You Can't Judge a Bridge by its Cover

Covers May Mislead and They Keep What's Important under Wraps

by
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The Misleading

Dates for construction and sometimes the names of builders are frequently painted over the entrances of covered bridges across Indiana. In keeping with this practice, "1860" is currently inscribed on the portal of the Ceylon covered bridge in Adams county and replicated on a mural depicting it. George Gould, the dean of Hoosier covered bridge study, reported that "1862" was painted on Ceylon's portal in 1977, although, he observed, "some" dated construction at 1860. Gould had briefly consulted the county commissioners' records to locate construction information and failed to nail down a date. On its covered bridge website, Indiana's state Historical Bureau continues to use 1862 as the date for Ceylon's construction, even though county painters have moved away from it.[1]

As a part of a citizen campaign to get the Ceylon bridge restored, "Geneva Proud" has nominated the structure to the National Register of Historic Places. That process required – for the first time – a documented answer to the bridge's construction date. The ensuing tail-to-the-seat research ultimately and unexpectedly required four days of reading in the county records. To include any preliminary preparations for construction around 1860, my records-reading started with 1857. For the whole next decade, the county commissioners responded to a goodly number of petitions from township trustees and donated a couple hundred tax dollars each to the construction or repair of many relatively inexpensive bridges across Adams county. The trustees, in turn, supervised design and contracted with some local personage for construction or repair. None of these projects was large or complicated enough to involve a roofed and sided, long-span, timber-truss structure – what we typically refer to as a "covered bridge."

The first inkling of a new style of bridge came in 1868 when a trustee petitioned for $4,000, not just for a few hundred dollars, to replace a timber bridge over the Wabash at Buena Vista (now Linn Grove). For the first time, the commissioners called for the construction of "a covered bridge...with two stone abutments and [to] cross the river with one span." Considering the construction of a "Smith Plan or Patent truss bridge," two board members travelled to Miami county,

Ohio, to examine some of these new-fangled structures. On the members' return to Indiana, the board itself took charge of construction of the new bridge over the Wabash River at Buena Vista/Linn Grove and committed to contracts totaling $5,873.[2]

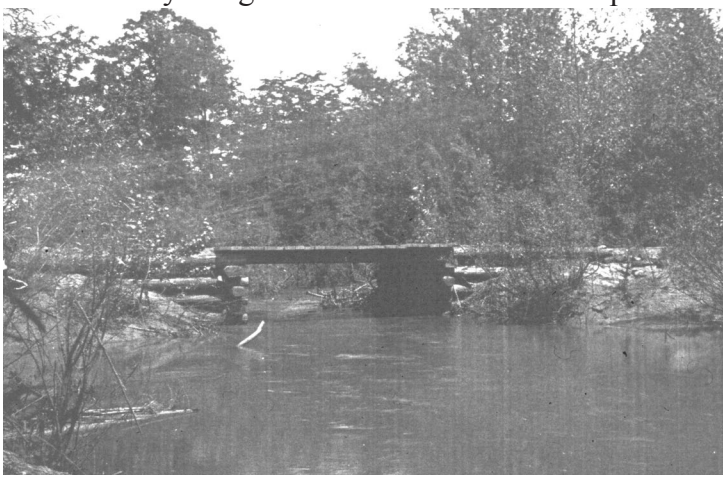
In the next decade the Adams county commissioners let four more long-span covered structures *before* they got around to building the Ceylon bridge in 1879. By this time, the county board had generally shifted its preference from serviceable all-timber Smith trusses to a combination timber and iron design. The Smith Bridge Company of Toledo, Ohio, presented the commissioners with "the best and lowest bid" for a Howe-truss superstructure at Ceylon for $1,722.50. M. J. Huffman received the county's nod for the stone masonry abutments at $1,525.40.[3]

We will have a look a little later at some of the important matters that tend to be hidden under a bridge's covers. Right now, however, let's remain focused on the date painted on Ceylon's portals – "1860" instead of "1879."

Some Low-Down Learning from the Misleading

Having done a little research, we are now a bit smarter and maybe even tempted to become a little smart-alicky by wagging a finger or two at the sign painter and the folk who advised him – those who together got the Ceylon bridge construction date wrong. Before turning the page, however, let's see if there is anything we can learn from the inaccurate cover. Where, after all, did "1860" come from? The fault, dear fellow sleuth, may lie in confusing the previous structural crossing of the Wabash River at this or near-adjacent site with the current one.

We know, as said earlier, there were lots of simple bridges inexpensively built, repaired, and rebuilt in Adams county by local craftsmen before the first long-span covered structure was erected in 1868 by a professional out-of-county designer and contractor. Where practicable, the county commissioners and township trustees had regularly constructed timber-beam spans atop timber bents. When the stream was especially wide and deep, the current swift, or the streambed difficult to anchor into, the authorities might try to limit the number of timber bents needed for a given structure by crossing at least the center parts of the stream with longer timber or combination timber and iron low-truss spans.



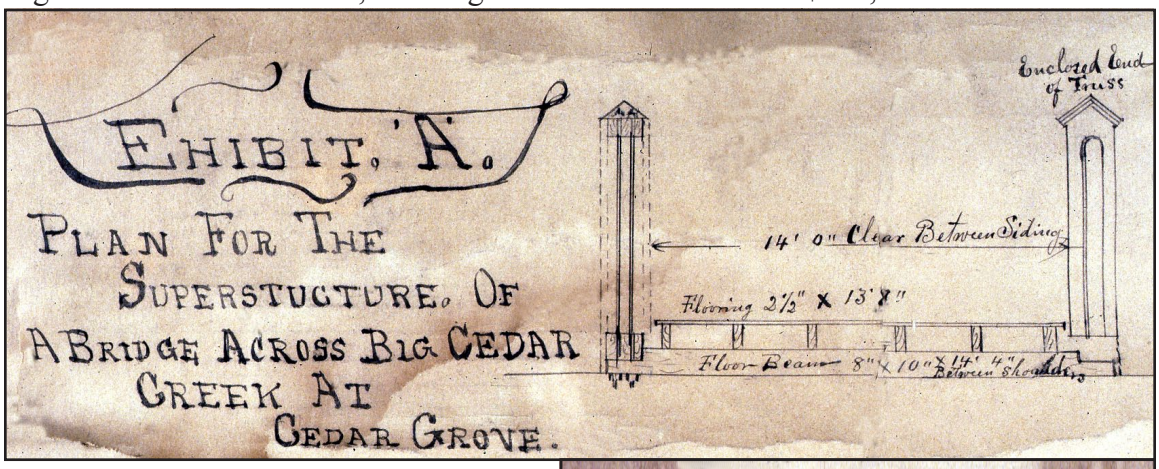
Tinber beams on timber abutments.
(Unidentified date and location in Posey county.)

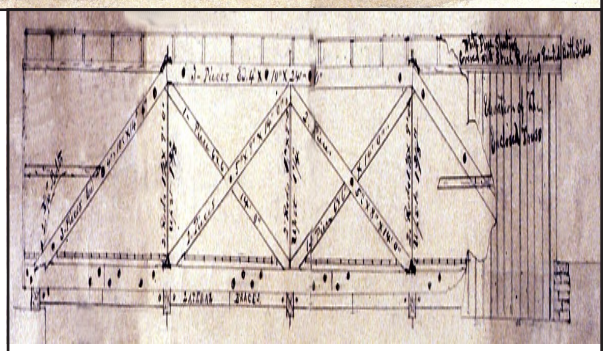
Besides the fairly rapid decay of untreated timber, flood waters both often undermined timber piles and increased the water pressure on low-set timber superstructures by heaping floating debris around them. Together, these factors rendered timber beam and low-truss spans as decidedly impermanent. Their life-cycle was on average from ten to twenty years. On the other side of the local balance sheet, such bridges were simple to design and relatively inexpensive to build, repair, and replace. Their construction made especially good sense to local authorities where timber and carpenters were plentiful and population too sparse to provide for more than a quite limited tax base. This was the world of many hundreds of timber bridges built across Indiana up to 1900, not that of the more occasional, long-span timber mansions raised above the torrents on high cut-stone abutments that are so revered today.

In 1859 – fourteen years before the town of Ceylon was even platted – P. N. Collins, the Wabash township trustee, petitioned the county for help to build a bridge across the Wabash near the lands of Cornelius Baker. The Bakers had a "settlement" just north of the Carrington ford on the old Godfrey trace close to where the Ceylon covered bridge sits. The commissioners agreed to Collins' request in March 1860 and appointed Dr.

B. B. Snow, who lived across the river and south of the Bakers, to estimate the cost of construction. In June, Collins rather than Snow presented the board with a proposal for a river bridge and three separate smaller ones on the levee north of the river – all for the grand sum of $725. The careful commissioners appropriated $700 and named Dr. Snow as superintendent of construction. Snow was ordered to draft plans and specifications for the bridges, to give a six-week notice for letting, and to receive sealed proposals.[4] In 1860, then, the county and township built the Baker bridge across the Wabash near where the Ceylon span sits.

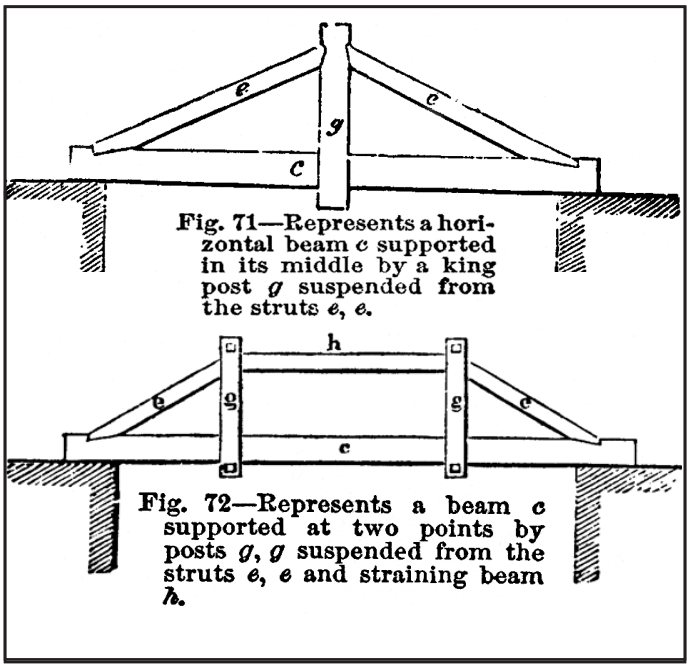
The so-called Baker bridge was "weather-boarded," although as one of four built for $700, the new river structure couldn't have been too elaborate. The report of weather-boarding tells us two things at once: First, the Baker bridge did not have timber trusses high enough to be braced across their tops and roofed while leaving enough room for vehicles to travel through them. Hence it was not a "covered" bridge. Second, it consisted – at least in part – of a timber or timber and iron low-truss span or two which could be somewhat protectively sided against decay with weather-boarding.[5]





Weather-boarded 9-foot high (Howe) trusses. John Burkhart plan (1899) Franklin county.

We may never know exactly what form of low truss or trusses were behind Baker's weather-boarding. But we do know the basic truss patterns typically used in this once-common but now vanished world of timber spans. In the late 16th and early 17th centuries, Andrea Palladio, Vincenzo Scamozzi and Faustus Verantius presented drawings and descriptions of some of the earliest known timber-truss patterns without naming them. Although these early patterns were most commonly used to support roofs, German and Swiss carpenters appear to have been most active in extending these patterns to timber-truss bridge design and construction in Early Modern Europe.[6]

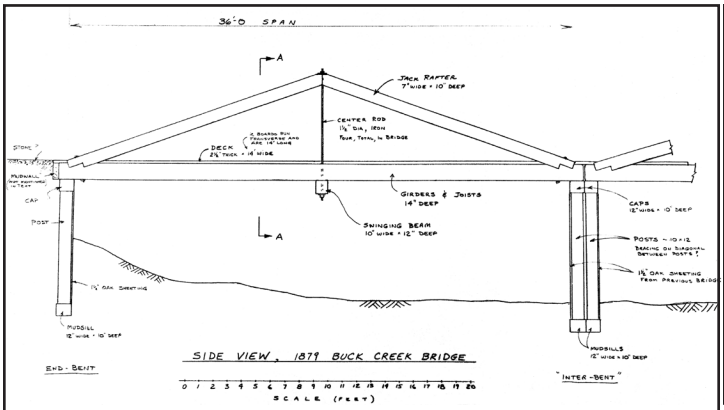


Some of the truss patterns that European architects of the Renaissance described show up in the earliest American textbook on civil engineering,[7] and in somewhat modified forms in old photographs, surviving plans and drawings, and specifications written out in Hoosier county records. They typically included – from the simplest to the more complex forms, and from the shortest to the longest spans – what have become labeled as king-posts, queen-posts, multiple king-posts, and multiple queen-posts, any one of which reasonably skilled local carpenters and blacksmiths could fabricate and erect.

Figs. 71 (king-post) and 72 (queen-post) from D. H. Mahan, *Civil Engineering* (1858), 177.

The labels for these patterns are a bit anachronistic when used to describe the typical low-truss bridge. Both the king and queen forms were used in the layouts shown and in the inverted positions. American designers often added diagonal members to the webs of the classical patterns. On occasion a carpenter or railroad engineer designed an even more exotic variation or truss form for construction.

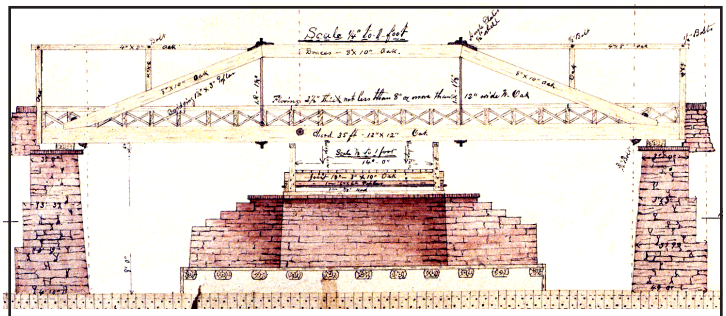
King-post truss spans in timber seldom extended over 30 feet. They were, in time, also built in iron or steel.



Drawing from written specifications for king-posts in Marion county. -- courtesy of James A. Barker, P.E.

Wrought-iron king-post approach span of Briscoe Bridge (#271), Warrick county.

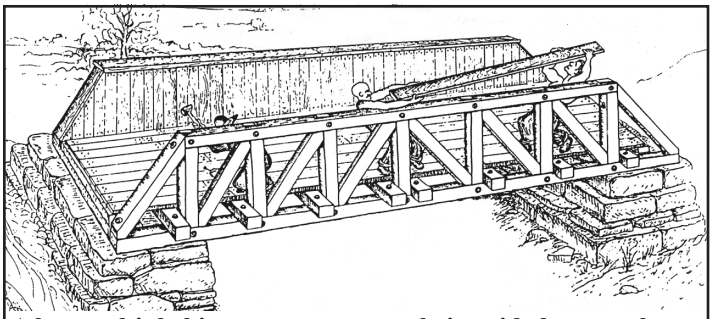
Queen-posts transformed the king-post pattern into a somewhat longer span – in timber, up to 60 feet. Like the kings, queen-posts were fabricated in iron and steel. The last examples to survive in Indiana were all in metal.



Low queen-post span with end frames to support weather-boarding. John Burkhart 1889 plan, Franklin county.

The low, steel queen-post trusses of Jefferson #144 were fabricated and erected in 1914, relocated in 1937, and demolished in 1909.

Either the king or queen form could be extended by adding panels. Hoosier designer-builders multiplied the king's pair of right triangles to support spans as long as 88 feet. The two surviving multiple king-post structures in Indiana do not have the low trusses that would have been found under the Baker bridge's weather-boarding. They are, instead, high enough to be covered with a roof as well as siding.



A low multiple king-post truss span being sided or weather-boarded.

When washed down Mud Creek, Homer's multiple king-post trusses were rescued for reuse as a barn.

The Important Stuff under Wraps

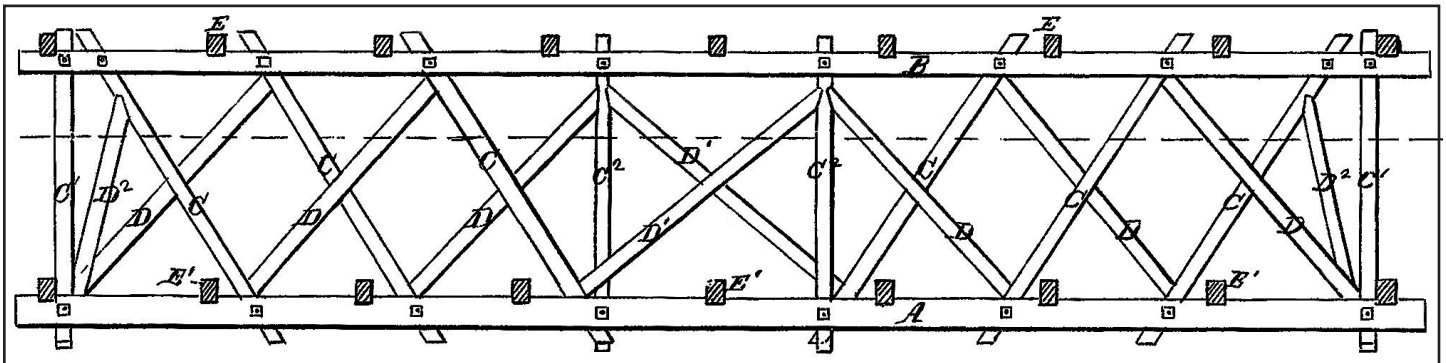
Although there are at least seven different truss patterns under wraps in Indiana, it's not clear how much the average covered bridge visitor recognizes one from another. The great genius in these structures is found not in their siding or roofing, but in how structural work is done to support the superstructure and carry loads across the span. Let us not come away from a bridge festival having seen – beyond the food stalls and flea market tables – only lath and shingles.

The Pioneer Engineers Club is in process of restoring and relocating Homer's multiple king-post trusses to Caldwell Pioneer Acres in Rush County.
-- 2009 photo courtesy of Anthony Dillon.

If the Buena Vista (Linn Grove) bridge were still around for us to examine and we took a cursory look under the covers at its Smith trusses, we'd undoubtedly see an essentially all-timber structure which relied on iron only for bolting some of the timber members to each other.[8] With free rein to nostalgia, one might imagine some hearty farmer-carpenters hewing bridge timbers out of old-growth trees along the river bank and assembling them into a bridge with local talent, much as a barn might have been raised in the neighborhood. Such visions would have been accurate enough for the construction of many of the low-down structures like the Baker bridge, but they are hardly valid reports of the grand, next generation of high structures that Buena Vista and Ceylon represented. These magnificent covered bridges are products of the American industrial age.

Buena Vista's timbers would not have shown signs of hewing. They would have been planed. They would not have come from local forests. Pine was shipped to Robert Smith from either the occupied southern states or the upper peninsula of Michigan. The trusses would have been prefabricated in Ohio into standard-sized members for the length and loading of a Smith-design span, erected in the factory's yard to see that everything fit properly, match-marked, and then dismantled for shipping by rail to the site where, in this case, a Fort Wayne contractor – Wheelock, McKay, and Underhill – quickly erected the span on the already-prepared stone substructure.

Robert Smith was a man on the move. His truss patterns were evolving and the locale of Smith's operations shifting in these years. Smith started his bridge-building in Miami county, Ohio, and, in 1869, moved his operations to a newly-built factory in Toledo where he perfected his special skill at organizing a system of prefabrication.[9] Smith was also talented at design. He received his first patent for a truss type in 1867 and his second in 1869.[10] But like a lot of inventors, Smith kept improving on his models beyond what showed up in

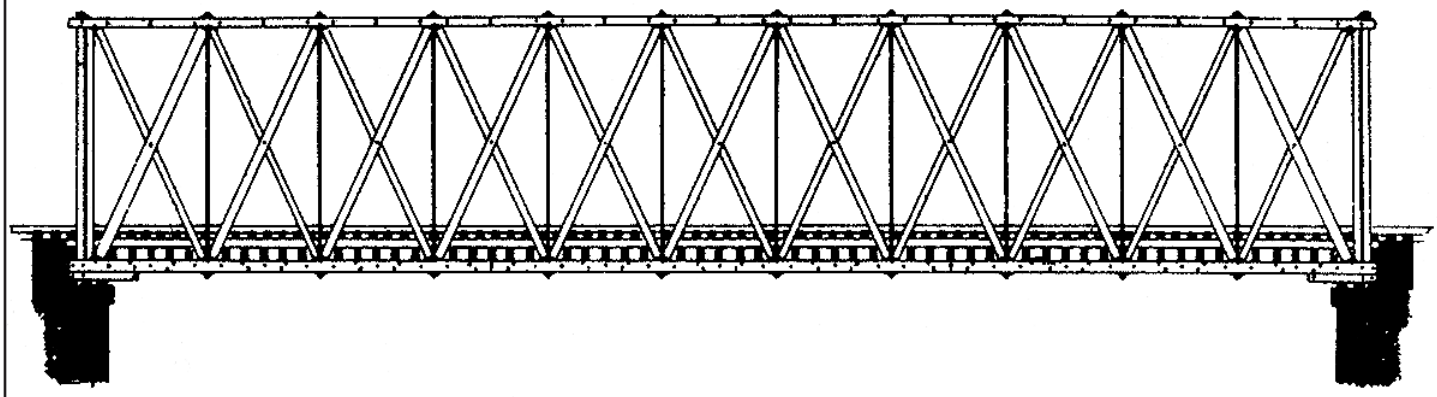


Smith's 1867 patent drawing. The viewer can peak at this design through the opening between the top of the siding and the roofing shown on the post-card view of "The Old Bridge" at Linn Grove (Buena Vista) placed at the beginning of this essay.

patents, especially in ways that facilitated prefabrication and that conserved increasingly scarce and therefore ever more expensive timber.[11]

The Ceylon bridge followed a quite different pattern and represented an important advance in bridge-design and technology. As the industrial age unfolded, there was a pronounced shift from timber to iron, and the Adams county board of commissioners explored some of the latest trends. The editor of the *Decatur Democrat* reported in 1876 that the board had "been inspecting iron bridges in surrounding counties with a view to putting up more permanent bridges hereafter in this county, believing it to be better for the county in the long run."[12]

Not ready, however, to rush headlong into the very latest, the Adams county board moved *to*, but not *through*, the gateway into the era of iron bridges. After their out-of-county inspection of iron bridges, the commissioners settled on the combination timber and iron Howe-truss pattern for their next three major bridges, including Ceylon. When, in July 1877, the commissioners contracted with Smith Bridge for the superstructure of the



None of William Howe's patents quite duplicate the pattern conventionally used in Adams county and across the nation as Howe trusses.

Monroe Street (Decatur) bridge, they selected the company's "Howe Truss No. 2 Plan of Bridge" for the design. In September, at the suggestion of the Preble township trustee, the board specified that it wanted "a Howe truss covered bridge" at Scheiman's.[13]

The Ceylon's Bridge's high Howe trusses.

The Howe represented a culminating break-through in bridge design. In the judgment of J. G. James, "the Howe truss... was the crowning glory of the wooden bridge era, generally accepted as the best ever, and the subject of perhaps the most profitable bridge patent ever granted." "...Only the all-iron truss forms halted its total dominance."[14] William Howe addressed and solved a major problem with timber trusses: continuing rigidity.[15] As a system of interconnected rigid triangles, trusses by definition need to keep their members in tight contact with one another. As timber dries, it tends to shrink; as wood works under stress, it may deform or creep; as it is subjected to moisture, timber rots away, especially at the ends of members. Howe substituted threaded wrought-iron vertical rods for the more usual timber posts. These rods could secure general rigidity by pulling the members of the truss web snugly against each other and to the chords through cast-iron bearing-blocks. The rods could also be re-tightened over time as timber members aged. By simplifying truss tuning to the tightening and loosening of nuts on metal rods, Howe's system facilitated prefabrication and reduced the need for a lot of skilled carpentry at erection, advantages Robert Smith, for one, knew how to exploit.

As is the case with covered bridges generally, there's a lot to discern from under Ceylon's wraps.

Notes

1. George E. Gould, *Indiana Covered Bridges Thru the Years* (Indianapolis, 1977), 27-28, 48; George E. Gould, "Adams County Revisited," Indiana Covered Bridge Society *Newsletter*, July 1975: 1-2. The documentary source for the Indiana Historical Bureau's construction date of 1862 is not cited in the Bureau's 1998 publication, "Covered Bridges in Indiana," *Indiana History Bulletin*, 69, #1.

2. Adams County, "Commissioners Record," E: 115, 121, 134-137, 180, 247.

3. Adams County, "Commissioners Record," H: 409, 415, 426, 479, 524.

4. Alan S. Baumgartner, ed., *Geneva and Area Centennial, 1872-1972*, 25; Wabash township in "Adams County Tax Records" (Adams County Archives, Decatur), 1850, 1855, 1860, 1865; Adams County, "Commissioners Record," C: 407, 420-421, 451.

5. Adams County, "Commissioners Record," D: 134.

6. J. G. James, "The Evolution of Wooden Bridge Trusses to 1850," *Journal of the Institute of Wood Science* (London, U.K.), June and December 1982: 116-135, 168-193; Joseph Gies, *Bridges and Men* (New York, 1963), 100-105.

7. D. H. Mahan, *An Elementary Course of Civil Engineering, for the Use of Cadets of the United States Military Academy* (New York, 1858), 176-177.

8. Six Smith-truss structures can be found in Indiana: Spencerville (DeKalb county), Old Red and Wheeling (Gibson county), Vermont (Howard county), Cataract Falls (Owen county), and North Manchester (Wabash).

9. Matthew Reckard, "Smith Trusses: Bringing Covered Bridges into the Industrial Age," (J. A. Barker Engineering, Bloomington, Indiana), currently available electronically at "Covered Bridge Restoration–Best Practices."

10. Robert W. Smith, "Improvement in Bridges," U. S. Patent #66,900 (July 1867); "Improved Bridge," U. S. Patent #97,714 (December 1869).

11. Raymond E. Wilson classified Smith's trusses into four different types. See Wilson, "The Smith Patented Truss," Indiana Covered Bridge Society *Newsletter*, April 1966: 1, 3-4; "The Story of the Smith Truss," National Society for the Preservation of Covered Bridges, Inc., *Covered Bridge Topics*, April 1967: 3-5; "More on Smith Trusses," ICBS *Newsletter*, January 1972: 2.

12. *Decatur Daily Democrat*, 27 July 1876: p3 c2.

13. For the Monroe Street and Scheiman bridges, see Adams County, "Commissioners Record," G: 547, 555-568; H: 26-28, 46, 49, 59-61, 139, 237, 260, 311, 337.

14. James, "Wooden Bridge Trusses," *JIWS*, December 1982: 178; Francesca da Porto, "Pine Bluff Bridge," HAER No. IN-103 (National Covered Bridges Recording Project, 2002); Francis E. Griggs, Jr., "It's a Pratt! It's a Howe! It's a Long! No, It's a Whipple Truss," *Civil Engineering Practice*, Spring/summer 1995: 73-75; Jeff Shroyer, "Howe Trusses in Indiana," Indiana Covered Bridge Society *Newsletter*, October 1980: 1-3.

15. William C. Howe, "Truss-Frame for Bridges," U. S. Patent #1,685 (July 1840); "Manner of Constructing the Truss-Frames of Bridges and Other Structures," U. S. Patent #1,711 (August 1840); "Truss-Bridge," U. S. Patent #4,726 (August 1846).

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