Form No. 10-300 (Rev. 10-74) PH0353418

DATA SHEET

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY	
RECEIVED	MAR 25 1976
DATE ENTERED	SEP 29 1976

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

~~HISTORIC~~

Technical: Laughery Creek Triple Intersection ~~Through-Truss~~ Bridge

AND/OR COMMON

** Laughery Creek Triple Intersection Through-Truss Bridge

2 LOCATION

STREET & NUMBER

Spanning Laughery Creek just (S of Aurora) west of ~~State Route~~ IN 56 __NOT FOR PUBLICATION

CITY, TOWN: Aurora vic. __VICINITY OF

CONGRESSIONAL DISTRICT: 9

STATE	CODE	COUNTY	CODE
Indiana	18	Dearborn & Ohio	029 & 115

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
__DISTRICT	X PUBLIC	X OCCUPIED	__AGRICULTURE	__MUSEUM
__BUILDING(S)	__PRIVATE	__UNOCCUPIED	__COMMERCIAL	__PARK
X STRUCTURE	__BOTH	__WORK IN PROGRESS	__EDUCATIONAL	__PRIVATE RESIDENCE
__SITE	**PUBLIC ACQUISITION**	**ACCESSIBLE**	__ENTERTAINMENT	__RELIGIOUS
__OBJECT	__IN PROCESS	__YES: RESTRICTED	__GOVERNMENT	__SCIENTIFIC
	__BEING CONSIDERED	X YES: UNRESTRICTED	__INDUSTRIAL	X TRANSPORTATION
		__NO	__MILITARY	__OTHER:

4 OWNER OF PROPERTY

NAME

Commissioners of Dearborn and Ohio Counties, jointly

STREET & NUMBER

County Courthouses

CITY, TOWN: Lawrenceburg and Rising Sum __VICINITY OF STATE: Indiana

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC.

STREET & NUMBER

CITY, TOWN STATE

6 REPRESENTATION IN EXISTING SURVEYS

TITLE: Historic American Engineering Record

DATE: 1973-74 X FEDERAL __STATE __COUNTY __LOCAL

DEPOSITORY FOR SURVEY RECORDS: Library of Congress

CITY, TOWN: Washington STATE: D.C.

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
__EXCELLENT	__DETERIORATED	__UNALTERED	X ORIGINAL SITE
X GOOD	__RUINS	X ALTERED	__MOVED DATE______
__FAIR	__UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The large metal bridge over Laughery Creek, probably constructed of wrought iron, makes use of what is known as a triple intersection truss, sometimes called a triple truss, triple intersection Whipple truss, or triple quadrangular truss. The name comes from the fact that each of the diagonal tension members crosses three panels as it runs from the upper chord to the bottom chord.

The bridge is composed of two lines of parallel trussing which support a roadway 18 ft. wide. The trusses are about 40 ft. deep, span a distance of almost 300 ft., and rest on stone abutments of random ashlar. Their length is divided into 21 panels each measuring 14 ft. 2 in.

Like other metal truss bridges, the Laughery Creek bridge is composed of three basic structural systems working together: the TRUSSES themselves, the UPPER LATERAL SYSTEM, and the FLOOR SYSTEM. The trusses consist of the CHORDS (upper and lower), which take forces due to bending, and the WEB, which takes forces due to shear. The upper lateral system, located in the horizontal plane of the upper chords, takes transverse loads and makes the structure rigid. The floor system supports the deck and transfers live loads to the trusses.

UPPER CHORD: The upper chord, as well as the inclined end posts (which actually are continuations of the upper chord) are built-up members consisting of angle sections joined by web plates to form channel sections; the top flanges of these channel sections, in turn, are connected by a cover plate, while the bottom flanges are connected by small batten strips.

LOWER CHORD: The lower chord is composed of multiple eyebars, pin connected at the panel points. The eyebars increase in number toward the center of the span, where the greatest tensile forces occur. They are arranged in two systems: some cross alternating panels and are placed within the plane of the vertical posts, while others (those that increase in number toward the center) each cross two panels and are placed outside the plane of the posts. Where bars of this second set cross panel points to which they are not connected, they rest on brackets attached to the ends of the floor beams, thus minimizing the deformation of the bars likely to occur as they sag under their own weight.

WEB: The web, that portion of the truss forming the plane between the upper and lower chords, is made up of 18 vertical posts, 18 diagonal tension members, 8 counter rods, and 2 first-panel hangers. The posts are built-up members composed of rolled channel sections joined by bar lacing, the diagonals are eyebars, the counters are small square rods, and the first-panel hangers are angle sections welded corner to corner to form a cruciform cross section. To counteract the tendency of the posts to buckle because of their slenderness and height, a horizontal strut runs between each post, bracing them at mid-height.

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Description (continued)

UPPER LATERAL SYSTEM: The upper lateral system is composed of latticed struts which run perpendicularly across the bridge joining the upper panel points of the two trusses, and lateral bracing rods which join the panel points diagonally. In addition, sway braces join the two trusses by running between every third post just above mid-height.

FLOOR SYSTEM: The floor beams are suspended by U-shaped hangers from the pin connectors at the lower panel points. They are built-up members of flange angles joined by web plates and covered by flange plates. The depth of the beams increases toward their centers. Lateral bracing rods, running diagonally across the bridge, are bolt connected to the floor beams near their ends. Between the floor beams, I-beam stringers (not original) help support the present concrete roadway.

The bridge is fixed at the southern end and rests on rollers at the northern end. The rollers, however, no longer function, as shown by the warping of the lower chord eyebars in the two southernmost panels of the west truss.

Each portal contains plaques showing the bridge's date, builder, and the names of the county commissioners responsible for its construction, with the north portal showing the Dearborn County commissioners, and the south portal having those for Ohio County.

8 SIGNIFICANCE

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW			
_PREHISTORIC	_ARCHEOLOGY-PREHISTORIC	_COMMUNITY PLANNING	_LANDSCAPE ARCHITECTURE	_RELIGION
_1400-1499	_ARCHEOLOGY-HISTORIC	_CONSERVATION	_LAW	_SCIENCE
_1500-1599	_AGRICULTURE	_ECONOMICS	_LITERATURE	_SCULPTURE
_1600-1699	_ARCHITECTURE	_EDUCATION	_MILITARY	_SOCIAL/HUMANITARIAN
_1700-1799	_ART	X ENGINEERING	_MUSIC	_THEATER
X 1800-1899	_COMMERCE	_EXPLORATION/SETTLEMENT	_PHILOSOPHY	_TRANSPORTATION
_1900-	_COMMUNICATIONS	_INDUSTRY	_POLITICS/GOVERNMENT	_OTHER (SPECIFY)
		_INVENTION		

SPECIFIC DATES 1878 BUILDER/ARCHITECT Wrought Iron Bridge Company

STATEMENT OF SIGNIFICANCE

The Laughery Creek bridge, which dates from 1878, is the oldest known metal bridge surviving in Indiana, as well as the most unusual. It was built by the Wrought Iron Bridge Company of Canton, Ohio, a large bridge manufacturer of the time, which apparently took a great deal of pride in its bridge at Aurora, for it pictured the structure extensively in its advertisements and promotional literature.

The bridge replaced an earlier wooden structure built in 1868, and the abutments date from that time. The unusual triple intersection design probably resulted from three goals: to make the entire crossing with a single span (thus requiring unusually deep trusses), to place the diagonals close to the standard economical inclination of 45°, and to maintain a reasonably short panel length. The design appears to be a variation of the Whipple Truss, common in the late 19th century, in which the diagonals cross two panels instead of three. The Whipple Truss was considered by engineers of the time to be an improvement over the simple Pratt Truss, in which diagonals cross only one panel; and it is reasonable to suppose that the builders of the Laughery Creek bridge assumed that a triple intersection truss would have similar advantages over a Whipple.

Unlike the Whipple, the triple intersection truss was never common in this country, probably because it required more material, more connection points, a greater number of differently sized members, and was confusing to analyze structurally. The greatest interest in the design appears in bridge books of the 1870's, but by the '80's and '90's it apparently was considered obsolete. It is not known how many were built in the United States, but the total cannot have been large. The Laughery Creek bridge, therfore, is not only a rare survivor, it is a rare type to begin with.

9 MAJOR BIBLIOGRAPHICAL REFERENCES

Commissioners' Reports, Dearborn County, Vol. 15; Dearborn Co. Courthouse, Lawrenceburg.
Johnson, John Butler, The Theory and Practice of Modern Framed Structures (New York, 1896).
Lawrenceburg (Ind.) Register, August 15-29, 1878.
Shreve, Samuel H., A Treatise on the Strength of Bridges and Roofs (New York, 1882).

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY less than 1

UTM REFERENCES

	ZONE	EASTING	NORTHING		ZONE	EASTING	NORTHING
A	16	683010	4321420	B			
C				D			

VERBAL BOUNDARY DESCRIPTION

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE
Indiana	18	Dearborn	029
Indiana	18	Ohio	115

11 FORM PREPARED BY

NAME / TITLE
Donald E. Sackheim & Alex P. Gratiot, Historians; Eric N. DeLony, Architect

ORGANIZATION: Historic American Engineering Record — DATE: March, 1975

STREET & NUMBER: National Park Service — TELEPHONE: 202-523-5460

CITY OR TOWN: Washington — STATE: D. C.

12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS:

NATIONAL ___ STATE x LOCAL ___

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

FEDERAL REPRESENTATIVE SIGNATURE [signature]

TITLE Indiana State Historic Preservation Officer — DATE March 22, 1976

FOR NPS USE ONLY
I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

[signature] DATE 9/29/76

Acting DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST: [signature] DATE 9/27/76

KEEPER OF THE NATIONAL REGISTER

AD 76-18

RECEIVED 2280
MAY 4 2002
NAT. REGISTER OF HISTORIC PLACES
NATIONAL PARK SERVICE

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determination for individual properties and districts. See instruction 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 Laughery Creek Bridge

other names/site number "Triple Whipple" bridge; Dearborn County Bridge #95; Ohio County Bridge #27; 029-029-50023; 115-029-00002

2. Location

street & number Old State Road 56, 2.5 miles south of Aurora, Indiana [N/A] not for publication

city or town Aurora [X] vicinity

state Indiana code IN county Dearborn/Ohio code 029/115 zip code 47001

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 36 CFR 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 [ ].)

[signature] State Historic Preservation Officer 4·24·02
Signature of certifying official/Title Date

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:

Sign

[ ] 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
See continuation sheet [ ]. Additional Documentation Accepted

Edson H. Beall 5/29/02

5. Classification

Ownership of Property
(Check as many boxes as apply)

[ ] private
[X] public-local
[ ] public-State
[ ] public-Federal

Category of Property
(Check only one box)

[ ] building(s)
[ ] district
[ ] site
[X] structure
[ ] object

Number of Resources within Property
(Do not count previously listed resources.)

Contributing	Noncontributing	
		buildings
		sites
		structures
		objects
		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.

1

6. Function or Use

Historic Function
(Enter categories from instructions)

TRANSPORTATION
Sub: Road-Related (Vehicular)

Current Functions
(Enter categories from instructions)

VACANT/NOT IN USE
Sub: N/A

7. Description

Architectural Classification
(Enter categories from instructions)

Other: Triple-Intersection Pratt Through Truss

Materials
(Enter categories from instructions)

foundation Stone
walls
roof
other Wrought Iron, Steel, Concrete

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

Laughery Creek Bridge
Name of Property

Dearborn/Ohio Counties, Indiana
County/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.)

[ ] **A** Property is associated with events that have made a significant contribution 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

Periods of Significance
1868-1952

Significant Dates
1868, 1878

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

Cultural Affiliation
N/A

Architect/Builder
Wrought Iron Bridge Company, Canton OH (Bridge)
William Green & Co. (abutments)

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

[X] 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 -16

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 2.884 acres

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

	Zone	Easting	Northing
1.	16	683010	4321420
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 Joseph P. Saldibar III

organization Colorado Historical Society date 15 February 2002

street & number 1300 Broadway telephone 303-866-3741

city or town Denver state CO zip code 80203

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____________________

street & number____________________ telephone__________

city or town________________ state________ zip code__________

Section 7: Architectural Description

Introduction:

The Wrought Iron Bridge Company of Canton, Ohio fabricated this single-span, pin-connected triple-intersection Pratt through truss which is seated upon cut-stone abutments. The bridge is 302 feet long and carries an 18-foot wide concrete roadway approximately 20 feet above Laughery Creek. All bridge members are made of wrought iron with the exception of the I-beam stringers and expansion bearings, which are made of steel. Originally part of the Madison-Lawrenceburg highway, the bridge was bypassed in 1959 and is now closed to traffic.

Environment:

The bridge stands in a quiet setting just a few hundred feet from IN-56, a state highway. The structure has been closed to traffic for many years. On the southern end, the bridge is barricaded by what appears to be two verticals from another, now-demolished bridge. These "verticals" are pairs of laced channels that have been welded to the endposts to block vehicular access. The northern end of the bridge is open; however, the road leading to the bridge on this end has been gated.

The Ohio County (southern) end of the bridge is located in a small residential area, including several farmhouses that pre-date the metal bridge. The Dearborn County (northern) side of the bridge is located in a wooded area, bordered by a boating club and Riverview Cemetery (1869, #029-029-50022). Laughery Creek is navigable to small watercraft, and is often used by fishermen and recreation boaters. Trees and underbrush have begun to overtake the bridge, particularly at the Dearborn County end.

The bridge:

The upper chord and endposts of the trusses are of especially heavy construction. Crafted, heavy channels (composed of built-up angles) are joined by a wide cover plate. The bottom flanges of the channels (forming the inside of the chord and endposts) are reinforced with battens.

Pairs of laced, heavy channels subdivide the truss into most of its 21 panels. The initial verticals at each end are cruciform in section, and are composed of built-up angles. The intermediate verticals are protected against buckling by a horizontal strut known as a "center channel." This strut runs at mid-height, and consists of a pair of small channels riveted together with battens. The center channel is tightened by a pair of adjustable diagonals which slope downward from the endpost/top chord connection to the first intermediate vertical.

Pairs of eyebars serve as diagonals, and stretch across three panels. Counters are made of small square rods. The truss is largely uncountered, mostly due to the sheer weight of the bridge (which generally limits the reversal of stress from tension to compression in the diagonals). There are a total of nine diagonals and four counters per truss. Brackets placed on each intermediate vertical help to hold the eyebars in place and prevent excessive flexing of the diagonals while under load.

A two-track system of eyebars forms the lower chord. The inner track of eyebars are a panel wide, and are placed at every other panel. The outer track stretches across two panels and consists first of a single eyebar, then a pair of eyebars, a pair of eyebars, a set of three eyebars, and a set of three eyebars. At the center panel, there are three single-panel eyebars in the outer tier and a single-panel eyebar in the inner tier. Brackets attached to the floor beams help to support the double-intersecting outer track eyebars where they cross panel points to which they are not attached.

The two trusses are connected to each other above the roadway by latticed struts at each panel point. Bracing rods join each panel point diagonally, forming a series of boxed "X"s at the top of the trusses. For additional stabilization, sway braces at every third vertical join the trusses at mid-height.

U-bolted to the lower pins, plate-girder floor beams carry steel I-beam stringers and a concrete deck. The stringers and deck were added c.1947, replacing the original timber stringers, timber deck, and macadam wearing surface (the latter was probably an early 20th-century addition.) Lateral bracing rods criss-cross the between the floor beams, and are bolt-connected to the beams near their ends.

The truss rests on a cut-stone substructure, which was built in 1868 for a timber bridge which preceded the current iron span. Both abutments were capped with concrete c.1947 during the bridge's rehabilitation. The northern abutment is 31 feet wide and 13 feet long, and is 15 feet high. The southern abutment is larger and more substantial than its northern counterpart. It is 30 feet wide and 20 feet long, and is 20 feet high. Anchor bolts with star-shaped anchor plates supported both abutments; today the bolts remain, but only the southern abutment retains the anchor plate. Because of a shift in the creek's course, the southern abutment now extends into the water by a few feet. The bridge trusses are fixed at the southern end, and rest on an expansion roller nest (c1947) at the northern end.

Decoration is mostly limited to a few simple plaques. At each end of the bridge, attached to the first latticed strut, is an iron plaque with the names of the county commissioners. The southern portal, in Ohio County, lists the commissioners for that county, and the northern portal, in Dearborn County, follows the same arrangement. Each plaque is topped by a small section of decorative ironwork, which was typical of WIBCo spans of the period.[1]

Also stretching across the portals (at mid-height) is a latticed, three-section portal bracing. The outer sections incline downward from the center to the endposts. Attached to this bracing is another plaque inscribed with the name of the builder: "*Wrought Iron Bridge Company Builders Canton Ohio*". Above the portal bracing is a thin metal plate extending nearly the width of the bridge; this appears to be a sign setting the speed limits on the bridge (the words "no faster than a walk" can be made out on one panel). Diagonal rods run between the upper and middle portal bracings; at their intersection is a small metal plaque with the date, "*1878*".

Condition and Integrity:

The bridge is in very good condition, considering its age and relative lack of maintenance. The trusses exhibit only surface rust. No signs of accelerated deterioration are noticeable. The concrete deck, often the most deteriorated portion of a historic bridge, is in good condition. The only damaged members are a diagonal which has been indented slightly (perhaps from an automobile collision), and two eyebars in the lower chord, which have buckled outward. A metal pipe railing, of uncertain age, has suffered the most damage. Portions of the railing have come loose from the sides of the truss and lie on the road deck. The stone abutments, now 131 years old, are in good condition, but are in need of repointing.

The bridge retains almost all of its original members. The only replacement of members occurred in c.1947, when the State Highway Department replaced the original deck and stringers with steel stringers and a concrete deck. The upgrading and replacement of decks is a common occurrence among metal bridges. The new deck is now more than 50 years old, and does not detract from the appearance or integrity of the original members. The deck and stringers appear to be in good condition. The Highway Department also replaced the iron-bearing roller nests (used for expansion) under the north end of the trusses. The replacement nests used carbon-steel ball bearings, which have since rusted together. The resulting failure of the roller nest has caused some buckling in the eyebars of the lower chord members closest to the north abutment. Roller-bearing failure is relatively common among older metal truss bridges.[2]

Current plans call for restoring the bridge and opening it to pedestrian traffic, possibly as part of a longer bike-walk corridor along the Ohio River. The trusses will be cleaned and repaired. The bent members will be straightened and retained. At the same time, the rusted roller nest assemblies will be taken out and replaced with bronze/stainless steel nests, which are more durable. The stone abutments will be re-pointed and strengthened. A visitor parking area to the south will allow access to the structure.

The bridge retains much of its original structural integrity. It was originally designed for a load of about 100 pounds per square foot. Howard J. Barth and Associates of Greensburg, Indiana, an engineering firm that recently (1994) assessed the structure, found that it "was capable of 93 to 100 pounds per square foot" as a pedestrian bridge. The bridge was also determined to be capable of near-modern highway loads.[3]

Since 1878:

The bridge, once completed, remained in service for eight decades. The only known historic photograph of the bridge, taken at the turn of the century, shows a gravel country road in a relatively rural landscape.[4] Both bridge and road became part of State Road 56 in the 1920s when the route was absorbed by the Indiana State Highway Commission.

In the late 1940s, the Highway Department began a repair and rehabilitation project for what it called Structure 56-5-3163. The bridge's deck was, at the time, surfaced with macadam over timber, supported by timber stringers. The rehabilitation project removed the deck and stringers and replaced them with new steel stringers and a concrete deck. The stone abutments were given concrete caps. The original floor beams were retained, however.[5]

In 1959, the Highway Department bypassed the old Laughery Creek Bridge with State Highway Bridge # 56-58-4439A, a nine-span structure comprised of continuous steel beams and reinforced concrete girders. That bridge remains in place today, carrying traffic along busy SR 56.[6]

The Ohio River was both a force of providence and a force of destruction for 19th-century river towns. Lawrenceburg and Aurora, located along a sharp bend in the Ohio, were perhaps especially vulnerable to the river's fury. A number of floods plagued the towns, and the bridges which surrounded them. Since the bridge was constructed in 1878, more than a dozen serious floods (cresting over 60 feet) have hit Laughery Creek and the Ohio River. The worst, in 1937, crested at 81.8 feet. A flood level of 60 feet would bring Laughery Creek in contact with the lower chord of the bridge.[7] The survival of the Laughery Creek Bridge in the face of these floods is a testament to the quality of its design and construction.

Section 8: Statement of Significance

Part 1--The Bridge and Site

Introduction:

The Laughery Creek Bridge, Dearborn County, Indiana is a nationally significant example of a 19th century "catalog" iron bridge. It was built by the Wrought Iron Bridge Company of Canton, Ohio, which was one of the leading bridge-building firms of the late 19th century. At the time of its construction, and for many years after, it was the largest single-span bridge fabricated by the company. The company took great pride in the structure and featured it prominently in advertisements and literature.

The bridge is also significant for its unique Triple-Intersection Pratt truss design. It is the only extant Triple-Intersection Pratt truss in the world. This unusual design was the culmination of many decades of bridge engineering that sought to increase the capabilities of the iron truss while maintaining efficiency and cost-effectiveness. The design also allowed for a single-span highway bridge of 300 feet in length-- making it one of the longest (if not the longest) highway truss bridges of its day.

The bridge is also significant as a rare surviving example of the first period of long-span bridge construction, which took place in the United States from 1865 to 1885. During this period, engineers first began to use truss design to create iron bridges of more than 300 feet in span-length. Most of these structures were railroad bridges, replaced in the early 20th century. The Laughery Creek Bridge remains as a reminder of this great period of bridge engineering.

Truss bridges, in general, have received far less attention from engineers and historians than suspension, cantilever, and covered bridges. Many books which do cover metal truss bridges often do so only briefly, and tend to repeat information printed in earlier texts. Those books and publications that provide detailed information on metal truss bridges often mention the Laughery Creek Bridge and its unusual design. Judith Dupre, in her book <u>Bridges: A History of the World's Most Famous and Important Spans</u>, includes four truss bridges: a Fink truss, a Bollman truss, an early Whipple bowstring, and the Laughery Creek Bridge.[8] Donald C. Jackson includes the bridge in his book <u>Great American Bridges and Dams</u>, which lists the major engineering structures of each state.[9] T. Allen Comp includes the bridge in "Bridge Truss Types: A Guide to Dating and Identifying," a publication of the American Association for State and Local History.[10] Eric DeLony, Chief of the Historic American Engineering Record, features the bridge in his book <u>Landmark American Bridges</u>.[11]

DeLony, in a letter to Howard Barth & Associates (the firm which prepared restoration plans for the structure in 1993), states the following:

> "The following opinion is based on... my twenty-one year tenure with the Historic American Engineering Record. During this time, I have overseen the documentation of more than 900 historic bridges, and focused my own personal interests, research, writing, and publishing on the history of American bridge building... After comprehensive review of the facts, I emphatically stand by my assessment that [the] Laughery Creek Bridge is a nationally significant example of a pre-fabricated metal truss span."[12]

Early History:

Laughery Creek, named for Revolutionary War figure Archibald Lochry (killed in battle here), is one of many tributaries which feed into the Ohio River from southeastern Indiana.[13] Following the War, southeastern Indiana became the frontier for the beginnings of Westward Expansion. The 1818 Treaty of

St. Mary's opened up large areas of Indiana to settlement, and turned river communities into gateways for pioneers.[14]

Two of these communities were Aurora (founded 1819) and Rising Sun (founded 1814). In 1823 a road was laid out between them as part of a larger Ohio River route that connected Lawrenceburg with Madison.[15] These four towns, like many along the Ohio River, were prosperous and growing communities fueled by the burgeoning river boat trade. The road crossed a number of small streams along its 50-mile length, as well as two major tributaries: Indian-Kentuck Creek in Jefferson County, and Laughery Creek. When the intersecting stream was not fordable, ferries carried traffic from bank to bank. This arrangement prevailed for many roads in Indiana at the time.

The ferry at Laughery Creek lasted until 1867, when the county commissioners of Ohio and Dearborn Counties chose to replace it with a bridge.[16] River towns were enjoying a new wave of post-war prosperity following several decades of slow decline.[17] Traffic on the Madison-Lawrenceburg Road made a ferry impractical for crossing a small waterway like Laughery Creek. At the same time, the railroad network was making it easier to bring in outside materials and expertise-- including bridge supplies and engineers.

On 24 August 1867, at a joint meeting between the Ohio and Dearborn County commissioners, a decision was made to build a bridge "at the lower ferry" at a cost not to exceed $30,000.[18] In December of 1867 the county commissioners made the bridge project a reality by awarding a contract to John R. Frost of Hamilton County, Ohio. William Green & Co. was awarded the contract for the cut stone substructure.[19] Frost's bridge was substantial: 300 feet in length, 23 feet wide, and about 30 feet high. It was a Howe truss, with a wrought iron lower chord, following a design patented by Frederick H. Smith of Baltimore's Smith, Latrobe, & Co.[20]

Troubles plagued the project from the beginning. "Messrs. Green & Co." finished the north abutment in good time, but stalled on the southern abutment. There seemed to be no firm foundation for the stone, only quicksand, so the contractors were forced to drive timber piles instead. A seasonal flood caused further delays. The work was finally completed in December, 1868. "It looks as if they were here to stay," the *Aurora People's Advocate* dryly noted, "One would judge that they would last for all time."[21] Once the stonework was complete, Frost was able to begin his mammoth timber bridge.

On 9 September 1869, nearly two years after the project began, the bridge opened to traffic. To the ire of county officials, it was overdue and vastly over budget. Thanks to the unexpected abutment fiasco, the $21,000 budget had ballooned to $41,000.[22] The average going rate for a covered bridge in 1869 Indiana was about $10,000-$15,000, and the 3-story Dearborn County courthouse, completed in 1870, cost just $100,000.[23] In an article titled "Experimenting With the Peoples' Money", the *Lawrenceburg Register* thundered:

> "...but it is said, 'Oh, the Commissioners have the contractor's bond that it shall stand for five years'-- Yes, but if it goes down with the first big freshet (we have heard it has already been moved from its foundation) maybe Mr. Contractor will be around to build you a new bridge, and maybe he won't..."[24]

On the night of 3 June 1878 the bridge, less than a decade old, collapsed into Laughery Creek and was declared a total loss. "A perfect wreck," mourned the *Lawrenceburg Register*. Frustrated county officials could do nothing more than salvage what remained from the river and sell it for scrap, which they did.[25]

A New Bridge for Laughery Creek:

Needless to say, when the county commissioners met on 6 July 1878 they were less than satisfied with timber bridges. Their efforts to replace the Laughery Creek ferry had cost them thousands of dollars.[26] Nevertheless four of the six commissioners voted to rebuild the bridge.[27] They appointed Ohio County Commissioner John Hannah and Dearborn County Commissioner Frederick Slater to "examine such bridges as they may think expedient, and report in reference to their excellencies."[28]

It seems clear that when Hannah and Slater were sent to examine bridges, they were sent to examine *metal* bridges, for the two men did not consult any timber bridge builders about the possibility of spanning Laughery Creek. Instead, they journeyed to Canton, Ohio, home of the Wrought Iron Bridge Company. They met with David Hammond, the firm's president and main salesman. Hammond was a carpenter-turned engineer who left most of the "engineering" to trained professionals.[29] Despite his limitations, he spoke at length with Hannah and Slater, and gave them "all the information he could, in regard to bridge building."[30]

Intrigued by Hammond's sales pitch, the two commissioners traveled to Tifflin, Ohio, to see a 206-foot bridge which WIBCo was in the process of erecting over the Sandusky River. Next they swung to the south, and examined the Newport Bridge over the Ohio River at Cincinnati, with a center span of 415 feet. While in Cincinnati, the commissioners also looked at the recently completed Cincinnati Southern Railroad Bridge, a product of the Keystone Bridge Works of Pittsburgh, Pennsylvania. With a center span of 515 feet, it was the longest single span truss in the world.[31]

Each of these long-span bridges was a Whipple truss. The Tifflin bridge differed in one important respect, however. It did not have enclosed Phoenix-like columns for bridge members like the two Ohio River spans. Hannah and Slater found this important. When they reported their findings on 27 July 1878, they stated:

> "As far as our judgement goes, we would recommend the wrought iron bridge built at Canton, Ohio for one reason, and that is this: you can get at all parts of the Canton bridge, to paint it, which you cannot, on a tubular bridge, and the result will be that the rust on the inside of those tubes will eventually eat through, and for that reason we favor the Canton bridge.

The contention by the two county commissioners that the tubular column was rust-prone, however, does not seem to be supported by present or past literature.[32] The decision was likely based on the horse sense of the commissioners. Neither man was an expert on bridges or iron-- Hannah was a farmer, and Slater was a farmer and merchant.[33] Like many county commissioners of the day, they relied mostly on intuition, advice, and hearsay to make their decisions. It was a system that J.A.L. Waddell would later blast as "synonymous with ignorance, cupidity, and graft."[34] Nonetheless, the two counties had certainly gone out of their way to gather information, sending two of their own on a 500-mile journey to meet with bridge salesmen and examine various bridge types.

The county commissioners pondered the report of Hannah and Slater and, in a meeting on 5 August 1878, decided to advertise for a new bridge. Dearborn County engineer Henry Fitch drew up the specifications. They called for one of three bridge types:

1) Iron bridge, 300 feet, single span, to be built on the old stone abutments;
2) Iron bridge, 200 feet, single span, to the same specifications as (1), to be built on the old south abutment and a new north abutment;
3) Timber bridge, 200 feet, single span, on the abutments described in (2).

The bids were due on 2 September 1878. Notices were placed in the *Lawrenceburg Register* and *Rising Sun Saturday News* each week, and every other day in the *Cincinnati Daily Enquirer* and *Cincinnati Daily Gazette*.[35]

On 9 September 1878, the commissioners met again to review the bids. A number of bids had been received but, according to Henry Fitch, many did not meet the requirements stated in the public notice. Only four bids appeared to meet the standards: the Wrought Iron Bridge Company, the Keystone Bridge Company, and two others.[36] Slater moved to build the proposed 300-foot iron bridge, and the motion carried. After much discussion, the commissioners settled on Wrought Iron's "Plan A" for a 300-foot bridge. The contract required that the bridge be finished by 1 December 1878, with a $20-per-day penalty imposed for every day over that.[37] A bond was filed, and the work began.[38]

The building of the new bridge was chronicled in the "Around Town" columns of the local newspapers, including the *Rising Sun Recorder* and the *Lawrenceburg Register*. The contract was announced on 12 September, and "four carloads of iron arrived in Aurora for the Laughery Bridge" in mid-November. The trusses themselves were finished by 16 November.[39]

On December 7th, the *Rising Sun Saturday News* reported that the bridge was still not done, and was overdue. The same day, the *Rising Sun Recorder* reported that Ohio County had paid $10.45 to C.C. Murdock for "work on bridge", as well as $5.25 to George Gibson for "nails for bridge."[40] It seems likely that the timber deck was being laid during the first week of December.

The bridge was finally completed on 10 December 1878. According to the terms of the contract, Wrought Iron was charged $200 for the 10-day delay. The late fee was later forgiven. The total cost of the bridge (not including the late fee) was $17,458.00, much less than John Frost's timber span had cost in 1869. The bill was split between the two counties based on their taxable income: Dearborn County paid $14,526.95 (83%), while smaller Ohio County paid $2,931.05 (17%.) Officials in Rising Sun took out a $2,000 loan at 7% interest to finance their portion of the bridge, and were 'paid up' by 1880.[41]

Part 2--The Design

The development of the truss:

The father and son team of Caleb and Thomas Pratt patented the truss which bears their name in 1844.[42] The Pratt truss had diagonals acting in tension, and verticals acting in compression, in direct opposition to the leading timber truss design of the day—the Howe. In an iron bridge, this meant that the long diagonals could be kept thin without the risk of buckling. This saved metal and money.

Pratt trusses gradually became the standard for American bridge design, first in railroad construction and then, in the 1880s, for highway use. By 1885 the Pratt and its variants dominated the market, while the Howe was relegated to covered bridges. The Warren truss, patented in 1848, would not become a major truss type until the 20th century.[43]

The first attempt to tinker with the basic Pratt design came in 1846, when Squire Whipple built the first truss which bears his name.[44] He patented the design the following year. Whipple was, like Thomas Pratt, a college graduate. In addition to bridge engineering, he was a surveyor, teacher, and farmer.[45]

Whipple backed up his new truss with the publication of a milestone engineering text. *A Work on Bridge Building* (1847) was the first American book to outline a method for calculating the forces acting on a truss. It also discussed the nature of truss bridges and the strengths of wood and iron. Written in simple fashion for the practical builder, not the scholar, *A Work on Bridge Building* laid the groundwork for the science of bridge building that we know today.

Nineteenth century bridge designers, including Whipple, believed that the optimal angle of the diagonals should be 45 degrees. In order to reach this desired angle, designers could adjust the height of the verticals or the width of the panels (the areas between the verticals). Whipple invented a third option--keeping the panel width and truss height the same, and extending the diagonal members across two panels instead of one. This allowed for improved bracing, better distributed tension among members, and greater truss strength.[46] A stronger bridge was a longer bridge, and Whipple trusses were often used in the late 19th century for spans of more than 150 feet.

It seems inevitable that, given the success of double-intersecting, someone would move on to triple-intersecting (it appears that no one moved on to quadruple-intersecting, at least not with Pratt trusses).[47] The design first appeared in bridge design books in the 1870s. Here it was referred to as a "triple intersection truss", "triple truss", "triple quadrangular", and "triple system...of the Whipple type."[48]

The argument for triple-intersecting was reasonable. The longer the span, the deeper the truss becomes, in order to maintain rigidity and to minimize the amount of metal needed in the chords. The deeper the truss, the wider the panels become in order to keep the diagonals at the proper slope. The wider the panels, the greater the distance between the floor beams. The further apart the floor beams are, the heavier the stringers and deck must be to carry the weight of traffic between panel points. All of these things increase the dead load placed on the bridge, requiring heavier and more expensive members and decreasing the allowable live load.

By crossing three panels instead of two (or one), the trusses could be made very deep without the correspondingly wide panels while still retaining the desired 45-degree angle. Thus the long, strong bridge that deep trusses allowed could be had without the need for a cumbersome, heavy, and expensive floor system. Thus, despite the relative complexity of the design (the truss required more pinned connections and more variations in the size of members), it could be considered economical.

The deep trusses allowed by the triple-intersection made it useful for spanning large distances. The lack of information on other triple-intersection trusses, however, prevents us from knowing exactly what they were capable of. The only other known American triple-intersection, the Rondout Bridge in New York, had two spans of 264 and 241 feet, respectively.[49] These lengths could have been handled by Whipple trusses. At the other end of the scale is a proposed 715-foot truss designed by Thomas Clarke, which also employed the triple-intersection system. Clarke, a noted engineer, was a significant supporter of triple-intersecting trusses.[50]

The triple-intersection truss had its share of problems, or so it seemed. Aside from the number of posts, connections, and pins, there was the factor of metal fatigue. The longer the diagonals in a truss, the more subject they are to flexing as a load moves across the bridge. This in turn can result in metal fatigue at the center of the diagonal, causing them to wear out and occasionally snap under load. This was a noted problem in the Whipple truss.[51] In practice, large triple-intersections like Laughery Creek were so heavy that the reversal of stress from tension to compression (and the resulting flexing) was not a major factor. But bridge engineers, wary of long diagonals, tended to avoid using them.

The need for short panels also came under scrutiny in the 1880s. While engineers of the 1870s advocated short panels as a means of maintaining economy, the engineers of the 1880s supported the exact opposite view. Wide panels became "such a prominent feature of present good practice" that they became standard practice for engineers.[52] Subdivided panels, as in the Baltimore and Pennsylvania trusses, meant that the verticals could be kept far apart while maintaining a light floor system. This, in turn, allowed for the same deep trusses provided by the triple-intersection. The Pennsylvania went a step further by arching the upper chord, making the bridge deep where it needed to be, and less deep where it did not. This design meant shorter and fewer verticals, lighter floor beams, and increased capacity. It also marked the end of multiple-intersecting trusses, at least in theory. In practice, however, Whipple trusses continued to dominate the bridge industry.

By 1878 there were a number of competing designs on the market. Some, like the Pratt, were open to any bridge builder; others, like the Lenticular, were the exclusive property of a single bridge firm.[53] The commissioners of Dearborn and Ohio Counties had several truss types to choose from, even with the site considerations and restrictions they faced (see Site Considerations, below). Available truss types would have included the Whipple, Triple-Intersection Pratt, Post, Pennsylvania, and Lattice Warren.[54] Of course, because the county commissioners were not engineers, the number of truss types they had to choose from was determined by the number and types of designs submitted by bidding companies.

Site Considerations:

The design of the Laughery Creek Bridge was due to several factors. The county commissioners desired to re-use the stone abutments which had cost so much to construct in 1868. Although builders were given the option of designing a shorter span with a new north abutment, the commissioners seem to have had their hearts set on re-using both abutments. In the meeting on 9 September 1878, when the bids were reviewed, the commissioners moved quickly to build the 300-foot truss. One might conclude that they were overly confident in the ability of bridge builders to span such a distance. The 300-foot Howe truss had raised eyebrows in 1869: it had "a span a hundred feet longer than anything of the kind known in this latitude."[55] The county officials may have been of the opinion that if timber could not handle the bridge they wanted, than certainly iron would.

Another factor in the design was the lack of a supporting pier in the center of Laughery Creek. Had one existed, a two-span timber bridge would probably have served the counties until the 20th century. Unfortunately, the difficulties encountered with laying the southern abutment exposed the potential for similar problems in mid-stream. Also, Laughery Creek was a fairly swift and dangerous river.[56] Finally, construction of a pier would have been an added expense that the thrifty commissioners would have rather done without.

Cost, of course, was the most deciding factor of all. An 1859 state law placed the county commissioners in charge of bridge construction in their particular county. The commissioners could authorize a toll bridge operated by a private company, or they could pay for the bridge themselves and charge a toll to pay for construction. Tolls, however, were a complicated and sensitive political issue. Where tolls were not feasible, the county could choose to erect a bridge using tax dollars. In many cases private subscriptions from local citizens were encouraged.[57]

In the case of Laughery Creek, where two sets of commissioners were involved, the issue became more complex. The price of the bridge had to appeal to two sets of men from two different counties with two different tax rates and financing structures. The funding for the 1869 bridge was split 50/50.[58] The new bridge, however, was split according to each county's tax base: Dearborn 83%, Ohio 17%.[59] Thus Dearborn, paying the larger share, and Ohio, the smaller (and poorer) county, both had very good reasons for keeping the price as low as possible.

Putting it all together:

Because of the length of the Laughery Creek bridge, and the desire to keep costs as low as possible, Wrought Iron's engineers turned to the triple-intersection truss. Despite the many connections and different-sized members, it was still cheaper to build than the Pennsylvania, which had all of these things and an arched upper chord as well. The Pennsylvania, moreover, was relatively new to the bridge scene (1875). The Post truss was already losing its popularity by this point, and it seems unlikely that anyone would have considered it for Laughery Creek. The Lattice Warren (multiple-intersecting) was difficult to pin because of the increased stress at the connection points. Lattice Warrens usually involved a lot of riveting, which was expensive. Thus, the only real choices were the Whipple and "Triple Whipple".

The Laughery Creek Bridge has 21 panels, each about 14 feet wide. A Whipple truss of similar dimensions would have 15 panels, with panels nearly 20 feet wide.[60] This would have meant a much heavier floor system. For a railroad, the Whipple may have presented the better choice, because a heavy floor system was desirable for the heavy trains which crossed it, and the money needed for stronger bridge members was easily found in the deep pockets of the major railroad companies.

But the buyers of the Laughery Creek Bridge were not railroad men. They were not looking for a heavy-duty bridge, nor did they have the funds available to pay for one. For highway commissioners in the 1870s, massive Whipples and subdivided Pennsylvanias were still in the realm, and the cost range, of the mighty railroads.

In the end, the decision to choose the Wrought Iron Bridge Company's "Plan A" was based on cost. It was the cheapest bid received for the type of bridge the commissioners wanted: an iron bridge re-using the costly stone abutments. Not being engineers themselves, they relied mostly on the bids and their own intuition to decide what to build. Given the comments of Slater and Hannah, it appears that they favored WIBCo. from the beginning. By choosing the Triple-intersection, however, the commissioners did themselves a favor. They chose a bridge that would handle heavy traffic for eight decades-- certainly a long lifespan for a 19th-century 'wagon bridge.'

Comparisons:

The design of the Laughery Creek Bridge exhibits some standard practices common in 1878, and some unusual features not found on most highway bridges of the time. The triple-intersecting diagonals, of course, set the bridge apart, and the extreme length of the span is also notable. Many bridge members are normal in design, but oversized in scale. The long diagonals and tall intermediate verticals are good examples. The very heavy members of the upper chord are fabricated much like a railroad structure, understandable given the extreme length and size of the trusses. The center channel strut was commonly used to prevent buckling in tall trusses.[61]

The two-track system of eyebars in the lower chord is notable. Eyebars had been used for lower chords since Linville introduced them to the Whipple trapezoidal truss in 1861.[62] The double system on the Laughery Creek Bridge reveals a sophisticated response to a significant problem encountered when designing a long truss. Stress on the lower chord increases towards midspan, and in a long truss the effect of this stress is magnified. To keep the lower chord from buckling, designers used many small and often heavy eyebars. At Laughery Creek, the designers cut down on the number of eyebars needed by making them double-intersecting. To tie in the unsupported panel points, they devised an "inner track" of single-intersecting eyebars which connect the unsupported posts to the main chord. This effective, metal-saving arrangement is one of the reasons why Wrought Iron's bid was 30% less than its competitors.

The depth-to-length ratio is also notable considering the length of the span. The bridge has a truss height of 40 feet, and a length of about 300 feet, for a ratio of 1:7.5. Generally, a lower ratio meant better economy.[63] In long-spanning Whipple trusses, however, designers found it hard to keep the ratio below 1:10.

The Cincinnati Southern Railway Bridge, for example, had a span length of 515 feet and a depth-to-length ratio of 1:10. This meant that the panels were nearly 26 feet long (25 feet was usually considered the maximum efficient length). If the bridge were to have a more efficient depth-to-length ratio of 1:8, it would have been 64 feet high with panels 32 feet long. By contrast, had the bridge been triple-intersecting, it could maintain a 1:8 ratio with panels only 21 feet wide.

The low ratio of the Laughery Creek Bridge demonstrates the efficiency of the truss type and the creativity of the designers. The bridge was one of the few long-span metal truss bridges of the day to meet or exceed the efficiency ratio that was generally standard for smaller Whipple and Pratt trusses.[64]

Size:

The Laughery Creek Bridge is significant in part because of its immense size. Single-span highway truss bridges of 300 feet simply did not exist in 1878. The few bridges that did span more than 300 feet were either railroad bridges built by large, deep-pocketed railroad companies, or other structural designs (suspension, arch) which had greater capabilities than the metal truss bridge.

The largest truss bridge in the country in 1878 was Jacob Linville's Cincinnati Southern Railway Bridge over the Ohio River at Cincinnati (1877). This was a railroad bridge that included several large Whipple trusses; the largest spanned 515 feet. There were other railroad truss bridges over 300 feet, employing several truss designs. A search of metal truss catalogs of this period, as well as a survey of exiting literature (modern and contemporary), reveals no highway truss covering as much distance in a single span as the Laughery Creek Bridge. It is entirely possible that this bridge was the longest single-span highway truss bridge in the United States at the time of its construction.

Thus, the extreme length of the Laughery Creek Bridge represents an important part of American bridge-building history. Previously, large spans had been in the realm of wealthy railroads or specially trained engineers. The Laughery Creek Bridge opened the door to large-scale "catalog" bridges, which could be ordered by counties and rural areas for their highways at a reasonable price—and without the need for extensive knowledge in bridge design and engineering principles. For three decades after the construction of the Laughery Creek Bridge, long-spanning bridges were constructed by bridge-building companies. Not until the mid 1910s, with the advent of the State Highway Department, would specially trained engineers resume responsibility for building such structures.

Finally, the Laughery Creek Bridge stands as a rare survivor, not only as a truss type, but also as a long-spanning bridge from this early and influential period in bridge construction. Between 1860 and 1885, American engineers pushed the iron truss to new limits, utilizing clever truss designs to get the most from the material. The construction of the Steubenville Bridge (1863), a 320-foot Whipple truss, marked the beginning of long-span bridge construction in the U.S.[65] This first period ended around 1885 with the introduction of steel as a building material. Steel, much stronger than iron, allowed for longer bridge spans.

The other bridges dating from this period-- the Steubenville Bridge (1863), Cincinnati Southern Railway Bridge (1877), C&A RR Missouri River Bridge (1879), etc. --have all been demolished. Only the "Triple Whipple" remains to illustrate the tremendous developments in the field of long-span bridge design taking place at this time.

Part 3--The Company

Introduction:

The Wrought Iron Bridge Company of Canton, Ohio was a leading fabricator of metal bridges in the late 19th century. The firm specialized in prefabricated highway bridges which were sold to county commissioners and featured in widely distributed catalogs. There were many "catalog" bridge builders in the 19th century, but Wrought Iron was one of the largest and most important. The scope and importance of the company can be seen in the comments taken from widely scattered "Historic Bridge Inventories":

"...an important 19th century bridge fabricating company." (*South Dakota, 1988*)

"...one of the most successful late-19th century bridge companies..." (*New Jersey, 1992*)

"...an innovative and prolific company..." (*Massachusetts, 1988*)

"...an early and prolific wrought iron bridge builder." (*Maryland, 1996*)

"...one of the two largest vehicular bridge erectors in the country during the late 1800s..." (*Nebraska, 1991*)

"...a prominent bridge building company..." (*Illinois, 1993*)

"...a recognized pioneer in early metal truss technology." (*Kentucky, 1982*)

"...one of the leading bridge-building firms in the United States." (*Ohio, 1983*)

"...a major national metal bridge fabricator..." (*Indiana, 1999*)

History:

David Hammond started his career as a carpenter's apprentice in Canton.[66] During the Civil War he started a general contracting business (1861) and erected several wooden bridges.[67] Hammond had no formal training in engineering, but had excellent practical understanding of the process. He received his first patent, for a bowstring truss design, in 1864.[68]

Other bridge-related patents followed, and with these in hand, Hammond organized the Wrought Iron Bridge Company in 1866 with himself as president. Five years later, in 1871, the company was incorporated with $100,000 capital. The relatively short interval between founding and incorporation is an indicator of the success of the firm and the business sense of David Hammond and his associates. Wrought Iron's main rival, Zenas King, incorporated in 1871 after thirteen years of operation, while the Columbia Bridge Company took more than 30 years to do so.[69]

Included on the list of officers for 1871 is Job Abbott, listed as Chief Engineer. Abbott, a graduate of Harvard and Lawrence Scientific School, received a degree in Engineering in 1864. He began his career as railroad engineer, a job that brought him to Canton, OH. He decided to settle in the town and soon set up business as a civil/mining engineer and patent expert. He studied law and was admitted to the Ohio bar, allowing him to become a patent lawyer, as well.[70] Between 1866 and 1871 he handled many of David Hammond's 16 patent applications.[71]

Abbott became as interested in the bridges he was helping to patent as the laws which protected them. In 1871 he left the legal profession and became an official employee of Wrought Iron. David Hammond, always on the lookout for experienced talent, named him Chief Engineer. A year later he also became the company's Vice President.

One of Abbott's talents was his ability to secure patents from other inventors, bringing their designs into the Wrought Iron stable. Early examples include the "Patented Oval Wrought Iron Tubular Bridge", patented in 1867 by Cleveland physician William Rezner, and the "Improved Combination Truss Bridge", which was a version of the Post Truss.[72] Abbott's engineering skill and eye for new designs helped the company to consistently improve their products over the years.

Like most bridge manufacturers, Hammond began by specializing in iron bowstring trusses. Rival bridge-builder Zenas King was the leader in this field, constructing bowstring trusses throughout the Midwest and as far away as Wyoming and New York.[73] Wrought Iron was close behind in sales, however, with bridges from Mississippi to Minnesota.[74] Business increased from $200,000 in 1871 to $400,000 in 1872, and $500,000 in 1873.[75]

Wrought Iron quickly proved itself with several record-breaking bowstring bridges. In 1871, Wrought Iron built a 215-foot bowstring arch in Lansing—this was the first bridge of this type to exceed 200 feet. Later, the company set a new record with a 265-foot bowstring span at Foxburg, Pennsylvania.[76]

Like most bridge-builders of the day, Wrought Iron began to move away from the bowstring truss in the mid-1870s. Pratt trusses and their variants made up more and more of the bridge market each year. By the mid-1870s, Wrought Iron was building more Pratt-style trusses than Bowstrings.[77]

In 1874 the company released its first catalog, which included truss designs, plans for movable and plate girder bridges, substructures, and a list of spans built by the company. It also included a large section on iron bridges in general, including a history of iron bridge-building in Europe and America, discussions on the strength and durability of wrought iron, load requirements, and advice for county commissioners.[78] This was perhaps the most thorough and well-prepared bridge catalog ever prepared by any bridge company. The likely goal of this booklet was to convince county commissioners to switch to iron bridges. The company did offer plans for a combination wood/iron truss, but cautioned that "in our opinion, [they] are not a desirable construction for road bridges in any location."[79]

The 1874 catalog does not include an example of a triple-intersection truss, indicating that perhaps the Laughery Creek Bridge was a special design for the firm. The company liked to modify its plans to suit individual locations to offer "a material savings in cost" and thus, a lower bid.[80] In the case of the Laughery Creek Bridge, the company probably received information about the site from County Commissioners Hannah and Slater when they visited the Canton offices.

Business continued to grow throughout the 1870s and 1880s, and Wrought Iron established itself as one of the largest bridge-building firms in North America. The company issued their second catalog in 1885, which included a list of work completed in 30 states.[81] In 1874 the company reported that it had built 25,000 feet of bridges (appx. 16% of all iron bridges built in America up to that point). The 1885 catalog reported that the company had built nearly 232,000 feet of bridges, or 44 miles.[82] Operations extended into Canada, where Wrought Iron built rather extensively in the eastern provinces.[83] The firm maintained a large network of sales agents who supplied both designs and prices to local governments. This network of agents, which extended from California to Boston, along with branch offices in Chicago, Kansas City, and New York (among others), played a key role in the growth and success of the company. Only rival bridge-builder King Bridge Co. could boast of a similar sales force.[84]

Although it was now seven years old, the Laughery Creek Bridge was still the company's finest engineering triumph. It appears prominently on the front page of the 1885 catalog, and was featured in company advertisements for many years after its construction. The *Indiana State Gazetteer* and the *Indianapolis City Directory* both carried a lithograph of the bridge until the company's dissolution in 1901.[85] In the firm's hometown of Canton, an 1890 directory also carries a prominent picture of the "Aurora Bridge". The bridge was a symbol of what Wrought Iron was capable of, and as such it was circulated from coast to coast in the form of brochures and advertisements.[86]

In the company's later years business remained healthy. The fabricating plant was moved from the east end of 3rd Street to a larger plant at the south end of Dueber Avenue. E.J. Landor, who had joined the firm as an engineer in 1877, became chief engineer in 1886 and general manager in 1888.[87] Landor was a graduate of Rensselaer Polytechnic Institute, and was part of a new class of trained engineers that gradually replaced the "rule of thumb" bridge builders common in 19th century America. His employment at Wrought Iron is another example of David Hammond's progressive policy of hiring trained talent to build his bridges.[88]

David Hammond remained with the firm through the 1890s, but Job Abbott left the firm in 1880 to help organize the Toronto Bridge Company (He remained a Director at Wrought Iron until his death in 1896). Later, he moved to Montreal, where he founded the Dominion Bridge Company. Dominion Bridge, still in business today, became Canada's leading bridge fabricator.[89]

On 14 April 1900 the American Bridge Company was formed in New Jersey. This firm, the brainchild of financier J.P. Morgan, immediately acquired 24 of the nation's largest bridge-building firms, including the Wrought Iron Bridge Company. Production in the company's shops was turned over to the new conglomerate, and all bridges subsequently produced in the Dueber Avenue plant were the products of the American Bridge Co.[90] Like many other fabricating shops, the Canton plant was eventually shut down as new plants were completed in Ambridge, PA and Gary, IN.

Comparisons:

In late 1999, a survey of State Historic Preservation Offices and State Transportation Departments was conducted to determine how many Wrought Iron Bridge Company bridges remained extant in the United States. Forty-six of forty-eight states responded (Alaska and Hawaii were presumed to have no WIBCo bridges). This survey revealed that nearly 150 bridges built by this company still remain.

Of these bridges, the Laughery Creek Bridge is undoubtedly the best surviving example. It is the largest single-span bridge remaining. It is also the only extant bridge that was featured in the company's catalogs, which were used to advertise the successes of the company to prospective clients around the U.S. Thus, the Laughery Creek Bridge is the most significant surviving bridge built by this nationally important 19th-century bridge-building firm.

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Endnotes:

1. For example, the Stonelick Bridge in Clermont County, OH carries the same decorative cresting. See The Ohio Historic Bridge Inventory, Evaluation, and Preservation Plan (1983), 46.

2. Repairing and Restoring Historic Bridges: Keeping Faith with Their Makers, 49.

3. Letter from Howard J. Barth & Associates, Inc. to Indian Division of Historic Preservation and Archaeology, 2 July 1997 (State Historic Preservation Office Files, Indianapolis). The bridge has lost very little of its strength after 120 years of service. In addition to its capacity as a pedestrian bridge, it was found to be capable of handling HS-18 (one way) or HS-13 (two way) traffic loads. This is much better than other iron bridges of similar age, and is more comparable to a highway structure from the 1960s.

4. "Laughery Bridge, Aurora" (Postcard), Indiana Division, Indiana State Library, Indianapolis, n.d. The view in the postcard is looking north towards the bridge portal from the Ohio County side. Riverview Cemetery (1869) is visible in the distance.

5. State Highway Commission of Indiana, Bridge Contract #2703 (1946)

6. *Inventory of Bridges on the State Highway System of Indiana* (Indianapolis, 1997), 169.

7. *Dearborn County Register* (6 Mar. 1997), p. 7A, col. 5. The 1937 floods, worst in the area's history, brought the level of the water up to about 500 feet above sea level. The bridge deck is about 480 feet above sea level. The construction of the Markland Dam in 1956-63 raised the level of the river and the creek by 10-20 feet, although this had "no significant relation to the height of floods." See Johnson, Leland R., The Falls City Engineers, 30-31.

8. Dupre, Judith, and Frank O. Gehry. Bridges: A History of the World's Most Famous and Important Spans. New York: Black Dog and Leventhal, 1997, 51.

9. Jackson, Donald C. Great American Bridges and Dams. Washington, D.C.: Preservation Press, 1994, 199.

10. Comp, T. Allen, and Donald Jackson. Bridge Truss Types: A Guide to Dating and Identifying. Washington D.C.: American Association for State and Local History, 1977, 5.

11. DeLony, Eric. Landmark American Bridges. Boston: Little, Brown, & Co., 1993, 74-75.

12. Letter from Eric DeLony to John Graf, Howard Barth & Associates, 4 February 1993, p. 1.

13. "History Purists Try to Correct Spelling of Creek's Name." *Indianapolis Star* (8 Feb. 1981), Sect. 2, p. 10, col. 5.

14. Dearborn County Interim Report

15. Shaw, History of Dearborn County, 439.

16. HAER Report, 5.

17. Jefferson, Ohio, and Dearborn County Interim Reports

18.*Lawrenceburg Press* (29 Aug. 1867), p. 3, col. 3. The *Press* copied articles from various Aurora newspapers when covering Aurora news. In similar fashion, the Aurora papers would copy *Press* articles for their sections on Lawrenceburg news.

19. *Lawrenceburg Register* (17 Dec. 1868), p. 3, col. 2. The article also notes that the bridge was way over budget, and that Ohio County officials were forced to take out additional loans to pay their estimated $15,000 bill. This was $8,000 more than originally expected.

20. HAER Report, 5.

21. *Lawrenceburg Press* (26 Nov. 1868), p. 3., col. 2. See Note #18.

22. *Ibid.*

23. Among surviving Indiana timber bridges, the 1868 Darlington Bridge (185', Howe truss) cost $11,000; the 1871 Potter's Ford Bridge (265', 2 span, Howe truss) cost $13,000. As late as the 1930s, the State Highway Department was awarding 300-foot bridge contracts for less than $40,000.

24.*Lawrenceburg Register* (16 Sept. 1869), p. 2, col. 1.

25.HAER Report, 5.

26. The cost of the 1st bridge, given its short life span, worked out to about $12.85 per day of use.

27. Commissioners Report, Dearborn, V15, p 131. The three Ohio County Commissioners voted to replace the bridge; of the three Dearborn County officials only Fred Slater voted in favor of a new span.

28. HAER Report, 5

29. Timeline

30. HAER Report, 5

31. HAER Report, 6. The report cites F.W. Brown's Cincinnati and Vicinity (1898) as stating that the Newport Bridge was a product of the Edgemoor Bridge Works of Wilmington, Delaware. Other sources site Jacob Linville's Keystone Bridge Co. as the builder. See Victor Darnell, A Directory of American Bridge-Building Companies, 1840-1900, p. 68.

32. For example, the Wrought Iron Bridge Company examined a 12-year-old tubular bowstring near Canton and found "...that oxidation proceeds even less rapidly on the inner surface of a closed column than on the outer surface..." 1874 Catalog, p 14.

33. Cooper, Iron Monuments, 6

34. Cooper, Artistry and Ingenuity, 100. The *Aurora People's Advocate* had a different view: "We presume men associated as Commissioners are quite as likely to make an occasional miscalculation as when acting in an individual capacity. Even the sharpest businessmen, handling their own money, are occasionally unfortunate in enterprises outside the line of business to which they are bred." (23 Sept. 1869, p. 4, col. 1)

35. HAER Report, 6; *Lawrenceburg Register* (15 Aug. 1878), p. 3, col. 6.

36. *Ibid.* Fitch and the commissioners referred to Wrought Iron as the "Canton Bridge Co.", and made reference to the "Pittsburgh Bridge Co." No specific reference to Keystone Bridge (based in Pittsburgh) was made, but the *Rising Sun Recorder* (30 Nov. 1878, p. 3 col. 4) mentions that Keystone Bridge had submitted a bid 20 minutes past the deadline. According to the *Recorder*, this bid was thus rejected; however, according to the commissioners' record, it was in fact accepted. There was a "Pittsburgh Bridge Company" active in that city in 1878, as well as an Iron City Bridge Co. and a Shiffler Bridge Co. See Victor Darnell, A Directory of American Bridge-Building Companies, 1840-1900, pp 65-69.

37. *Ibid.*

38.*Rising Sun Recorder* (21 Sept. 1878), p. 5 col. 3

39.*Lawrenceburg* Register (12 Sept. 1878), p. 3 col. 2; Lawrenceburg *Register* (31 Oct. 1878), p. 3 col. 1; *Rising Sun Recorder* (2 Nov. 1878), p. 3 col. 3; *Lawrenceburg Register* (14 Nov. 1878), p. 3 col. 1; *Rising Sun Recorder* (16 Nov. 1878), p. 3 col. 3

40.*Rising Sun Saturday News* (7 Dec. 1878), p.3 col.1; *Rising Sun Recorder* (7 Dec. 1878), p. 3 col. 3

41.*Ibid.*

42. Condit, 96.

43. Ibid., 97-99.

44. Cooper, 62.

45. Condit, 98.

46. Cooper, 62.

47. The Warren truss, on the other hand, came in single, double, triple, and quadruple designs. The latter was very similar to the Town Lattice trusses of the covered bridge era.

48. HAER report, 2.

49. Darnell, "The Other Literature of Bridge-Building." *IA* (1989), p.43.

50. HAER report, 2. Shreve (1873) included an entire chapter on triple-intersection Pratts in his book.

51. Cooper, 67.

52. *Ibid.*, 68.

53. In this case, the Berlin Iron Bridge Company of Connecticut.

54. Comp, pp. 6-7.

55. *Lawrenceburg Register* (16 Sept. 1869), p. 2, col. 1.

56. There were at least two drownings at the bridge site between 1877 and 1878.

57. Cooper, 2.

58 *Lawrenceburg Press* (29 Aug. 1867), p. 3, col. 3. Dearborn County made the offer to pay for half of the bridge. They also pledged $5,000. Of course, they believed at the time that the timber bridge would cost less than $30,000. In the end, the each county paid $19,250 ($41,000 minus $2,500 from a private subscription).

59. HAER report. Ohio County, in particular, seemed hard hit by the unexpected costs of the 1869 bridge. Splitting the cost on each county's taxable property was probably their idea, since Dearborn was larger and more prosperous than Ohio.

60. HAER report, 4. Then again, the Steubenville Railroad Bridge (1865) by Jacob Linville, a Whipple truss, employed 26 panels in its 320-foot single span. See Condit, p. 114,

61."Historic American Engineering Record: Laughery Creek Bridge, IN-16.", 3.

62. DeLony, Eric. "Surviving Cast and Wrought Iron Bridges in America." *IA* (V19 no2), p. 38; Historic Highway Bridges of Pennsylvania, p. 115; Kemp, Emory. "The Fabric of Historic Bridges." *IA* (V15 no2), p13.

63. HAER report, p.2; Kemp, West Virginia's Historic Bridges., 123.

64. Among surviving Indiana bridges, the depth-to-length ratio generally ranges between 1:4 and 1:9. Typically, the ratio increases according to length.

65 . Condit, 140.

66. Heald, Edward T. The Stark County Story, Volume 1, 629.

67. Simmons, David A. "Uncommon Wrought Iron Bridge in Morrow County." *Ohio County Engineer* (Spr. 1992), p. 12; Heald, 629.

68. Simmons, "Uncommon", 12.

69.Heald, 629; Simmons, "The King Iron Bridge and Manufacturing Company" *IA* (1989), p. 31. Simmons mentions the early incorporation by King, saying "the fact that King did it [incorporate] relatively early in the life of his company again illustrates his clear appreciation of the intricacies of the business world."

70. Transactions of the A.S.C.E. (1896), p. 538.

71. Simmons, "Uncommon", 13.

72. Simmons, Timeline, 27; Wrought Iron Bridge Company, Designs of Wrought Iron Bridges., 45.

73. Simmons, "King Iron Bridge", 27-28. King was without doubt the biggest bridge manufacturer of the early 1870s, along with the Phoenix Bridge Company, Keystone Bridge Company, American Bridge Company (Chicago), and Wrought Iron Bridge Company. See also Darnell, "The Other Literature of Bridge Building", *IA* (1989), p. 42.

74. Information on WIBCo's activities comes from a variety of sources, including the 1874, 1885, and 1893 catalogs, as well as survey and National Register information compiled by various states. Simmons (*IA*, 1989, p. 39) notes that comparisons between rival bridge companies are hard to make. He cites the wordings of King's and Wrought Iron's catalogs from the 1880s: King lists the total number of structures built, while Wrought Iron lists their accomplishments in terms of linear feet.

75. Heald, 629.

76. Designs of Wrought Iron Bridges, 23.; Simmons, "King Iron Bridge", 27.

77. Looking at the surviving WIBCo bridges from 1874 to 1879, Pratt-style bridges outnumber Bowstrings 4 to 1.

78. Wrought Iron Bridge Company, Designs of Wrought Iron Bridges., 4; Simmons, "Bridge Preservation in Ohio" (Cities and Villages), 16; Darnell, "The Other Literature of Bridge Building (IA, 1989), 42.

79. Design of Wrought Iron Bridges, 41. The truss shown is a Post truss, which is curious because only a handful of combination Post trusses were ever built (one survives today in Indiana, though not a WIBCo product). Later, the company offered combination trusses on the Thatcher pattern, although all of their surviving Thatcher trusses are all-metal. See the 1885 Illustrated Pamphlet of Wrought Iron Bridges, back cover.

80. Illustrated Pamphlet, 3.

81. Illustrated Pamphlet, pp 19-24. There are a total of 412 bridges listed individually, representing "a few of the bridges most available to inspection."

82. Design of Wrought Iron Bridges, 9; Illustrated Pamphlet, pp 19-24.

83. Conversations with David Simmons, Ohio Historical Society, and Robert Passfield, Parks Canada.

84. Indiana State Gazetteer and Business Directory, 3; State of New Jersey, Dept. of Environmental Protection, Bridge Inventory: Old Mill Road Bridge/Hunterdon County, 3; Simmons, "King Iron Bridge", IA 1989, p. 32.

85. Indiana State Gazetteer and Business Directory, 3; R.L. Polk & Co.'s Indianapolis City Directory, 3.

86. City of Canton, Its Various Advantages, 32.

87. Heald, 630.

88. *Ibid.*; Simmons, "Cities and Villages", 16. The HAER report (p. 9, endnote 20) suggests that Hammond's progressive recruitment of trained talent may have kept them in touch with the latest in bridge design-- in this case, an 1878 article in Engineering News by Thomas Curtis Clarke that extolled the virtues of the triple-intersection truss.

89. Conversations with Robert Passfield, Parks Canada, and Wayde Brown, Division of Municipal Affairs, Halifax, Nova Scotia; Transactions of the A.S.C.E., (1896), p. 538. Later Abbott moved on to New York, where he served as a consulting engineer for several railroads.

90. Darnell, A Directory, 86. Wrought Iron did complete a few bridges in 1901, among them a 99-foot Pratt through truss in Carroll County, Illinois, which is still extant.

10. GEOGRAPHICAL DATA

Acreage of Property: 2.884 acres.

UTM References:		Zone	Easting Northing
	A	16	683010 4321420

Verbal Boundary Description:

The boundary is defined by a circle whose center is at the exact midspan of the Laughery Creek Bridge. The circle has a radius of 200 feet.

Boundary Justification:

The boundary as described includes the bridge and abutments, and a portion of Laughery Creek to establish the setting of the bridge.

11. FORM PREPARED BY

Name/Title: Joseph P. Saldibar III
Bridge Survey Coordinator
Indiana Department of Natural Resources
Division of Historic Preservation and Archaeology
402 West Washington Street, Room W274
Indianapolis, IN 46204

Telephone: 317-232-1646

Date: 15 December 1999

National Register of Historic Places Continuation Sheet

Photographs:

The following is common to all photographs:

1) Laughery Creek Bridge
2) Dearborn County, Indiana
4) Paul C. Diebold
5) 21 December 1999

Items 3 and 6 vary, as follows:

Photo #	Description and view
1.	Portal, south end, looking N.
2.	Portal, north end, looking S.
3.	Side view of trusses, looking NE.
4.	Side view of trusses, looking NW.
5.	Side view of trusses, looking SW.
6.	Side view of trusses, looking SE.
7.	Side view of trusses, 3/4 view, looking NW.
8.	Portal, south end, showing bridge end and 1869 abutment, looking NE.
9.	North end of bridge, showing bridge end and 1869 abutment, looking E.
10.	Underside of bridge, looking S across Laughery Creek.
11.	Portal, south end, showing decorative plaques, looking N.
12.	Upper portion of bridge, looking N.
13.	West truss, side view, looking NW.
14.	Detail of intermediate verticals, diagonals, and bracing, looking NE.
15.	Detail, intermediate vertical and diagonal bracket, looking NE.
16.	Detail, intermediate vertical, showing laced connections, looking NE.
17.	Detail, NW endpost and roller nest assembly, looking SE.
18.	Lower chord, west truss, looking NW.
19.	Detail, pinned connection of lower chord, floor beam (note decorative end), diagonal, and intermediate vertical, looking E.
20.	Endpost-top chord connection, looking NE.
21.	Endpost-top chord connection, close-up view of (7), looking NE.
22.	Detail, c.1947 concrete deck and deck drain.