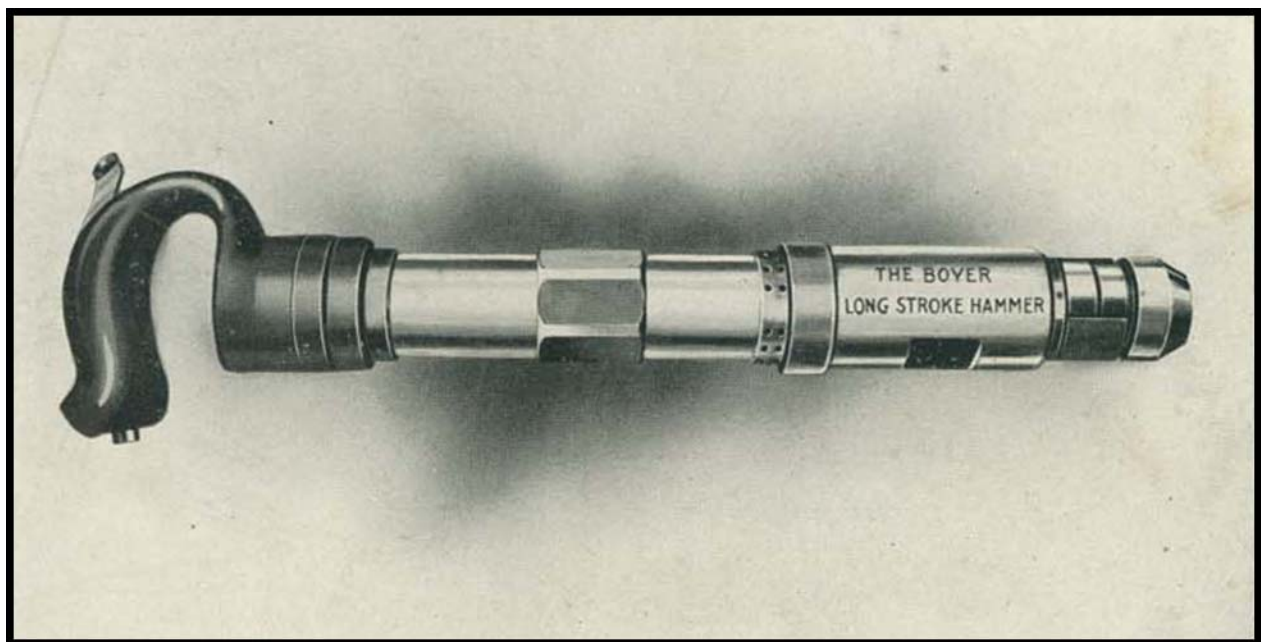


Photo 15: The Boyer Rivet Hammer, Chicago Pneumatic Tool Company

Riveting began after hole patterns on the structural shapes were laid out and drilled, and the assembly temporarily held together with fit-up bolts. Rivets were made or purchased to lengths specified by the grip length (total thickness of pieces to be riveted). For example, if three pieces of metal equal the thickness (grip) of $\frac{7}{8}$ ", then rivets of $2 \frac{1}{8}$ " length (shank) were required (photo 16). Rivets were heated to about 800 to 1800 degrees Fahrenheit in an oil or gas furnace. For field riveting, a coke or coal fire was often used.

Shop rivets were driven by hydraulic riveting machines (photo 18) or compressed air riveters. This method of riveting was considered more efficient than hand-driven rivets. With machine-driven rivets, not only are the heads perfectly formed, but the shank of the rivet upsets and completely fills the hole (photo 17).

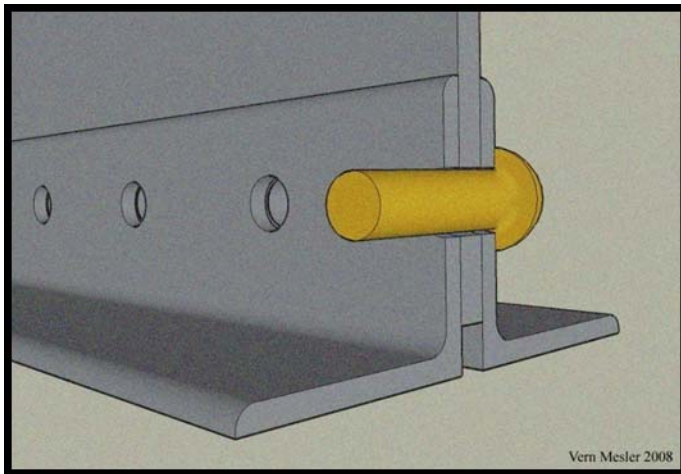


Photo 16: Rivet grip and shank

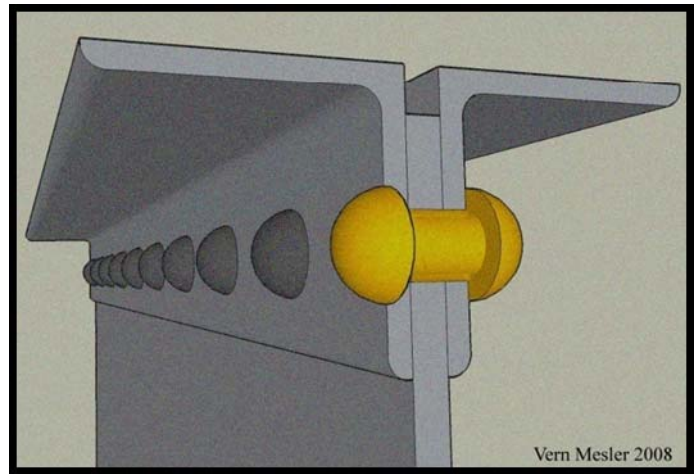


Photo 17: Fully formed rivet

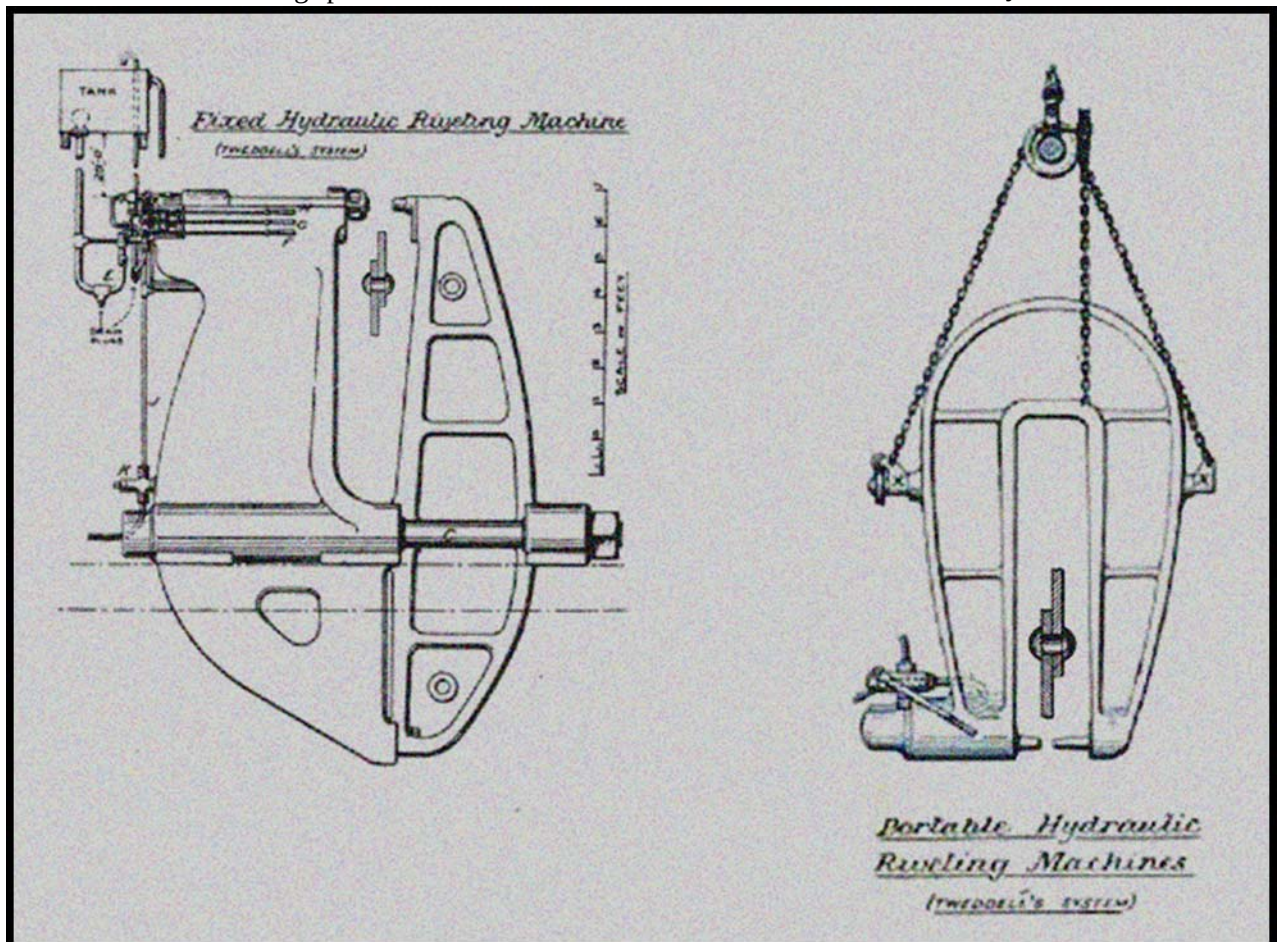


Photo 18: Portable Hydraulic Riveting Machines

Painting would have been the last operation at the Canton Bridge Company before the TR 241 Bridge was shipped to Findlay. The paint used for the bridge was likely a mixture of lead and oil, but there is no record of the color selected for the bridge. J. A. L. Waddell provides some insight into a 19th century bridge engineer's approach to paint color selection.

“Architectural effect in bridge-building seldom derives much aid from paint, for the reason that it is generally best, on account of both convenience and good taste, to use but one color in painting a bridge. A proper choice of color, however, is a material advantage; and it is correct to vary the color in certain accessory portions of the structure, such as machinery-houses, the lettering on name-plates, etc. Some engineers have advocated painting the tension and compression members of different colors, but this would get one into difficulties in spans where certain strictly tension-members are made stiff. Ornamental figures should be painted of the same color as the rest of the bridge. In general, it may be stated that for ordinary conditions of landscape the heavier the structure the lighter should be the color of the paint used, for reason that if a bridge has a appearance inclining toward clumsiness this objectionable effect can be lessened by reducing the prominence of its members; while, on the other hand, a bridge which is of such an extremely light and airy design as to produce an appearance of weakness can be made to look stronger by adopting a paint of dark color, and thus bringing its members into greater relief in respect to surrounding objects. With very dark backgrounds, however, it will often be advisable to use a light-colored paint even for slight structures, so as to give the bridge a definite outline.”

The TR 241 Bridge was shipped from Canton, Ohio, by rail. At a rail siding in Findlay, the bridge would have been unloaded, probably with a gin pole, the common method of the day, then secured to a wagon and delivered to the erection site. The American Pictorial Monthly, in an article written in 1902, presents a description of the process by which bridges such as the TR 241 Bridge were erected.

“Arriving at its destination the erecting department takes charge of the work and what is said to be the most interesting part of the whole work then begins. Large timbers are procured and framed into bents of false work which are placed in position about fifteen feet apart and directly under the location of each floor beam of the bridge. Planks are then laid from bent to bent, the traveling derrick for raising the iron work is erected and the false work is then ready to receive the bridge. The floor beams, lower chords and laterals are placed in position, the parts are raised and then the sections of top chord are made to connect with all members; and when the last connection is made the wedges under the floor beams are knocked out and the bridge is swung free from the false work.

The removal of the temporary structure, putting on the joints and planks, setting up the railing, adjusting the bridge, making every connection tight, attaching the name plates showing the year in which the bridge is built, the Canton Bridge Company, Canton, Ohio, as builders and the names of officials who let the contract, another inspection by the buyers who examine it from top to bottom, another coat of paint and the bridge is turned over to the county or township officers for public traffic..”

The Township Road 241 Bridge has no recorded history. Those who watched the bridge being erected in 1895 recorded nothing of their impressions on that day. By 1895 the erection of an iron truss bridge was a common sight across the country and the new iron truss bridge spanning the Blanchard River in Hancock County was seen as nothing more than an improvement to Township Road 241. Today, one hundred and thirteen years after it was erected, many of those who drive across the TR 241 Bridge are frightened by the rattling sound of metal against metal and find nothing of value in a rusty old bridge. To know the value of this wrought iron bridge is to carefully read the unwritten words the craftsmen left in building the Township Road 241 Bridge.

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