



Historic Bridge Riveting Guidance

This guidance was developed through a compilation of plan notes from bridge projects in Ohio, Michigan, and Pennsylvania. The guidance was reviewed and approved by members of the Federal Highway Administration, Ohio Division; Ohio Department of Transportation Office of Environmental Services, and Office of Structural Engineering; Ohio's State Historic Preservation Office; the Ohio Historic Bridge Association; and HistoricBridges.org. A consortium of bridge engineers also provided technical language and input on this initiative.



The intent of the Historic Bridge Riveting Guidance is to assist in the design, planning, and contract bidding processes for federalized historic bridge rehabilitation projects which feature rivet construction. The following specifications and sources may be applied when in-kind replacement of rivets is recommended on select members and components of the bridge, or when replacing the rivets throughout the entire structure.

The Historic Bridge Riveting Guidance conforms to the department's ongoing initiatives established under *System Preservation and Environmental Stewardship:*

Stipulation 6, Appendix C, of the Programmatic Agreement among The Federal Highway Administration, The Advisory Council on Historic Preservation, The State Historic Preservation Office, and The State of Ohio, Department of Transportation Regarding Implementation of the Federal-aid Transportation Program in Ohio (Agreement No. 16734). The Stipulation states that ODOT and FHWA will promote routine maintenance, proper treatments of materials, and rehabilitation and reuse of historic bridges based on guidance established by the American Association of State Highway and Transportation Officials (AASHTO), National Park Service (NPS), and ODOT's *Ohio Historic Bridge Maintenance and Preservation Guidance*, and recommendations outlined in ODOT's Historic Bridge Management Plans.

Recommended Procedures and Guidance:

Riveting

In order to retain integrity of design, materials, workmanship, and original construction methods on National Register bridge projects, replacing the original rivets in kind may be preferable for historic accuracy. The following procedures and guidance can be used when planning and bidding on the restoration of riveted iron and early steel historic bridges:

A. Removal. A pneumatic rivet buster shall be used to remove rivet heads. Chisels and/or punches shall be placed in the rivet buster to punch out rivets after the rivet heads are removed. If a rivet cannot be removed with a rivet buster, an electric or pneumatic hand grinder shall be used. Do not damage steel material that's to remain.



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B. Quality Control. The Contractor shall submit documentation to the Engineer of the proposed rivet removal and installation method and quality control procedures prior to construction.

C. New Rivet holes. Rivet holes for new structural steel plates and members shall be either drilled or punched.

(1) **Drilled.** Steel angles or plates having a thickness equal to or greater than $\frac{3}{4}$ inch for grade A36 and $\frac{5}{8}$ inch for grade 50 shall be drilled. All holes shall be drilled at 90 degrees to the working surface. Extreme pressure shall not be applied to the drilling device as to punch through the material. When drilling through more than one member, the members shall be secured tightly to prevent misalignment of holes due to shifting or separation of the members.

(2) **Punched.** If holes are punched they shall be punched to a diameter $\frac{1}{8}$ inch less the required size and reamed to the correct size as specified above. After reaming, the holes shall be inspected for radial cracking. If radial cracking is present or holes are misaligned, the holes shall be reamed to the next larger rivet size. All holes shall be $\frac{1}{32}$ inch to $\frac{1}{16}$ inch greater than the rivet shank diameter. Holes deemed to be out of tolerance shall be welded shut and re-drilled or reamed to allow for the next larger size rivet.

(3) **Oversized Holes.** Where riveting new steel to existing steel, the new holes shall match the existing holes in diameter and alignment within the tolerances specified above. If the existing steel has deformed holes due to elongation, advanced corrosion or other mechanical damage, it shall be reamed to accommodate the next larger size rivet. The minimum required row spacing, pitch and edge clearances shall be maintained when enlarging existing rivet holes. The enlarging of existing rivet holes shall be limited to 20 percent of the rivets or 10 rivets in a single pattern, whichever is less. Exceptions to these requirements may be approved as field conditions necessitate, but shall be reviewed by the Engineer prior to performing the work. The Contractor shall notify the Engineer when encountering such field conditions.

D. Preparation. Before members are riveted together all chips, burrs and foreign material resulting from drilling, punching or corrosion shall be removed from the surfaces to be joined. If burrs are removed by chamfering, the depth shall not exceed $\frac{1}{32}$ inch. Members to be riveted together shall be temporarily pinned or bolted and rigidly clamped together while riveting. Drifting of parts during assembly shall not distort or enlarge the holes. The Contractor shall determine the number and pattern of temporary pins or bolts necessary to bring surfaces into adequate contact for riveting. Such pattern shall be approved by the Engineer. Temporary pins or bolts shall be successively removed as rivets are installed. Rivet grip lengths will vary depending on location. The length of un-driven rivets shall be sized to provide minimum head dimensions as specified in ANSI B18.1.2. (See AISC, manual of Steel Construction, Sixth Edition, 4-83 for guidance).



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E. Installation. The rivets shall be heated in an electric, gas or kerosene furnace and shall be driven within the range of 1500-1950 degrees F. The maximum heating temperature will make the rivets a light yellow in color. Avoid continual heating of rivets in furnace after they have reached driving temperature (excessive “soaking”). Direct flame impingement on the rivets shall be avoided during heating. The rivet shall then be positioned into the hole. Prior to working the rivet, the diameter, the length, temperature and fit shall be evaluated and if all is not correct, the rivet shall be rejected and corrective actions shall be taken. Any slag formed on the rivets shall be knocked clear prior to riveting. 83 03DS713 (A445) BCY: KAZ 3 of 6 08-27-08

Rivets shall be ins pressure-driven, using a machine wherever possible; or by using a Boyer field-riveting hammer (or approved equal), at the engineer’s discretion. The driven rivets shall be tight and in uniform contact with the surfaces of the joined members. The surfaces of angles or plates to be riveted shall not be scared from the process of driving the rivets.

Known examples of sources for either used or rebuilt riveting equipment include:

Michigan Pneumatic Tool, Inc., Detroit, MI (313-933-5890)

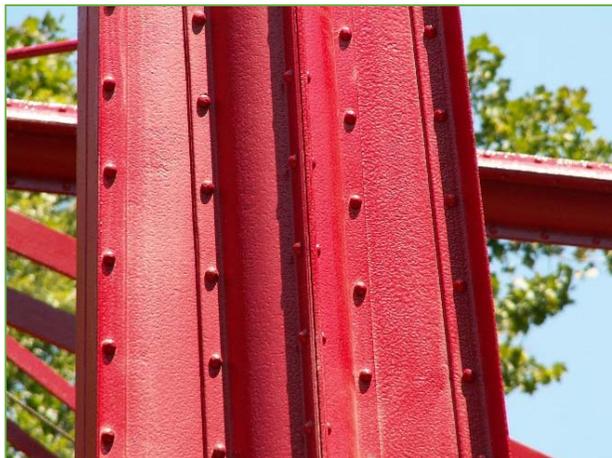
Mankel Backsmith Shop, Cannonsburg, MI (616-874-6955)

Jay-Cee Sales and Rivets, Farmington, MI (800-521-6777)

Champion Rivet Company, Cleveland, OH (800-348-1660)

F. Workmanship. Installation of rivets shall be accomplished in a workmanlike manner. Rivet assemblies shall be of uniform quality and free from cracks, gaps, sharp edges, burrs, loose parts or other defects which might render the assemblies unsuitable for its intended purpose.

Quality Control The Contractor shall be responsible for all riveting quality control. All rivets shall be inspected immediately upon completion of driving and forming to ensure the rivet heads are seated against the plate or angle surface and are not cracked. The Contractor shall visually inspect each rivet for the conformance with ANSI standard B18.1.2. Sound each rivet to ensure it is clamped tightly in place. Loose rivets or button head dimensions out of specification shall be rejected and replaced at no additional cost.





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The following is a sample list of contractors with experience in riveting structural steel and iron on historic bridge projects:

(1) Terry Jagielski: JAG Maintenance & Riveting

Terry Jagielski
JAG Maintenance & Riveting
4391 E Territorial Rd.
Cambden, Michigan 49232
Phone: (517) 567-2215

(2) Doug Lockhart: Lockhart Ironworks, LLC

Doug Lockhart-Lead Blacksmith
4515 Township Road 430
Logan, Ohio 43138
Contact: Doug Lockhart or
Danielle Russell -Owner
740-603-6535
Lockhartironworks@gmail.com
www.facebook.com/themakersofhandforgediron
www.themakersofhandforgediron.com

(3) Nels Raynor: Bach Ornamental & Structural Steel

Nels Raynor
Bach Steel
4140 Keller Rd
Holt, Michigan 48842
Phone: 517-581-6243
Alternate Phone: 517-455-4443
nels@bachsteel.com
www.bachsteel.com

(4) Steve Howell: Ballard Forge

Steve Howell
Ballard Forge
Seattle Washington
Phone: (206) 235-3246
Ballardforge@msn.com
www.ballardforge.com

