



Town Lattice Covered Bridges Regional Variations

Presented to:

Second National Covered Bridge Conference
June 6, 2013

Presented by:

Sean T. James, P.E., Project Manager
(sjames@hoyletanner.com)

Hoyle, Tanner
& Associates, Inc.
Manchester, NH USA



Presentation Outline

- Acknowledgement to Joseph D. Conwill
- Truss Issues
- Ithiel Town Background
- Town's Patents
- Town's Papers
- Town Lattice Distribution
- Variations
 - Truss Variations
 - Bridge Variations
- Summary
- References



Truss Issues

- Sweep (Twisting or Curving in the Direction of Their Length)
- Racking (Leaning Sideways)
- Chord Buckling



Truss Issues

Sweep



Pre-Rehabilitation

Comstock Covered Bridge (Built 1883) – Montgomery, VT



Post Rehabilitation

Hoyle, Tanner
& Associates, Inc.



Truss Issues

Rack



Green River Bridge (Built 1870) – Guilford, VT



Truss Issues

Chord Buckling



Hutchins Covered Bridge (Built 1883) – Montgomery, VT



Truss Issues

Chord Buckling



Hutchins Covered Bridge (Built 1883) – Montgomery, VT



Truss Issues

Chord Buckling



Scott Covered Bridge (Built 1870) – Townshend, VT



Truss Issues

Chord Buckling

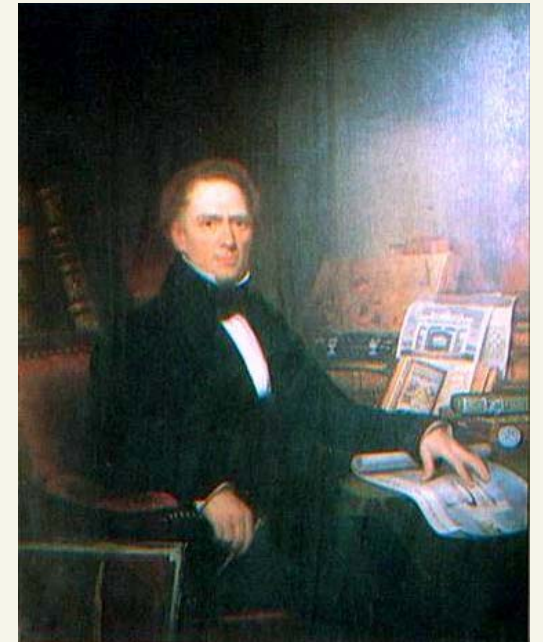


Scott Covered Bridge (Built 1870) – Townshend, VT



Ithiel Town Background

- Ithiel Town (1784-1844)
 - October 3, 1784 - Born in Thompson, CT
 - 1792 - Moved to Cambridge, MA to Live with an Uncle
 - 1812 - Moved to New Haven, CT. Works as Builder/Architect.
 - 1818 – First Bridge – Yadkin River Covered Bridge, Salisbury, NC
 - 1819-20 – Cape Fear Bridge – Fayetteville, NC
 - Likely Fully Developed Example of Town Lattice



Courtesy

<http://www.trinitynewhaven.org/Home/History/Biographies/tabid/238/Default.aspx>

Ref. 9 - Sanders, John L.

Hoyle, Tanner
& Associates, Inc.



Ithiel Town Background

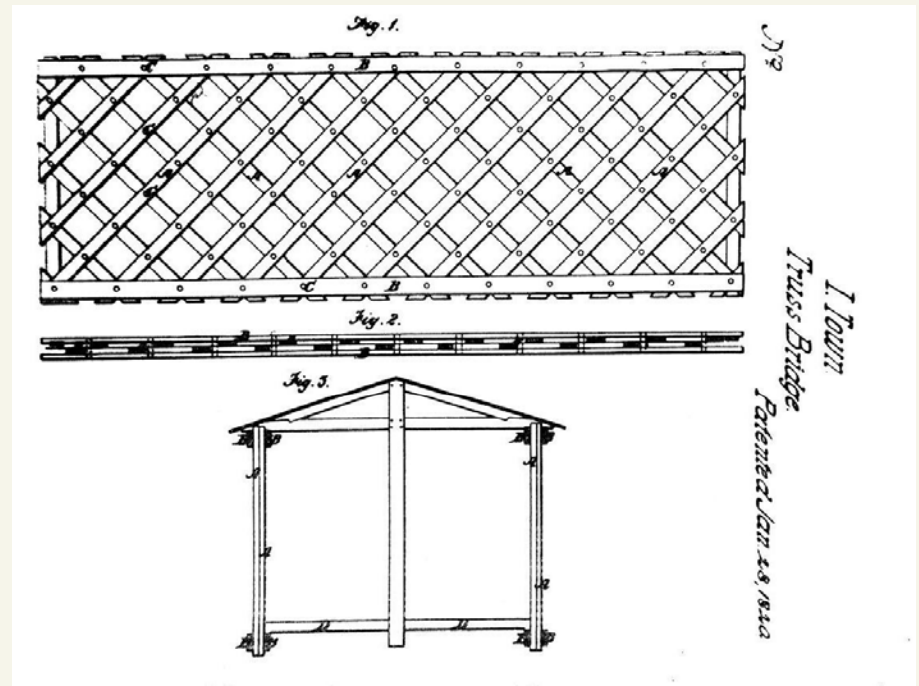
- Ithiel Town (1784-1844)
 - January 28, 1820 – First Town Lattice Patent
 - \$1/Foot for Use; \$2/Foot if Used Without Permission
 - 1825 – Establishes Office In New York City
 - Connecticut State Capital
 - 1829 – Begins Six year Partnership w/Alexander J. Davis
 - North Carolina State House – Raleigh – Redesign
 - Spends Time in Europe
 - April 3, 1835 – Second Town Lattice Patent Granted
 - June 12 or 13, 1844 – Buried in Grove Street Cemetery, New Haven, CT

Ref. 9 - Sanders, John L., Trinity Episcopal Church



Town's Patents

- Original Patent
 - Granted January 28, 1820
 - Single Upper and Lower Chord in Drawing; Double Mentioned in Text
 - “..of about 45 degrees or any angle that may be necessary for a brace..”



1820 Patent Reconstruction



Town's Patents

- Original Patent
 - “..after which secure all joints by 1, 2, 3 or more trunnels or iron bolts with wedges to the trunnels and heads and nuts to the bolts to keep the parts of each joint in close contact.”



*Trunnels with Wedges – Haverhill-Bath, NH Covered Bridge
(Built 1827-1829)*



Town's Patents

- Original Patent
 - “..after which secure all joints by 1, 2, 3 or more trunnels or iron bolts with wedges to the trunnels and heads and nuts to the bolts to keep the parts of each joint in close contact.”



Pier Covered Bridge (Built 1907) – Newport, NH Covered Bridge

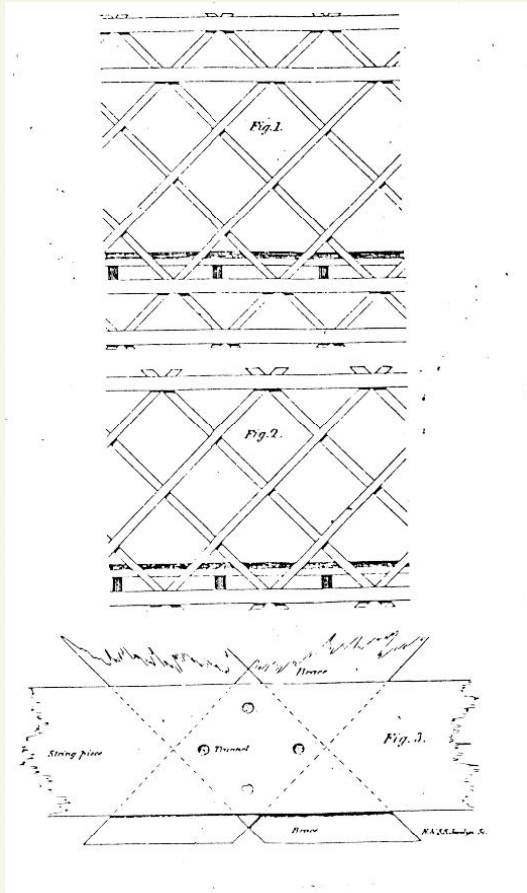


Town's Papers

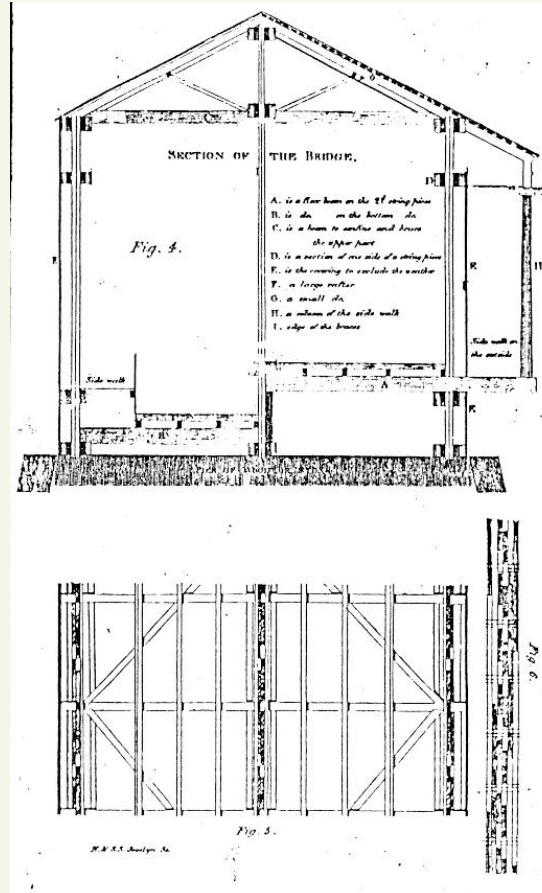
- “A Description of Ithiel Town’s Improvement in the Construction of Wood and Iron Bridges” – 1821
- Expands Upon 1820 Letter Patent
 - One or Two Lanes and Sidewalks
 - Two Trusses – Suspension Post in Center
 - Floor beams on Upper, Lower Chord
 - Plank – 10” or 11” Wide, 3-3-½” Thick
 - Plank – Sawed from White Pine or Spruce
 - Trunnels – 1-½” Diameter White Oak



Town's Papers



Ref 12 – Figure 1, 2, 3



Ref 12 – Figure 4, 5



Town's Papers

- “A Description of Ithiel Town’s Improvement in the Construction of Wood and Iron Bridges” – 1821
 - “For any span or opening not exceeding one hundred and thirty feet, one string-piece at top and one at bottom of each truss, if of a good proportion and well secured, will be sufficient, (see Fig. 2;) but as the span is extended beyond one hundred and thirty feet, two or more at top and bottom would be required as shown in Fig. 1....”
 - “Very flat pitched roofs will be preferable, as it will, in that case, be a greater support to the upper part of the bridge.”



Town's Papers

- “Some Account and Description of Ithiel Town’s Improvement in the Construction and Practical Erection of Bridges, Aquaducts and Rail Road Bridges, Whether Built Entirely of Wood or Cast or Wrought Iron” – 1831
 - Built Bridges
 - Northampton, MA – 1,080 Feet Long
 - Over the Susquehannah River – 2,200 Feet Long (220’ Spans)
 - Others in NH, CT, NJ, RI, PA, VA, NC, SC



Town's Papers

- “Some Account ..” – 1831
 - “...I have been enabled, from constant practice, to make many improvements in the principle, and in the arrangement of the materials. Consequently, the pamphlet originally published, is defective in many respects; so much so, as not to be a proper guide...”¹³
 - 12 Advantages for this Mode
 - No Abutment Lateral Pressure, Availability of Material, No Iron Work Required, Load Distribution, Lower Cost, Stronger Joints



Town's Patents

- 'Improved Patent'
 - Granted April 3, 1835
 - "...What I claim is the improvement is the addition of another similar set or series of bracing of similar kind and dimensions, to be placed in a similar manner, either directly opposite to the former; or in any manner so as to bring the second tier not opposite of the former; but so that all the intersection of the braces of the latter series shall fall between those of the former braces on the horizontal string pieces; after which, another string piece is to be formed similar to the others at the top and bottom..."



Town's Papers

- “A Description of Ithiel Town’s Improvement in the Principle, Construction and Practical Execution of Bridges, Roads, Railroads, and Aquaducts Whether Built Entirely of Wood, or of Cast or Wrought Iron” – 1839.
 - “..and to be far more secure against its trusses twisting, leaning sideways, or curving in the direction of their length.”¹⁵



Town Lattice Distribution

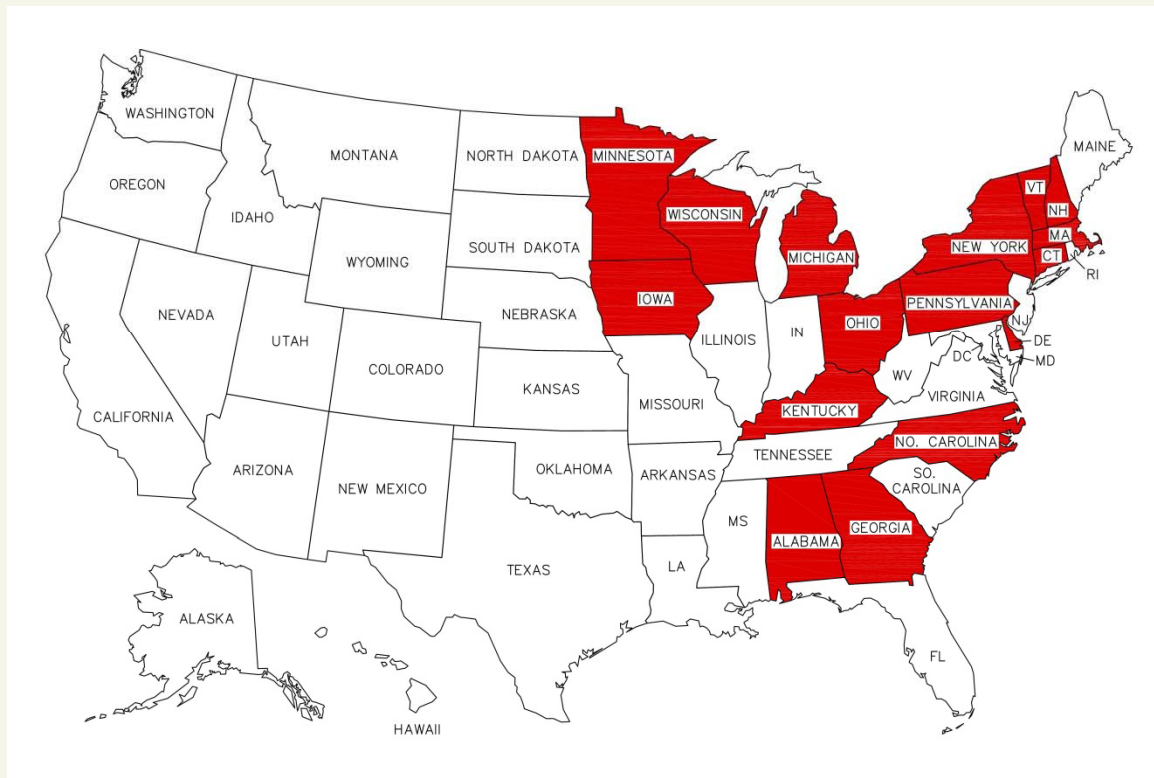
- 143 Extant Town Lattice Covered Bridges in the US
- 81 In Quebec Canada (69 Town Variants)

State	No.		State	No.
AL	5		MN	1
CT	2		NH	20
DE	2		NY	13
GA	11		NC	1
IA	7		OH	13
KY	1		PA	19
MA	5		VT	42
MI	1		WI	3



Town Lattice Distribution

- 143 Extant Town Lattice Covered Bridges in the US



Base Map Source

<http://forums.augi.com/showthread.php?58157-Anyone-have-a-decent-USA-map-in-DWG-format>

Hoyle, Tanner
& Associates, Inc.



Variations

- Town Truss Variations
 - Single Upper Chord
 - Square Lattice Members
 - Triple Lattice
 - Quad Lattice
 - Quebec Variations
 - Splayed Lattice
 - Railroad Bridges



Variations

- Town Bridge Variations
 - Built-In or Added Arches
 - Metal Splice Clamps
 - Outriggers
 - Sidewalks
 - Roof Framing



Truss Variations

Single Upper Chord



Beaverkill Covered Bridge (Built 1865) – Rockland, NY

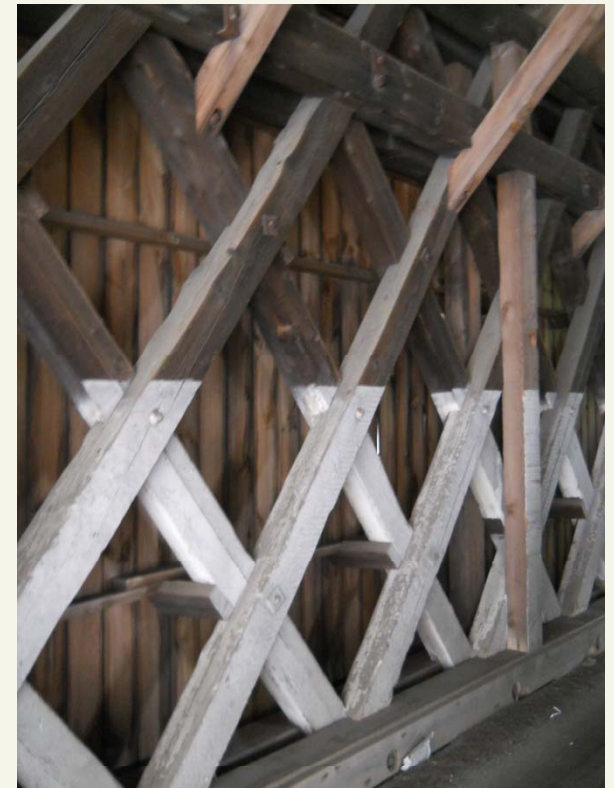


Truss Variations

Square Lattice Members



Cornish-Windsor Covered Bridge (Built 1866) – NH/VT





Truss Variations

Square Lattice Members



Cornish-Windsor Covered Bridge (Built 1866) – NH/VT



Truss Variations

Square Lattice Members



Orford-Fairlee Covered Bridge (1856-1936) – Photo Courtesy George Pease Collection, NSPCB



Truss Variations

Triple Lattice

- Rare Variant - Three Layers of Lattice
- Unbroken Pattern of Lattice from End to End



*Cowlesville Bridge over Cayuga Creek, Wyoming County, New York (32-61-01)
Built 1874, Lost to Arson 1966 – NSPCB Archives Richard Allen Collection*



Truss Variations

Triple Lattice



Cousineau Bridge over Brandy Creek at Valcourt (Built 1888) (61-66-02)
Photo Courtesy Jack Schmidt – 6-30-11



Hoyle, Tanner
& Associates, Inc.



Truss Variations

Quad Lattice



Zumbrota Covered Bridge (Built 1869) – MN

Photo Courtesy: <http://www.alpsroads.net/roads/mn/zumbrota/>



Truss Variations

Quebec Variations

- Quebec Colonization Bridges
- 'Standard Design' Used Until the 1950's
- No Connections Between Lattice, Verticals Added at Crossbeams
- Lost Cousin in VA?



Truss Variations

Quebec Variations



*Pont Balthazar, Farnham Quebec (Built 1932) – 11/12/2007
Photo Courtesy William Caswell, Jr.*



Truss Variations

Quebec Variations



*Hureault, Quebec (Built 1955, Lost 1983) – Photo from 1973
Photo Courtesy Richard Roy*



Truss Variations

Quebec Variations



Wakefield, Quebec (Built 1998) – 11/8/2007

Photo Courtesy William Caswell, Jr.

<http://www.360cities.net/image/interior-bridge-wakefield-quebec#16.88,-0.33,100.0>

Hoyle, Tanner
& Associates, Inc.



Truss Variations

Quebec Variations



Trent's Mills Bridge (Dates Unknown) – Buckingham County, VA
Photo Courtesy William Caswell, Jr.



Truss Variations

Splayed End Lattice

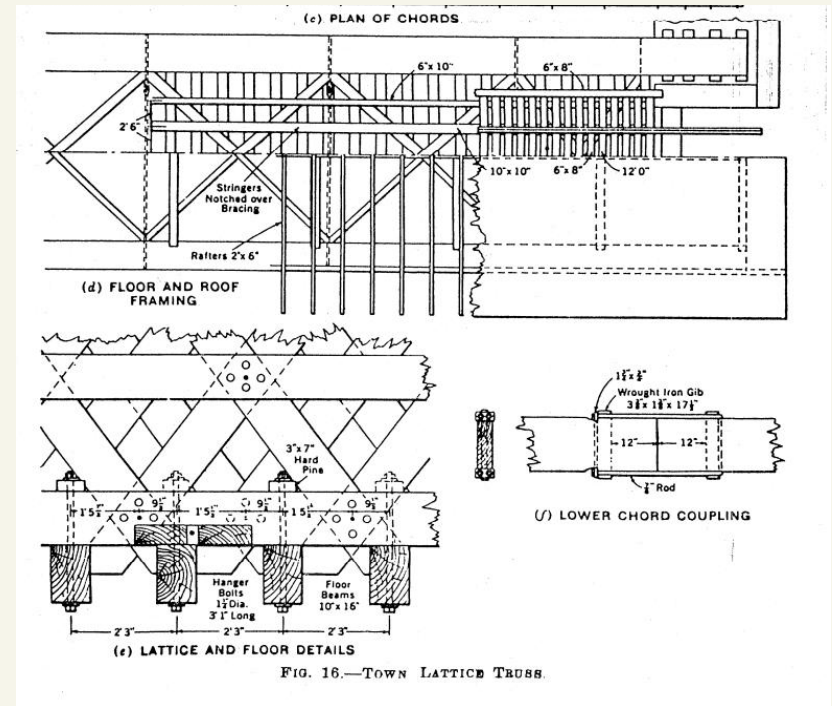
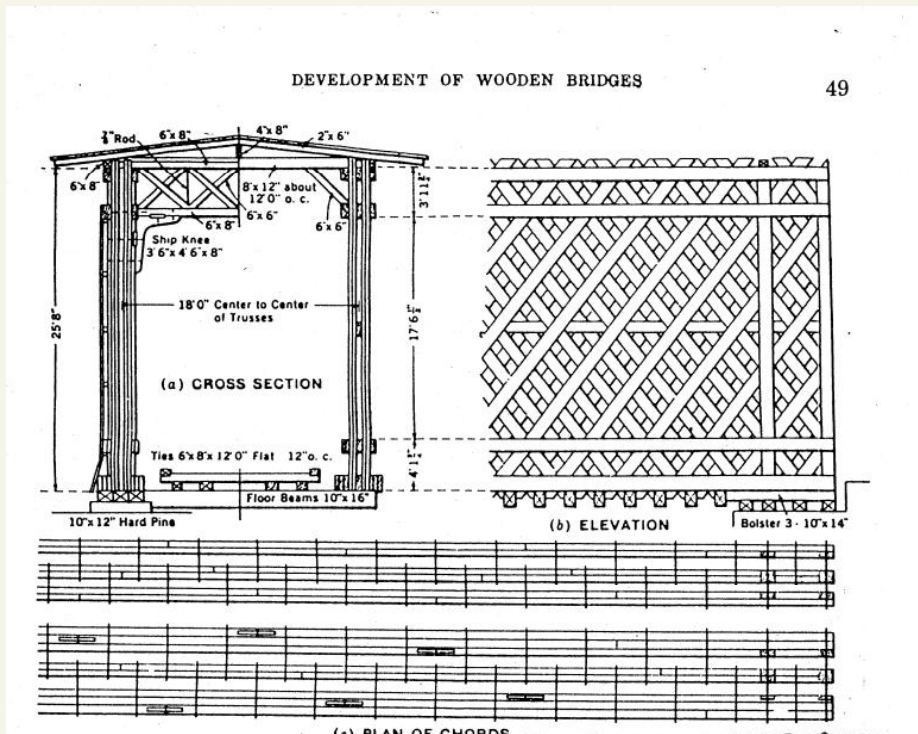


Beaverkill Covered Bridge (Built 1865) – Rockland, NY



Truss Variations

Railroad Bridges



Ref: "A History of the Development of Wooden Bridges" - 1932



Truss Variations

Railroad Bridges

- Fisher Bridge – Wolcott, VT
- Built in 1908 - Unique Full-Length Cupola





Truss Variations

Railroad Bridges



Fisher Covered Bridge (Built 1908) – Wolcott, VT



Truss Variations

Railroad Bridges



Pier Covered Bridge (Built 1907) - Newport, NH



Truss Variations

Railroad Bridges



Pier Covered Bridge (Built 1907) - Newport, NH
Photo Courtesy William Caswell, Jr.



Bridge Variations

Built-In or Added Arches



Haverhill-Bath, NH Covered Bridge (Built 1827-1829)

Oldest Remaining
Town Lattice Truss
(Built 1827-1829)

Hoyle, Tanner
& Associates, Inc.



Bridge Variations

Built-In or Added Arches



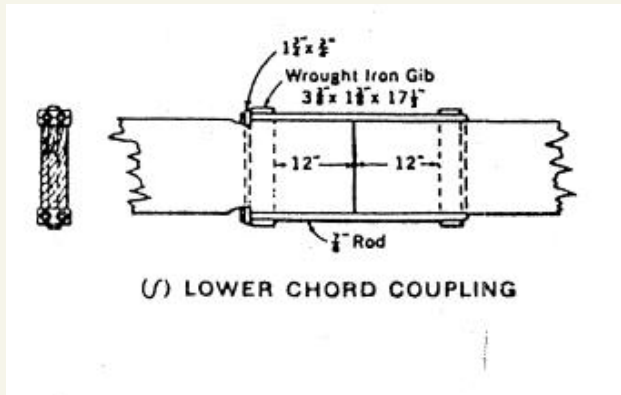
Wright's Bridge (Built 1906) – Newport, NH



Bridge Variations

Metal Splice Clamps

- Fisher Bridge – Wolcott, VT



Ref: "A History of the Development of Wooden Bridges" - 1932



Fisher Bridge (Built 1908) – Wolcott, VT



Bridge Variations

Outriggers



Beaverkill Covered Bridge (Built 1865) – Rockland, NY



Bridge Variations

Outriggers



Scott Covered Bridge (Built 1870) – Townshend, VT



Bridge Variations

Outriggers



Cresson Covered Bridge (Built in 1859) – Swanzey, NH





Bridge Variations

Sidewalks



Haverhill-Bath, NH Covered Bridge (Built 1827-1829)





Bridge Variations

Sidewalks



Ashuelot Covered Bridge (Built 1864) – Winchester, NH





Bridge Variations

Sidewalks



Thompson Covered Bridge (Built 1832) – Swanzey, NH

Hoyle, Tanner
& Associates, Inc.



Bridge Variations

Roof Framing



Longley Covered Bridge (Built 1863) – Montgomery, VT



Bridge Variations

Roof Framing



*Cousineau Bridge over Brandy Creek at Valcourt (Built 1888) (61-66-02)
Photo © Dale Travis – Photo by Jack & June Schmidt – 6-30-11*



Summary

- Ithiel Town (1784-1844)
 - 2 Patents, Multiple Papers
 - Improvements Made to Design
- Popular Truss Type, Economical to Construct
- Some Designs Can be Subject to Rack and Sweep
- 143 Town Lattice Covered Bridges in U.S. – 81 Quebec
 - Only Eight West of the Mississippi River
- Multiple Variations to Truss and Bridge



References

1. American Wooden Bridges. American Society of Civil Engineers, N.Y., NY. 1976
2. Conwill, Joseph D. "Bath-Haverhill Covered Bridge at Woodsville, NH". National Society for the Preservation of Covered Bridges. Topics. Spring 2010. Pages 6-11.
3. Conwill, Joseph D. "Railroading with Henry A. Gibson, Photographer". National Society for the Preservation of Covered Bridges. Topics. Winter 2006. Pages 1-3.
4. Conwill, Joseph D. "Tension Stresses in Town Lattice Bottom Chord". National Society for the Preservation of Covered Bridges. Topics. Summer 2011. Pages 11-12.
5. Conwill, Joseph D. "The Great Ithiel Town Patent Mystery". National Society for the Preservation of Covered Bridges. Topics. Summer 2007. Pages 3.
6. Conwill, Joseph D. "The Squared-Timber Lattice Truss". National Society for the Preservation of Covered Bridges. Topics. Spring 2011. Pages 13-16.
7. Conwill, Joseph D. "The Triple-Plank Lattice Truss". National Society for the Preservation of Covered Bridges. Topics. Fall 2011. Pages 5-6.
8. Lawrence, Mildred "Virginia's Covered Bridges". National Society for the Preservation of Covered Bridges. Topics. Fall 2007. Pages 4-11.



References

9. Sanders, John L. "Town, Ithiel (1784-1844)". North Carolina Architects & Builders A Biographical Dictionary. Web. April 6, 2013. <http://ncarchitects.lib.ncsu.edu/people/P000032>
10. "Ithiel Town, Architect of Trinity Church. Trinity Episcopal Church. Web. April 6, 2013. <http://www.trinitynewhaven.org/Home/History/IthielTown/tabid/119/Default.aspx>
11. Town, Ithiel. 1820 Letter Patent
12. Town Ithiel. "A Description of Ithiel Town's Improvement in the Construction of Wood and Iron Bridges Intended as a General System of Bridge-Building". American Journal of Science. Printed by S. Converse. New Haven, CT, 1821.
13. Town, Ithiel. "Some Account and Description of Ithiel Town's Improvement in the Construction and Practical Execution of Bridges, Aqueducts and Rail Road Bridges, Whether Built Entirely of Wood, or of Cast or Wrought Iron". New York, 1831,
14. Town, Ithiel. 1835 Letter Patent.
15. Town, Ithiel. "A Description of Ithiel Town's Improvement in the Principle, Construction, and Practical Executions of Bridges, Roads, Railroads, and Aqueducts, Whether Built Entirely of Wood, or of Cast or Wrought Iron.". Hitchcock, Stafford, Printers, New Haven, 1839