

Nels Raynor, Craftsman

This is a story about a craftsman restoring a one hundred and four year old metal truss bridge. First, some background about the bridge. The multi-span State Street Bridge that spanned the Cass River in Bridgeport, Michigan, is in its final stages of restoration. No famous engineer designed this bridge. The bridge is a Pratt through truss, a common and popular truss design. Two large cast iron bridge plaques survive and are attached to the portals, the only ornamental fixtures connected to the bridge. A simple railing is made up of two four inch channels. The bridge was built by Joliet Bridge and Iron Company in 1906 and the mill stamps embossed on the steel sections show that Joliet Bridge and Iron purchased steel from the Cambria, Carnegie, and Jones and Laughlin mills to fabricate the bridge. What makes this bridge special is its place in time. In 1906 people and cargo were still traveling by horse and wagon, and only a few thousand cars were in use in the United States. In 1906 Henry Ford began production of his Model N car, and in October 1908 he began the production of his most famous car, the Model T, and would continue production until 1928, producing over fifteen million cars. The State Street Bridge, with its pin connections and upset eye-bars, would be among the last of its kind to be fabricated. The automobile would make its design obsolete for bridges. It is an important structure because its technology began in the early nineteenth century and it is the record of a craft technology that would be replaced with modern steel materials, the electric arc welding process, and bridge designs to accommodate the automobile. The history of the State Street Bridge is not written in books but in the structure itself, and identifying for the public this important historic record begins with the preservation of the bridge.



*State Street Bridge prepared for removal from its original abutments*



*A span of the State Street Bridge moved through Bridgeport to its restoration area.*



*Dismantling began in January in preparation for primer painting and restoration*

The process for restoring the State Street Bridge began with the work of the Bridgeport Charter Township, the Michigan Department of Transportation Bay Region Transportation Service Center, and Spicer Group engineering firm. After the restoration documentation successfully weaved through the various levels of Federal, State, and County government, the work was let for bidding. A General Contractor, Davis Construction, of Lansing, Michigan, was awarded the contract in 2009. Nels Raynor of Bach Ornamental & Structural Steel, in Holt, Michigan, was employed by the General Contractor to do the restoration work.

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A fitting description of Nels Raynor was written by Mike Mort in his book *A Bridge Worth Saving*: “I first saw Nels Raynor as he was walking a wide-flange beam high over a construction site on a cold winter morning. From the ground, he appeared to be cross between Rudolph Nureyev and Grizzly Adams. Up close, he was soft-spoken and genteel.” Nels is all that—and a craftsman. His passion is in the art of metal, the place of metal in art, and in historic metals and the restoration of historic bridges.

If you talk to Nels for any length of time you’ll begin to hear him tell stories about his dad, the late Louis Raynor, Professor of Art at Michigan State University. He talks about his father’s many art exploits and strong artist opinions. Nels credits his father for his love of metal fabrication and has a great respect for his father’s work and opinions.

I often visit Nels’ shop in Holt. I remember a visit last year when I stopped by his office, a small space at the front of his shop. In one corner a table with shop fabrication prints, some laid out flat and haphazardly and others rolled up, dust covered, and stored in metal cubbyholes around the table. Along a wall a desk with a lap-top computer nestled among cutting orders, invoices, and other assortment of paper. A file cabinet with its top surface stacked with books and catalogs. A few chairs that require special skills to remain in an upright position. On this visit I noticed something different in his office: sitting in the midst of his office mayhem was a collection of his father’s ceramic vases, bronze figures, and on the floor a tall ceramic vase.



*Louis Raynor art exhibited at Bach Ornamental & Structural Steel*

My first thought as I saw this art was that it should be properly displayed under the soft lights of an art gallery, to be viewed and appreciated by the art community. But during subsequent visits to Nels’ shop to inspect his progress on restoration of the State Street Bridge, I come to realize that Louis Raynor’s art was exactly where it should be, displayed along with his son’s fabrication tools.



*Nels alongside one of his decorative rivet display assemblies*



*Pictures of Nels’ son Brock and his father at a potter’s wheel*



*Nels inspects new vertical splice sections for the State Street Bridge*

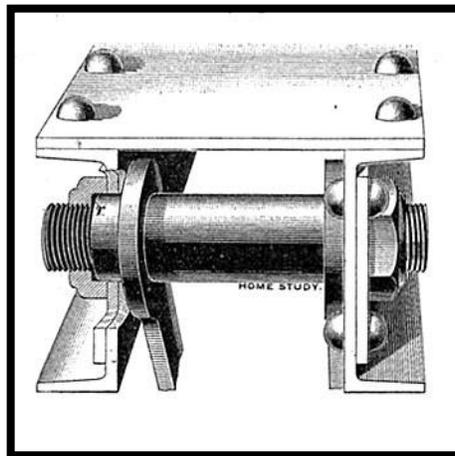
The State Street Bridge was removed from its abutments on January 13<sup>th</sup>, 2010, and placed in an empty lot within Bridgeport. On a cold January day Nels and his crew began dismantling the multi span bridge. As with any construction job, a multiple of unforeseen situations always present themselves, but Nels' focus was always on protecting the original material of the historic bridge. His experience with other restoration projects prepared him for the many challenges this restoration project would bring. One historic feature of a pin connected metal truss bridge is the bridge pin and recessed nuts, which are often replaced without replication and destroyed. The recessed nut is a historically significant feature of a historic metal truss bridge, and replacing it with a new standard threaded nut diminishes the overall historic appearance of the bridge and its historic record.

An article from an 1897 Home Study Book I purchased some years ago from an antiques store titled "Why Recessed Nuts are Used for Chord Pins--Reason for Turning Down the Ends of the Chord Pins--The Use of Washers on Chord Pins" provided an answer for its unique design: "*due to variations in the widths of the members [as in a top chord member as shown in the Home Study drawing below], may be obviated by increasing the grip of the pin sufficiently to cover the variations and using washers. But washers for this purpose were found to be in some respects objectionable. They formed an additional item of expense in the manufacture of chord pins, were liable to get lost, and were inconvenient for the purposes of erection. This led to the idea of making the nut and washer in one piece. As a consequence, a patented recessed pin nut, made of wrought iron, pressed to the required form, appeared upon the market some years ago.*"

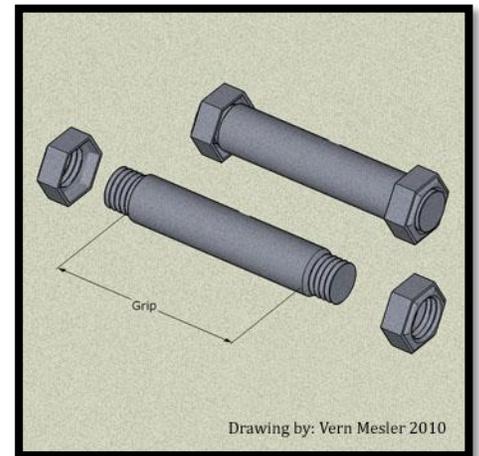
Nels Raynor was especially proud of removing all of the recessed nuts on the two span bridge without destroying them. Unfortunately, seven failed a non-destructive test (a failure that may be due to a possible manufacturing defect). However, the seven will be replicated to match the original, including the thread type, something rarely done on a restoration project.



*Nels Raynor holds a bridge pin and recessed nut removed from the State Street Bridge*



*Home Study drawing of a top chord member for a pin connected metal truss bridge*



*The length of a grip is the unthreaded section of a bridge pin*

Once Nels completed the dismantling the State Street Bridge in Bridgeport, he and his crew transferred the major riveted sections to his shop in Holt. Restoration of the bridge requires hundreds of steel rivets. From Nels' collection of rivet hammers, a #60 Boyer field rivet hammer was prepared and a new holder-on purchased from Michigan Pneumatic Tool Inc. in Detroit, along with a large inventory of steel rivets from Jay-Cee Sales & Rivet, Inc., of Farmington, Michigan. The bottom vertical pin connections where the bottom chord and diagonal eyebars are held in place were beyond restoring due to pack rust, and the inclined end post pin connections at the end bearing pads were also beyond restoring.

All of the vertical connections had to be replicated, from the bridge pin to the batten plate. Vertical end splices were fabricated to replicate the channel and the pin-hole connection reinforced riveted plate. To rivet the reinforcement plates, Nels modified a 100-ton C-frame web punch press he had acquired at an auction in Chicago to accommodate rivet dies he purchased for the job. Nels developed a procedure for punching, for riveting the replicated vertical pin connections and for arc welding full penetration welds to the original vertical channel to produce an accurate replication of the vertical connection. This replication procedure was repeated for the pin connected ends of the inclined end posts.

Most of the rivets driven by Nels and his crew were in the new cover plates for the top chord and inclined end post channels. Nels used his #60 Boyer field rivet hammer for driving the rivets, along with a holder-on and bucking bar. He used a propane gas forge to heat the rivets.



*#60 Boyer field rivet hammer  
on a riveted top chord cover plate*



*Tom Platt "Kooter" rivets section of a  
bearing end pad with Nels' 100-ton  
C-frame hydraulic press*



*Replicated vertical pin connections are  
arc welded with full penetration welds to  
the original vertical channel*

Nels and his crew are preparing to reassemble the restored State Street Bridge in Bridgeport. Soon afterwards the final painting will begin and the placement of the bridge on the new abutments, the bridge ready to be used as a pedestrian pathway. Nels is proud of the work he and his crew have done on the State Street Bridge. For Nels, this is what it means to be a craftsman, to take pride in work well done.

Vern Mesler

<http://www.historicbridgerestoration.com/>