Connecticut River Bridge at Springfield, 1840

First application of Howe truss
1,264 ft long, 7 spans, 180 ft each
Through truss: Dover Point, NH

Pony truss: Portland & Ogden RR, White Mtns, NH

Deck truss: Troy & Greenfield RR
Howe roof truss used in Elysium, 1907, approx 120’ span
B&O RR Transfer Bridges, 26th St pier on Hudson River, New York City
Moose Brook Bridge pre-2004 fire, built 1918
William Howe patent for cast iron node, 1846
Nodal castings with “sleeves”
Comins node casting patent
Nodal Castings from Rexleigh Covered Bridge, New York
Nodal Castings from Ceylon Covered Bridge in Indiana
Piper patent for nodal casting 1861
A classic Howe truss in good condition, with cast iron nodes, could be selected and then shored, the verticals loosened, instrumentation installed, the nuts tightened to change the stress levels in the members, the shoring removed, and live loads applied. Data could be gathered throughout this process and a time history of member forces and displacements compiled. The database would be useful in calibrating analytical models for the Howe truss. The final report would provide understandable, practical information on the behavior, modeling, and design of Howe truss bridges.

Year 1: Identify bridge, complete agreement with owner; assess condition, design shoring, define experimentation methodology; select contractor to shore bridge; begin installation of instruments; begin to acquire data; produce prelim analysis

Year 2: Monitor periodic data; develop elastic models; acquire data during prestressing and removal of shoring; perform live load testing; develop viscoelastic models; produce intermediate analysis

Year 3: Write final report analyzing test results and providing recommendations for rehabilitation and design of Howe trusses.
Dario Gasparini at Snyder Brook Bridge, 2009
In 1891-93, the Concord & Montreal Railroad built a 30-mile, single-track branch line from its main line at Whitefield, New Hampshire to the Town of Berlin, where lumber and paper industries were booming. The line passed through the towns of Jefferson, Randolph and Gorham, along the northern edge of the Presidential Range. Shortly after the line's completion, the Boston & Maine Railroad leased the branch for 91 years.

No information has been found concerning the first bridge at this location, but presumably it was a wood structure. The years of World War I brought the need for longer, heavier, and faster freight hauls on this division and much of the line was upgraded to accommodate heavier rolling stock. This bridge is one of three known Howe pony truss bridges that were built on the line in 1918 and one of only two that survive. While it was accepted that wood bridges might have a shorter service life than steel bridges, they were economical to build, could be easily repaired, and gave evidence of distress long before failure. The Howe pony truss was the type of choice for short spans on Boston & Maine lines. Patented in 1840 by Massachusetts millwright David Howe (1801-1867), the Howe truss addressed the inherent difficulty of constructing tension connections in wood by using adjustable wrought iron rods instead of wood planks for vertical tension members. The Howe truss was favored by railroads for its rigidity and sleek, refined appearance, and was used extensively on railroad lines in the United States and Europe in the nineteenth century.

The Boston & Maine’s Berlin Branch saw regular use for both passenger and freight trains until the 1960s. The line was leased to Guilford Transportation in 1983 and to New Hampshire & Vermont Railroad in 1989. In 1996, the connector from Wausuck Junction to Berlin was abandoned and the New Hampshire Division of Parks and Recreation (Department of Resources and Economic Development) purchased and converted the section from Jefferson to Gorham into multiple-use recreational trail called the Presidential Range Rail Trail. On May 20, 2004, the Moose Brook Bridge burned under suspicious circumstances. The New Hampshire State Historic Preservation Office, in collaboration with the National Society for the Preservation of Covered Bridges (NSPCB), salvaged the charred trusses for possible future repurposing. The New Hampshire Bureau of Trails erected a replacement bridge on the old abutments in the summer of 2004.

The National Covered Bridges Recording Project was undertaken by the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Heritage Documentation Programs Division (Richard O’Connor, Chief), a division of the National Park Service, U.S. Department of the Interior: The Federal Highway Administration’s (FHWA) National Historic Covered Bridge Preservation Program funded the project.

Christopher K. Mantz, HAER Architect, served as project leader. The 2006 HAER field team consisted of Anne E. Kiel, field supervisor, Jeremy T. Mauro and Bradley M. Rowley, architects, and Caleb Berthiau. IC1MOS intern, Romans. Lute Bennett wrote the history. Jeff Lowe produced the formal photographs.

Research sponsored by FHWA led to an agreement between HAER, NSPCB, and Case Western Reserve University (CWRU) to reconstruct the bridge and ship it to Cleveland for extensive testing. The reconstruction of the bridge was led by Timothy Andrews, Barns and Bridges of New England, assisted by Wil Truss. Carrie Stasavich led the engineering studies at CWRU. Project assistance was provided by David Wright, NSPCB, and Venn Meister, Lansing Community College.
While not as picturesque as traditional covered bridges, boxed pony trusses are a product of the same era and building traditions. Low trusses, or "pony" trusses, are an economical way to build short-span bridges. Because of their height, pony truss bridges do not have overhead bracing and, when built of wood, need to be housed differently than full-height timber bridges to allow for the passage of vehicles. The most common solution was to house each truss separately, leaving the deck uncovered. No one knows how many wooden pony truss bridges once existed, but there are presently only eight known survivors in North America.
Reconstructing the Moose Brook Bridge

Tim Andrews
Barns & Bridges of New England
Arson, spring 2004: view after fire
Pre-2004 details of Moose Brook Bridge
Revealed end post casting, Snyder Brook Bridge
Careful handling to avoid further destruction, Sept 19, 2010
Grinding fouled threads to save both nut and rod
Chalk markings read “BYM RR, Gorham.” Originally built elsewhere, assembled on site.
Hand-planing rough timbers cost less than factory produced, Feb 24, 2011
Lofting truss members based on forensic geometry
Squaring up bottom chord laminates
Hand-tooled housings for truss vertical rods and cast shoes
Truss top chord,
Final fit of cast shoe
Fire-damaged end shoe
Arc-welded repairs
Lofting and plumb scribe layout of first diagonals, March 10, 2011
Final fit and assembly of mid-span braces and counters. Third time’s a charm.
Two panels left to finish, Mar 24, 2011
First truss assembled, Apr 28, 2011
Homemade wrench, 5” for small nuts; three upper nuts are replications
First truss off loaded at Case Western Reserve University, Aug 17, 2011
Final assembly of first truss, Aug 17, 2011
Brazing to Repair the Castings

Vern Mesler & Kevin Whitford
Lansing Community College
Braze filler metal not bonded to the base metal
In a previous repair, three layers of braze filler metal had been applied. None of the layers were fused to the previous layers and there was no bonding of the braze filler metal to the cast iron base metal.
Assembly of second truss at Case Western, Mar 19, 2012
Tightening bolts on second truss, Mar 19, 2012