NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

MAR 14

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in How to Complete the National Register of Historic Places Registration Form (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name **Cataract Covered Bridge**

other names/site number 119-101-10014

2. Location

street & number junction of CR 235W and CR1000N over Mill Creek in Leiber State Recreation Area N/A ☐ not for publication

city or town Cataract ☒ vicinity

state Indiana code IN county Owen code 119 zip code 46120

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this ☒ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36CFR Part 60. In my opinion, the property ☒ meets ☐ does not meet the National Register criteria. I recommend that this property be considered significant ☐ nationally ☒ statewide ☐ locally. (☐ See continuation sheet for additional comments.)

J. C. S. 2.3.05

Signature of certifying official/Title Date

Indiana Department of Natural Resources

State or Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is:

☒ entered in the National Register.
☐ See continuation sheet.

☐ determined eligible for the National Register
☐ See continuation sheet.

☐ determined not eligible for the National Register

☐ removed from the National Register

☐ other, (explain:) _____

for Edson H. Beall — Signature of the Keeper — Date of Action 4/27/05

5. Classification

Ownership of Property
(Check as many boxes as apply)

- ☐ private
- ☐ public-local
- ☒ public-State
- ☐ public-Federal

Category of Property
(Check only one box)

- ☐ building
- ☐ district
- ☐ site
- ☒ structure
- ☐ object
- ☐ landscape

Number of Resources within Property
(Do not include previously listed resources in the count)

Contributing	Noncontributing	
0	0	buildings
0	0	sites
1	0	structures
0	0	objects
1	0	Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register

0

6. Function or Use

Historic Functions
(Enter categories from instructions)

TRANSPORTATION: Road-Related

Current Functions
(Enter categories from instructions)

TRANSPORTATION: Pedestrian-Related
RECREATION/CULTURE: Outdoor Recreation

7. Description

Architectural Classification
(Enter categories from instructions)

OTHER: Smith Truss Bridge

Materials
(Enter categories from instructions)

foundation: STONE: Limestone
walls: WOOD: Weatherboard
roof: WOOD: Shake
other:

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

Cataract Covered Bridge | Owen | IN

Name of Property | County and State

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- [x] **A** Property is associated with events that have made a significant contriibution to the broad patterns of our history.
- [ ] **B** Property is associated with the lives of persons significant in our past.
- [x] **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [ ] **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)
Property is:

- [ ] **A** owned by a religious institution or used for religious purposes.
- [ ] **B** removed from its original location.
- [ ] **C** a birthplace or grave.
- [ ] **D** a cemetery.
- [ ] **E** a reconstructed building, object, or structure.
- [ ] **F** a commemorative property.
- [ ] **G** less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions)
ENGINEERING
TRANSPORTATION

Period of Significance
1876

Significant Dates
1876

Significant Person
(Complete if Criterion B is marked above)
N/A

Cultural Affiliation
N/A

Architect/Builder
Smith Bridge Company
Baragan, William

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographic References

Bibliography
(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

- [ ] preliminary determination of individual listing (36 CFR 67) has been requested
- [ ] previously listed in the National Register
- [ ] previously determined eligible by the National Register
- [ ] designated a National Historic Landmark
- [ ] recorded by Historic American Buildings Survey # _____
- [x] recorded by Historic American Engineering Record # IN-104

Primary location of additional data:

- [x] State Historic Preservation Office
- [ ] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [ ] Other

Name of repository:

10. Geographical Data

Acreage of Property Less than 1 acre

UTM References (Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing
1	16	516060	4364680
2			
3			
4			

☐ See continuation sheet

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title Charles Cantwell; Christopher Baas; Matt Reckard, and Mark Brown

organization Quincy High School Foundation; IDNR; Barker Engineering date 10-07-2001

street & number 402 W. Washington, Rm W299 telephone 317/ 232-4157

city or town Indianapolis state IN zip code 46204

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white** photographs of the property.

Additional items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO.)

name Indiana Department of Natural Resources, Division of State Parks and Reservoirs

street & number 402 W. Washington, Rm. W298 telephone 317/ 232-4124

city or town Indianapolis state IN zip code 46204

Cataract Covered Bridge, Owen County, Indiana

Narrative Description

The Cataract Covered Bridge is a Smith Truss type wooden bridge constructed in 1876. It spans Mill Creek in the Cataract Falls State Recreation Area, located in northern Owen County. The bridge is oriented east to west, and Mill Creek flows from south to north. It is adjacent to a modern concrete bridge that is part of County Road 1000N, and which replaced the covered bridge in 1988. The State Recreation Area lies to the bridge's north and west, and its immediate context includes a parking lot, grass covered picnic areas, and the creek. Cataract's Upper Falls are located approximately 200' to the north, and forested private property is located to the east.

The bridge abutments are 23' wide, 6' thick, and 129' apart. They are constructed of rusticated limestone blocks laid in a common bond, and the stones in the upper courses are roughly half the size of the stones in the lower courses. Random coursed dry-laid wing walls extend perpendicular from the abutments, and retain the road approaches. A stone mud wall is located where the approaches meet the abutments. The western approach is paved in asphalt.

The bridge spans 140' across Mill Creek about 10' above the creek's stone bottom. An additional 5' in length extends off both ends. It is approximately 21' tall to the roof's peak, 20' wide from roof eave to roof eave, and provides a single traffic lane of approximately 13.'

The white pine trusses are spaced approximately 15' apart and consist of alternating diagonals sandwiched between top and bottom chords, and bolted where they cross. The diagonals in tension are notched into each chord, and their tails extend beyond the lower chord. The diagonals in compression butt against the tension diagonals. The six diagonals at the center of the bridge are notched and have tails because they all can be in tension under certain loading conditions.

The chords consist of three parallel rows of timbers bolted together. Bottom chord timbers are spliced together with fish plates, and the top chords use butt joints. The chords terminate in a vertical end post, and an inclined timber brace runs from its base to near the top of the first tension diagonal.

The trusses are joined with upper and lower lateral bracing. For each set of bracing, one diagonal is adjacent (above or below) to the second, and they are bolted where they intersect. A cast iron fitting reinforces the attachment of the diagonals to the chords.

Cataract Covered Bridge, Owen County, Indiana

The bridge deck consists of floor joists that hang from the bottom chords and support three layers of wood planks. The bottom layer is attached to the floor joists and laid in a 45-degree angle. The second parallels the joists. The third creates two runners the length of the bridge where wheels typically track.

The bridge has a low-pitched, shake covered gable roof that extends approximately 5' past the truss ends, and has approximately 2' eaves. The bridge is enclosed in modern board-and-batten siding painted red. The downstream side has three windows that provide views of the falls. The portal openings have rounded upper corners, and horizontal wood trim that simulates a column, capital, and pediment.

Cataract Covered Bridge, Owen County, Indiana

Statement of Significance

The Cataract Covered Bridge is eligible for the National Register under Criteria A and C for its significance in the broad patterns of Indiana's transportation history and as an excellent example of the Smith bridge type. Built in 1876, it is the only surviving covered bridge in Owen County, and one of only six Smith trusses in Indiana.[1] This late 19th Century bridge type was patented by Robert W. Smith and built by his company. The Cataract Covered Bridge is generally regarded as being the country's best and most intact remaining example of this truss type.[2]

History[3]

As its name suggests, the community at Cataract, Indiana, has been intimately linked to the falls in Mill Creek, originally known as Eel River. Early settler Isaac Teal built a mill about 1820 near the lower falls. Theodore Jennings, for whom Jennings Township would be named, was apparently attracted to the beauty of the falls and their economic potential. In 1841, he purchased the ruins of Teal's mill, both falls, and surrounding land totaling 1000 acres. Before long Jennings constructed mills for flour, wool, barrels, and eventually lumber. In 1876, the same year the current bridge was built, the community that grew around these workshops reached a population of about 100 and was the principal settlement of Jennings Township.[4]

In 1876, a network of roads connected Cataract with neighboring communities. While the little village was not located on the direct route between Spencer and Greencastle, merchants and others could have made the trip between the Owen and Putnam county seats by way of Santa Fe (now Cuba) to the south and either Cloverdale or Needmore (now Cunot) and Putnamville to the north. Roads also connected Cataract to Bowling Green to the west (in Clay County) and, perhaps most importantly, to the Louisville and New Albany Railroad to the east at Quincy.[5]

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[1] The others are the 1872, 150' North Manchester Bridge across the Eel River in North Manchester, Wabash County; the 1875, 170' Old Red Bridge across Big Bayou Creek near Jimtown, Gibson County; the 1877, 164' Wheeling Bridge across the Patoka River near Oatsville, Gibson County; the 1873, 186' Coburn Bridge across St. Joseph River in Spencerville, Dekalb County; and the 1875, 102' Vermont Bridge, moved to Highland Park in Kokomo, Howard County.

[2] Communications with Jim Barker and Matt Reckard regarding covered bridge historian's opinion of the bridge, and the bridge being a likely candidate for HAER documentation.

[3] Source for historical text from Brown, Mark M. and Matt Reckard. *Cataract Bridge, Cataract, Indiana.* Report by J. A. Barker, Inc. for Indiana Department of Natural Resources, 2001, revised 2002.

[4] Owen County Historical and Genealogical Society, 58-59.

[5] Alfred T. Andreas, 1968.

Cataract Covered Bridge, Owen County, Indiana

A bridge was built just below the Upper Falls before 1875, and would have provided a critical link between the mills and shops at Cataract and the residents across the river in the northern and eastern sections of Jennings Township. It was swept away, along with more than a dozen other bridges in Owen County, by a flood that crested on August 2, 1875. Widespread damage across the county included the loss of much topsoil, most of the corn and wheat crops, and severed telegraph and railroad connections. While there was very little loss of life and only one reported incident of looting, the Owen County Journal estimated damages at a half-million dollars.[6]

The county commissioners began discussing replacing the lost bridges almost immediately. On August 19, they issued an order advertising for bids to repair nine bridges, including "one across Eel River, known as the Cataract bridge, in Jennings township." For reasons that are not clear, the commissioners did not keep to their advertised intent to accept bids for the Cataract Bridge on August 31, 1875. Instead, on September 9, they decided to seek bids for a new wooden bridge and specified that

> the style, plan and finish, are to be in all respects like the covered spans of the bridge over White River, at Gosport, and known as the "Smith Wooden Truss."[7]

Perhaps the commissioners had initially hoped to repair any remaining fabric of the Cataract bridge or to reuse the existing abutments. Surely, they were impressed that the Gosport bridge survived the flood. Whatever the case, in specifying the "Smith Wood Truss," the commissioners were in some respects going through the motions of competitive bidding as Smith trusses were typically prefabricated by the Smith Bridge Company in Toledo, Ohio. Under these circumstances, then, it is not surprising that on October 22, the commissioners awarded the contract

> to furnish all material, build and complete the superstructure of a "Smith's High Double Wood Truss" Bridge across the Eel River in Jennings Township[8]

to the Smith Bridge Company of Toledo, Ohio, at the cost of $14.35 per linear foot of bottom chord. A separate contract for the abutments was awarded to William Baragan.

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[6] *Owen County Journal* (Spencer, Indiana), August 5, 12, 1875.
[7] Ibid, August 21, 1875. A picture of the Gosport Bridge is on page 38 of Gould, 1977.
[8] Owen County, *Commissioners' Record* (Owen County Archives, Spencer, Indiana; hereinafter cited as *Record*) 10 (October 22, 1875), 141.

There seems to be no further record of the matter in the *Commissioners' Record* until payment for the abutments ($1678.84) and the bridge ($2009.00) on December 5 and 6, 1876. William H. Troth, who had been Owen County Auditor in 1875, received $30.00 to cover unspecified "services rendered in the construction of Cataract Bridge.[9] The new bridge at Cataract was constructed just above the upper falls near the water-powered mill complex established by Jennings. The cut stone abutments are about 23 feet wide and 6 feet thick.

Wingwalls were built perpendicular to them out of dry-laid rubble. There are 129 feet between abutments and the single lane bridge has about 10 feet of clearance over normal creek levels. Truss lower chords are 140 feet long; including roof extensions the entire structure is 150 feet long. The two trusses are 16' 6" tall overall; the entire structure to the peak of the roof is about 21 feet tall. There are 13 feet 8 inches clear between the inner faces of the two trusses' chords; total structure width between roof eaves is just less than 20 feet.

Little is known about the post-construction history of the bridge. A 1939 photo shows the bridge with an aged metal roof, the presence of wheelguards, and signs over both portals that read "$1 FINE FOR RIDING OVER BRIDGE ANY FASTER THAN A WALK."[10] At some point the truss members were whitwashed. The present board siding, roof shingles, and the top layer of board decking were installed in 1995. Each may have been replaced several times before in the bridge's 125-year history. Vandals cut the first window in the north wall in 1980 to remove artwork painted on it in 1977. The present windows are the result of the 1995 repairs. A new concrete bridge replaced the Cataract Bridge in 1988.[11] Shortly thereafter, its ownership was transferred to the Indiana Department of Natural Resources becoming part of Cataract Falls State Recreation Area, a part of Leiber State Recreation Area.

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[9] Owen County, *Record* 10 (December 5, 1876), 276; (December 6), 285, 287

[10] Part of the sign is illegible, but probably read as stated. See page 95 of *Covered Bridges of the Middle West*, R. A. Sanders, Stephen Ggreen Press, Brattleboro VT, 1970.

[11] Cataract, photo file; "Vandals Remove Art Work. . . And Wall . . . From Cataract Covered Bridge," unattributed newspaper clipping March 30-31, 1980, Covered Bridge Folder; "Cataract Covered Bridge To Be Dedicated Saturday, Oct. 7," *Evening World* (Spencer, Indiana), Sept. 29, 1995, Covered Bridge Folder; all in Owen County Information Cabinet, Genealogical Collection, Owen County Public Library.

Few alterations were made to the original structure. One compression diagonal in the upstream truss had been replaced with a timber of different dimensions and species. A pair of vertical steel rods had been added to the downstream truss where a tension diagonal's lower end has broken off. The concrete mudwalls atop the backsides of the abutments presumably replaced stone originals. The bridge's plank guardrails had been removed. Dates for these alterations are not known, but were addressed in the 2004 rehabilitation.

Robert W. Smith and the Smith Bridge Company

Robert W. Smith (1834-1898) was the son of an Ohio cabinetmaker. He had little formal education and by his midteens was a builder's carpenter. Apparently some of his early independent work included barns with self-supporting roofs. In his late twenties, Smith ran a woodworking machine shop and lumberyard in Tippecanoe City, Ohio, with his brother. At some point Smith turned his attention to wooden bridges and received a patent for his version of a double-intersection Warren truss in 1867.[12] Also in 1867 Smith moved to Toledo, Ohio, to take advantage of better transportation facilities and organized the R. W. Smith & Company partnership. That year the company built five bridges; two years later it completed 75. Smith received a second bridge patent in 1869 for roofing and lateral-bracing systems. The Cataract Bridge makes it clear that while Smith continued to modify his designs, he did not bother to apply for additional patents. In 1870, the company's name was changed to Smith Bridge Company and reorganized as a joint stock company. Over a period of time the Smith Bridge Company made the transition to the exclusive fabrication of metal bridges.[13] Apparently, metal swing-bridges were a specialty. Smith sold the business in 1890 and turned his attention to real estate. American Bridge Company, a division of United States Steel, in 1901, acquired the company, renamed Toledo Bridge, as part of a nation-wide consolidation of the bridge-fabrication industry.[14]

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[12] The term "double intersection Warren" is based on Allen T. Comp and Donald Jackson, "Bridge Truss Types: A Guide to Dating and Identifying," *History News* 32, No. 5 (May 1977; republished as Technical Leaflet 95 by the American Association for State and Local History): 8 (of republished version). The bridge literature uses many terms to describe Smith's trusses such as those at Cataract including: "Type 3" (Gould, 8),"Type 4" (Wilson, 5), "half lattice" (Cockrell, 84), and "Warren Quadrangle Truss" (Tim Douglas, "Restoration Work Begins On Covered Bridge at Cataract," *Owen County Leader* (Spencer, Indiana) 82, January 12, 1995).

[13]David A. Simmons, "Neighboring Wood and Iron Bridges Share Heritage," *Ohio County Engineering News*, (February 1988): 20. For information on the metal bridges constructed by the Smith Bridge and Toledo Bridge Companies in Indiana, see James L. Cooper, *Iron monuments to distant posterity: Indiana's metal bridges 1870-1930* (N.P.: Privately Printed, 1987).

[14]Clark Waggoner, ed., "The Smith Bridge Company," *History of Toledo and Lucas County* (New York: Munsell & Co, 1888), 786; Waggoner, "Robert W. Smith," *History of Toledo and Lucas County*, 786-787; Eldon M. Neff, "Highlights in the Life of Robert W. Smith," *Connecticut River Valley Covered Bridge Society* XI, No. 4 (Spring 1963); for photographs of Smith and his bridge works see John Diehl, "Bridges to the Past," *Timeline* 15, No. 3 (May-June 1998): 38; Robert W. Smith, "Improvement in Bridges" and "Improved Bridge."

Historical Context of the Cataract Bridge

The Smith truss, used on the Cataract Bridge, was one of the last of a long tradition of innovative wooden trusses. With roots in the work of Italian Renaissance architect Andrea Palladio and his predecessors, the wooden truss was by no means an American invention. But wooden covered bridges were built on an unparalleled scale in the United States with its vast expanse of land and plentiful supplies of timber. Parke County, northwest of the Cataract Bridge, which has 31 of the 87 covered bridges surviving in Indiana, provides a glimpse of the original density of covered bridges in the United States.

The challenges and opportunities presented by American rivers certainly contributed to the development of wooden truss technology. Timothy Palmer constructed a three-span structure for the 495-foot timber bridge over the Schuykill River at Philadelphia in 1806. Named the "Permanent Bridge," it may well have been the first use of roof and siding to protect the trusses from rot-causing moisture. Six years later Lewis Wernwag built a single-span 340-foot covered bridge a short distance upstream from Palmer's permanent bridge.[15] Multi-span bridges could also be impressive. Theodore Burr built a twelve-span, 2,520-foot bridge at Harrisburg, Pennsylvania in 1817.

Burr was one of the first American builders to receive a patent for a covered bridge. Awarded in 1804, the Burr arch truss proved a very durable technology – Hoosiers continued to build Burr arches into the 1920s.[16] Burr's patent used arches to reinforce a king-post truss. The king post is a structural system dating back to at least the Middle Ages in which a vertical tension member, either wood or metal, is used to hang the deck or roadbed from heavier members arranged like a triangular roof gable. These heavy sloping timbers are always under compression.[17] Both Indiana's oldest and longest covered bridges, the 1838 Ramp Creek Bridge of Putnam County (subsequently re-erected across Salt Creek, Brown County) and the 434-foot Medora Bridge, respectively, are Burr arch trusses.

All courtesy of David Simmons, Ohio Historical Society; Victor C. Darnell, *A Directory of American Bridge-Building Companies: 1840-1900* (Washington, D.C.: Society for Industrial Archeology, 1984), 55-56, 85-86.

[15] On Wernwag's bridge see Lee H. Nelson, *The Colossus of 1812: An American Engineering Superlative* (New York, New York: American Society of Civil Engineers, 1994).

[16] These include the 155-foot Nevins Bridge across the Little Raccoon Creek near/at Minshall of 1920 and the 80-foot Edna Collins Bridge across Little Walnut Creek near/at Clinton Falls of 1922. See DeLorme Publishing Company, 9.

[17] The Philips Bridge, Arabia, Indiana, across Big Pond Creek is a 43-foot king-post truss. Publishing Company, 9. For an illustration of a simple king post, see Diehl: 33.

In 1820 Ithiel Town patented his lattice truss. Town's lattice consisted solely of a network of diagonals and no vertical members. It was very popular with carpenters because it used large numbers of identical light wooden planks. It also had the advantage of being structurally redundant. As a result, the bridge would stand even if one or two timbers failed. None of the four or five Town trusses built in Indiana survive.[18]

The next important innovation was the Long truss.[19] Col. Stephen Long was the first to apply French mechanical theory – at that time among the most advanced in the world – to timber bridge design in United States. Long based his truss on modules, or panels, with diagonal timber in compression and vertical timbers in tension. The brilliance of Long's design was in the use of wedges that insured compression of the diagonals and that could easily compensate for shrinkage. He received the first of several patents in 1830.[20]

In 1840, however, William Howe, probably with assistance from his brother-in-law Amasa Stone, rendered the Long truss obsolete. Generally known as the Howe truss, the system of Howe and Stone replaced the wooden vertical members and the wedges of the Long truss with threaded metal rods. The diagonal timbers and the vertical rods were connected in such a way that tightening nuts on the vertical rods set the diagonals in compression. Not only did this simplify construction without changing the behavior of Long's design, but it also marked the beginning of the transition from wood to all metal trusses. Indeed, railroads began using all-metal Howe trusses in the mid-1840s.[21] About twenty Howe trusses survive in Indiana, including the 150-foot, Cades Mill Bridge, built in 1854 across Coal Creek near Veedersburg and the 376-foot Williams Bridge across the East Fork of the White River in Lawrence County.[22]

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[18] Gould, 7.

[19] The bridge was built in 1840 to carry Main Street over the Whitewater River at Brownsville, Indiana. It was documented, disassembled, and re-erected in a highly modified form at its current location in Columbus, Indiana.

[20] D[ario] A. Gasparini and Caterina Provost, "Early 19th Century Developments and Truss Design in Britain, France and the United States," *Construction History* 5, 28-30; Dario Gasparini and David Simmons, "American Truss Bridge Connections in the 19th Century. I: 1829-1850," *Journal of Performance of Constructed Facilities* 11, No. 3 (August 1997): 119-122.

[21] Gasparini and Simmons: 122-125.

[22] DeLorme Publishing Company, 9.

When Smith received his first patent in 1867, he was competing against established and highly reputable Burr arch and Howe trusses. Indeed, Smith often constructed Howe trusses if his clients preferred them. One of Smith's competitive advantages came from his move to Toledo and the shipping capacity of its railroads. Eldon M. Neff has noted that Smith

> framed the bridges at Toledo, disassembled and shipped them to the bridge site, where they were erected either by his men, or another bridge builder. If the cost of shipping materials were too great, he designed the bridge at Toledo, and arranged to obtain materials near the bridge site, if his men were to erect the bridge. In some cases, other builders using his bridge design, secured their own materials, and paid a royalty to the Smith Bridge Company.[23]

By this system, Smith trusses were built in Ohio, Indiana, Pennsylvania, and Oregon.[24] It is not entirely clear how many other wooden bridge builders were doing this in the 1870s, but the procedure became standard for metal bridge builders. It is ironic that Smith developed a covered bridge system only to use a production method generally associated with the metal bridges that superceded his invention. The use of this mass-production approach to wooden truss fabrication challenges the general conception of covered bridges as the work of artisans of a pre-industrial era.

The 1870s saw strong growth of the metal truss and by the 1880s it had become the dominant bridge type. Local preference and special circumstances often could disrupt this national pattern, however. Such would seem to be the case in Indiana. Indiana covered bridge construction was at its peak in the 1880s. A little more than twenty-five percent of the covered bridges extant in 1998 were built between 1900 and 1922. The persistence of wood construction can be attributed in part to the steel shortages of World War I, but most of these bridges were built because county commissioners preferred covered bridges. But these were exceptions that eventually yielded to the rise of state highway departments and their well-funded preference for standard designs.[25]

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[23] Neff: 4.

[24] Gould, 17. Apparently, while none survive, Smith trusses were the most popular truss type in Oregon for a period. See Nick and Bill Cockrell, *Roofs Over Rivers: A Guide to Oregon's Covered Bridges* (Beaverton, Oregon: Touchstone Press, 1978), 84.

[25] Richard Sanders Allen, *Covered Bridges of the Middle West* (Brattleboro, Vermont: The Stephen Greene Press, 1970), 58-69. On the rise of the Indiana State Highway Commission and its development of standard designs, which was fairly representative of national patterns, see James L. Cooper, *Artistry and Ingenuity in Artificial Stone: Indiana's Concrete Bridges, 1900-1942,* (N.P.: Privately Printed, 1997), 108-159.

Design and Construction Features of the Cataract Bridge

The Cataract Bridge shows evidence of its manufacturing process, advanced for a covered bridge. Many covered bridges have hewn timbers of irregular size, finish, and even wood species. The Cataract Bridge timbers have smooth, planed surfaces and uniform dimensions. Furthermore, at every joint between the dozens of timbers and spacer blocks that make up the chords both pieces of wood are match-marked with numbers painted in red. This would have been done at the factory in Toledo to ensure proper reassembly once the bridge reached Cataract.

The arrangement of the diagonal members of Smith trusses like the one at Cataract is distinctive. A truss in which the diagonals form a repeating "W" or zigzag pattern is known as a Warren truss. At Cataract there are two such patterns next to each other. Where one set of diagonals "zigs" the other "zags" to create a type of lattice pattern some have called a "Double Intersection Warren" truss. Bolts connect the diagonals in the two planes where they cross. Another distinctive feature of Smith trusses is the inclined timber brace between the base of the end post and a point near the top of the outermost tension diagonal.

All of the main structural elements in Smith trusses are wood (metal is limited to fasteners and relatively small castings). Construction of effective tension joints has historically been problematic in wood structures, and Cataract is not an exception. Tension members in Smith trusses include the lower chords and some of the diagonals.

At Cataract, as in many covered bridges, the lower chord's timbers are spliced together with wooden "fish plates." The fish plates are shaped like elongated "C"s, whose ends fit into notches cut in the timbers they connect. At Cataract many of these joints are broken; either one end of the "C" or wood on the end of a timber has sheared off. The top chord, a compression member, uses simple butt joints.

Tension diagonals in Smith trusses also use notches. The ends of the diagonals are sandwiched between chord timbers, and both diagonals and chord timbers are notched. The diagonals must extend beyond the chord they are joined to for the tension joint to work (just as notched logs in a cabin extend beyond the building's corners). On Smith trusses all of the diagonals that point outwards as they go upwards are built like this.

Diagonals that point inwards as they go upwards are always in compression near the ends of the truss, and so can be built differently. The ends of these diagonals are simply butted up against tension diagonals where they meet the chord. The chord and the two diagonals thus all meet at about the same point.

Near the center of the trusses, however, diagonals in both directions may be in tension, depending on load conditions. Tension diagonals from different directions can't meet at a single point because of their "tails" extending beyond the chord. Instead the joints are about two feet apart (the tips of the "tails" are just inches apart). This is the reason for the changed geometry near the center of Smith trusses that has mystified some observers.

Loads on the diagonals of the Cataract Bridge trusses get progressively smaller between the ends and the center of the bridge. The size of the timbers does too. All are about 7 inches thick, but their width varies. The biggest, the outermost tension diagonals, are about 12 inches wide. The width is reduced in 1" increments until the smallest, at the bridge's center, are only about 6 inches wide. This accurate sizing of members to loads reflects the knowledge of structural mechanics that had been gained since the first covered bridges were built.

The Cataract Bridge has cast iron fittings in two shapes. One, found next to the base of the endposts, provides a solid seat for the intermediate length brace. The other is found in the upper and lower lateral bracing, which helps maintain the vertical alignment of the trusses and resists wind loads. The Smith Bridge Company used this patented casting to firmly bolt the lateral bracing to the chords.[26] This special casting also has flanges that keep the lateral bracing diagonals firmly notched together.

[26] Robert W. Smith, "Improved Bridge," U.S. Patent No. 97,714 (December 7, 1869), figures 6-8. Smith's first patent was "Improvement in Bridges," U.S. Patent No. 66,900 (July 16, 1867).

Cataract Covered Bridge, Owen County, Indiana

2004 Bridge Restoration

Structural evaluations beginning in 2001 identified deterioration evident in a visible "lean," the loss of positive camber, rotten timbers, and missing and broken abutment stones. Continued settling warranted the bridge's removal from its abutments in January of 2003 to the western bank of Eel Creek. A 2004 rehabilitation of the bridge was funded with assistance from Lugar Bill appropriations specifically for the preservation of covered bridges, and TEA-21 funds administered by the Indiana Department of Natural Resources. Rehabilitation included the removal of the earlier installations of a timber diagonal, steel rods, and concrete mudwall. The abutments were repaired by cleaning and repointing the mortar, relaying the bridges bearing stones, and replacing a missing corner stone. Deteriorated material was removed from truss members, and like material was attached with bolts or epoxy. Camber was restored with the repair of sheered fish plates, and the addition of thin shims to the diagonal ends. A new cedar shake roof was installed. The portals were restored based on historic drawings and the examination of other Smith bridges. The approaches were reconstructed with dry-laid wing walls that support an asphalt path at an ADA accessible slope.

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Verbal Boundary Description

In plan, a rectangle measuring 200'x 80' centered on center of the span and the centerline of the bridges roadway. The rectangle's long sides parallel the bridge chords and the short ends parallel the portals.

Boundary Justification

The rectangular boundary includes the bridge, abutments, and its approaches with approximately 25' of buffer off both ends and sides.

Photographs

Photos by Christopher Baas
February 15, 2005

1. View of bridge looking northeast.
2. View of bridge looking southeast.
3. View of east approach and portal looking west.
4. View of east portal.
5. View of lateral bracing and west abutment looking west.
6. View of lateral bracing and east abutment looking east.
7. View of north chord looking northeast. Center of span is at the middle window.
8. View of south chord looking southwest. Center span of span is between the second and third crossed diagonals from the left of the image.
9. View of roof lateral bracing looking east.
10. Detail of chord member numbering system. The numbers are oriented to the outside of the chord. A diagonal is in the image's upper right corner, a joist is to the left, and the curb is along the bottom.