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THE WOODEN AGE OF INDIANA'S COVERED BRIDGES

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I. ORIGINS OF COVERED BRIDGES

Today, covered wooden highway bridges stand as a reminder of a bygone era in American history. When traveling the lesser known roads of Indiana one may encounter just such a monument to the past. Too many times these historical artifacts are marred by the ravages of time and the destructiveness of vandalism. Yet many of the few remaining structures are now being preserved as historical landmarks by such organizations as local covered bridge societies and various parks departments. Although it is costly to keep these bridges in sound structural condition, it is indeed worthwhile to attempt this preservation of American history in order that we may view firsthand their design and utility. This will lead us to an understanding and appreciation of the bridge builders of Indiana in their successful efforts to cause form to follow function in overcoming the topographical adversities of the natural landscape.

Within the following pages, the reader will find the history of covered bridges in Indiana, what the bridges are constructed of and why. Various types of covered bridge structures are examined as
there are many diversified styles. Also, this paper looks at the bridge builders from Indiana and the surrounding areas. Finally, this paper examines what is being done today to preserve these historical artifacts.

Existing covered bridges are included in what is called the "Wooden Age" of America. The American Wooden Age lasted from the 1600's until the late 1800's. Not unique to America, a similar circumstance was existent in Great Britain from the time of the Romans until the timber lands dwindled in the 1300's.

Both countries' Wooden Ages were marked by a heavy dependence on wood as a building material and fuel source. Britain and America also used their abundant stands of wood because it was readily available and inexpensive to harvest.

In Britain the arts of stonemasonry and metal working began to replace carpentry skills as the timber supplies were depleted. However, these woodworking skills were not lost completely through the ages. The very same carpentry skills once used in Britain were again revived out of necessity
by the transplanted British citizens in the American colonies.

Because it was so plentiful, wood became the favored building material of the colonists. The early Americans used wood for many purposes; for fuel, chemicals, naval supplies, the construction of houses, boats, roads, railroads, machinery and bridge trusses.¹ In fact, it was America's dependence on wood that had caused her to lag behind the rest of the Western World in iron production. Since wood could be used cheaply for many purposes, the American industries did not produce iron on a large scale until the 1830's and early 1840's. Even then, iron production was limited to the more established regions of the East Coast.² In Indiana, the production of heavy metals did not begin until the late 1800's and was limited to the Lake Michigan area where raw materials needed to make iron could easily be transported across the lake. Because of the great distance from the iron mills in the north to the many bridge sites down state, it was too costly to transport iron parts, hence wooden bridges were the norm during the 1800's.
Covered bridges were not unique to America. They had been constructed in Europe centuries before the first American covered bridge was built in Pennsylvania (1812). During the early 1800's the American bridge builders did not seek innovations in bridge design. Rather, these builders designed and employed variations of the old tried and true wooden truss system.³ The form and design of the American bridges fulfilled the basic function of transporting goods and people across waterways and ravines. Knowing that the old design techniques produced sound wooden bridges, radical truss design changes occurred slowly. Some bridge designs, such as the Post truss, patented in 1863 (to be discussed later), called for a combination of iron and timber members. By the 1880's on the East Coast, bridges were being constructed entirely of metal.

THE DEVELOPMENT OF COVERED BRIDGES IN INDIANA

As the population of the Eastern Seaboard ventured westward in search of new territory, Indiana became a stopping point (often permanent) for many settlers.⁴ After defining its state's boundaries by way of
Indian treaties and meeting the population requirements, Indiana was granted statehood in 1816.

Since Indiana's roads in the early 1800's were few and poor in quality, the growing population demanded a better system of transportation. Often, these early roads were no more than foot paths and old "buffalo traces".5

This need was met with the development of our major roadways built from 1826 to 1850 (see illustration #1). The first of these through Indiana was the National Road. Originating in Wheeling, West Virginia, the road was completed through Indiana in 1838.

Another east/west roadway was the Paoli Pike running from New Albany westward to Vincennes. North to south ran the Michigan Road extending from Madison to Michigan; also, there was the Lafayette and Jeffersonville Turnpike. Along these roadways, covered bridges could often be found spanning the many waterways.6

Indiana was blessed with large stands of timber
for use in construction of the wooden bridges to span the natural barriers of travel that intersliced the highways. In 1816, 87% of Indiana was covered with broad leaf deciduous trees, while the remaining 13% was wet and dry prairie (see illustration #2). At this time, Indiana had no natural stands of pine. The major tree species were beech, maple, oak, hickory, white ash, white basswood, yellow buckeye and the current state tree, the tulip or yellow poplar.

Many of Indiana's settlers had carpentry skills with experience in shipbuilding and house or bridge construction. Many of these carpenters were employed by wooden bridge builders and companies. In addition to several out of state builders, there were many prominent Indiana builders. These builders were Joseph J. Daniels, William T. Washer, Archibald M. Kennedy and Sons, Thomas Hardman, Phillip Ensminger, George Woentz and Sons and Josiah Durfee. Also there were countless small local bridge builders who constructed only one or two bridges.

The principles of wooden bridge building had their basis in common wood construction of the time
(the Wooden Age) not in advanced engineering techniques. In fact, none of the builders mentioned were professional engineers. It was application of these simple principles that enabled the skilled carpenters to construct covered bridges from a pre-designed truss system.

Most of Indiana's bridge builders used one of ten truss types. The trusses used were the queenpost, multiple kingpost, Burr, Wernway, Town, Long, Howe, Smith, Childs or Post.

Each builder had his own unique style that added special touches to the bridge. However, regardless of the builder or truss design, each wooden covered bridge had basic structural features in common. First, each bridge rested on abutments and sometimes piers. Abutments were at the end of the structure located on each bank of the river (see illustrations 3 & 4). Piers comprised the middle supports that ran from the bed of the river up to the underside of the bridge. Usually the abutments and piers were made of cut stone, either bedrock or limestone, but later around the turn of the century, some were made of iron and concrete. The stone for
these structures was often taken from nearby quarries.

Northwestern Indiana featured a large lacustrine plain (located near what is today Interstate 65) rich in limestone. Sections of southern Indiana were rich in deposits of both bedrock and limestone. Bedrock was quarried throughout the Norman Upland. This escarpment extends from Brown County south to the Ohio River. The famous Bloomington limestone quarries are located in an area of extensive karst topography known as the Mitchell Plain.

Abutments* were formed by first digging a large hole at least four feet below the low water mark on each bank. Large squared timbers, usually of oak, were then placed in the hole to make a smooth surface for the stone to rest on. If a quicksand condition existed at the site, bags of wool were sometimes sunk or more commonly wood or iron pilings were driven to stabilize the ground. Next, the precisely cut stone was placed, usually by skilled stonemasons.

*The abutments and piers of bridges discussed later will be of cut stone unless noted otherwise.
In the early bridge abutments and piers, the stone was lain without the use of mortar. However, after 1870, mortar was frequently used for the joints. Some abutments had wings attached. These wings would protrude at slight outward angles from the bridge at each corner to prevent high water from backwashing into the interior of the bridge.

Not surprisingly, the stone-work, including the abutments and piers, often cost more to construct than the ridges wooden superstructure. For example, a proposal for a bridge to be constructed in Vermillion County submitted by the builder J.J. Daniels, set the price for the wooden superstructure at $3200, and the stone work at $7600.

After the abutments came the erection of the false work across the river (similar to scaffolding). This was built to support the bridge during construction. The false work was always removed after the completion of the bridge.

The third step in the construction of a covered
bridge was the cutting and fitting of the chords or stringers. Chords are the long squared timbers found spanning the bridge lengthwise top and bottom (see illustration #3). The lower chords form the basis of the bottom of the bridge. The floor beams, usually "x'd" are placed between the chords for spacing and support (see illustrations 5 & 6). The floor joists are placed over the beams and are nailed to the chords. The planking of the bridge's floor or roadway is then laid.

The upper chords also add support to the bridge when joined to the lower chords with vertical or diagonal members. To support the roof, joists are nailed to the upper chords. Together the upper and lower chords form the basis for the bridge's truss.

The wood for the chords was often of oak or walnut taken locally. However, in the mid to late 1800's bridge builders seemed to prefer the more flexible and lightweight pine from Michigan. Since roads and railroads were more numerous by that time, the builder no longer had to choose and prepare
the lumber at the site.

For bridges less than forty feet, the chords were usually one piece of timber that spanned the entire length of the bridge on each side. In longer spans the timber was laid end on end and attached or spliced together with iron plates and bolts at varying intervals on each side of the bridge so as not to weaken the support system.

To complete the formation of the truss in general, vertical and/or diagonal members or posts of wood and sometimes iron, are placed within and were attached to the chords, giving the bridge rigidity (see illustration #3).

Protecting the interior of the bridge, not only was siding hung (usually of poplar) but also the roof extended or overhung up to twelve feet beyond the end of the bridge. The overhand shielded the interior from blowing rain or snow. The top front section of the overhang is called the portal. The final touch in the construction of a covered bridge was a coat of readily available lead paint.
Bridges are measured by spans. If a bridge rests entirely on the two end abutments it is one span. When one or more piers are added at varying points across the river for support, the bridge is then called a multi-span structure. Each section supported is one span.

II. TYPES OF ALL WOOD COVERED BRIDGE TRUSSES

From four to six hundred covered bridges were built in Indiana from the 1820's to the 1920's. Around sixty-two percent of these bridges were of the Burr truss, twenty-five percent Howe truss and the remainder were one of eight other lesser designs. 10

THE QUEENPOST TRUSS

The most primitive type of bridge truss was the uncovered king post. Basically, this truss is a triangle of wooden members with a vertical post in the center (see illustration #7). No bridges of this type were ever constructed in Indiana. However, a variation of this design, the queenpost was used on several occasions. The queenpost replaces the kingpost center point with a horizontal
wooden beam (see illustration #7). The resulting shape is now a rectangle with triangles at each end resting on one continuous chord. The queenpost truss design is suitable for short spans of less than seventy-five feet.

The first covered bridge on the National Road in Indiana was a queenpost truss. Completed in 1834 this tiny bridge of forty-nine feet carried two lanes of traffic over Symons Creek at Dublin in Henry County.

One other example of a queenpost truss is the J.H. Russel Bridge (see illustration #8). Built in 1897 over Square Rock Branch by a local carpenter Pearly Weaver, this bridge stood at forty-two feet. The J.H. Russel Bridge was built near what is now the Turkey Run Airport in Parke County. The bridge was moved from its site and put up for sale. No interest was shown and the bridge was eventually destroyed around 1983.

Queenpost bridges were easy to construct requiring only simple carpentry skills for framing. Although this design was never popular in Indiana, hundreds
of queenpost truss bridges were constructed in many eastern states with over one hundred still standing and in use today.

THE MULTIPLE KINGPOST TRUSS

The multiple kingpost truss (not to be confused with the uncovered simple kingpost), was a later variation of the queenpost truss. This design features a rectangle intersected with a series of uprights or posts of timber attached to the chords (see illustration #9). Connected with iron bolts to the uprights are diagonal timbers each slanted away from the center. The center is a recognizable triangle, that is intersected with one upright, over two panels. The multiple kingpost truss is ideal for spanning creeks from sixty to eighty feet wide.

As with the queenpost, not many multiple kingpost bridges were constructed in Indiana. Only one such bridge is still standing, this is the Phillips in Parke County. J.A. Britton (see full discussion of Britton in Burr truss section), built this bridge in 1909 over the Big Pond Creek in 1909.
It is forty-nine feet with concrete abutments. This bridge is easily and often confused with the all-timber Howe truss (to be discussed later).

THE BURR TRUSS

Even though the multiple kingpost truss by itself was never a favorite with Indiana covered bridge builders, when combined with two interior upward wooden arches, creating the Burr truss, it became the most popular wooden truss style used in the Hoosier State. The Burr truss, patented in 1804 by Theodore Burr, had proven itself in the East long before the covered bridge building boom began in Indiana (see illustration #9).

The Burr became the preferred design in Indiana because of a political and functional reasons. First, during the 1800's there were several local "home town" builders and families who specialized in the construction of this kind of bridge. These builders, Daniels, Britton, Wolf, Washer and Kennedy, actively promoted their services to commissioners in counties near their home towns. Then as it
is today, public works projects were let to bids with the lowest bidder receiving the contract. Usually, the local bridge bidder with his own lumber yard, such as the Kennedy family, could eliminate long distance transportations costs because of his close proximity to the site and could therefore, provide construction services at a cheaper cost than those far away.

Secondly, the Burr truss was very popular in Indiana because it was functional. The arch design was most sturdy and able to hold heavy loads. Many Burr bridges, some over one hundred years old, are still in use today! The Burr truss bridges are suitable for both modest spans less than forty feet and extremely long multi-spans over four hundred feet.

Distinctive in appearance, the Burr truss bridge is easy to recognize. It features two great wooden arches that extend the entire interior length of each span or bridge (see illustration #10). Often, the center of the arch was over fourteen feet from the bridge floor. The butts of the
Arches extend below the floor surface and are attached to the abutments where the load weight is transferred to the stone (see illustration #4). If the bridge is multi-span, the arch butts would also be attached to the piers. To help preserve the life of the timbers, an iron plate was usually placed between the wood and stone.

The arch may be made of single pieces of timber shaped and placed on end. It also may be formed by laminating several smaller pieces of timber together (similar to the butcher block) with the ends staggered. In both cases, the timbers would be joined with iron bolts and plates. The Burr truss, with the exception of iron bolts, was a bridge constructed entirely of wood. Truly, this bridge design, unique to this country, was a product of the American Wooden Age. In Indiana, this bridge design was used widely for many years by numerous bridge builders (those who made their livelihood from covered bridge construction, will be discussed below).

J.J. DANIELS

Daniels, born in Marietta, Ohio in 1826, learned
his carpentry skills from his father Stephen, also a bridge builder. Daniels made Indiana his permanent home in 1853. He first worked for the Evansville and Crawfordsville Railroad as a bridge designer. About 1861, he moved to Rockville in Parke County, where he started his own bridge-building business. 12

Daniels may have built nearly fifty covered highway and railroad bridges in Indiana from 1850 to 1904. Many of these have since been destroyed or closed to traffic. Eleven are still in use.

Perhaps the most famous Daniels' product in Indiana is the Jackson Bridge (see illustration #11 and #12). Anyone who has taken a canoe trip down Sugar Creek near Rockville, has surely encountered this beautiful structure. Built in 1861, the bridge is one span of two hundred and seven feet with a unique double arch on each side, not attached to piers. At the time of its construction, Jackson Bridge was billed as the longest covered bridge in the state.
An even longer Daniels' bridge was the Freedom Bridge in Owen County. Built over the West Fork of the White River in 1882, it was originally six hundred fifteen feet over four spans. The bridge was dismantled in 1966.

An effort to restore part of this bridge was undertaken by Indiana University Professor Henry Remak. He managed to raise $5,000.00 to purchase one span of the dismantled bridge. Remak hoped that this part of the bridge could be reconstructed near the Bloomington campus in a historic village setting. To this day, Remak's plans have not materialized due to a lack of funds. Freedom Bridge now lays dismantled and rotting in a farm field near Bloomington.

Daniels' longest covered bridge, the Terre Haute, surpassed Freedom Bridge by two spans and was perhaps, three hundred feet longer; however, no exact data can be found. The Terre Haute Bridge was built over the Wabash River in 1864 or 1865. This unique two lane multispan bridge proved not to be as sturdy as other Daniels' bridges. It was demolished some forty years later in 1904.
The largest Daniels' bridge still standing is the Medora Bridge in Jackson County. He built this bridge in 1875 over the East Fork of the White River. It is four hundred feet long with three spans.

Not all Daniels bridges were huge multispan structures. Many of his bridges were meager in size. One such bridge is the Billie Creek at Rockville, in Park County (see illustration #13). Billie Creek is the al name given to Williams Creek. This bridge is sixty-five feet long and is located adjacent to the Billie Creek Village.

Neet Bridge, the last that Daniels built, is located in his home town of Rockville (see illustration #14). Constructed over Little Raccoon Creek in 1904 and still standing today, it is a medium sized bridge of one hundred forty three feet with concrete abutments.

Although Daniels preferred to construct Burr truss bridges, he did not limit himself only to this design. At the request of county commissioners in charge of bridge contracts, Daniels would erect a Howe truss bridge (see section on Howe truss).
W.T. Washer was a lesser known covered highway bridge builder from Cannelton. Originally, Washer was a partner in the Smith Bridge Company. He left his job and started his own bridge building business in the 1860's. On his own, Washer built some twenty covered bridges in Indiana. Several were of the Burr type, while a few were the Smith Patent truss (see section on Smith Truss). Most of Washer's bridges were erected in the southwestern part of Indiana. Two such Burr truss bridges were Huffman Mills and Shoals, both over the Anderson River.

Huffman Mills Bridge was built in 1864 at the Perry-Spencer County line. It is still in use at its original site in Huffman. This bridge is one span at one hundred forty feet.

Shoals Bridge was built one year later in 1865 at Spencer County. It was located near what is now Santa Claus Land and stood at ninety-eight feet in length. Shoals Bridge was removed in 1967 after over one hundred years of service.

No other material was available on Washer's life history.
J.A. BRITTON AND SONS

Born near Rockville in 1839, Britton was indeed a true Hoosier covered bridge builder. Britton's father taught him carpentry skills. However, the young man lost interest in this trade. For a short time, Britton became an attorney and also fought in the Civil War. He returned to Rockville in 1879, once again taking up carpentry. He worked for a few years as a day laborer on covered bridge construction jobs. Britton received his first contract on a bridge job in 1882 marking the beginning of the family business. Britton had eight sons, four of whom - Edgar, Eugene, Carlton, and Lawrence helped with the business.

Around twenty-three Britton bridges (usually small one or two spans), were built in Parke and Putnam Counties. Fifteen of the family's bridges are still standing.

Britton built his first covered bridge, most commonly called the Narrows but sometimes referred to as Lusk, in 1882 over Sugar Creek in Parke County (see illustrations #15 & #16). It is called the
Narrows because it is located over a rocky narrowing section of Sugar Creek, and Lusk because the Lusk family farm and mill were once located nearby. This bridge is one span, one hundred twenty-one feet long. Both the Narrows Bridge and the Lusk farm are now part of Turkey Run State Park.

Two excellent examples of the later Britton bridges still in use are the Jeffries Ford (1915), and the Nevins (1920). The Jeffries Ford is one of the longest Britton Bridges constructed - two hundred four feet over the Big Raccoon Creek near Bridgeton, Parke County.

The last Britton family covered bridge was the Nevins (see illustration #18). Built over the Little Raccoon Creek near Catlin, Parke County, this bridge is one hundred fifty-five feet long, resting on concrete abutments.

The elder Britton died in 1934, like Daniels at the age of ninety.

AARON WOLF AND SON

The Wolf's were believed to be from Crawfordsville;
however, there is little data available on their family history. There is even some questions as to who was the father and who was the son. Dr. Gould believes that Aaron was indeed the father and Henry was his son. The father/son team built seven covered bridges from 1838 to 1860, all the Burr truss type. Three of these bridges are still in use.

Aaron Wolf's first and perhaps most recognized bridge, was built over Ramp Creek in 1838 near Fincastle, Putnam County. This two lane bridge is one span at ninety-six feet. The Ramp Creek Bridge was moved to its current site over the Salt Creek at the north entrance of Brown County State Park in 1932. Thanks to the preservation efforts of the Indiana State Park Commission, riding through the Ramp Creek Bridge can still be enjoyed by the many thousands who visit the scenic park annually.

Aaron Wolf built one more two lane bridge. This was the Raccoon Bridge, originally located over the Big Raccoon Creek in Putnam County (see
illustration #19). This one hundred twenty-two foot bridge was moved and reconstructed in 1938 as a one lane bridge over the Little Walnut Creek and renamed Clinton Falls. It was destroyed in 1969.

Henry Wolf constructed only one two lane bridge. This was the Yountsville Bridge over Sugar Creek in Montgomery County (see illustration #20). Built in 1858, it was one span at one hundred sixty feet. At the time of it's construction, the Yountsville Bridge was the highest structure of this type in the state. It was some forty feet above the bed of Sugar Creek. Unfortunately, Yountsville was destroyed in 1948 and replaced with a modern concrete structure.

Two of Henry Wolf's bridges still standing are the Portland Mills and Crooks both in Parke County. Constructed in 1856 originally over the Big Raccoon Creek, Portland Mills is one hundred thirty feet long (see illustrations #21 & #22). In 1960, the bridge was moved to a site over the Little Raccoon Creek replacing the Dooley Station Bridge
that was destroyed by arsonists in 1960 (see illustration #23).

The Crooks Bridge, also built in 1856, is located over the Little Raccoon Creek. (See illustration #24). This bridge is one hundred thirty-two feet long.

ARCHIBALD M. KENNEDY AND SONS

The Kennedy family were the last of the great Indiana Burr truss covered bridge builders. Archibald, born in 1818, was originally from South Carolina. His family moved to Indiana in 1825, settling first in Fayette, then Parke County. Later, Archibald returned to Fayette County and married. He had six children. Kennedy moved the family to Wabash County taking up the trade of carpentry. In 1864, the Kennedy family moved to a farm east of Rushville, in Rush County. Archibald, with his two sons Emmett and Charles, and later his grandsons Karl and Charles, constructed more than fifty covered highway bridges in Indiana; thirteen of which are still standing. Most of these bridges were the Burr truss type, however, a few were Howe truss (see section on the Howe truss).
The first Kennedy bridge was at Dunlapsville over the East Fork of the Whitewater River in Union County (see illustration #25). Erected in 1870 on the site of the old Cockefair (woolen) Mill, the Dunlapsville Bridge was two spans with a length of three hundred fifteen feet. The bridge, after one hundred and one years of service, was destroyed in 1971.

In Marion County, the Kennedy's constructed nine bridges from 1880 to 1882. The first and longest was the White River or West Newton Bridge located just east of the town West Newton. It stretched four hundred sixty five feet with three spans over the West Fork of the White River. The abutments and piers were of cutstone, but were coated with cement. The West Newton Bridge was removed in 1950.

The Kennedy family was best known in Indiana for the detail work they incorporated into their bridge designs. Most Kennedy bridges featured arched portals with detailed decorative corbels and scroll work.

During the late 1870's, the Kennedy's chose to
use the more flexible lightweight Michigan pine, as opposed to local Indiana timber, for the major sections of their bridges. They shipped the pine from Michigan (the closest source to Indiana) to their bridge yard in Rushville. Here the timber was cut and fitted, then the pre-fabricated bridge pieces were shipped to the construction site. Emmett supervised this aspect of the business.\textsuperscript{19}

By using this method of prefabrication, the Kennedy's were able to save valuable time and money since they did not have to haul to each site heavy sawing equipment. From 1881 to 1884, a period of thirty-six months, the Kennedy's were able to erect some twenty-four covered bridges.\textsuperscript{20} Depending on the length, the bridge prices varied from $5,000.00 for the Vine Street Bridge to nearly $17,000.00 for the Martinsville Bridge.\textsuperscript{21}

Perhaps the most detailed bridges built by the Kennedy's were the "village type". The village bridges (none of which are still standing), featured covered pedestrian walkways attached to each side of the bridge separated from the roadway with barriers. These bridges were ideal for towns with
heavy pedestrian traffic. The village bridges were graceful in appearance and did not look like the typical box-shaped covered bridge. The sides of the village bridges were open with the hand rails being supported with wooden spindles. The roof was designed to overhang enough on the sides to protect the interior truss work.

The four Kennedy village bridges were the East Hill, 1881-1940; Circleville, 1883-1949, both in Rushville; East Connersville, 1887-1935; Fayette County and the Vine Street in Shelbyville, 1892-1958 (see illustrations #26, #27, #28, & #29).

Some of the finishing touches on the Kennedy village bridges were most unusual. For example, the East Connersville Bridge has both ceilings of the arched walkways, each over three hundred feet long, panelled with wood. On the Vince Street Bridge, both the walkways and ceilings were panelled. While the strips of panelling added beauty to the village bridges, they also provided a safety measure by covering the exposed roof rafters where pesky wasps would often nest in the summer.

Rush County boasts the most Kennedy bridges still
standing in Indiana - seven. One fine example is the Moscow Bridge over the Big Flat Rock River (see illustration #30). This bridge, built in 1886, is three hundred thirty feet long with two spans. The Moscow Bridge has an extra added feature - lattice work along the sides to allow for ventilation.

Emmett and his sons built the last Kennedy family bridge in 1918, forty-eight years after Archibald constructed his first. The Mitchell Bridge was built over the Noland Fork near Webster, in Wayne County. For a Kennedy bridge it was of modest size, only one span at one hundred feet. The abutments were concrete. The Mitchell Bridge was removed in 1965.

THE WERNWAG TRUSS

The first Lois Wernwag truss bridge was built in Pennsylvania in 1812. The Wernwag is similar in appearance to the Burr truss, in that it has heavy wooden arches running the length of the bridge on each side, and also it has the kingpost panels (see illustration #31). However, in the Wernwag, the posts are flared or slanted outward,
ridding the design of the traditional kingpost triangles. There were also small iron braces between the posts.

Only one covered bridge constructed in Indiana can be positively identified as a Wernwag truss. This is the Washington Street Bridge. Built over the White River as part of the National Road, Lois Wernwag contracted this bridge in 1831 and his sons William and Louis Jr., finished the job. Because of the financial crisis that struck Indiana in the 1830's, the bridge was not completed until 1835. It was two spans, however, the length is unknown. The Washington Street Bridge cost the State of Indiana $18,000.00 to build - an enormous sum of money for one bridge at that time. The bridge was removed in 1902.

There may have been other bridges of this type built, but there are no accurate records available to prove this. There is also a chance that many early bridges were misclassified as being poorly formed Burrs.

The Wernwag truss was not a popular bridge design
in Indiana because, unlike the Burr, there are no local builders who specialized and promoted this type of truss system.

**THE TOWN TRUSS**

The Town truss was designed and patented in 1820 by Itheil Town of Connecticut (see illustration #31). This design features a double layer truss, each with a criss cross pattern of light weight uniform boards arranged at a forty-five to sixty degree angle. Where each board crossed a wooden treenail or "trunnel" was driven to hold the pieces together. The truss design looks similar to a common garden lattice.

The Town truss bridge was easy to construct. The only heavy pieces of timber were for the stringers. The lattice structure could be cut and assembled elsewhere, then transported to the construction site. The erection of a Town truss bridge called for simple framing techniques and a team of skilled carpenters. A bridge of this design is very sturdy and suitable for spans up to two hundred feet.
A total of four Town truss bridges were built in Indiana. Two of these unusual bridges were contracted and constructed by the inventor himself. Just by chance, Town was in Indianapolis designing the new state capitol building. The two Town bridges were Biddle Island, North and South. They were on the same roadway both crossing the Wabash River at Logansport in Cass County. An island separated the two bridges halfway across the river. These bridges were built in 1838 and were destroyed less than forty years later.

Little is known about the other two Town truss bridges. One was the Mishawaka Bridge in St. Joseph County. It was constructed in 1846 and was destroyed twenty-eight years later. The last Town truss bridge built in Indiana was the Columbus. Samuel Hege constructed this bridge over Driftwood Stream in 1847 at Columbus in Bartholomew County. The date of its removal is unknown.

The Town truss was a very popular bridge design in the New England area. However, in Indiana the more sturdy Burr truss remained the preferred design during the Wooden Age.
III. THE INTRODUCTION OF METAL

The next five truss types; the Long, Howe, Smith, Childs and Post to be discussed, demonstrate the slow transitional process from the wooden age to the metal age of bridge building in Indiana. All of these bridge types, with the exception of some Smiths, featured main truss members of both wood and metal - usually iron; however, all were still covered bridges.

THE LONG TRUSS

Designed and patented in 1830 by Colonel Stephen Long, this truss designed features three or more panels of boxed "x's" with counterbraces of iron rods. It is interesting to note the inclusion of iron members in the truss system. The Long truss began the gradual shift of the Wooden Age to the Iron Age in bridge building (see illustration #32).

The Long, again, was not a popular truss style in Indiana. Fewer than ten Long truss bridges were built in the Hoosier State. Three bridges of this type were constructed along the National Road. However, no data is available describing
their sizes and locations. Two other identified Long truss bridges are the Springvale One and the Brownsville.

The Springvale One Bridge was constructed in 1847 over the Wildcat Creek in Tippecanoe County. It served as a towpath bridge for the Wabash and Erie Canal in Lafayette for eleven years.

Constructed by Adam Mason in 1840, the Brownsville Bridge stood over the East Fork of the Whitewater River in Union County (see illustration #33). This bridge was one span at one hundred sixty-six feet. The Brownsville Bridge was dismantled in 1974 but was not destroyed. It was placed in a storage shed at Eagle Creek Park at Indianapolis with the hope of having the bridge reconstructed in a historical village setting within the park. Dr. Gould estimates that it would cost from $75,000.00 to $100,000.00 to restore and reassemble the Brownsville Bridge at a new location. Funds were not made available by the Indianapolis Department of Parks and recently (January 24, 1986), the Brownsville Bridge was sold to the city of Columbus for $1,350.00
It will replace the Clifty Creek Bridge that was destroyed by arsonists in late 1985.

THE HOWE TRUSS

Invented and patented in 1840 by William Howe, the Howe became a popular design for both highway and railroad bridges in Indiana. The Howe is very similar to the Long truss in that it features a series of boxed "x's", but the sides of the boxes are two or sometimes three iron rods. The interior of the boxes are two wood diagonal beams crossed by one beam (see illustration #32). A variation of this design called the single or simple. Howe features only one diagonal wooden beam between the side iron rods (see illustration #34). In both Howes, the vertical iron rods could be tightened and adjusted when needed, to prevent the superstructure of the bridge from sagging, as it settled on its foundation. The iron rods used in the Howe design were light weight when compared with wooden beams. To insure uniformity, the iron rods were cast at a foundry, then shipped to the construction site.
In Indiana, both the single and the usual Howe designs were erected from the 1850's until the early 1900's. There are still twenty Howe truss bridges standing.

Many of Indiana's Howe truss bridges were constructed by local builders. The more notable builders were Philip Ensminger, Ripley County; Thomas Hardman, Ripley County; George Woentz and Sons, DeKalb County; Daniels, Kennedy, Britton (see section on Burr truss) and Joseph Durfee of Hamilton County.

A fine example of an Ensminger bridge was the Pipe Stem, located near Pierceville, over Ripley Creek, also in Ripley County. Built on iron pipes in 1889, this bridge stood at fifty-nine feet with concrete abutments. The Pipe Stem bridge was removed in 1971.

Hardman was known to have constructed four covered Howe truss bridges all in Ripley County. Two of these bridges that are still standing are the Otter Creek and the Bushing. The Otter Creek Bridge was built near Houlton in 1884. It stands
at one span of one hundred twelve feet. The Busing Bridge was constructed over Laughery Creek just east of Versailles. Built in 1885, the bridge's length is one hundred seventy-six feet.

George Woentz and Sons can be credited with constructing two Howe truss bridges, both in DeKalb County. These were the Houlton and Cedar Chapel Bridges. Built in 1884 over Fish Creek, the Houlton Bridge was one hundred three feet long. This bridge was destroyed by arsonists in 1963. The Cedar Chapel Bridge was originally built over Cedar Creek, south of Garrett in 1884. The length is one hundred ten feet with concrete abutments. In 1974, the Cedar Chapel Bridge was moved to the Conner Prairie Settlement in Hamilton County.

Durfee was a very important bridge builder in Central Indiana. He built several bridges in Hamilton and Marion Counties. His first bridge was the Eller Heady over the West Fork of the White River, west of Fishers and east of the Conner farm in Hamilton County. Built in 1870, it was his largest bridge - three hundred five feet over
two spans. The Eller Heady Bridge was removed in 1957.

The Potters Bridge was completed one year after the Eller Heady in 1871 (see illustration #35). Still standing, but closed to traffic, this bridge is located over the West Fork of the White River, north of the town of Noblesville in Hamilton County. Potters Bridge is two spans of two hundred fifty-nine feet. The abutments are concrete while the pier is cut stone.

Another Durfee bridge is Trader's Point. Built in 1880, this small bridge of eighty-eight feet was originally located over the Fishback Creek in Marion County. The Trader's Point Bridge was moved to its current location, the Brown Farm in 1960 (see illustration #36).

J.J. Daniels, although preferring to construct Burr truss bridges, did indeed erect several Howe truss bridges from 1870 to 1900. One example of a Daniels' Howe is the Williams Bridge. Still standing over the East Fork of the White River,
in Lawrence County, this bridge was built in 1884 and is three hundred seventy-six feet long.

The Kennedy family constructed at least six Howe truss bridges, however, none are still standing. Two of these bridges, the Buck Creek or Acton, and the Mud Creek, were located in Marion County. The Buck Creek Bridge, built in 1881, was located on the east side of the county. It was ninety-six feet long and the date of its removal is unknown. The Mud Creek Bridge was located in the North East corner of the county near Castleton. Constructed in 1882, this bridge was only fifty-six feet long. The Mud Creek Bridge was removed in 1955.

The Kennedy family also constructed a few all timber, single, Howe truss bridges. In these bridges, the upright iron rods were replaced with timber. One example of a Kennedy all timber Howe is the Logan Creek Bridge. Built in 1874, this bridge was located in Dearborn County and was ninety-four feet long. It was removed in 1962.
Another fine example of the all timber Howe, although the builder is unknown, is the Bean Blossom Bridge. Built in 1880 and still in use, this bridge, located over the Bean Blossom Creek in Brown County, is sixty feet long. (See illustration #37).

Although not a local builder, the Smith Bridge Company did construct both Howe and their own patent truss bridges in Indiana (see below). One example of the Ohio company's Howe truss type still standing is the Scipio Bridge in Jennings County. Built in 1886 over Sand Creek, it has a length of one hundred forty-eight feet. The cost to build Scipio Bridge was $600.00 per lineal foot.27

THE SMITH TRUSS

The Smith truss was designed and patented by Robert Smith of Ohio, in 1867. The Smith Company erected timber, iron, and combination bridges. In Indiana, most of the bridges built by this company were all wood; however, some were a combination.

There were four types or variations of this truss
put forth by the inventor. The first type was a series of single timbers slanted at a forty-five degree angle between the chords. Type two added to the first, a series of counter braces set at sixty-five degrees, creating open "V's" (see illustration #34). The third type added double counter braces to the design. The final variation, type four, used both single and double bracing and counter bracing timbers, any of which would be replaced with metal (see illustration #38).

The Smith Bridge Company, like other builders during this time, would prefabricate the bridge at the company's yard, then ship the pieces to the site for assembly. Twenty-five Smith truss bridges were constructed in Indiana, only six are still standing.28

One example of a Smith bridge still standing is the Cataract Falls Bridge. Built in 1876, it stretches one hundred forty feet over the Mill Creek in Owen County. A gristmill had been located at one time, at the falls near the bridge.
Another interesting Smith Bridge Company project, although no longer standing, was the Gosport Bridge. Constructed in 1870, this bridge was originally three spans of wood crossing the West Fork of the White River in Owen County. The length of this bridge was three hundred thirty-nine feet. In 1955, the sturdy Gosport Bridge was destroyed by arsonists.

THE CHILDS TRUSS

The Childs truss, designed and patented by Horatio Childs in 1846, was used on only one occasion in Indiana. Similar to the Long truss, the Childs uses iron tension rods instead of heavy timber counter braces (see illustration #39).

Several bridges of this truss design were constructed in Ohio. In fact, the one Childs truss bridge in Indiana was built on the state line with half of the structure in Ohio. The College Corner Bridge was built in 1893 in Union County over the Four Mile Creek. This bridge was one hundred eight feet and was removed in 1961.
THE POST TRUSS

One of the most unique truss types is the Post. Designed and patented by Simeon Post, of New Hampshire in 1863, the Post truss was used on only one occasion in the world for a covered wooden highway bridge. This unusual bridge, Bell's Ford was constructed in 1869 by Robert Patterson in Seymour, Jackson County.

The Post truss used in the Bell's Ford bridge features a series of panels with timber posts that slant inward toward the center (see illustration #38). The middle of the truss is an open inverted "V". Double counter braces of iron rods are placed diagonally over two panels for added strength. The top chords in this bridge design are wood, while the bottom chords are iron. Roughly, the Post truss used in the Bell's Ford Bridge was half wood and half iron. Although Bell's Ford is the only combination iron/wood Post truss constructed, other all metal Post bridges were common during the late 1800's, especially for the use as railroad bridges.
IV. EFFORT OF HISTORICAL PRESERVATION

Many efforts have been put forth by both private and public parties to preserve Indiana's covered bridges. Preserving a covered bridge is very much like preserving an old house. Care must be taken to protect the timbers from weather damage and dry rot. Also the foundation or abutments must maintain sturdiness. Paint and the replacement of worn out members all aid in prolonging the life of a covered bridge.

Many preservation efforts undertaken by private citizens or organizations entail moving the bridge from its original site to one on private property. Two examples of such bridges are Traders Point and Cedar Chapel. The Traders Point Bridge was moved in 1960 from Fishback Creek in Marion County to a site over a nearby pond on D.W. Brown's farm. The Cedar Chapel Bridge was moved from DeKalb County to Conner Prairie in Hamilton County in 1972. This bridge was sold to the settlement for $1,343.00. With proper care, it will stand for many more years.
Many of Indiana's covered bridges are also carefully preserved by the state and local public parks departments. The Indiana State Department of Parks and Recreation has moved or annexed many bridges to their jurisdiction. One example is the Narrows Bridge at Turkey Run State Park. The local park department of Hamilton County has undertaken the responsibility of preserving its only remaining public covered bridge. Robert Busby, Superintendent of the parks department estimated that it costs the county $454.00 annually to maintain Potters Bridge; $300.00 for paint and $144.00 to light the bridge at night.31

Parke County, boasting the most covered bridges still standing in one county in the United States, has made a tremendous effort to preserve its remaining covered bridges. All of the covered bridges on public roads are under care of the county. Each year in October, the citizens of Parke County, along with the Parke County Historical Society, host the Covered Bridge Festival to promote the importance of these bridges and also to raise money for preservation.
The Indiana Covered Bridge Society also has a great interest in the preservation of covered bridges. A not-for-profit organization, the Society's members possess a wealth of knowledge on the subject of covered bridges. The Society actively promotes and supports the preservation of covered bridges.
CONCLUSION

The existing covered bridges of Indiana stand as reminders of a bygone era in American history. These artifacts stress the early American society's dependence on wood as a building material. In Indiana, this "Wooden Age" lasted for nearly one hundred years.

Due to the poor condition of Indiana's roads and the locations of the steel and iron mills (in the northwestern part of the state), in the early 1800's, it was often not possible or economically feasible to transport large quantities of steel or iron over land for bridges. As a result, many of the state's interior bridges were wooden. As the roads improved in the late 1800's, steel and iron were more frequently used for bridge construction. This transitional process from wood to metal bridges was slow. The bridges after 1860, although covered, often used some metal members in the truss design. Indiana's Post truss bridge, being half wood and half metal, demonstrates, at the time of construction, that the old wooden covered bridges would soon be outdated, to be replaced by sleek metal structures.
Indeed the introduction of metal members to bridge construction began a new phase or era in American bridge building. A new type of bridge has emerged along with a new age; the metal age.

The covered bridge designers and builders must surely have been the precursors of Frank Lloyd Wright in terms of "form follows function" philosophy. Indiana's covered bridges were very adaptable to the environment. Their form was mandated by not only the function of bearing load, but also of type and availability of materials. Simply, these bridges were built with wood and stone because these materials could usually be found near the construction site and also, there was an abundance of laborers skilled in carpentry and stone masonry. Since the wood truss and flooring were susceptible to rotting and warping when exposed to the elements, it made sense to the bridge designers and builders to cover the structure with easily replaceable roofing and siding.

The people who built Indiana's covered bridges overcame many obstacles, from high flood waters
in the spring, to outbreaks of fever among laborers in the summer. These men were not overwhelmed by such adversities. They responded to problems with perseverance and resourcefulness. We owe the future of Indiana to the carpenter's and builders' inventiveness and practical approaches to resolving the problem of movement of goods and people across barriers. Their efforts began the development of a sound road network in Indiana, thus allowing for accessibility to markets, increased commerce, and an abundant way of life for all citizens along the roadways.
FOOTNOTES


2Hindle, p. 11.

3Hindle, p. 5.


7Dillon and Lyon, p. 45.

8Gould, p. 9


11 Gould, p. 7
12 Gould, p. 14
14 Ibid. George Gould, Indiana Covered Bridges thru the Years, p. 18
15 George Gould, "Indiana's Covered Bridges Built by Inventive and Skillful Craftsmen - Once there were 600 and 102 Still Stand", Outdoor Indiana, Vol. 43, No. 1 (February, 1978), p. 13.
16 Gould, Indiana Covered Bridges Thru the Years, p. 16
17 Gould, Indiana Covered Bridges Thru the Years, p. 19.
19 Ibid, George Gould, Outdoor Indiana, p. 7
20 Ibid, George Gould, Outdoor Indiana, p. 7
21 Ibid, George Gould, Indiana Covered Bridges Thru the Years, pp. 12 & 13.
22 Gould, Indiana Covered Bridges Thru the Years, p. 13
24 Gould, *Indiana Covered Bridges Thru the Years*, p. 31.

25 Gould, *Indiana Covered Bridges Thru the Years*, p. 27.

26 Letter to the author from Dr. George Gould of West Lafayette, Indiana (June 6, 1985).

27 Ketcham, p. 18

28 Ibid. George Gould, *Indiana Covered Bridges Thru the Years*, p. 17

29 Ibid, George Gould, *Indiana Covered Bridges Thru the Years*, p. 37

30 Ibid, George Gould, *Indiana Covered Bridges Thru the Years*, p. 34

31 From a brief phone conversation with the author on August 26, 1985.
Indiana's Vegetation 1816

Indiana's Major Roadways

1826-1850

1) Michigan Road
2) National Road
3) Lafayette and Jeffersonville Turnpike
4) Paolie Pike

Source: Dillon and Lyon, Indiana: Crossroads of America, 1978
ARCH MEMBER
DIAGONAL BRACE
VERTICAL POST
ROADWAY
TOP CHORD
BOTTOM CHORD
CENTER PIER
WATER LEVEL
END ABUTMENT
TIMBER BASE
RIVER BOTTOM
END ABUTMENT

DOUBLE SPAN BURR ARCH TRUSS
4. Abutment with Arch Butts
6. Floor Beams
KINGPOST

QUEENPOST
3. The J. H. Russell Bridge
MULTIPLE KINGPOST

BURR ARCH
10. The Interior of a Burr Arch Bridge
11. The Jackson Bridge
12. The Jackson bridge by Fredrick Polley
14. The Nest Bridge
15. The Narrows Bridge
16. The Narrows Bridge by Fredrick Polley
17. The Jeffries Ford Bridge
19. The Raccoon Bridge by Fredrick Polley
20. The Yountsville Bridge by Fredrick Polley
21. The Portland Mills Bridge
22. The Portland Mills Bridge by Fredrick Polley
23. The Dooley Station Bridge
25. The Dunlapsville Bridge by Fredrick Polley
26. The East Hill Bridge by Fredrick Polley
27. The Circleville Bridge by Fredrick Polley
23. The Connersville Bridge by Fredrick Polley
29. The Vine Street Bridge by Fredrick Polley
30. The Moscow Bridge by Frederick Polley
LONG

HOWE (USUAL)
33. The Brownsville Bridge
35. The Potters Bridge
36. The Traders Point Bridge
37. The Bean Blossom Bridge by Fredrick Polley
SMITH 4

POST
CHILDS
40. Single Burr Arch
41. Interior of a Howe Truss
42. Interior of a Howe Truss
Indiana's Covered Bridges 1985

Source: Indiana Covered Bridge Society Inc.
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Source: George Gould, *Indiana Covered Bridges Thru the Years*

Key: L=Little, B=Big, bp=Bridge has been bypassed, ??=there is uncertainty about builder or the construction date


Hardesty, Barbara, *Parke County Covered Bridges: Bridge Route Guide Completely Revised*, Parke County Historical Society, (no date of publication).

Indiana Covered Bridge Guide, Indiana Covered Bridge Society, Inc., Indianapolis, (no date of publication).


Personal letter received by author, June 6, 1985, from Dr. George Gould of Lafayette, Indiana, detailing the destruction of covered bridges since the publication of his book in 1977.