# Indiana Historic Bridge Inventory

## Volume 1: National Register Eligibility Results

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Report prepared for

**Indiana Department of Transportation**

Report prepared by

**M&H Architecture, Inc.**

**A** MEAD & HUNT **company**

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# 1. Executive Summary

Historic bridges are an important part of the heritage, development, and transportation system of Indiana. As the state's population and economy have grown, certain historic bridges have been replaced with modern bridges to accommodate today's higher traffic volumes and larger vehicles. Recognizing the need to preserve important bridges, the state adopted a historic bridge preservation program in 2006. The details of this program are described in the *Programmatic Agreement on the Management and Preservation of Indiana's Historic Bridges* (PA). An important aspect of this preservation program is completion of a statewide historic bridge inventory of publicly owned bridges constructed through 1965. The purpose of the inventory is to identify bridges that are eligible for listing in the National Register of Historic Places (National Register). The Indiana Department of Transportation (INDOT) retained M&H Architecture, Inc., a Mead & Hunt, Inc. (Mead & Hunt) company, to complete the inventory. These inventory results are recommended by INDOT and approved by the Federal Highway Administration (FHWA) and Indiana State Historic Preservation Office (INSHPO).

The results of the statewide historic bridge inventory are presented in the following sections of this report:

- Section 2: Introduction to Indiana's historic bridges – This introductory section explains the importance of historic bridges to the heritage and development of the State of Indiana and describes the population that was subject to the statewide historic bridge inventory. The state's historic bridge preservation program is also introduced.

- Section 3: Overall methodology for historic bridge inventory – This section presents, in general terms, the methodology for conducting the inventory. Readers are referred to Appendix A of this report for details about the system used to evaluate the eligibility of bridges for listing in the National Register.

- Section 4: Eligibility recommendations – This section presents the bridges recommended eligible for listing in the National Register. The bridges are presented according to applicable National Register Criteria.

- Section 5: Special circumstances and periodic updates – This section describes the mechanism through which new information concerning a particular bridge would be considered. It also explains the process for completing periodic updates of the inventory.

A total of 5,313 structures made up the population of Indiana bridges subject to this inventory. These structures are publicly owned and were constructed through 1965. The inventory identifies those that qualify for listing in the National Register. The following will be considered historic bridges in the state's preservation program:

- Bridges previously listed, determined eligible, or that contribute to historic district - 356
- Bridges recommended eligible as result of this inventory - 444
- Total number of historic bridges - 800

# 2. Introduction to Indiana's Historic Bridges

This introductory section includes an explanation of the importance of historic bridges to the heritage and development of the State of Indiana, prepared by Indiana bridge expert Dr. James L. Cooper, Professor Emeritus of History, DePauw University. This section also describes the population that was subject to the statewide historic bridge inventory conducted by a team of preservation professionals from Mead & Hunt. Lastly, the section provides an introduction to the state's historic bridge preservation program developed by INDOT in coordination with the FHWA and Advisory Council on Historic Preservation (ACHP).

## A. Indiana's heritage in bridges

From prairie grasslands to rolling river hills, the natural Hoosier landscape exhibits a quiet beauty. Only on Indiana's borders—with the Ohio and Wabash Rivers—is the landscape interrupted by imposing waterways. Soon after human footprints began to spread and multiply across the land, waves of built environments followed. Even modest rivers and creeks ultimately became bridged and re-bridged as population increased and transportation evolved.

The existing stock of older bridges on Indiana's roads and highways illustrates the richness and diversity of the state's spanned resources. It speaks to the inventiveness and artistry of forebears who worked with the materials at hand to fashion efficient structures for one era that continued to function in succeeding ones. Hoosier builders first worked in timber and stone, then iron and steel, and finally in concrete. Each of these materials has its own set of characteristic strengths and weaknesses that set parameters for bridge design. The ingenuity of artisans and craftsmen, inventors and engineers, along with the fabricators and contractors who worked with these varied bridge materials made the Indiana landscape both more humanly useful and beautiful in myriad ways. The resulting diversity of bridges provides treasured elements of community and neighborhood identity for Hoosiers.

***Covered timber-truss bridges (1838-1925)***

Covered timber-truss bridges are among the state's oldest and most revered spans. An important key to heritage tourism in Indiana today, covered bridges are at the center of numerous regional and local festivals that, according to festival organizers, have enticed approximately a million visitors to and within Indiana in a given year within the last decade. Most covered bridges were built as wagon bridges when horses, mules, and oxen provided the motive power on roadways. About half of the more than 90 extant timber-truss structures continue to serve on county or park roadways now used by horseless carriages of many kinds.

Ohio and Indiana carpenters specializing in timber trusses made and erected most of the state's extant covered bridges and erected them on substructures typically built to county specifications by local masons. The specialist carpenters who fabricated the timber superstructures mostly relied on tried-and-true truss systems. The artisans' stamps are found less in the overall truss design than in the particular timbers used, the sizes of given members, the nature of truss connections, the kinds and amounts of bracing, and the nature of decorative portal or entrance features. Except where remodeled, each covered bridge carries the DNA of its craftsmen creators.

***Stone arches (1840-1934)***

The genealogy of the stone arch stretches even further back than the timber truss. Indeed, some arches are still in use today that engineers designed and built centuries ago to expedite the movement of their legions across the Roman Empire in various parts of Europe, Africa, and Asia. While the paternity of Indiana's arches in stone is much more recent and less grand than those of imperial Rome, Hoosier structures remain important for documenting regional quarrying and highlighting the craftsmanship of masons in the working and erecting of cut stone.

Indiana Oolitic limestone has long been recognized for its sculptural potential, and blue or Laurel limestone noted for its strength. Important high-rise buildings in cities across the American landscape, along with a number of "City Beautiful" bridges, have been sheathed in Indiana Oolitic. Their grace is complemented by the toughness of blue or Laurel limestone, on blocks of which the state capitol building as well as dozens of roadway arches have been founded. Some urban park directors promoted the "rustic" look of masonry arches for their parkways. The New Deal's Civilian Conservation Corps (CCC) also favored the rusticity of stone for parkways. With the single known exception of an arch at McCormick's Creek State Park, the CCC directors typically settled for building metal-plate arches with stone walls and parapet railings in Indiana. In most cases, they believed they lacked enough experienced masons in their workforce to erect stone arch rings.

Some Hoosier communities commemorate their arched monuments in stone and the skilled craftsmen who shaped and raised them. The elected leaders and citizen preservationists of Carroll County, for example, have teamed up to restore the state's oldest arch, which once carried the Wabash and Erie Canal over Burnett's Creek, and to establish a park around it. In a different section of the state, the Ripley tourist director is in process of developing a guide to the county's wealth of roadway arches.

***Metal-truss spans (1869-1953)***

Indiana's older metal-truss bridges speak to factory-centered national industry. The oldest design and fabrication came first largely from the east. Indeed, for a spell, Indiana seemed like a colonial extension of Ohio, only later to develop its own design-and-build metal fabrication with markets to the north and west as well as within Indiana.

Design exploded into a plethora of truss forms (e.g., deck, pony, thru) and systems. A number of the systems were patented. Materials of choice—each with their own properties and possibilities—changed over time from cast to wrought iron and then to steel. Important methods of connection also evolved from the all-American pinning to bolting, then to riveting, and finally to non-forge welding.

Hoosier county roadways are blessed with representative spans of many combinations of designers and fabricators, truss forms and systems, materials, and connections. A number of Indiana counties have capitalized on heritage and function by investing in the restoration of some of their older metal-truss structures for continued vehicular use. These counties include—but are not limited to—Allen, Bartholomew, Carroll, Dearborn, Elkhart, Franklin, Hancock, Jefferson, Morgan, Newton, Orange, Owen, Putnam, and Warrick.

***Reinforced-concrete bridges (1900-1958)***

Around 1900, the practice of bridge building in the nation and particularly in Indiana moved into an era of reinforced concrete, the design of which mushroomed into beams of many kinds and arches of several forms and reinforcing systems. For a time, one Hoosier—Daniel B. Luten—played a leading national role in innovative and efficient reinforced-concrete design and construction. In the first decades of the 20th century, Luten held more patents for reinforced-concrete design and construction techniques than all other persons taken together in the United States. Luten-design was built into several thousand spans—filled, tied, open-spandrel, double-drum, T, spandrel-braced, bowstring or through, and horse-shoe arches; trussed beams, slabs, and girders—throughout the North American continent.

Many of the oldest, extant Hoosier roadway arches were designed to mark off and celebrate the urban downtown; others complemented landscaped parks designed to bring nature back into the city. The filled-spandrel "City Beautiful" arches tended to employ one of the various patented Melan systems of reinforcing that operated essentially as metal ribs encased in concrete. They were also typically clothed, on the insistence of landscape architects or park directors, in stone-facing.

Driven by the engineering values of his day, Luten designed steel reinforcing and concrete to work together as a composite material, which provided for the safe carrying of the same loads as in the Melan-system arches for a fraction of the steel and concrete designed into them. Luten also rejected add-on decoration to his designs. His essentially modernist aesthetic led him to see beauty in the structural form and materials themselves. Sleek and thin lines, along with the contrast of polished and bush-hammered concrete, marked the combination of design with craftsmanship that Luten pursued in his filled-spandrel arches— at a fraction of the cost to the taxpayer of an equivalent decorated Melan-system structure.

Reinforced-concrete beam spans were generally shorter than arches and came in a much wider variety of formats (e.g., slabs, through girders, and T-beams—also referred to as tee beams). The design principles required for these beam spans were less complicated than for arches, and a number of county engineers soon began to eliminate the cost of the middle man by drawing their own designs for modest beam structures, much like their forebears had done in the days when timber-trestle and combination timber and iron pony-truss structures dotted Indiana roadways for short-span crossings. As with the age of timber, so too, in the age of reinforced concrete, did some county engineers develop their forms over time into discernable regional patterns and styles that added a distinctive man-made context to the natural landscape.

***State highways and standard-design bridges (1919-1965)***

The context for the design and construction of roadway bridges in Indiana changed dramatically in two stages—one in 1919; another after 1935—as the consequence of the establishment of the federal Bureau of Public Roads (1894) and of state highway departments as alliance partners. Dominated by graduates of engineering programs from land-grant universities in the Midwest and from private universities on the coasts, and dedicated to the Progressive faith in the credentialed professional as the promoter of the general welfare, the Bureau favored the establishment, first, of farm-to-market roads built to professional specifications and with government-designed bridges. Later, Henry Ford's initiatives forced the Bureau and its state highway allies to move from short-haul wagon roads to hard-surfaced, statewide-to-nationwide highways designed for automotive vehicles.

For Indiana, the first stage of this shifting context occurred in 1919 when, as the last state in the union to do so, Indiana created a functioning State Highway Commission (ISHC). The ISHC gradually absorbed and rebuilt stretches of old county roadways into a state highway system. The old roadways were improved through straightening, grading, and widening and resurfaced first in gravel and later in concrete. The ISHC systematically replaced bridges they inherited from the counties with those of state design.

The Bureau of Public Roads and its state highway allies believed that bridge design should not be subject to the marketplace; that it was most properly a government function performed by government-salaried professional engineers. Only construction should be subject to competition, and even that needed to be highly regulated. The federal-state highway alliance also moved to standardize design as much as possible. To provide for safety in every case, a one-size-fits-all model inevitably produced over-design for many, if not most, cases. It did not produce the kind of engineering efficiency or innovation that Daniel Luten and other engineers in the private sector had previously honored.

From 1919 until about 1935, the state built to its own, increasingly standardized designs, while the counties and cities of Indiana continued to pursue competitive design as well as construction. Innovation throve in the marketplace and on local roads. Elements of the innovation—especially the introduction of continuity and rigid framing in design—also appeared in the federal-state highway alliance system within Indiana.

By 1934-1935 in the Great Depression, relief payments consumed almost all local tax revenues. County bridge-building and its system came to a dramatic and near-permanent halt in Indiana. New Deal programs did begin to funnel some funds into local government for selected infrastructure projects. The design of the occasional new bridge built in the late 1930s with federal funds, though, had to meet federal-state highway standards. The Second World War extended the near-moratorium on local bridge construction. In the postwar period, construction resumed within an extensive federal-aid system that replaced competitive design with mandated standard specifications.

***Standard design and factory-made bridges***

While American designers knew about and experimented with pre-stressing in the decades before the Second World War, the innovation took hold in European practice. The Army Corps of Engineers discovered its application on liberated roadway bridges as troops freed Western Europe from the Nazis. After V-E Day, triumphant Yankee Army engineers brought the value of applied pre-stressing back home with them.

Growing reliance in the federal-state highway alliance on beams and growing federal control over almost all post-war bridge construction encouraged prefabrication. Factory-cast beams (or channels) began to flood the marketplace as the Second World War started and ended. Soon after the war—from the mid-1950s onward—thousands of factory-made pre-stressed beams also built to federal specifications routinely carried federal-aid bridges erected on state and county roadways. Factory production and standard design are as hand in glove.

No part of the Progressive era impulse proved more successful than that of the Bureau of Public Roads (now the Federal Highway Administration). Its ascendence is confirmed in the near-monopoly of control it has come to exert over the design and construction of roadway bridges in Indiana and elsewhere in the United States.

Even though most of the postwar federal-aid bridges had been built using a series of standard plans, they nonetheless contribute to the considerable diversity of Indiana's historic spans built in the century before. Generations of innovative designers and engineers conceptualized and planned the great smorgasbord of functional beams, trusses, and arches that carry vehicular traffic on Hoosier city streets and county roadways today. Inside those particular forms, the record of regional artisans, craftsmen, fabricators, and builders can be found inscribed on the worked timber, stone, metal, and concrete of hundreds of highway structures. Indiana's cultural capital is wide and deep within its spanned heritage.

*- James L. Cooper*
*13 January 2008*

## B. Indiana's historic bridge population

A total of 5,313 structures made up the population of Indiana bridges subject to this inventory. These structures are publicly owned and were constructed through 1965. To initiate this inventory, INDOT provided state and county National Bridge Inventory (NBI) bridge inspection databases in June 2006. Mead & Hunt used these databases as a baseline data source to help identify the state's pre-1966 bridge population. This identification process was supplemented with information provided by counties and members of the public via a questionnaire and website comment form.

In identifying the state's pre-1966 bridge population, bridges that are outside the scope of the historic bridge inventory were excluded. The following categories of bridges were excluded from the inventory and do not appear in *Volume 2: Listing of Historic and Non-Historic Bridges*:

1. Bridges built after 1965
2. Bridges privately or railroad owned

3. Bridges for which INDOT does not have primary maintenance responsibility (including border bridges and bridges maintained by other state and federal agencies)

4. Bridges carrying the Interstate Highway System[1]

Bridges already listed in or determined eligible for listing in the National Register, including those contributing to a historic district, were not reevaluated as part of the inventory. These bridges are identified in the comprehensive list of historic bridges provided in Volume 2.

Indiana's population of more than 5,300 bridges built through 1965 is diverse. This is represented by the many bridge types and subtypes, different transportation routes and geographic locations within the state, and range of construction dates, among other features. The era of state-governed bridge design and standardization of structural forms began around 1920. Prior to this time, bridges were constructed by local craftsmen, bridge builders, and private companies. This initial era of bridge design in Indiana had a local flavor as designers and builders concentrated their work in certain parts of the state. With the establishment of the Indiana State Highway Commission (ISHC) and broader use of standardized designs, bridge designs across Indiana became less dependent on local preferences and practitioners. Consideration for aesthetics also waned as production of bridge designs that could be erected quickly and inexpensively became increasingly important in the state's efforts to meet the burgeoning demand for transportation routes, especially after World War II.

Nineteenth-century bridge construction generally conformed to established types such as timber and metal trusses and stone arches. While these three bridge types were frequently used in Indiana, comparatively few remain. Through research and experimentation, new types were introduced and utilized throughout the period by local bridge builders, bridge fabricating companies, and ISHC bridge engineers. During the twentieth century, advancements in materials such as steel, reinforced concrete, and prestressed concrete, impacted the types of bridges designed and utilized by Indiana's engineers. Types such as steel beam or girder, reinforced concrete arch, and concrete slab accommodated increasing span lengths and vehicular loads. These three forms were used extensively in Indiana during the twentieth century.

Table 1 summarizes the various bridge types built in Indiana, including the percentage built during the subject period and the date range of their use. More information on historic bridge types and their construction is found in the report *Indiana Bridges Historic Context Study, 1830s – 1965* (February 2007). Appendix D provides a glossary of basic bridge types and terms.

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[1] Bridges carrying the Interstate Highway System were previously considered for National Register eligibility under the provisions of the Historic Preservation Exemption for the Interstate Highway System included in Section 6007 of SAFETEA-LU reauthorization legislation (effective March 10, 2005). Therefore, they were not reevaluated during the current inventory project.

**Table 1**
**Summary of Historic Bridge Population**

| Bridge Type | Percentage built within subject period[2] | Date range of use in Indiana (extant bridges) | Subtype (NBI/INDOT code and type) |
|---|---|---|---|
| Reinforced concrete slab | 15% | 1900-1965 | 101A - Reinforced concrete slab<br>119A - Reinforced concrete slab - under fill<br>201A - Continuous reinforced concrete slab |
| Reinforced concrete girder and beam | 16% | 1904-1965 | 102A - Reinforced concrete girder<br>102B - Reinforced concrete beam<br>103 - Reinforced concrete girder - trans. girder/floor beam system<br>104 - Reinforced concrete tee beam<br>105 -Reinforced concrete box girder - multiple<br>119D - Reinforced concrete girder - under fill<br>122 - Precast concrete beam<br>202A - Continuous reinforced concrete girder<br>203 - Continuous reinforced concrete girder - trans. girder/floor beam system<br>204 - Continuous reinforced concrete tee beam |
| Reinforced concrete rigid frame and box | <1% | 1920-1965 | 107A - Reinforced concrete rigid frame<br>119C - Reinforced concrete box - under fill<br>207A - Continuous reinforced concrete rigid frame<br>207B - Continuous reinforced concrete rigid box<br>219B - Continuous reinforced concrete box - under fill |
| Concrete arch | 16% | 1900-1965 | 111A - Reinforced concrete arch<br>111B - Open spandrel reinforced concrete arch<br>111C - Unreinforced concrete arch<br>112 - Thru reinforced concrete arch<br>119B - Reinforced concrete arch - under fill<br>119E - Precast concrete arch - under fill<br>211 - Continuous reinforced concrete arch |

[2] This column represents the estimated proportion of each bridge type relative to the total population of Indiana bridges subject to this inventory. Several bridge types comprise less than 1 percent but taken together represent 3 percent of the total population.

**Table 1**
**Summary of Historic Bridge Population**

| Bridge Type | Percentage built within subject period[2] | Date range of use in Indiana (extant bridges) | Subtype (NBI/INDOT code and type) |
|---|---|---|---|
| Metal arch | 2% | 1895-1965 | 311 - Metal pipe arch (round pipe)<br>312B - Thru steel arch<br>319A - Multiplate - under fill<br>911 - Aluminum arch<br>919B - Aluminum multiplate arch - underfill |
| Steel beam | 25% | 1895-1965 | 302A - Encased steel beam<br>302D - Simple steel beam<br>302G - Composite steel beam<br>303E - Welded steel thru girder-floor beam system<br>303H - Steel beam floor beam system<br>402A - Continuous steel beam<br>402C - Continuous encased steel beam<br>402D - Composite continuous steel beam |
| Steel girder | 1% | 1897-1965 | 302C - Riveted plate girder<br>302E - Simple steel girder<br>302H - Composite steel girder<br>303B - Simple steel girder-floor beam system<br>303F - Riveted plate girder-floor beam system<br>403C - Continuous riveted plate girder-floor beam system<br>403D - Composite continuous riveted plate girder-floor beam system<br>402B - Continuous steel girder<br>402E - Composite continuous steel girder<br>402H - Continuous riveted plate girder<br>403A - Continuous steel girder-floor beam system |
| Steel deck truss | <1% | 1913-1953 | 309 - Steel deck truss |
| Metal pony truss | 4% | 1884-1965 | 310A - Warren<br>310A - Parker<br>310A - Pratt<br>310A - Other variations<br>310C - Bailey truss<br>910B - Iron pony truss |

**Table 1**
**Summary of Historic Bridge Population**

| Bridge Type | Percentage built within subject period[2] | Date range of use in Indiana (extant bridges) | Subtype (NBI/INDOT code and type) |
|---|---|---|---|
| Metal thru truss | 4% | 1869-1949 | 310B - Baltimore<br>310B - Other variations - Double-intersection Warren, Triple-intersection Pratt (Whipple), Camelback<br>310B - Parker<br>310B - Pennsylvania<br>310B - Pratt<br>310B - Warren<br>910A - Iron thru truss |
| Steel movable | <1% | 1932 | 316 - Bascule |
| Prestressed concrete I-beam | 2% | 1952-1965 | 502 - Prestressed concrete I-beam<br>504 - Prestressed concrete tee beam<br>602 - Continuous prestressed I-beam |
| Prestressed concrete box beam | 11% | 1950-1965 | 505 - Prestressed concrete box beams - multiple<br>506 - Prestressed concrete box beams - spread<br>605 - Continuous prestressed concrete box beams - multiple<br>606 - Continuous prestressed concrete box beams - spread |
| Timber truss | 1% | 1838-1922 | 710 - Timber covered bridge |
| Timber other | <1% | 1913-1960 | 701 - Timber slab<br>702A - Timber beam<br>702B - Timber girder<br>702C - Timber trestle |
| Stone | <1% | 1840-1934 | 811 - Stone arch<br>819 - Masonry culvert - under fill |

## C. Statewide historic bridge preservation program

Completion of the statewide historic bridge inventory of publicly owned bridges constructed through 1965 is an important aspect of Indiana's historic bridge preservation program. INDOT, in coordination with the FHWA, ACHP, and the INSHPO, developed this program as a result of the PA executed in August 2006. Key aspects of the statewide historic bridge preservation program are:

- A list of bridges for preservation, which will result from this inventory and a later process to select certain historic bridges that are most suitable for preservation
- Incentives for bridge owners to help prevent the loss of these important historic resources
- A clearly defined process to manage historic bridges in Indiana

To assist in the development of the PA and monitor its success upon implementation, FHWA formed a Historic Bridge Task Group, including representatives from the ACHP, INSHPO, INDOT, Indiana Local Technical Assistance Program (LTAP), Historic Landmarks Foundation of Indiana, Historic Spans Task Force, Indiana Association of County Highway Engineers and Supervisors, Indiana Association of County Commissioners, and Senator Richard Lugar's Office. The following parties signed or concurred in the PA:

- FHWA (signatory)
- INSHPO (signatory)
- ACHP (signatory)
- INDOT (invited signatory)
- Historic Spans Task Force (concurring party)
- Historic Landmarks Foundation of Indiana (concurring party)

The PA streamlines the federal Section 106 process for projects involving historic bridges. The development of a list of bridges for preservation as a result of the PA will create a prioritization mechanism that will allow the state and local governments to advance bridge projects expeditiously and cost effectively. This list of bridges for preservation will allow INDOT and local government agencies to manage, define, and plan for transportation projects more effectively with respect to quality, need, time, resources, and cost. This will be achieved by using a programmatic approach rather than an individual project-to-project approach.

In the past, controversy and negotiation between state, local government agencies and historic preservation groups could stall a transportation project for years. The PA essentially eliminates the controversy by establishing the status of historic bridges up front. For county bridge owners, uncertainties associated with the bridge development process are eliminated because counties will know early in the planning process which bridges are historic, which bridges must be preserved, and what mitigation is required for each bridge project. The PA further benefits state and local agencies and members of the public interested in preserving Indiana's heritage by focusing preservation efforts on excellent examples of historic bridges that are found to be most suitable for preservation.

# 3. Methodology for Historic Bridge Inventory

The methodology for conducting the statewide historic bridge inventory involves two major steps:

1. Gathering necessary data for use in evaluating bridges
2. Evaluating the eligibility of bridges for listing in the National Register

This section presents an overview of the methodology that was applied to complete the inventory. The first step involved gathering appropriate data needed to evaluate the eligibility of each bridge in the subject population. Data gathering was multifaceted, involving research, data analysis, review of photographs of bridges, and field survey. A process was developed to determine what level of data was needed for each bridge. Further details on this methodology are contained in preliminary reports, especially *Bridge Stratification, Data Collection, and National Register Criteria for Evaluation* (March 2007, draft) and *Methodology to Determine Bridges for Field Survey* (August 2007).

## A. Data gathering

Various types of engineering and historical data were collected for Indiana's pre-1966 bridge population to support the evaluation of National Register eligibility. Research efforts included an analysis of:

- INDOT standard plans
- INDOT bridge plans
- NBI data
- INDOT inspection file records and photographs
- INSHPO files related to bridges, including survey records, Historic American Engineering Record forms, nominations for National Register listing, and determinations of eligibility
- Selected county highway commissioner records
- Historic bridge collection data of Dr. James L. Cooper

The historic context study entitled *Indiana Bridges Historic Context Study, 1830s – 1965* (February 2007) provided the framework to understand the broad patterns of roadway transportation development and bridge design and construction in Indiana. It also presented themes relevant to understanding the significance of Indiana bridges built during the subject period. The understanding that emerged from the context study shaped the framing of a methodology for surveying bridges and of criteria for evaluating the National Register eligibility of bridges.

The public and stakeholder groups were given opportunities to submit information related to bridges. Information gained from public involvement, including responses to a questionnaire sent to local stakeholder groups, which included: Indiana County Commissioners; Indiana County Auditors; Indiana County Historians; Indiana County Historical Societies; INDOT, District Bridge Engineers; Historic Landmarks Foundation of Indiana; and submissions to the project website, assisted in identifying structures with potential historic and/or engineering significance. Three specific data gathering tasks—county bridge research, transportation route research, and field survey—are described below. The approach to each of these tasks was developed in consultation with INDOT.

*County bridge research*

Research was conducted in select Indiana counties with high concentrations of county-owned bridges to document and confirm bridge construction dates, bridge designers and builders, and information about bridge types, materials, and/or cost. Counties where records had previously been studied by Dr. Cooper were not selected since his research files were available to researchers. Researchers reviewed county commissioner minutes, county council records, road record books, and other available records. Research was conducted in the following counties:

- Boone
- Clay
- Clinton
- Crawford
- Delaware
- Howard
- Jackson
- Knox
- Madison
- Marion
- Owen
- Parke
- Tippecanoe
- Warren
- Wayne

Identified historical information assisted in the application of the National Register Criteria for Evaluation of bridges.

*Historic transportation routes*

As part of data gathering, Mead & Hunt identified significant statewide transportation routes to help evaluate historical significance of related structures. Nineteen routes were identified representing the major periods in Indiana transportation history: Canal transportation (mid-nineteenth century); Pre-Indiana State Highway Commission (nineteenth century through 1916); Indiana State Highway Commission (1917-1920s); and early US highways (1920s-1940s). These routes were identified using the context study, 1876 *Historical Atlas of Indiana*, and state highway maps from 1870 through 1930. Results were provided to INDOT and INSHPO for comment. The identified transportation routes include:

- *Canal Transportation*
  - Wabash & Erie Canal
  - Whitewater Canal
  - Central Canal

- *Pre-Indiana State Highway Commission*
  - Michigan Road
  - National Road
  - New Albany-Vincennes Turnpike
  - Lincoln Highway
  - Dixie Highway

- *Indiana State Highway Commission*
  - ISHC Main Market Highway No. 1
  - ISHC Main Market Highway No. 2
  - ISHC Main Market Highway No. 3
  - ISHC Main Market Highway No. 4
  - ISHC Main Market Highway No. 5
  - State Route No. 6
  - State Route No. 7
  - State Route No. 10

- *Early US Highways*
  - US Route 20 (Boston to Yellowstone Park)
  - US Route 50 (Annapolis, Maryland to Sacramento, California)
  - US Route 52 (Huntington, West Virginia to Fowler, Indiana)

Bridges within a corridor associated with each route were subject to field survey due to their potential association with a significant transportation system in the state.

*Field survey*

Field survey was a key component of the data gathering activities as it provided additional information about structures. Bridges were selected for field survey based on the identification or likelihood of characteristics that may possess significance, as outlined in the National Register Criteria, and the need to gather additional information to complete the eligibility evaluation. Characteristics of bridges selected for field survey were:

- Example of an uncommon type in the state
- From the earliest era of Indiana bridge construction
- Demonstrates early use or evolution of a standard plan
- Demonstrates variations or refinements within type
- Possesses special features related to engineering innovations and architectural treatments
- Identified historical association, such as association with significant transportation route
- Potential work of a master

During field survey activities, the structures were studied and documented with digital photographs and written notes. Field surveyors verified NBI and inspection information, identified or confirmed character-defining and special features, noted significant alterations that would impact National Register-eligibility, and recorded the potential for historical associations.

Bridges were selected for field survey in consultation with INDOT, FHWA, and INSHPO. Bridges that were known to have been significantly altered were not included as candidates for field survey and were evaluated based on information obtained during other data collection activities. Collected data and the developed historic context formed the basis for evaluating the eligibility of Indiana's pre-1966 bridges. The National Register Criteria applied to the subject bridge population are summarized below.

## B. National Register Criteria for Evaluation

The evaluation of Indiana's pre-1966 bridge population uses a points-based system to allow for a consistent application of the National Register Criteria for Evaluation on which it is based. The system, which builds upon the existing process used by INDOT and INSHPO, is described in Appendix A. Bridges built through 1965 were evaluated to allow for a margin of comfort around the National Register's 50-year age requirement. In general, to qualify for listing in the National Register, a property must be at least 50 years old or possess exceptional importance. For purposes of the Indiana historic bridge inventory, bridges that are not quite 50 years old are treated as if they meet the minimum age requirement and do not need to possess exceptional significance.

Two of the four National Register Criteria were found to be most applicable to Indiana's historic bridges:

- Criterion A – Recognizes bridges that have an important association with a transportation system, program or project, or event in state or local history that is significant within the context of Indiana's transportation and bridge-building history.

- Criterion C – Recognizes bridges that are significant in their design or construction, considering such elements as engineering features and architectural treatment. The majority of Indiana's historic bridges are significant under Criterion C.[3]

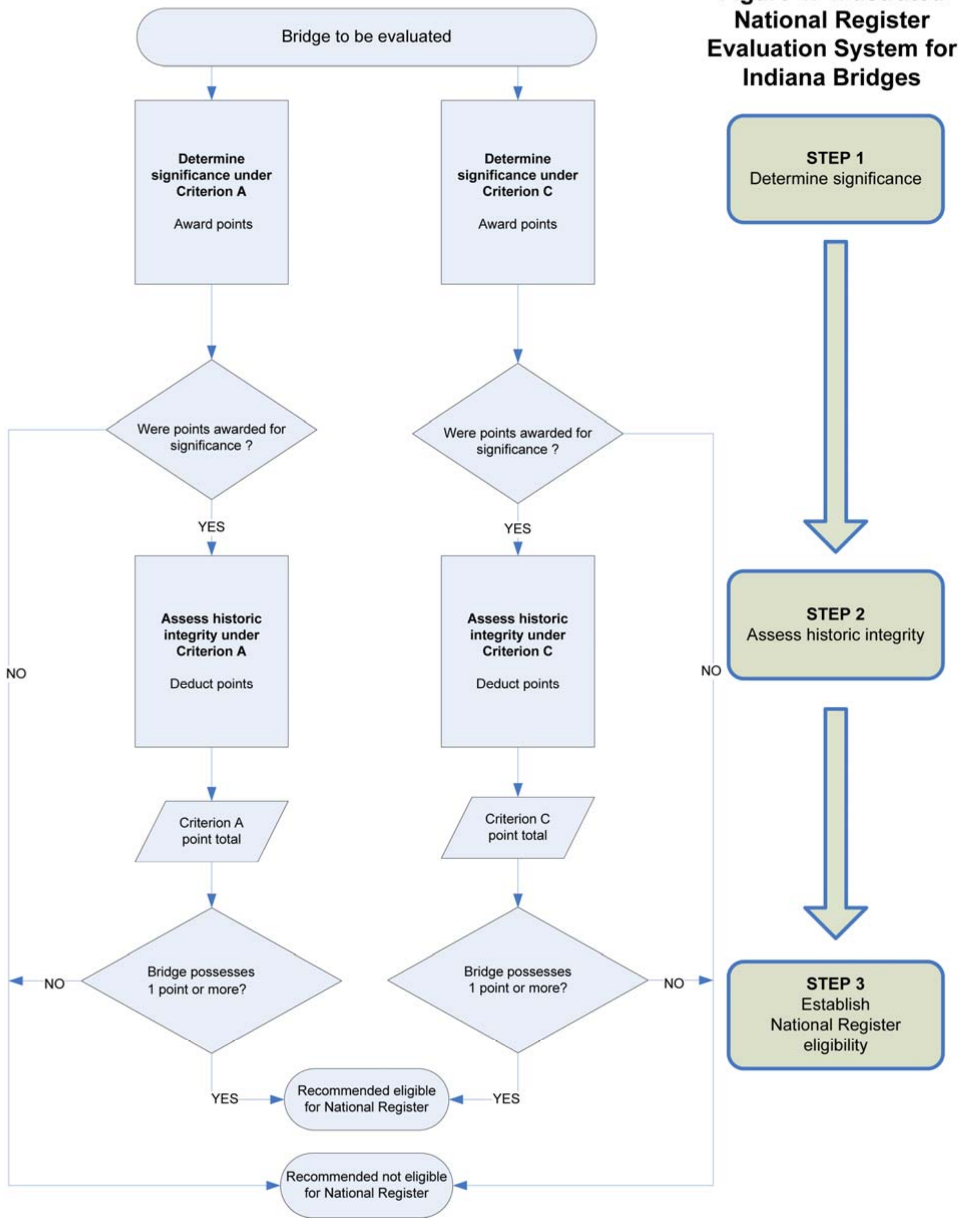
Two other National Register Criteria were found not to apply. Criterion B recognizes properties that are associated with the lives of persons significant in our past. The significant works of important engineers, designers, fabricators, or builders are considered to be eligible under Criterion C, which recognizes the work of a master, rather than Criterion B. Criterion D recognizes properties that have yielded, or may be likely to yield, information important in prehistory or history. It is most often applied to archaeological properties and was found not to apply to extant bridges in Indiana.

[3] One aspect of this criterion relates to historic districts; however, assessing the eligibility of historic districts is outside the scope of this project.

The National Register evaluation system used to apply Criteria A and C to Indiana's bridges is illustrated in Figure 1. The significance of a historic bridge under these criteria can be judged and explained only when a bridge is evaluated within its historic context. National, state, and local trends and events that led to the design and construction of Indiana's bridges are outlined in the *Indiana Bridges Historic Context Study, 1830s – 1965*. An understanding of the historic context for bridges in Indiana informed the development of the point system used to evaluate bridges. This points-based system follows a three-step process:

- Step 1: Determine significance
- Step 2: Assess historic integrity
- Step 3: Establish National Register eligibility

**Figure 1. Illustrated National Register Evaluation System for Indiana Bridges**



Separate point systems were used to determine significance under National Register Criteria A and C. Since structures may be significant under one or both criteria, bridges were evaluated applying both systems. In Step 1, bridges that have significance are awarded a point value that allows them to continue in the evaluation process. In the assessment of historic integrity under Step 2, points are deducted for integrity considerations. The deduction of points due to a loss of historic integrity is directly related to whether or not a bridge can convey its historic significance. Alterations that occur during a bridge's historical period may contribute to its significance and, in this case, integrity points are not deducted. Alterations that diminish a bridge's ability to convey significance result in a deduction in points.

A bridge earns a total point value following the determination of significance and assessment of historic integrity. This total is used in Step 3 to establish National Register eligibility. Bridges that meet the established point threshold for each criterion are recommended eligible for the National Register, while bridges that do not meet this threshold are recommended not eligible. The points system is explained further in Appendix A of this report.

# 4. Eligibility Recommendations

Bridges recommended eligible for listing in the National Register are presented according to which of the two National Register Criteria (Criterion A or C) were found to apply. Some bridges were found to meet both criteria. The following numbers of bridges are recommended eligible for the National Register:

Meets Criterion A - 33
Meets Criterion C - 396
Meets Criterion A and C - 15
Total recommended eligible as a result of this inventory - 444

## A. Criterion A

Criterion A recognizes bridges that have an important association with a transportation system, program or project, or event in state or local history that is significant within the context of Indiana's transportation and bridge-building history. Bridges that are recommended eligible were found to have a significant association with one or more of these three aspects of history:

1. A historic transportation system or important crossing
2. A historic program or project
3. An event in state or local history

For a bridge to be considered eligible for the National Register under Criterion A, it must retain historic integrity as represented by an ability to convey its historic significance. Criterion A relates to the significance of a bridge gained through its historical associations; therefore, integrity of location, setting, feeling, and association are especially important in demonstrating the structure's significance. Integrity of design, workmanship, and materials are also important but alterations that affect these aspects do not result in the same level of diminished integrity under Criterion A.

Bridges that met the established point threshold for Criterion A following the determination of significance and assessment of historic integrity are recommended eligible for the National Register. Bridges recommended eligible under Criterion A are summarized in Table 2. Bridges already listed or determined eligible for the National Register, including those known to contribute to a historic district, have already been evaluated and were not reevaluated or included in Table 2. See Volume 2 for a significance statement for each bridge and the associated rationale for the eligibility recommendation along with a listing of bridges already listed or determined eligible for the National Register, including those known to contribute to a historic district.

**Table 2**
**Bridges Recommended Eligible Under Criterion A**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Boone | 052-06-03138 | 19110 | Reinforced concrete arch |
| | 052-06-03140 | 19140 | Reinforced concrete arch |
| | 052-06-03141 | 19150 | Reinforced concrete arch |
| | 052-06-03142 | 19160 | Reinforced concrete arch |
| Carroll | 075-08-03486 | 24960 | Unreinforced concrete arch |
| Cass | 025-09-03841 | 6490 | Reinforced concrete arch |
| Clinton | (421)39-12-00930 | 32220 | Reinforced concrete arch |
| Crawford | 064-13-03507 | 23050 | Unreinforced concrete arch |
| Dearborn | 050-15-00210A | 18790 | Continuous riveted plate girder |
| | 050-15-01232A | 18780 | Reinforced concrete arch - under fill |
| Decatur | 00002 | 1600002 | Reinforced concrete arch |
| | 00237 | 1600178 | Stone arch |
| Dubois | 00055 | 1900045 | Simple steel beam |
| Floyd | 00046 | 2200045 | Reinforced concrete arch |
| Franklin | 052-24-00825 | 19420 | Reinforced concrete arch |
| Fulton | 00091 | 2500038 | Reinforced concrete arch - under fill |
| Greene | (231)157-28-03525 | 27860 | Reinforced concrete arch |
| | (231)157-28-03526 | 27870 | Reinforced concrete arch - under fill |
| | (231)157-28-03527 | 27880 | Reinforced concrete arch - under fill |
| Henry | 00902 | 3300157 | Concrete tee beam |
| Huntington | 105-35-05447A | 25280 | Continuous prestressed concrete I-beam |
| Jennings | 050-40-00854 | 18670 | Reinforced concrete arch - under fill |
| | 00040 | 4000038 | Stone arch |
| Johnson | 00026 | 4100021 | Reinforced concrete arch |
| LaPorte | 00505 | 4600143 | Bascule bridge |
| Lawrence | 050-47-01335 | 18460 | Reinforced concrete arch |
| | P000-47-07093 | 60460 | Metal pipe arch-round pipe |
| Marion | 0310L | 4900018 | Reinforced concrete arch - under fill |
| | 1807F | 4900146 | Reinforced concrete girder |
| | 2410F | 4900209 | Continuous reinforced concrete slab |
| | 2415F | 4900619 | Reinforced concrete arch |
| | 3102F | 4900290 | Prestressed concrete box beam-multiple |
| | 3802F | 4900375 | Reinforced concrete arch |
| Martin | 050-51-01295 | 18410 | Reinforced concrete arch - under fill |
| Monroe | 00015 | 5300009 | Reinforced concrete arch - under fill |
| | 00919 | 5300135 | Reinforced concrete slab |
| Montgomery | 00011 | 5400007 | Multiplate arch - under fill |

**Table 2**
**Bridges Recommended Eligible Under Criterion A**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Newton | 000K2 | 5600113 | Multiplate arch - under fill |
| | 000K3 | 5600114 | Reinforced concrete girder |
| Orange | 00018 | 5900013 | Iron thru truss |
| | 00034 | 5900024 | Continuous encased steel beam |
| | 00206 | 5900099 | Encased steel beam |
| Porter | 00171 | 6400123 | Reinforced concrete arch - under fill |
| Putnam | 040-67-01838B | 13740 | Reinforced concrete girder |
| Shelby | 00093 | 7300084 | Reinforced concrete arch |
| | 00149 | 7300137 | Stone arch |
| Vigo | 040-84-01637A | 13620 | Reinforced concrete arch - under fill |
| Wayne | 040-89-01291ADJ | 14135 | Reinforced concrete girder |

## B. Criterion C

Criterion C recognizes bridges that are significant in their design or construction. The majority of Indiana's historic bridges are significant under this criterion. Bridges that are recommended eligible for listing in the National Register under Criterion C were found to have a significant association with one or more of these three aspects of design or construction:[4]

1. Distinctive characteristics of a type, period, and method of construction, or a variation, evolution, or transition that reflects an important phase in bridge construction

2. Work of a master

3. Possesses high artistic values

For a bridge to be considered eligible for the National Register under Criterion C, it must retain historic integrity as represented by an ability to convey its historic significance. Criterion C relates to the engineering and/or architectural significance of a bridge; therefore, integrity of design, workmanship, and materials are especially important because they allow a structure to convey the physical features that characterize its type, period, and method of construction. A change in location, setting, feeling, or association may result in diminished integrity. If the relocated bridge spans the same type of feature, such as water, a roadway, or railway, as the original and its engineering or architectural significance is unaltered, the loss of one of these aspects of integrity typically does not result in a bridge being considered not eligible.

[4] An additional aspect of Criterion C relates to historic districts; however, assessing the eligibility of historic districts is outside the scope of this project.

Bridges that met the established point threshold for Criterion C following the determination of significance and assessment of historic integrity are recommended eligible for the National Register. Bridges recommended eligible under Criterion C are summarized in Table 3. Bridges already listed or determined eligible for the National Register, including those known to contribute to a historic district, have already been evaluated and were not reevaluated or included in Table 3. See Volume 2 for a significance statement for each bridge and the associated rationale for the eligibility recommendation along with a listing of bridges already listed or determined eligible for the National Register, including those known to contribute to a historic district.

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Allen | 00032 | 0200022 | Iron thru truss |
| | 00110 | 0200079 | Reinforced concrete girder |
| | 00191 | 0200142 | Reinforced concrete slab |
| | 00236 | 0200172 | Steel pony truss |
| | 00242 | 0200178 | Iron thru truss |
| | 00268 | 0200201 | Iron thru truss |
| | 00277 | 0200207 | Prestressed concrete box beam-multiple |
| | 00290 | 0200216 | Iron thru truss |
| | 00525 | 0200261 | Reinforced concrete arch |
| | 00532 | 0200331 | Reinforced concrete girder |
| Bartholomew | [00119] | XX034 | Steel pony truss |
| | 00001 | 0300003 | Steel pony truss |
| | 00026 | 0300024 | Steel thru truss |
| | 00046 | 0300042 | Steel thru truss |
| | 00047 | 0300043 | Steel thru truss |
| | 00130 | 0300121 | Steel pony truss |
| | 00165 | 0300138 | Reinforced concrete slab |
| | 046-03-03782BWBL | 10340 | Composite continuous steel beam |
| Benton | 00037 | 0400024 | Steel pony truss |
| | 00078 | 0400042 | Steel pony truss |
| Boone | 00018 | 0600011 | Steel pony truss |
| | 00070 | 0600052 | Reinforced concrete girder |
| | 00086 | 0600059 | Simple steel beam |
| | 00207 | 0600140 | Steel thru truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Brown | 00042 | 0700031 | Steel pony truss |
| | 00127 | 0700075 | Steel pony truss |
| Carroll | 00153 | 0800113 | Steel pony truss |
| | 00502 | 0800129 | Encased steel beam |
| | 075-08-03486 | 24960 | Unreinforced concrete arch |
| | 075-08-03653B | 24970 | Steel thru truss |
| | 218-08-03279 | 28910 | Reinforced concrete arch |
| Cass | 00203 | 0900137 | Riveted plate girder - floor beam system |
| Clark | 00063 | 1000053 | Steel pony truss |
| | 403-10-01941A | 32000 | Steel thru truss |
| Clay | 00123 | 1100101 | Reinforced concrete girder |
| | 00145 | 1100122 | Reinforced concrete slab |
| | 00301 | 1100237 | Continuous reinforced concrete girder |
| | 046-11-01313A | 17020 | Steel pony truss |
| Clinton | 00054 | 1200058 | Prestressed concrete I-beam |
| | 00076 | 1200075 | Prestressed concrete box beam-multiple |
| | 00077 | 1200076 | Prestressed concrete box beam-multiple |
| | 00116 | 1200109 | Prestressed concrete box beam-multiple |
| | 00195 | 1200151 | Precast concrete beam - channel beam |
| | (421)39-12-01792B | 32200 | Steel pony truss |
| | (421)39-12-01793B | 32210 | Steel pony truss |
| Crawford | 00007 | 1300004 | Steel thru truss |
| | 00011 | 1300008 | Steel pony truss |
| | 00025 | 1300018 | Riveted plate girder |
| | 00038 | 1300030 | Steel pony truss |
| | 00039 | 1300031 | Steel thru truss |
| | 00040 | 1300032 | Steel thru truss |
| | 00043 | 1300071 | Steel thru truss |
| | 00091 | 1300078 | Steel pony truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Crawford (cont.) | 00129 | 1300069 | Concrete tee beam |
| | 037-13-01457 | 11860 | Reinforced concrete slab |
| | 064-13-03507 | 23050 | Unreinforced concrete arch |
| Dearborn | 00024 | 1500021 | Reinforced concrete arch - under fill |
| | 00055 | 1500050 | Steel thru truss |
| | 046-15-01987A | 17540 | Steel thru truss |
| Decatur | 00033 | 1600022 | Stone arch |
| | 00045 | 1600033 | Stone arch |
| | 00080 | 1600061 | Stone arch |
| | 00089 | 1600069 | Stone arch |
| | 00106 | 1600085 | Stone arch |
| | 00109 | 1600088 | Stone arch |
| | 00114 | 1600092 | Stone arch |
| | 00118 | 1600096 | Stone arch |
| | 00124 | 1600101 | Stone arch |
| | 00131 | 1600107 | Continuous steel girder-floor beam system |
| | 00134 | 1600110 | Stone arch |
| | 00137 | 1600113 | Stone arch |
| | 00138 | 1600114 | Stone arch |
| | 00159 | 1600133 | Stone arch |
| | 00237 | 1600178 | Stone arch |
| Dekalb | 00134 | 1700135 | Steel pony truss |
| Delaware | 00085 | 1800070 | Steel thru truss |
| | 00108 | 1800090 | Steel pony truss |
| | 00134 | 1800111 | Steel thru truss |
| Delaware | 00701 | 1800193 | Simple steel beam |
| Dubois | 00114 | 1900080 | Prestressed concrete box beam-multiple |
| | 162-19-01925A | 28400 | Steel pony truss |
| | 164-19-03717A | 28450 | Continuous reinforced concrete slab |
| Elkhart | | XX029 | Stone arch |
| | | XX019 | Steel pony truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Elkhart (cont.) | 00303 | 2000113 | Prestressed concrete box beam-multiple |
| | 033-20-03906A | 10970 | Continuous reinforced concrete slab |
| Fayette | 00025 | 2100020 | Multiplate arch - under fill |
| Floyd | 00024 | 2200023 | Continuous reinforced concrete slab |
| Fountain | 00005 | 2300003 | Iron thru truss |
| | 00066 | 2300054 | Steel pony truss |
| | 00097 | 2300075 | Steel thru truss |
| | 00104 | 2300081 | Steel thru truss |
| | 00113 | 2300088 | Steel thru truss |
| | 00126 | 2300099 | Reinforced concrete arch |
| | 00131 | 2300103 | Steel thru truss |
| | 00142 | 2300112 | Steel thru truss |
| | 00143 | 2300113 | Iron thru truss |
| | 00211 | 2300140 | Steel thru truss |
| Franklin | 00025 | 2400015 | Concrete tee beam |
| | 00041 | 2400025 | Concrete tee beam |
| | 00044 | 2400028 | Reinforced concrete slab |
| | 00045 | 2400029 | Reinforced concrete slab |
| | 00078 | 2400053 | Stone arch |
| | 00089 | 2400060 | Reinforced concrete slab |
| | (1X)1-24-06625B | 516 | Steel thru truss |
| Gibson | 00313 | 2600229 | Steel pony truss |
| | 00401 | 2600282 | Steel pony truss |
| | 00402 | 2600283 | Steel pony truss |
| Gibson | 041-26-03917E | 14560 | Continuous riveted plate girder-floor beam system |
| Grant | 00100 | 2700072 | Prestressed concrete I-beam |
| | 00712 | 2700163 | Continuous reinforced concrete slab |
| Greene | 00021 | 2800014 | Steel pony truss |
| | 00024 | 2800016 | Steel pony truss |
| | 00108 | 2800073 | Steel thru truss |
| | 00110 | 2800074 | Steel pony truss |
| | 00195 | 2800135 | Steel pony truss |
| | 00233 | 2800162 | Steel thru truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Greene (cont.) | 00237 | 2800165 | Steel pony truss |
| | 00255 | 2800204 | Timber beam |
| | 00260 | 2800175 | Timber beam |
| | 00272 | 2800176 | Timber beam |
| | 00311 | 2800190 | Steel pony truss |
| | 057-28-00341C | 20710 | Steel thru truss |
| | 057-28-03042D | 20720 | Steel thru truss |
| Hamilton | 00023 | 2900021 | Reinforced concrete slab |
| | 00133 | 2900120 | Continuous reinforced concrete slab |
| Hancock | 00017 | 3000085 | Steel thru truss |
| Harrison | 00050 | 3100031 | Concrete tee beam |
| Hendricks | 00143 | 3200109 | Reinforced concrete arch |
| | 00162 | 3200121 | Prestressed concrete I-beam |
| | 00272 | 3200214 | Continuous reinforced concrete girder |
| Henry | 00241 | 3300146 | Multiplate arch - under fill |
| Howard | 00132 | 3400113 | Reinforced concrete slab |
| | 00504 | 3400122 | Prestressed concrete I-beam |
| | 00508 | 3400126 | Prestressed concrete I-beam |
| | 026-34-03651B | 6840 | Steel pony truss |
| Huntington | 00113 | 3500074 | Steel thru truss |
| | 00133 | 3500088 | Continuous reinforced concrete girder |
| | 105-35-05447A | 25280 | Continuous prestressed concrete I-beam |
| Jackson | 00006 | 3600005 | Steel pony truss |
| | 00154 | 3600099 | Steel pony truss |
| | 00158 | 3600103 | Steel thru truss |
| | 00189 | 3600125 | Steel pony truss |
| | 00194 | 3600129 | Continuous steel beam |
| | 00197 | 3600132 | Steel pony truss |
| | 031-36-01775C | 9210 | Steel thru truss |
| | (11)31A-36-01677E | 10250 | Steel thru truss |
| Jasper | 049-37-01938B | 17940 | Steel thru truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Jay | 00008 | 3800190 | Steel thru truss |
| | 026-38-03430A | 7040 | Steel thru truss |
| Jefferson | 00041 | 3900028 | Steel pony truss |
| | 00144 | 3900080 | Steel pony truss |
| | P000-39-07097 | 60280 | Multiplate arch - under fill |
| Jennings | 00007 | 4000007 | Reinforced concrete girder |
| | 00008 | 4000008 | Steel pony truss |
| | 00015 | 4000015 | Reinforced concrete slab |
| | 00024 | 4000023 | Continuous reinforced concrete slab |
| | 00029 | 4000028 | Steel thru truss |
| | 00034 | 4000032 | Reinforced concrete arch - open spandrel |
| | 00040 | 4000038 | Stone arch |
| | 00050 | 4000048 | Iron pony truss |
| | 00055 | 4000053 | Stone arch |
| | 00064 | 4000059 | Steel thru truss |
| | 00082 | 4000074 | Reinforced concrete girder |
| | 00109 | 4000100 | Reinforced concrete arch |
| | 00147 | 4000114 | Reinforced concrete arch |
| Knox | 00055 | 4200178 | Steel pony truss |
| | 00141 | 4200224 | Steel pony truss |
| | 00165 | 4200004 | Steel thru truss |
| | 00232 | 4200098 | Steel thru truss |
| | 00377 | 4200147 | Timber trestle |
| | 00392 | 4200261 | Concrete tee beam |
| Lake | 00243 | 4500135 | Reinforced concrete arch |
| | 00245 | 4500137 | Continuous steel beam |
| | 912-45-06596B | 33035 | Reinforced concrete rigid frame |
| | (12)912-45-02352B | 33080 | Composite continuous steel beam |
| LaPorte | | XX022 | Riveted plate girder |
| | 00505 | 4600143 | Bascule bridge - lift bridge |
| Lawrence | 00052 | 4700027 | Steel thru truss |
| | 00054 | 4700029 | Steel thru truss |
| | 00068 | 4700042 | Steel pony truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Lawrence (cont.) | 00079 | 4700052 | Steel pony truss |
| | 00100 | 4700125 | Steel thru truss |
| | 00107 | 4700077 | Steel pony truss |
| | 00139 | 4700106 | Steel thru truss |
| | 00150 | 4700111 | Continuous encased steel beam |
| | 00172 | 4700114 | Continuous reinforced concrete girder |
| | 00179 | 4700117 | Steel thru truss |
| | 00203 | 4700147 | Encased steel beam |
| Madison | 00087 | 4800077 | Steel pony truss |
| | 00123 | 4800107 | Continuous reinforced concrete girder |
| Marion | 0409F | 4900491 | Continuous reinforced concrete girder |
| | 1104F | 4900071 | Continuous reinforced concrete girder |
| | 1109L | 4900076 | Reinforced concrete arch |
| | 1123F | 4900638 | Reinforced concrete arch |
| | 1202F | 4900497 | Continuous reinforced concrete girder |
| | 1303F | 4900088 | Continuous reinforced concrete girder |
| | 1501F | 4900100 | Prestressed concrete box beam-multiple |
| | 1615F | 4900116 | Simple steel beam |
| | 1807F | 4900146 | Reinforced concrete girder |
| | 2308F | 4900192 | Continuous reinforced concrete girder |
| | 2406F | 4900205 | Composite continuous steel beam |
| | 2410F | 4900209 | Continuous reinforced concrete slab |
| | 2414F | 4900620 | Reinforced concrete arch |
| | 2520L | 4900233 | Continuous reinforced concrete slab |
| | 2615L | 4900255 | Reinforced concrete arch |
| | 3012L | 4900286 | Reinforced concrete slab |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Marion (cont.) | 3102F | 4900290 | Prestressed concrete box beam-multiple |
| | 3901F | 4900377 | Continuous reinforced concrete girder |
| | 4101F | 4900390 | Prestressed concrete box beam-multiple |
| | 4403F | 4900415 | Continuous reinforced concrete girder |
| | 4513F | 4900484 | Continuous reinforced concrete slab |
| | 4602F | 4900431 | Reinforced concrete girder |
| | 4610F | 4900438 | Reinforced concrete slab |
| | P000-49-07961 | 60563 | Reinforced concrete rigid frame |
| | P000-49-07962 | 60565 | Reinforced concrete rigid frame |
| Marshall | 00231 | 5000006 | Stone arch |
| Martin | 00022 | 5100006 | Steel pony truss |
| | 00044 | 5100019 | Steel pony Truss |
| | 00046 | 5100021 | Steel pony truss |
| | 00047 | 5100022 | Steel pony truss |
| | 00049 | 5100024 | Steel pony truss |
| | 00050 | 5100025 | Steel thru truss |
| | 00058 | 5100029 | Steel deck truss |
| | 00067 | 5100034 | Steel pony truss |
| | 00068 | 5100035 | Iron thru truss |
| | 00073 | 5100040 | Steel pony truss |
| | 00137 | 5100061 | Steel pony truss |
| | 050X-51-07333T | 18841 | Bailey truss |
| Miami | 00063 | 5200050 | Iron thru truss |
| | 00090 | 5200070 | Steel pony truss |
| | 00110 | 5200087 | Reinforced concrete slab |
| | 00159 | 5200122 | Steel thru truss |
| Monroe | 00015 | 5300009 | Reinforced concrete arch - under fill |
| | 00083 | 5300061 | Steel pony truss |
| | 00114 | 5300110 | Steel thru truss |
| | 00182 | 5300091 | Reinforced concrete slab |
| | 00913 | 5300130 | Steel pony truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Montgomery | 00011 | 5400007 | Multiplate arch - under fill |
| | 032-54-03342C | 10490 | Steel pony truss |
| | 032-54-03347A | 10470 | Reinforced concrete arch - open spandrel |
| Morgan | 00103 | 5500084 | Reinforced concrete girder (trans girder) floor beam system |
| | 00146 | 5500121 | Iron thru truss |
| | 039-55-03108B | 13110 | Continuous riveted plate girder-floor beam system |
| | 252-55-01968 | 30720 | Reinforced concrete girder |
| Newton | 00149 | 5600093 | Steel thru truss |
| Orange | 00015 | 5900010 | Steel pony truss |
| | 00018 | 5900013 | Iron thru truss |
| | 00031 | 5900021 | Steel thru truss |
| | 00034 | 5900024 | Continuous encased steel beam |
| | 00049 | 5900035 | Steel thru truss |
| | 00059 | 5900043 | Steel pony truss |
| | 00063 | 5900046 | Steel pony truss |
| | 00064 | 5900047 | Steel pony truss |
| | 00077 | 5900058 | Steel pony truss |
| | 00090 | 5900063 | Steel pony truss |
| | 00095 | 5900065 | Steel thru truss |
| | 00102 | 5900070 | Steel thru truss |
| | 00103 | 5900071 | Iron thru truss |
| Owen | 00002 | 6000001 | Steel thru truss |
| | 00027 | 6000025 | Steel pony truss |
| | 00048 | 6000038 | Steel pony truss |
| | 00059 | 6000048 | Steel pony truss |
| | 00083 | 6000058 | Steel pony truss |
| | 00103 | 6000075 | Steel pony truss |
| | 00105 | 6000077 | Steel pony truss |
| | 00135 | 6000095 | Iron pony truss |
| | 00143 | 6000103 | Reinforced concrete girder (trans girder) floor beam system |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Owen (cont.) | 00144 | 6000105 | Reinforced concrete girder (trans girder) floor beam system |
| | 00158 | 6000116 | Reinforced concrete girder (trans girder) floor beam system |
| | 00188 | 6000134 | Steel pony truss |
| | 157-60-05190A | 27960 | Continuous prestressed concrete box beam-spread |
| Parke | 00021 | 6100017 | Reinforced concrete girder |
| | 00072 | 6100059 | Continuous steel beam |
| | 00106 | 6100091 | Reinforced concrete girder |
| | 00198 | 6100147 | Prestressed concrete I-beam |
| | 00220 | 6100165 | Reinforced concrete girder |
| | 00237 | 6100180 | Reinforced concrete girder |
| | 00248 | 6100218 | Continuous reinforced concrete girder |
| | 00281 | 6100191 | Reinforced concrete slab |
| Perry | 00082 | 6200047 | Steel pony truss |
| | 00083 | 6200105 | Steel pony truss |
| | 00098 | 6200054 | Steel pony truss |
| Pike | 00032 | 6300157 | Steel thru truss |
| | 00071 | 6300057 | Steel thru truss |
| | 00144 | 6300098 | Steel pony truss |
| | 00147 | 6300100 | Steel thru truss |
| | 00169 | 6300110 | Steel pony truss |
| | 00297 | 6300179 | Riveted plate girder - floor beam system |
| Porter | | XX024 | Thru steel arch |
| | P000-64-07069 | 60160 | Reinforced concrete girder |
| Posey | 00013 | 6500044 | Steel thru truss |
| | 00032 | 6500295 | Simple steel beam |
| | 00058 | 6500198 | Steel pony truss |
| | 00059 | 6500002 | Steel pony truss |
| | 00065 | 6500201 | Concrete tee beam |
| | 00091 | 6500247 | Steel thru truss |
| | 00148 | 6500183 | Steel pony truss |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Posey (cont.) | 00163 | 6500238 | Steel pony truss |
| | 00195 | 6500150 | Steel thru truss |
| | 00202 | 6500251 | Steel thru truss |
| | 00211 | 6500163 | Steel pony truss |
| | 00327 | 6500255 | Steel thru truss |
| Pulaski | 00196 | 6600106 | Iron thru truss |
| | 00291 | 6600152 | Steel pony truss |
| | 119-66-03454A | 25850 | Steel thru truss |
| Putnam | 00010 | 6700009 | Steel thru truss |
| | 00049 | 6700036 | Reinforced concrete girder |
| | 00071 | 6700057 | Steel thru truss |
| | 00073 | 6700059 | Steel thru truss |
| | 00137* | 6700122 | Steel thru truss |
| | 00139 | 6700124 | Steel thru truss |
| | 00152 | 6700131 | Steel thru truss |
| | 00187 | 6700161 | Steel thru truss |
| | 00199 | 6700173 | Steel pony truss |
| | 00211 | 6700182 | Steel pony truss |
| | 00276 | 6700217 | Continuous reinforced concrete girder |
| | 00279 | 6700219 | Continuous reinforced concrete girder |
| | 00286 | 6700222 | Continuous reinforced concrete girder |
| | 00288 | 6700223 | Continuous reinforced concrete girder |
| Randolph | 00021 | 6800012 | Encased steel beam |
| | 00049 | 6800035 | Steel pony truss |
| | 00114 | 6800089 | Steel pony truss |
| | 00226 | 6800181 | Steel pony truss |
| | 00284 | 6800217 | Steel pony truss |
| | 00305 | 6800230 | Concrete tee beam |
| | 028-68-04065 | 7830 | Reinforced concrete arch |

**This determination has been sent to the Keeper of the National Register for a final eligibility decision.*

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Ripley | 00003 | 6900003 | Stone arch |
| | 00014 | 6900013 | Steel thru truss |
| | 00050 | 6900037 | Stone arch |
| | 00061 | 6900046 | Stone arch |
| | 00070 | 6900053 | Stone arch |
| | 00073 | 6900055 | Stone arch |
| | 00080 | 6900063 | Stone arch |
| | 00132 | 6900106 | Continuous reinforced concrete slab |
| | 00133 | 6900109 | Reinforced concrete girder (trans girder) floor beam system |
| Scott | 00057 | 7200043 | Continuous reinforced concrete slab |
| Shelby | 00031 | 7300031 | Steel thru truss |
| | 00097 | 7300088 | Steel pony truss |
| | 00117 | 7300105 | Steel pony truss |
| | 00127 | 7300115 | Steel pony truss |
| | 00128 | 7300116 | Steel pony truss |
| | 00134 | 7300122 | Stone arch |
| | 00136 | 7300124 | Steel pony truss |
| | 00147 | 7300135 | Steel thru truss |
| | 00149 | 7300137 | Stone arch |
| Spencer | 00037 | 7400034 | Reinforced concrete arch |
| | 00114 | 7400106 | Reinforced concrete slab |
| | 00238 | 7400237 | Continuous steel beam |
| | 00259 | 7400196 | Reinforced concrete arch |
| | 00273 | 7400205 | Reinforced concrete slab |
| | 00308 | 7400168 | Reinforced concrete arch |
| St. Joseph | 00214 | 7100006 | Composite steel girder |
| | (933)31-71-02037 | 11048 | Riveted plate girder-floor beam system |
| Starke | | XX003 | Iron thru truss |
| | | XX027 | Steel pony truss |
| | [00141] | XX028 | Steel pony truss |
| | 00013 | 7500008 | Continuous reinforced concrete slab |
| Sullivan | 00121 | 7700108 | Iron thru truss |
| | 00147 | 7700130 | Reinforced concrete girder |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Sullivan (cont.) | 00236 | 7700200 | Reinforced concrete slab |
| | 00253 | 7700212 | Steel thru truss |
| Tippecanoe | 00036 | 7900021 | Riveted plate girder - floor beam system |
| | 026-79-03346B | 6690 | Steel thru truss |
| | 052-79-01784DEBL | 19010 | Steel deck truss |
| | 225-79-04016F | 29150 | Steel thru truss |
| | U0507 | 7900160 | Reinforced concrete rigid frame |
| Tipton | 00003 | 8000003 | Continuous reinforced concrete slab |
| | 00009 | 8000009 | Reinforced concrete slab |
| | 00059 | 8000051 | Reinforced concrete girder |
| Vanderburgh | 00620 | 8200007 | Steel deck truss |
| | 00810 | 8200071 | Steel thru truss |
| | 062-82-03958A | 21960 | Continuous reinforced concrete rigid frame |
| Vermillion | 00046 | 8300030 | Riveted plate girder - floor beam system |
| | 00070 | 8300040 | Riveted plate girder - floor beam system |
| | 036-83-03492A | 11480 | Steel thru truss |
| | 163-83-05325A | 28430 | Continuous steel girder |
| Vigo | 00018 | 8400012 | Reinforced concrete arch |
| | 00091 | 8400067 | Reinforced concrete girder (trans girder) floor beam system |
| | 00095 | 8400069 | Reinforced concrete girder |
| | 00151 | 8400113 | Steel pony truss |
| | 00194 | 8400148 | Prestressed concrete I-beam |
| | 00208 | 8400161 | Reinforced concrete slab |
| | 00322 | 8400211 | Prestressed concrete box beam-multiple |
| | 040-84-01637A | 13620 | Reinforced concrete arch - under fill |
| | 150-84-01708A | 27380 | Reinforced concrete arch - under fill |
| Wabash | 00165 | 8500535 | Steel thru truss |
| | 00181 | 8500585 | Continuous reinforced concrete slab |

**Table 3**
**Bridges Recommended Eligible Under Criterion C**

| County | County or State Bridge Number | NBI Number (or unique bridge number assigned) | Bridge type |
|---|---|---|---|
| Warren | 00023 | 8600020 | Steel pony truss |
| | 00036 | 8600029 | Steel thru truss |
| | 00089 | 8600075 | Steel pony truss |
| | 00092 | 8600078 | Steel thru truss |
| | 026-86-01572A | 6620 | Steel pony truss |
| | 055-86-03502B | 19740 | Steel deck truss |
| Warrick | 00140 | 8700045 | Continuous steel beam |
| | 00259 | 8700117 | Steel pony truss |
| | 00310 | 8700147 | Steel pony truss |
| | 00371 | 8700170 | Steel thru truss |
| Washington | 00039 | 8800027 | Steel pony truss |
| | 00058 | 8800038 | Steel pony truss |
| Wayne | 00191 | 8900141 | Reinforced concrete girder |
| | 00197 | 8900147 | Reinforced concrete arch - under fill |
| | 00213 | 8900160 | Steel pony truss |
| | 027-89-03748 | 7210 | Reinforced concrete arch |
| Wells | 00112 | 9000084 | Steel pony truss |
| | 00121 | 9000089 | Prestressed concrete box beam-multiple |
| | 00193 | 9000144 | Steel thru truss |
| White | [00298] | XX026 | Steel thru truss |
| | 00156 | 9100123 | Iron pony truss |
| Whitley | 00041 | 9200036 | Reinforced concrete box girder - multiple |
| | 00055 | 9200049 | Prestressed concrete I-beam |

# 5. Special Circumstances and Periodic Updates

This report provides eligibility recommendations for publicly owned bridges in Indiana built through 1965. It is possible that new or additional information may come to light concerning a particular bridge that may warrant reconsideration of its eligibility recommendation. This information may relate to the significance or integrity of the bridge. For example, a previously unknown, yet significant, historical association may be revealed through additional research or an unexpected discovery. An alteration that was not apparent through available records or plans may be identified that diminishes the historic integrity of a bridge. In such circumstances, a bridge should be reevaluated applying the points-based system used for the current inventory effort. It is also possible that a bridge may have been inadvertently excluded from the inventory project. In such circumstances, information should be collected following applicable data collection procedures and the bridge should be evaluated using the points-based system. The methodology detailed in Appendix A of this report would be applied under these special circumstances.

The methodology applied to Indiana's bridge population in conducting the statewide historic bridge inventory provides a consistent and replicable approach to determining the eligibility of a bridge, regardless of its structural type, material, features, or date of construction. However, there may be rare situations when the points-based evaluation system does not result in an agreed upon National Register-eligibility determination for a particular bridge. In such circumstances, FHWA, INDOT, and INSHPO may be required to determine National Register eligibility by following the established Section 106 review process as set forth in 36 CFR Part 800.4.

The PA that established Indiana's historic bridge preservation program, including the requirement to complete this inventory of historic bridges, also set forth a process to assess the need for periodic updates to the inventory. According to the established process, FHWA, INDOT, and INSHPO will consult at least every 10 years to determine if conditions have changed that would require updating the list of bridges eligible for the National Register. If these agencies agree that conditions have changed and an update is required, then an inventory will be completed following the process described in the PA. The inventory may at that time be expanded to include bridges built after 1965. If agencies determine that the existing inventory is still valid, then INDOT will notify the public and parties to the PA of this decision.

# Appendix A. System for Applying the National Register Criteria for Evaluation

# A. Introduction

The National Register Criteria for Evaluation to be applied to Indiana's bridge population, including the draft evaluation system, were developed prior to undertaking field survey activities. The evaluation system has been revised and updated to incorporate new information identified during the field survey and associated research activities. The final criteria and methodology applied to determine the eligibility of Indiana's pre-1966 bridge population is presented here as part of the results of the Indiana Statewide Historic Bridge Inventory.

The evaluation system has three steps—*Step 1: Determine significance*; *Step 2: Assess historic integrity*; and *Step 3: Establish National Register eligibility*. *Step 1: Determine significance* applies the National Register Criteria to determine if a structure possesses historic or engineering significance. The National Register employs four criteria for evaluation: A, B, C, and D. Criterion A and Criterion B involve an association; Criterion C involves design or construction; and Criterion D involves ability to yield information. Section B of this appendix outlines the National Register Criteria as they apply to the evaluation of Indiana's structures built through 1965.

Structures that are identified to have significant features or associations are awarded a point value that allows them to continue on in the evaluation system to *Step 2: Assess historic integrity*. In the assessment of historic integrity under Step 2, points are deducted for integrity considerations. The deduction of points due to a loss of historic integrity is directly related to whether or not a bridge can convey its historic significance. Following the determination of significance and assessment of integrity, a bridge has an awarded point value used in *Step 3: Establish National Register eligibility*.

Bridges that meet the established point threshold are recommended eligible for the National Register, while bridges that do not meet this threshold are recommended not eligible. Guidance is provided to assist with awarding points for significance and subtracting points during the assessment of historic integrity. The evaluation system steps are outlined in Figure 1.

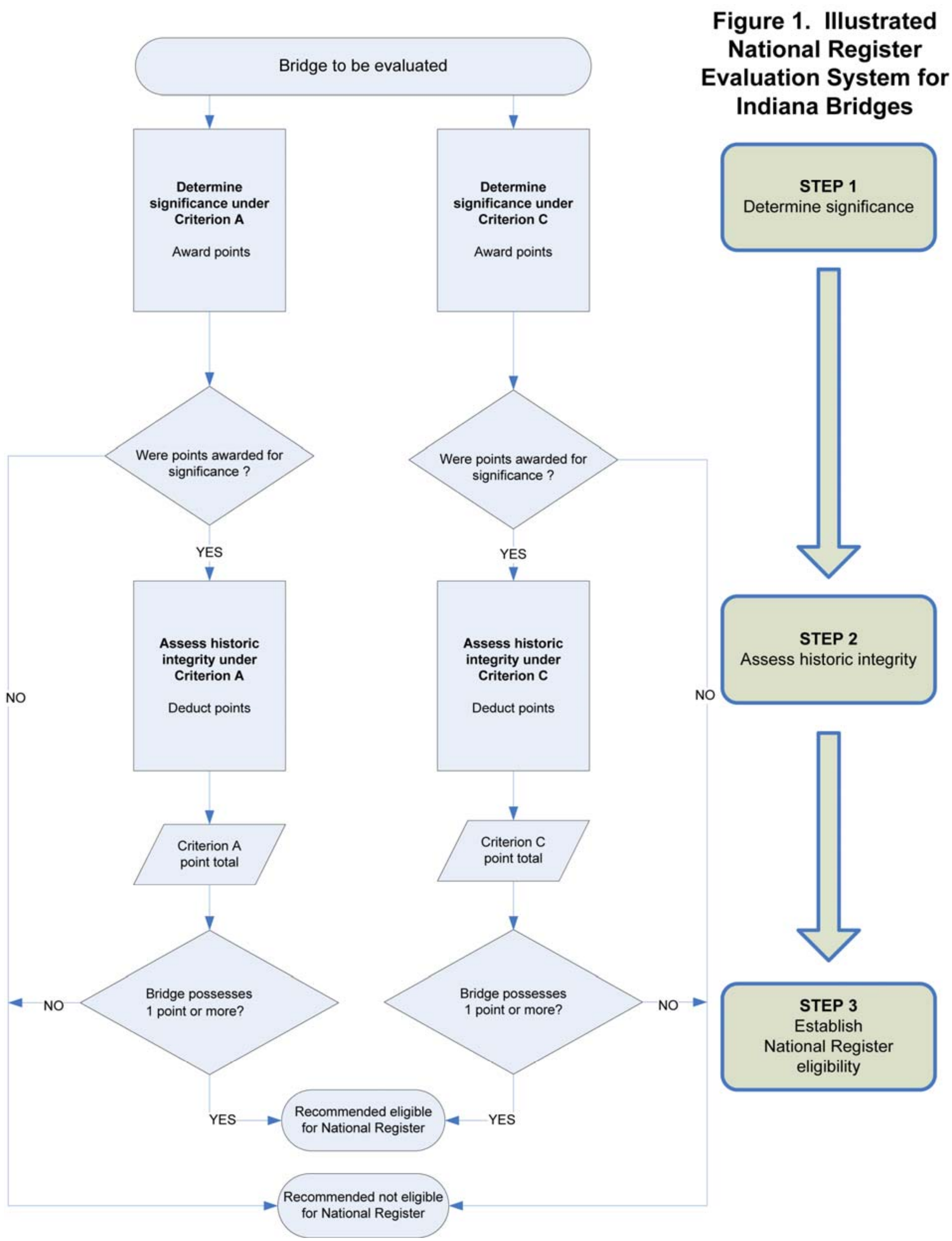


Figure 1. Illustrated National Register Evaluation System for Indiana Bridges
Bridge to be evaluated
Determine significance under Criterion A
Award points
Determine significance under Criterion C
Award points
Were points awarded for significance ?
Were points awarded for significance ?
YES
YES
NO
NO
Assess historic integrity under Criterion A
Deduct points
Assess historic integrity under Criterion C
Deduct points
Criterion A point total
Criterion C point total
Bridge possesses 1 point or more?
Bridge possesses 1 point or more?
NO
NO
YES
YES
Recommended eligible for National Register
Recommended not eligible for National Register
STEP 1
Determine significance
STEP 2
Assess historic integrity
STEP 3
Establish National Register eligibility

## B. National Register Criteria and application to bridges

The National Register Criteria for evaluation, established by the National Park Service, are outlined in *National Register Bulletin: How to Apply the National Register Criteria for Evaluation* and *National Register Bulletin: How to Complete the National Register Form*. The National Register Criteria will be applied to Indiana's bridges as follows:

*Criterion A: Events – Properties that are associated with events that have made a significant contribution to the broad patterns of our history.*
Criterion A recognizes bridges that have an important association with single events, a pattern of events, repeated activities, or historic trends that are significant within the context of Indiana's transportation and bridge-building history. This criterion applies to bridges that played a vital role in state, regional, or local settlement, or economic or transportation development.

*Criterion B: Persons – Properties that are associated with the lives of persons significant in our past.*
Criterion B recognizes bridges that illustrate the important achievements of a person who was significant in Indiana's past. Structures must be compared to other properties associated with the significant individual to identify the property that best represents a person's historic contributions. The significant works of important engineers, designers, fabricators, or builders are considered to be eligible under Criterion C, which recognizes the work of a master, rather than Criterion B. Since structures are not likely to qualify under Criterion B, the evaluation system does not include further discussion of this area of significance.

*Criterion C: Design/Construction – Properties that embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.*
Criterion C applies to bridges that are significant in their design and/or construction, including such elements as engineering and architectural treatment. This criterion is the most likely to apply to Indiana bridges. To be eligible under Criterion C, a bridge must meet at least one of the following four requirements, based on the associated historic context. The National Register definition of each requirement (presented in italics) is followed by an expanded discussion of its application to Indiana bridges.

(1) *Distinctive characteristics of a type, period, and method of construction, or a variation, evolution, or transition that reflects an important phase in bridge construction*

This requirement of Criterion C applies to bridges that have distinctive design or construction characteristics that demonstrate the following:

- The pattern of features common to a particular type of bridge.
- The individuality or variation of features that occurs within the type.
- The evolution or transition of that bridge type.

This criterion takes into consideration special bridge features and variations, choices and availability of materials and technology, and important firsts and innovations.

(2) *Work of a master*

This requirement applies to bridges designed by a significant engineer, designer, fabricator, or builder. For a bridge to be considered significant as the work of a master, it must express a particular phase in the development of the master's career, an aspect of their work, or a particular idea or theme. A master is considered a recognized figure in the field of bridge engineering and design. A master may also be a known craftsman whose work is distinguishable from others by its characteristic style and quality. A craftsman or firm known for a patented bridge design or characteristic form may be considered a master under this requirement.

Not every bridge associated with a master will be considered eligible under this requirement. Bridges must reflect the distinguishing characteristics of the significant engineer, designer, fabricator, or builder and retain integrity to be considered significant examples of their work.

(3) *Possess high artistic value*

This requirement applies to bridges designed with outstanding architectural style, architectural treatment, or ornamentation. To be significant under this requirement of Criterion C, a bridge must possess outstanding architectural treatment. The simple presence of any architectural treatment is not adequate.

(4) *Represent a significant and distinguishable entity whose components may lack individual distinction*

This requirement of Criterion C refers to historic districts. Assessing the eligibility of historic districts is outside the scope of this project.

*Criterion D: Information Potential – Properties that have yielded, or may be likely to yield, information important in prehistory or history.*

Criterion D recognizes properties that have yielded, or may be likely to yield, information important in prehistory or history. It is most often applied to archaeological properties and was found not to apply to extant bridges in Indiana. Therefore, the evaluation system does not include further discussion of this area of significance.

## C. Step 1: Determine significance

In Step 1, separate point evaluation systems were used for National Register Criterion A, recognizing an association with transportation systems, important program or project, or state or local history, and Criterion C, recognizing engineering or architectural significance. Since structures may be significant under one or both criteria, bridges were evaluated applying both systems.

### 1. Determine significance – Criterion A

Under Criterion A, a bridge is awarded 3 points for direct association with an important event or 6 points for a highly important event. Events associated with local, state, or national history may qualify. A discussion of the rationale used and steps taken to identify significant transportation systems in Indiana is described in *Section 3* of this report. In rare circumstances, events or associations may be multiple, overlap, or be concurrent, allowing a bridge to receive points for more than one association under Criterion A. Table A-1 summarizes significant historical associations for Indiana's bridges and the associated points that are awarded.

**Table A-1**
**Aspects of Significance Under Criterion A: Points to Assign**

| Category | Item | Points to assign |
|---|---|---|
| **Association with a historic transportation system or important crossing** | Canals (Wabash & Erie, Whitewater and Central, structure constructed pre-1900) | 6 |
| | Early historic roads (Michigan Road, National Road and New Albany-Vincennes Turnpike, structure constructed pre-1916) | 6 |
| | Lincoln Highway (structure constructed between 1915 and 1925) | 6 |
| | Dixie Highway (structure constructed between 1915 and 1935) | 6 |
| | Indiana State Highway Commission Routes (Main Market Highways 1-5 and State Routes 6, 7, and 10; structures constructed between 1919 and 1932) | 3 |
| | Early US Highways (US 20, US 50, US 52; structures constructed between 1927 and 1941) | 3 |
| | Bridge provides an important crossing to another state (U.S. Highway over Wabash or Ohio River) | 3 |

**Table A-1**
**Aspects of Significance Under Criterion A: Points to Assign**

| Category | Item | Points to assign |
|---|---|---|
| **Association with historic program or project** | Highly important program or project (Examples include bridges associated with Federal work relief programs or World War II related efforts) | 6 |
| **Association with state or local history** | Highly Important (Examples include bridges associated with an important state event, trend, or pattern) | 6 |
| | Important (Examples include memorial bridges with a direct association with event or individuals it is memorializing or bridges with a direct association with an important local event, trend, or pattern)[1] | 3 |

## 2. Determine significance – Criterion C

Under Criterion C, a bridge is awarded points for possessing engineering or architectural significance. Criterion C recognizes bridges that are significant in their design and/or construction. Such bridges will have a significant association with one or more of these three aspects of design or construction:

1. Distinctive characteristics of a type, period, and method of construction, or a variation, evolution, or transition that reflects an important phase in bridge construction

2. Work of a master

3. Possesses high artistic values

The aspects of significance for bridges based on National Register Criteria are defined below in Table A-2. A bridge may receive points in more than one area of engineering significance. Tables that further define the assignment of points, based on characteristics distinctive to each bridge type and subtype, are found in Appendix B of this report. Distinctive and/or uncommon bridge types, such as timber trusses, bascule, and unusual metal types, do not have individual Criterion C point tables developed because there are a limited number of examples.

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[1] To possess significance under *Criterion A*, a direct connection between the bridge and an important local event, trend, or pattern must be demonstrated. This project included state-level research and relied on public involvement to identify locally significant bridges.

**Table A-2**
**Aspects of Significance Under Criterion C: Points to Assign**

| Category | Item | Bridge type | Points to assign |
|---|---|---|---|
| **Distinctive characteristics of type, period or method of construction** | ***Built before specified year*** | Defined for each bridge type | 7 |
| | ***Distinctive type and/or uncommon type*** <br><br> ***OR*** <br><br> ***Only known example in the state*** | Defined for each bridge type | 7 |
| | ***Early example*** | Defined for each bridge type | 3 |
| | ***Early standard plan*** | Defined for each bridge type | 3 |
| | ***Rare – region*** | Six or fewer examples within an INDOT district | 2 |
| **Variation, evolution or transition of type** | ***Exceptional length – main span*** | Defined for each bridge type | 3 |
| | ***Exceptional length – overall*** | Defined for each bridge type | 3 |
| | ***Special features/innovation – important or unusual*** | Defined for each bridge type | 3 |
| | ***Special features/innovation – highly important or unusual*** | Defined for each bridge type | 4 |
| | ***Outstanding technological achievement*** | Defined for each bridge type | 7 |
| **High artistic value** | ***Selected ornamentation, notable but isolated*** | Defined for each bridge type | 3 |
| | ***Outstanding ornamentation or architectural treatment in overall design*** | Defined for each bridge type | 6 |

**Table A-2**
**Aspects of Significance Under Criterion C: Points to Assign**

| Category | Item | Bridge type | Points to assign |
|---|---|---|---|
| **Work of a master** | ***Work of a nationally important engineer, designer, fabricator, or builder*** | See list of engineers, designers, fabricators and builders in Appendix C. | 4 (if receiving points for another Criterion C item) |
| | ***Work of an important Indiana engineer, designer, fabricator or builder; or of an engineer, designer, fabricator, or builder of statewide significance in Indiana, regardless of office location*** | See list of engineers, designers, fabricators and builders in Appendix C. | 3 (if receiving points for another Criterion C item) |
| | ***Work of multiple nationally or Indiana important engineers, designers, fabricators, and builders*** | See list of engineers, designers, fabricators and builders in Appendix C. | 6 (if receiving points for another Criterion C item) |

**Distinctive characteristics of type, period or method of construction**
This requirement of Criterion C applies to bridges that demonstrate distinctive design or construction characteristics. The method for identifying such distinctions is explained below. Further details on how points were applied to specific bridge types are provided in Appendix B of this report.

*Built before specified year; distinctive type and/or uncommon type; and only known example in the state*
Certain bridge types and subtypes are readily recognized as possessing engineering significance because they are uncommon and/or distinctive. These include the only known example of a type in the state, a type that survives from the earliest era of Indiana bridge construction, or a type that was uncommonly constructed due to the challenging nature of its design and/or construction. Examples of bridge types in Indiana that are distinctive and/or uncommon include timber trusses, bascule, and unusual metal types. Additional distinctive and/or uncommon types are defined in the bridge tables in Appendix B of this report.

| | |
|---|---|
| Built before specified year | (+7 points) |
| Distinctive and/or uncommon type | (+7 points) |
| Only known example in the state | (+7 points) |

*Designed and built prior to the period of common use for bridge type*
Bridges that were constructed before the period of common use for a specific bridge type or as early examples of a standard plan are considered more significant than those constructed after the type was in

common or widespread use. The common date range and introduction of standard plans, if applicable, for each type was determined through the use of national bridge contexts, preparing the *Indiana Bridges Historic Context Study, 1830s-1965*, and subsequent research conducted for this project.

| | |
|---|---|
| Built during earliest period of use for type | (+3 points) |
| Built during early period of use for standard plans | (+3 points) |

*Rare examples of a bridge type*

Comparative information is an important consideration when evaluating the significance of a bridge that is a rare surviving example of its type. Overall rarity of a bridge type is addressed in the category recognizing a distinctive type and/or uncommon type. Bridge types with few other extant examples may justify accepting a greater degree of alteration or fewer remaining physical features that convey its engineering association. For this reason, points are awarded for examples of bridge types with few other extant bridges in a region within this step. Each of the six INDOT districts is considered a region for the purposes of this evaluation. Bridges that are the only known example of its type in the state are addressed above and receive 7 points.

| | |
|---|---|
| Six or less extant examples within the region | (+2 points) |

**Variation, evolution, or transition of type**

This aspect of Criterion C takes into consideration variation, evolution, or transition within bridge types as conveyed through important features, firsts, and innovations related to bridge design, fabrication, and construction. Exceptional length, special features, innovations, and outstanding technological achievements are examined to identify such a variation, evolution, or transition within a bridge type. The method for identifying such distinctions is explained below. Further details on how points were applied to specific bridge types are provided in Appendix B of this report.

*Exceptional length*

Exceptionally long main spans are indicators of engineering innovations that test the limits of existing technology and materials or lead to new and innovative designs. Exceptional overall structure length is an indicator of a significant crossing or engineering situation that is not apparent in evaluating main span length alone.

| | |
|---|---|
| Exceptional main span length for type | (+3 points) |
| Exceptional overall structure length for type | (+3 points) |

*Special features/innovation*

Special features in design, fabrication, and construction reflect unusual conditions that have been accommodated by the engineer, designer, fabricator, or builder. These features point to significance for the particular bridge as compared to the common designs and features for its type. An innovation is a newly introduced element that reflects more dynamic changes or transitions in a type, technology, or material. Innovations that led to the revision or update of a standard plan are awarded points under this category.

| | |
|---|---|
| Important or unusual design, fabrication, or construction feature(s) | (+3 points) |
| Highly important or unusual design, fabrication, or construction feature(s) | (+4 points) |

*Outstanding technological achievement*

Outstanding technological achievements represent features that are unique to the design of a particular structure. These achievements are highly significant and represent a greater accomplishment than innovations with lesser influence or impact.

| | |
|---|---|
| Outstanding technological achievement | (+7 points) |

**High artistic value**

This requirement applies to bridges designed with outstanding architectural style, architectural treatment, or ornamentation. To be significant under this requirement of Criterion C, a bridge must possess outstanding architectural treatment or quality in overall design. The simple presence of architectural treatment is not adequate. Some structures may possess high artistic value expressed in the overall form, use of materials, and engineering elegance, even though the bridge does not display a formal architectural treatment. In other cases, bridges that express no particular overall architectural treatment still have significant notable ornamental details. Bridge plaques are common for all bridge types and are not considered ornamental features. Aesthetic treatments vary within bridge types according to the material, context of surroundings, and era of and method of construction. These variances are considered when assigning points for high artistic value.

| | |
|---|---|
| Selected ornamentation, notable but isolated | (+3 points) |
| Outstanding ornamentation and/or architectural treatment in overall design | (+6 points) |

**Work of a master**

This requirement applies to bridges designed by a significant engineer, designer, fabricator, or builder. For a bridge to be considered significant as the work of a master, it must express a particular phase in the development of the master's career, an aspect of their work, or a particular idea or theme. A master is considered a recognized figure in the field of bridge engineering and design. A known craftsman whose work is distinguishable from others by its characteristic style and quality is also considered a master. A craftsman or firm known for a patented bridge design or characteristic form is considered a master under this requirement.

Bridges may be considered the work of a master if they were designed by engineers, designers, fabricators, or builders of national recognition, or Indiana-based individuals or firms that designed and built bridges within the state and whose work is distinguishable. Bridges built by those not based in Indiana and without national recognition and status will not be considered the work of a master unless unusual evidence suggests otherwise. Because Indiana State Highway Commission (ISHC) engineers were typically designing standardized structures,  they are generally not considered masters under this requirement.  An ISHC engineer publicly recognized for design excellence may be considered as a master.

Not every bridge associated with a master is considered eligible under this requirement.  The structure needs to demonstrate a significant phase or feature of their work and be distinguishable from other similar bridges by possessing significance in another category.  For this reason, points for work of a master are only awarded when another feature, such as high artistic value or unusual feature/innovation, is also identified.  Association with the work of a master or multiple masters on its own does not result in the assignment of points.  A list of engineers, designers, fabricators, and builders that are considered to be significant with their point assignment is found in Appendix C of this report.

Work of multiple important national or state engineers, designers, fabricators or builders
(+6 points)

Work of a nationally important engineer, designer, fabricator or builder
(+4 points)

Work of an important Indiana engineer, designer, fabricator or builder (regardless of office location)
(+3 points)

## D. Step 2: Assess historic integrity

For a bridge to be considered eligible for the National Register, it must retain historic integrity or most of the physical features that allow it to convey its historic significance. For the evaluation of Indiana's bridges, the seven aspects of integrity have been grouped into three categories: 1) materials, workmanship, and design; 2) location; and 3) setting, feeling, and association. The grouping allows for an assessment of closely related aspects of integrity.

Significant structures must retain historic integrity to be eligible for the National Register. As a result, points will be deducted from those awarded in *Step 1: Determine significance* to account for items that diminish a property's integrity. Different aspects of integrity affect the eligibility of a structure in different ways, depending on how each relates to the property's significance. Therefore, the assessment of integrity for Criterion A differs from the assessment for Criterion C, as defined below. The deduction of points is weighed more heavily for the aspects of integrity that are directly related to a property's ability to convey significance. In some cases, alterations during the structure's historical period may contribute to its significance. Integrity points are not deducted in these cases.

(1) Assessment of historic integrity – Criterion A

Criterion A relates to the significance of a structure gained through its historical associations. Therefore, integrity aspects of location, setting, feeling, and association play an important role in demonstrating the structure's significance. As a result, these aspects of integrity are weighed more heavily in the assessment of a structure's historic integrity. If the relocated bridge spans the same type of feature, such as water, a roadway, or railway, as the original and its historic association is unaltered, the loss of one of these aspects of integrity typically does not result in a bridge being considered not eligible.

Integrity aspects of design, workmanship, and materials are also important, but alterations that affect these aspects do not result in the same level of diminished integrity under Criterion A. Table A-3 summarizes alterations that warranted deduction of points for loss of integrity under Criterion A.

**Table A-3**
**Assessment of Historic Integrity Under Criterion A: Points to Deduct**

| Category | Item | Examples | Points to deduct |
|---|---|---|---|
| **Location, setting, feeling and association** | Extensive alterations | - Relocated and no longer directly associated with historic context<br>- Extensive overall loss of integrity<br>- Widening with additional lanes post World War II<br>- Widening with additional lanes not representing evolution of a route | -6 |

**Table A-3**
**Assessment of Historic Integrity Under Criterion A: Points to Deduct**

| Category | Item | Examples | Points to deduct |
|---|---|---|---|
| **Location, setting, feeling and association (cont.)** | Major alterations | - Relocated and the type of feature spanned (water, roadway, railway) is not the same as original<br>- Parallel bridge to accommodate widening of the roadway<br>- Shoulder widening post World War II<br>- Shoulder widening not representing evolution of a route | -4 |
| | Minor alterations | - Relocated and the type of feature spanned (water, roadway, railway) is the same as original<br>- Rural bridge has been encroached upon | -2 |
| **Materials, workmanship, and design** | | - Added railing<br>- Incompatible repair<br>- Deck replacement not in-kind[2]<br>- Removal of original architectural treatment<br>- Replacement of original rail/parapet with rail/parapet not in-kind or in character with the structure | -1 |

(2) Assessment of historic integrity – Criterion C

Since Criterion C relates to the engineering and/or architectural significance of a structure, the integrity aspects of design, workmanship, and materials are typically more important. This is because they allow a structure to convey its physical features and characterize the type, period, or method of construction.

Location and setting may be important under Criterion C when the design responds to the immediate environment. A change in location, setting, feeling, or association may result in diminished integrity. If the relocated bridge spans the same type of feature, such as water, a roadway, or railway, as the original and its engineering or architectural significance is unaltered, the loss one of these aspects of integrity typically does not result in a bridge being considered not eligible. Table A-4 summarizes alterations that warranted deduction of points for loss of integrity under Criterion C.

[2] Information related to changes in bridge deck materials was not available and therefore not considered in this inventory.

**Table A-4**
**Assessment of Historic Integrity Under Criterion C: Points to Deduct**

| Category | Item | Examples | Points to deduct |
|---|---|---|---|
| **Materials, workmanship, and design** | Extensive alterations | - Extensive overall loss of integrity | -7 |
| | Major alterations | - Repairs or changes defeating original structural action<br>- Alteration to masonry superstructure<br>- Removal of main members integral to superstructure<br>- Widening with new superstructure type<br>- Substantial repairs to superstructure not consistent with original<br>- Revising vertical clearance (truss only)<br>- Covering masonry superstructure with non-compatible material | -5 |
| | Minor alterations | - Replacement or addition of member not in kind with original<br>- Welding or other connection repairs not consistent with original<br>- Removal of original architectural treatment<br>- Replacement of original rail/parapet with rail/parapet not in-kind or in character with the structure (applies to all types but truss, under fill arch, and prestressed)<br>- Widening with in-kind or compatible superstructure, or sidewalk extension<br>- Mortar repair inconsistent with original | -3 |
| | | - Deck replacement not in-kind[3] | -2 |

[3] Information related to changes in bridge deck materials was not available and therefore not considered in this inventory.

**Table A-4**
**Assessment of Historic Integrity Under Criterion C: Points to Deduct**

| Category | Item | Examples | Points to deduct |
|---|---|---|---|
| **Location, setting, feeling, and association** | Major alterations | - Relocated and the type of feature spanned (water, roadway, railway) is not the same as original | -4 |
| | Minor alterations | - Relocated and the type of feature spanned (water, roadway, railway) is the same as original | -2 |

## E. Step 3: Establish National Register eligibility

The points awarded in *Step 1: Determine significance* and deducted in *Step 2: Assess historic integrity* are calculated to determine if a structure possesses both the significance and the historic integrity necessary for eligibility to the National Register under Criteria A and/or C.

- If a bridge possesses 1 point or more, the bridge is recommended eligible for the National Register.

- If a bridge possesses 0 points or less, the bridge is not recommended eligible for the National Register.

National Register eligibility recommendations based on the evaluation point system are subject to approval by INDOT. INDOT will forward their final recommendations, along with any public comments, to FHWA and the INSHPO for concurrence.

# Appendix B. Criterion C Point Application by Bridge Type

**Table B-1. Criterion C: Bridge type - Reinforced Concrete Slab**

| Category | Item | Subtype | | | Points to assign |
|---|---|---|---|---|---|
| | | **101A – Reinforced concrete slab** | **119A – Reinforced concrete slab – under fill** | **201A – Continuous reinforced concrete slab** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1910 | | | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Only known example in the state* | None identified | | | 7 |
| | *Early example* | None identified – points assigned under *Built before specified year* due to steady construction of this bridge type after 1909 | | | 3 |
| | *Early standard plan* | 1923–1924 | 1925–1926 | 1928–1929 | 3 |
| | *Rare – region* | N/A – more than 6 examples are found in all six regions | | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | Greater than 35 feet (pre–1945)<br>After 1944 – None identified | Greater than 35 feet (pre–1945)<br>After 1944 – None identified | None identified – steady increases in main span length across bridge subtype | 3 |
| | *Exceptional length – overall* | Greater than 45 feet (pre–1945)<br>After 1944 – None identified | Greater than 45 feet (pre–1945)<br>After 1944 – None identified | Greater than 300 feet | 3 |
| | *Special features/innovation – important or unusual* | Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br>A bridge carrying intersecting roadways endures live–load forces moving in two directions requiring specially engineered substructures and/or superstructure, resulting in an innovative design.<br>Horizontal curved decks represent an important bridge construction technique requiring specially engineered substructures and/or superstructures.<br>Variable depth is an important innovation in bridge construction to achieve greater span distances than can be achieved with a traditional form. | | | 3 |
| | *Special features/innovation – highly important or unusual* | None identified | | | 4 |
| | *Outstanding technological achievement* | Multiple examples from above | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Non–standard decorative railing with other aesthetic treatments<br>Rusticated facade<br>Turned balusters<br>Stone or brick veneer<br>Ornamental light standards | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | Multiple examples of above | | | 6 |

**Table B-2. Criterion C: Bridge Type - Reinforced Concrete Girder and Beam**

| Category | Item | Subtype | | | | | Points to assign |
|---|---|---|---|---|---|---|---|
| | | **102A – Reinforced concrete girder**<br>**102B – Reinforced concrete beam**<br>**104 – Reinforced concrete tee beam**<br>(Few distinctions exist between how these bridges are assigned by INDOT and county highway agencies. For this reason, these subtypes were evaluated together.) | **103 – Reinforced concrete girder – trans. girder/floor beam system** | **105 – Reinforced concrete box girder – multiple** | **122 – Precast concrete beam** | **202A – Continuous reinforced concrete girder** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1910 | | N/A | | Built before 1910 | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Only known example in the state* | Yes – Reinfoced concrete box girder – multiple only (one example)<br>None identified for other subtypes | | | | | 7 |
| | *Early example* | None identified – points assigned under *Built before specified year* due to steady construction of this bridge type after 1909 | | | Built before 1950 | None identified – points assigned under *Built before specified year* due to steady construction of this bridge type after 1909 | 3 |
| | *Early standard plan* | 1922-23 (Reinforced concrete Tee-beam only) | N/A | N/A | N/A – research identified the first ISHC standard plans for this bridge type in 1957; however, examples during this period do not appear to illustrate important trends within the evolution of this bridge type and that precast channel beams were an established bridge type built in Indiana prior to this date. Therefore, points were not awarded. | N/A | 3 |
| | *Rare – region* | N/A – more than 6 examples are found in all six regions | | | | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | Greater than 50 feet | Greater than 50 feet | N/A | None identified – steady increases in main span length across bridge subtype | Greater than 90 feet | 3 |
| | *Exceptional length – overall* | Greater than 200 feet | Greater than 90 feet | N/A | Greater than 120 feet | Greater than 490 feet | 3 |
| | *Special features/innovations - important or unusual* | Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br>Non-uniform truss webs incorporated into truss bridges to account for extreme skew represent a highly important variation within this bridge type.<br>Horizontally curved, cambered and Camelback girders are unusual variations within this bridge type designed to solve a unusual site condition or span greater distances than traditional girder bridges.<br>Horizontal curved decks represent an important bridge construction technique requiring specially engineered substructures and/or superstructures.<br>Variable depth is an important innovation in bridge construction to achieve greater span distances than can be achieved with a traditional form (built in or prior to 1950).<br>A bridge carrying intersecting roadways endures live-load forces moving in two directions requiring specially engineered substructures and/or superstructure, resulting in an innovative design.<br>Early examples of concrete thru girders (pre-1915) constructed with an integrated slab deck illustrates the transition between these two bridge types. | | | | | 3 |
| | *Special features/innovations – highly important or unusual* | Flared reinforced-concrete girder ends are an important feature that led to an increased span lengths within concrete girder construction. | | | | | 4 |
| | *Outstanding technological achievement* | Multiple examples from above<br>The patented Luten truss system used in slab, beam, and girder bridges was a highly innovative reinforcing arrangement incorporated into horizontal bridge forms as an economical alterative to traditional reinforced-concrete construction. | | | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Non-standard decorative railing with other aesthetic treatments | | | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | | | | 6 |

**Table B-3. Criterion C: Bridge Type - Reinforced Concrete Rigid Frame**

| Category | Item | Subtype | | Points to assign |
|---|---|---|---|---|
| | | **107A, 207A – Reinforced concrete rigid frame (Simple and Continuous)** | **119C, 219B – Reinforced concrete box – under fill (simple and continuous)** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1910 | | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Only known example in the state* | Yes | None identified | 7 |
| | *Early example* | N/A – These subtypes each contain a low population and are awarded points above as a distinctive type and/or uncommon type. | None identified – steady construction of this bridge type during its period of use | 3 |
| | *Early standard plan* | N/A – research found these bridge type were nonstandardized | | 3 |
| | *Rare – region* | N/A – These subtypes each contain a low population and are awarded points above as a distinctive type and/or uncommon type. | N/A – More than 6 examples are found in all six regions | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge subtypes | | 3 |
| | *Exceptional length – overall* | None identified – steady increases in overall structure length across bridge subtypes | | 3 |
| | *Special features/innovations – important or unusual* | Horizontal curved decks represent an important bridge construction technique requiring specially engineered substructures and/or superstructures. | | 3 |
| | *Special features/innovations – highly important or unusual* | None identified | | 4 |
| | *Outstanding technological achievement* | None identified | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | None identified | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | 6 |

**Table B-4. Criterion C: Bridge Type - Concrete Arch**

| Category | Item | Subtype | | | | Points to assign |
|---|---|---|---|---|---|---|
| | | 111A, 211 – Reinforced concrete arch (simple and continuous) | 119B – Reinforced concrete arch – under fill | 111B – Open spandrel reinforced concrete arch | 111C – Unreinforced concrete arch | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1910 | | | | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Last or only known example in the state* | None identified | No – regular forms<br>Yes – cantenary arch | Yes | Yes | 7 |
| | *Early example* | None identified – points assigned under *Built before specified year* due to steady construction of this bridge type after 1909 | | | | 3 |
| | *Early standard plan* | N/A – research found this type was nonstandardized | | | | 3 |
| | *Rare – region* | N/A – more than 6 examples are found in all six regions | | N/A – These subtypes each contain a low population and are awarded points above as a distinctive type and/or uncommon type. | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge subtypes | | N/A | | 3 |
| | *Exceptional length – overall* | Greater than 600 feet | Greater than 150 feet | Greater than 600 feet | N/A | 3 |
| | *Special features/ innovations – important or unusual* | Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br>Horizontal curved decks represent an important bridge construction technique requiring specially engineered substructures and/or superstructures.<br>Spandrel braced arches represents an important method of construction within this bridge type for their efficient use of materials.<br>Two-part skew represents an unusual variation within this bridge type. | | | | 3 |
| | *Special features/ innovations – highly important or unusual* | The patented Melan arch system reinforcing represents a highly important design innovation within this bridge type.<br>The patented Luten arch system reinforcing represents an efficient and highly important method of construction within this bridge type. | | | | 4 |
| | *Outstanding technological achievement* | Multiple examples from above | | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Non-standard decorative railing with other aesthetic treatments<br>Rusticated facade<br>Turned balusters<br>Molded details or decorative brackets<br>Refuge bays, ornamental piers and caps, or pilasters<br>Stone or brick veneer<br>Ornamental light standards | | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | Multiple examples of above | | | | 6 |

**Table B-5. Criterion C: Bridge Type - Metal Arch**

| Category | Item | Subtype | | Points to assign |
|---|---|---|---|---|
| | | **312B – Thru steel arch** | **311 – Metal pipe arch (round pipe)**<br>**319A – Multiplate – under fill**<br>**911 – Aluminum arch**<br>**919B – Aluminum plate arch – under fill** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1900 | | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Only known example in the state* | Yes | None identified | 7 |
| | *Early example* | None identified – steady construction of this bridge type during its period of use | | 3 |
| | *Early standard plan* | N/A – research found this type was nonstandardized | 1935 and 1936 – Multiplate arch only (319A) | 3 |
| | *Rare – region* | N/A – This subtype contains one example and points are awarded under *Only known example in the state.* | No – More than 6 examples exist in each of the six regions | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | N/A | None identified – steady increases in main span length across bridge subtypes | 3 |
| | *Exceptional length – overall* | N/A | Greater than 100 feet | 3 |
| | *Special features/innovation – important or unusual* | None identified | | 3 |
| | *Special features/innovation – highly important or unusual* | None identified | | 4 |
| | *Outstanding technological achievement* | N/A | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Non-standard decorative railing with other aesthetic treatments | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | Dressed stone, ornamental coursing/bonding patterns | | 6 |

**Table B-6. Criterion C: Bridge Type - Steel Beam**

| Category | Item | Subtype | | | | | | | Points to assign |
|---|---|---|---|---|---|---|---|---|---|
| | | Simple | | | | Continuous | | | |
| | | 302A – Encased steel beam | 302D – Simple steel beam | 302G – Composite steel beam | 303H – Steel beam floor beam system | 402A – Continuous steel beam | 402C – Continuous encased steel beam | 402D – Composite continuous steel beam | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Before 1900 | | | | | | | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Only known example in the state* | None identified | | | | None identified | | | 7 |
| | *Early example* | Before 1915 | | None identified – steady construction of this bridge type during its period of use | Before 1950 | Before 1935 | | Before 1950 | 3 |
| | *Early standard plan* | 1932-1933 – Bridges built during this period were awarded points only if their design matched known ISHC standard plans. | | N/A – research found this type was nonstandardized | | 1938-1939 | N/A – research found this type was nonstandardized | | 3 |
| | *Rare – region* | N/A – more than 6 examples are found in all six regions | | | | N/A – more than 6 examples are found in all six regions | | | 2 |
| **Variation, evolution or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge subtypes | | | | Greater than 115 feet | | | 3 |
| | *Exceptional length – overall* | Greater than 150 feet | | Greater than 400 feet | None identified – steady increases in overall structure length in this bridge subtype | Greater than 600 feet | None identified – steady increases in overall structure length in this bridge subtype | Greater than 600 feet | 3 |
| | *Special features/innovations – important or unusual* | Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br><br>Reinforced concrete stringers and/or jack-arch systems used in floor system design represent an unusual variation within this bridge type (1920 and earlier). | | | | | | | 3 |
| | *Special features/innovations – highly important or unusual* | Cantilevered spans allow greater bridge lengths to be achieved than could be gained with simple-span construction, representing of a highly important innovation in beam bridge construction. | | | | | | | 4 |
| | *Outstanding technological achievement* | Multiple examples from above | | | | | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Non-standard decorative railing with other aesthetic treatments | | | | | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | | | | | | 6 |

**Table B-7. Criterion C: Bridge Type - Steel Girder**

| Category | Item | Subtype | | | Points to assign |
|---|---|---|---|---|---|
| | | Simple | Continuous | | |
| | | **302C – Riveted plate girder**<br>**302E – Simple steel girder**<br>**302H – Composite steel girder**<br>**303B – Simple steel girder–floor beam system**<br>**303F – Riveted plate girder–floor beam system**<br>**303H – Steel beam floor beam system** | **402B – Continuous steel girder**<br>**402E – Composite continuous steel girder**<br>**402H – Continuous riveted plate girder** | **403A – Continuous steel girder–floor beam system**<br>**403C – Continuous riveted plate girder – floor beam system**<br>**403D – Composite continuous riveted plate girder – floor beam system** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1900 | | | 7 |
| | *Distinctive type and/or uncommon type OR Only known example in the state* | Yes – Plate–leg girder | | | 7 |
| | *Early example* | Before 1915 | None identified – points assigned under *Built before specified year* due to steady construction of this bridge type after 1899 | Before 1915 – Continuous steel girder–floor beam system (403A) only | 3 |
| | *Early standard plan* | 1932–1933 – simple steel girder (302E) only | N/A – research found these subtypes were nonstandardized | N/A – research found these subtypes were nonstandardized | 3 |
| | *Rare – region* | Yes – INDOT District 2 | | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge subtypes | None identified – steady increases in main span length across bridge subtypes | None identified – steady increases in main span length across bridge subtypes | 3 |
| | *Exceptional length – overall* | Greater than 250 feet | Greater than 1000 feet | Greater than 2000 feet | 3 |
| | *Special features – innovation important or unusual* | Substructures constructed of brick are extremely rare and represent a distinctive method of construction within the overall structure design.<br>Variable depth is an important innovation in bridge construction to achieve greater span distances than can be achieved with a traditional form.<br>Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br>A progression of raised and extended spans designed to solve site engineering problems represents an important variation in the design of the overall structure.<br>Early use of welding represents the initial application of an important innovation in metal construction. | | | 3 |
| | *Special features/innovation – highly important or unusual* | Cantilevered spans allow greater bridge lengths to be achieved than could be gained with simple–span construction, representing an important innovation in beam bridge construction. | | | 4 |
| | *Outstanding technological achievement* | Multiple examples from above | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Non–standard decorative railing with other aesthetic treatments | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | | 6 |

**Table B-8. Criterion C: Bridge Type - Steel Deck Truss**

| Category | Item | Subtype | Points to assign |
|---|---|---|---|
| | | **309 – Steel deck truss** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1900 | 7 |
| | *Distinctive type and/or uncommon type OR Only known example in the state* | Yes | 7 |
| | *Early example* | N/A – This bridge type contains a low population and are awarded points above as a *Distinctive type and/or uncommon type.* | 3 |
| | *Early standard plan* | N/A – Research did not identify standards for this bridge subtype during this period. | 3 |
| | *Rare – region* | Yes – All six INDOT districts | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge type | 3 |
| | *Exceptional length – overall* | Greater than 500 feet | 3 |
| | *Special features/innovation – important or unusual* | Cantilevered spans allow greater bridge lengths to be achieved than could be gained with simple-span construction, representing of a highly important innovation in beam bridge construction.<br>Early fabrication and use of rolled metal truss members represents the initial application of an important innovation in metal bridge construction. | 3 |
| | *Special features/innovation – highly important or unusual* | Stone arch approach spans provide a highly unusual and distinctive variation in the design of the overall structure.<br>Metal substructures and caissons, often patented structural elements, provide an important construction feature within this bridge type. | 4 |
| | *Outstanding technological achievement* | Multiple examples of above | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | None identified | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | 6 |

**Table B-9. Criterion C: Bridge Type - Metal Pony Truss**

| Category | Item | Subtype | | | | | | Points to assign |
|---|---|---|---|---|---|---|---|---|
| | | **310A – Warren** | **310A – Parker** | **310A – Pratt** | **910B – Iron pony truss** | **310A – Other variations** | **310C – Bailey truss** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Build before 1900 | | | | | N/A | 7 |
| | *Distinctive type and/or uncommon type OR Only known example in the state* | No – regular horizontal top chord<br>Yes – polygonal top chord | Yes | No – regular configuration<br>Yes – half deck only | Yes | Yes – King Post, Queen Post, Pratt truss leg bedstead, Warren truss leg bedstead, double intersection Warren, Bowstring | Yes | 7 |
| | *Early example* | Built 1900 – 1919 | | | N/A | | | 3 |
| | *Early standard plan* | 1923 – 1924 | 1939 – 1940 | N/A – research found this type was nonstandardized | | | | 3 |
| | *Rare – region* | No – more than six examples exist in each of the six regions | Yes – INDOT Districts 1 and 5 | Yes – INDOT Districts 2, 3, and 4 | N/A – These subtypes each contain a low population and are awarded points above as a distinctive type and/or uncommon type. | | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | Greater than 85 feet – regular horizontal top chord<br>Greater than 120 feet – polygonal top chord | Greater than 120 feet | Greater than 80 feet | N/A | | | 3 |
| | *Exceptional length – overall* | None identified – steady increases in overall structure length across bridge subtype | | | | | | 3 |
| | *Special features/innovation – important or unusual* | Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br>Metal substructures and caissons, often patented structural elements, provide an important construction feature within this bridge type.<br>Reinforced concrete stringers and/or jack–arch systems used in floor system design represent an unusual variation within this bridge type.<br>Deep truss webs represent an important innovation to achieve long spans in pony truss construction and are rarely found.<br>Early use of riveting (pre-1915) represents the initial application of a new metal bridge construction technique for Warrens.*<br>Early fabrication and use of rolled metal truss members represents the initial application of an important innovation in metal bridge construction (before 1930). | | | | | | 3 |
| | *Special features/ innovation – highly important or unusual* | Non–uniform truss webs incorporated into truss bridges to account for extreme skew represent a highly important variation within this bridge type.<br>Early use of riveting (pre-1920) represents the initial application of a new metal bridge construction technique for Pratts.*<br>Early use of bolting (pre-1910) represents the initial application of a new metal bridge construction technique.* | | | | | | 4 |
| | *Outstanding technological achievement* | Multiple examples of above<br>Pinned connections represent a highly unusual variation within Warren and Parker truss construction.*<br>Early use of all welded connectors represents the initial application of a highly important innovation in metal bridge construction. | | | | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | None identified | | | | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | | | | | 6 |

* Early truss types (e.g., Pratts) coincided with the prevalence of pinned connections, while Warrens and Parkers coincided with the prevalence of riveted connections. Consequently, points were assigned to the early use of riveting in Warrens to capture the earliest application of this connection for this subtype and points are assigned for the early use of riveting in Pratts to capture the transition to this connection for this subtype. Points are not assigned to early pinned Pratts because they already receive points under Built before specified year or riveted Parkers because they already receive points as an uncommon subtype. It is highly unusual to find Warrens or Parkers with pinned connections, for this reason points were assigned for this construction technique within these subtypes. Bolted connections occupied a transitional stage in truss design in general, and became more widespread in pony truss construction after 1910. For this reason points were assigned for this construction technique.

**Table B-10. Criterion C: Bridge Type - Metal Thru Truss**

| Category | Item | Subtype | | | | | | | Points to assign |
|---|---|---|---|---|---|---|---|---|---|
| | | **310B – Warren** | **310B – Parker** | **310B – Pratt** | **310B – Other variations** | **310B – Pennsylvania** | **310B – Baltimore** | **910A – Iron thru truss** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1900 | | | | | | | 7 |
| | *Distinctive type and/or uncommon type OR Only known example in the state* | No | No | No | Yes – Double intersection Warren, Triple intersection Warren, Whipple [triple intersection Pratt], Camelback, and Bowstring | Yes | Yes | Yes | 7 |
| | *Early example* | Built 1900-1919 | | | N/A | | | | 3 |
| | *Early standard plan* | N/A | 1922 and 1923 | N/A – research found this type was nonstandardized | | | | | 3 |
| | *Rare – region* | Yes – All six INDOT districts | Yes – INDOT Districts 2, 3, and 4 | Yes – INDOT Districts 2, 3, and 4 | N/A – These subtypes each contain a low population and are awarded points above as a distinctive type and/or uncommon type. | | | | 2 |
| **Variation, evolution, and/or transition of a type** | *Exceptional length – main span* | Greater than 135 feet | Greater than 195 feet | Greater than 190 feet | N/A | | | | 3 |
| | *Exceptional length – overall* | None | Greater than 1000 feet | Greater than 350 feet | N/A | | | | 3 |
| | *Special feature/ innovations - important or unusual* | Employing multiple thru-truss spans allows significant distances to be achieved, while substantially limiting the amount of substructure construction required, and represents an important variation in the design of the overall structure.<br>Metal substructures and caissons, often patented structural elements, provide an important construction feature within this bridge type.<br>Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br>Fish-belly floor beams<br>Early use of riveting (pre-1915) represents the initial application of a new metal bridge construction technique for Warrens.*<br>Early fabrication and use of rolled metal truss members (1920-1925) represents the initial application of an important innovation in metal bridge construction. | | | | | | | 3 |
| | *Special feature/ innovations – highly important or unusual* | Non-uniform truss webs incorporated into truss bridges to account for extreme skew represent a highly important variation within this bridge type.<br>Bolted connections represent a highly unusual variation in thru truss construction.*<br>Early use of riveting (pre-1915) represents the initial application of a new metal bridge construction technique for Pratts and Camelbacks.* | | | | | | | 4 |
| | *Outstanding technological achievement* | Multiple examples of above<br>Early use of welding represents the initial application of a highly important innovation in metal bridge construction.<br>Pinned connections represent a highly unusual variation within Warren and Parker truss construction for any year. * | | | | | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Ornamental portal elements | | | | | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | | | | | | 6 |

* Early truss types (e.g., Pratts and Camelbacks) coincided with the prevalence of pinned connections, while Warrens and Parkers coincided with the prevalence of riveted connections. Consequently, points were assigned to the early use of riveting in Warrens to capture the earliest application of this connection for this subtype and points are assigned for the early use of riveting in Pratts and Camelbacks to capture the transition to this connection for these subtypes. Points are not assigned to early pinned Pratts because they already receive points under Built before specified year, pinned Camelback because they already receive points as an uncommon subtype, or for riveted Parkers because this connection type with trusses appeared to be well-established by 1920 and prevalent within this subtype. It is highly unusual to find Warrens or Parkers with pinned connections, for this reason points were assigned for this construction technique within these subtypes. Bolted connections occupied a transitional stage in truss design in general, and became more widespread in pony truss construction after 1910. For this reason points were assigned for this construction technique.

**Table B-11. Criterion C: Bridge Type - Prestressed Concrete I Beam**

| Category | Item | Subtype | | Points to assign |
|---|---|---|---|---|
| | | **502 – Prestressed concrete I-beam** | **602 – Continuous prestressed I-beam** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | N/A | | 7 |
| | *Distinctive type and/or uncommon type OR Only known example in the state* | None identified | | 7 |
| | *Early example* | Built before 1960 | | 3 |
| | *Early standard plan* | N/A – Research identified the first ISHC standard plans for this bridge type in 1962; however, examples during this period do not appear to illustrate important trends within the evolution of this bridge type. By 1962 prestressed I-beams were an established bridge type that was being built in Indiana and AASHO had issued standards for prestressed beam design. Therefore, points were not awarded. | | 3 |
| | *Rare – region* | N/A – more than 6 examples are found in all six regions | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | Greater than 100 feet | None identified – steady increases in main span length across this bridge subtype | 3 |
| | *Exceptional length – overall* | Greater than 420 feet | Greater than 500 feet | 3 |
| | *Special features/innovations – important or unusual* | Substantial skew (greater than 45 degrees) represents a distinctive construction method to address engineering challenges.<br><br>Horizontal curved decks represent an important bridge construction technique requiring specially engineered substructures and/or superstructures. | | 3 |
| | *Special features/innovations – highly important or unusual* | None identified | | 4 |
| | *Outstanding technological achievement* | Multiple examples from above | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | None identified | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | 6 |

**Table B-12. Criterion C: Bridge Type - Prestressed Concrete Box Beam**

| Category | Item | Subtypes | | | | Points to assign |
|---|---|---|---|---|---|---|
| | | **505 – Prestressed concrete box beams – multiple** | **506 – Prestressed concrete box beams – spread** | **605 – Continuous prestressed concrete box beams – multiple** | **606 – Continuous prestressed concrete box beams – spread** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | N/A | | | | 7 |
| | *Distinctive type and/or uncommon type*<br>*or*<br>*Only known example in the state* | None identified | | | | 7 |
| | *Early example* | Built before 1955 | Built before 1960 | | | 3 |
| | *Early standard plan* | N/A – research did not identify standards for these bridge subtypes during this period | | | | 3 |
| | *Rare – region* | N/A – more than 6 examples are found in all six regions | | | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge subtypes | | | | 3 |
| | *Exceptional length – overall* | Greater than 300 feet | None identified – steady increases in overall structure length across these bridge subtypes | | Greater than 200 feet | 3 |
| | *Special features/innovations – important or unusual* | Substantial skew (greater than 55 degrees) represents a distinctive construction method to address engineering challenges.<br>Horizontal curved decks represent an important bridge construction technique requiring specially engineered substructures and/or superstructures. | | | | 3 |
| | *Special features/innovations – highly important or unusual* | None identified | | | | 4 |
| | *Outstanding technological achievement* | None identified | | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Non–standard decorative railing with other aesthetic treatments | | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | | | 6 |

**Table B-13. Criterion C: Bridge Type - Timber other**

| Category | Item | Subtypes | | | Points to assign |
|---|---|---|---|---|---|
| | | **701 – Timber slab** | **702A, 702C – Timber beam and trestle** | **702B – Timber girder** | |
| **Distinctive characteristics of type, period, or method of construction** | *Built before specified year* | Built before 1900 | | | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Only known example in the state* | None identified | | | 7 |
| | *Early example* | Built before 1922 | Built before 1915 | N/A | 3 |
| | *Early standard plan* | N/A – research found this type was nonstandardized | | | 3 |
| | *Rare – region* | No – More than 6 examples exist in each of the six regions | | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge subtypes | | | 3 |
| | *Exceptional length – overall* | Greater than 140 feet | | | 3 |
| | *Special features/innovation - important or unusual* | Horizontal curved decks represent an important bridge construction technique requiring specially engineered substructures and/or superstructures. | | | 3 |
| | *Special features/innovation – highly important or unusual* | None identified | | | 4 |
| | *Outstanding technological achievement* | None identified | | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | None identified | | | 3 |
| | *Outstanding ornamentation or architectural treatment in overall design* | None identified | | | 6 |

**Table B-14. Criterion C: Bridge Type - Stone**

NOTE: Masonry bridges were assigned 7 points as a *Distinctive type and/or uncommon type* due to their distinctive method of construction. Most masonry bridges represent an early bridge type and display some aesthetic treatment in the use of dressed stone, ornamental coursing, or bonding patterns. As such, points are not assigned for *Built before specified year*. Points also not assigned or for *High artistic value* unless a bridge displays *Outstanding ornamentation or architectural treatment in overall design*.

| Category | Item | Subtypes | | Points to assign |
|---|---|---|---|---|
| | | **811 – Stone arch** | **819 – Masonry culvert – under fill** | |
| **Distinctive characteristics of type, period or method of construction** | *Built before specified year* | N/A – see note above | | 7 |
| | *Distinctive type and/or uncommon type*<br>*OR*<br>*Only known example in the state* | Yes | | 7 |
| | *Early example* | N/A | | 3 |
| | *Early standard plan* | N/A – research found this type was nonstandardized | | 3 |
| | *Rare – region* | Yes – INDOT Districts 1, 2, and 4 | | 2 |
| **Variation, evolution and/or transition of type** | *Exceptional length – main span* | None identified – steady increases in main span length across bridge subtypes | | 3 |
| | *Exceptional length – overall* | None identified – steady increases in overall structure length across bridge subtypes | | 3 |
| | *Special features/ innovation – important or unusual* | Skews represent a distinctive construction method to address engineering challenges. | | 3 |
| | *Special features/ innovation – highly important or unusual* | Stone arch bridges designed with segmental or elliptical arches represent a highly important and unusual variation from the typical Roman (or semicircular) arch.<br>Offsetting arch ribs is a rare variation and difficult method of construction, employed to provide a skew in an arch bridge. | | 4 |
| | *Outstanding technological achievement* | Multiple examples of above | | 7 |
| **High artistic value** | *Selected ornamentation, notable but isolated* | Turned balusters<br>Molded details or decorative brackets<br>Ornamental piers and railing cap<br>Dressed stone, ornamental coursing/bonding patterns | | N/A – see note above |
| | *Outstanding ornamentation or architectural treatment in overall design* | Multiple examples of above | | 6 |

# Appendix C. List of Master Engineers, Designers, Fabricators, and Builders

## Introduction

This appendix identifies master engineers, designers, fabricators, and builders as determined through historic context research, Dr. Cooper's books, and information learned during field survey.

Individuals and firms on the list of master engineers, designers, fabricators, and builders are recognized in the field of bridge building or design. Their work is distinguishable from others by its characteristic style and quality. Bridges by these individuals and firms will receive points for work of a master when another feature, such as high artistic value or unusual feature/innovation, is also identified.

A separate list identifies non-master engineers, designers, fabricators, and builders that are known to have worked in Indiana but whose work does not appear to be distinguishable. Therefore, no points are assigned for significance as work of a master. Points may be assigned to these individuals if additional information is learned about their importance to Indiana bridge building or design.

**Table C-1**
**List of Master Engineers, Designers, Fabricators, and Builders**
(Points are assigned as the work of a master when another feature, such as high artistic value or unusual feature/innovation, is also identified.)

| Name and Location | Bridge Type or Form | Points to assign |
|---|---|---|
| American Bridge Company, Coraopolis, Pennsylvania | Metal truss | 3 |
| Attica Bridge Company, Attica, Indiana | Metal truss | 3 |
| Barker, B.F., Boone County Surveyor, Boone County, Indiana | Masonry arch | 3 |
| Bellefontaine Bridge and Iron Company, Bellefontaine, Ohio | Metal trusses | 3 |
| Bergen & Bergen, ISHC | Metal bridges | |
| Britton, J.A. & Sons, Parke County, Indiana | Timber-covered bridges | 3 |
| Brookville Bridge Co., Ohio | Metal truss | |
| Burk Construction Company | Metal bridges<br>Concrete bridges | 3 |
| Butts, William H., Franklin County | Timber-covered bridges | 3 |
| Caldwell & Drake | Metal truss | 3 |
| Canton Bridge Co., Canton, Ohio | Metal truss | 3 |
| Central States Bridge Company, Indianapolis | Metal truss | 4 |
| Chicago Bridge & Iron Co. | Metal | 3 |
| Cole, C.W., City Engineer, Mishawaka, Indiana | Concrete bridges | 3 |
| Concrete-Steel Engineering Co., New York | Concrete bridges | 3 |
| Daniels, J.J., Parke County, Indiana | Timber-covered bridges | 3 |
| East St. Louis Bridge Co., East St. Louis, Illinois | Metal truss | 3 |
| Elkhart Bridge and Iron Company | Metal truss | 4 |
| Fife, William J. | Masonry arch | 3 |
| Grosvenor, A.W., engineer, Fort Wayne, Indiana | Concrete bridges | 3 |
| Hammond, A.J., City Engineer, South Bend, Indiana | Concrete bridges | 3 |
| Howe, Malverd, engineer, Terre Haute, Indiana | Metal and concrete bridges | 3 |
| Indiana Bridge Company, Muncie, Indiana | Metal truss | 4 |
| Indianapolis Bridge Company, Indianapolis, Indiana | Metal truss | 4 |
| Jarrell, E.G., Muncie, Indiana | Metal truss | 3 |
| Kennedy, A.M. and Family, Rush County, Indiana | Timber-covered bridges | 3 |
| Kessler, George, landscape architect and bridge designer | Concrete arch bridges | 4 |
| King Iron Bridge and Manufacturing Company, Cleveland, Ohio | Metal truss | 3 |
| Klausmann, Henry W., County Surveyor, Marion County, Indiana | Masonry and concrete bridges | 3 |
| Lafayette Bridge Company, Lafayette, Indiana | Metal truss | 3 |
| Luten, Daniel B., Lafayette, Indiana | Concrete bridges | 4 |

**Table C-1**
**List of Master Engineers, Designers, Fabricators, and Builders**
(Points are assigned as the work of a master when another feature, such as high artistic value or unusual feature/innovation, is also identified.)

| Name and Location | Bridge Type or Form | Points to assign |
|---|---|---|
| M & P Construction | Concrete bridges | 3 |
| Massillon Bridge Company, Massillon, Ohio | Timber-covered bridges and metal trusses | 3 |
| McAnlis, C., City Engineer, Fort Wayne, Indiana | Concrete bridges | 3 |
| Miller, Charles W., Jennings County | Masonry arch | 3 |
| Milwaukee Bridge & Iron Works | Metal | 3 |
| Moore, William S., City Engineer, South Bend, Indiana; ISHC Chief Engineer, Indianapolis, Indiana | Concrete bridges | 3 |
| National Bridge Company, Lafayette, Indiana and Los Angeles, California | Concrete bridges | 4 |
| National Concrete Company, Indianapolis, Indiana | Concrete bridges | 4 |
| New Castle Bridge Company, New Castle, Indiana | Metal truss | 3 |
| Notter, George M., Worthington | Metal truss | 3 |
| O'Conner, J.C. | Masonry arch | 3 |
| Pan-American Bridge Company, New Castle, Indiana | Metal truss and metal beam | 3 |
| Rights, W.H., City Engineer, ISHC Assistant Engineer, Columbus, Indiana | Concrete bridges | 3 |
| Rochester Bridge Company, Rochester, Indiana | Metal truss | 3 |
| Scherzer, William<br>Scherzer Rolling Lift Bridge Company | Moveable | 4 |
| Schutt, R.L.<br>ISHC | Metal bridges | 3 |
| Sheehan, G. | Concrete bridges | 3 |
| Smith Bridge Company, Toledo, Ohio | Timber-covered bridge, composite truss, and metal truss | 3 |
| Smith, E.F.<br>(may also appear as I.E. Smith) | Concrete bridges | 3 |
| Smith, Robert W., Toledo, Ohio | Timber-covered bridges | 3 |
| Toledo Bridge Company, Toledo, Ohio | Metal truss | 3 |
| Vanfossan, J.P., Parke County | Concrete bridges<br>Timber bridges | 3 |
| Vincennes Bridge Company, Vincennes, Indiana | Metal truss | 3 |
| Wabash Bridge and Iron Works, Wabash, Indiana | Metal truss | 4 |
| Washer, William T., Cannelton, Indiana | Timber-covered bridges | 3 |
| Western Bridge Works, Fort Wayne, Indiana | Iron truss | 4 |
| Wheelock, Alpheus and Associates, Auburn, Indiana (related to Western Bridge Co.) | Timber-covered and metal bridges | 3 |

**Table C-1**

**List of Master Engineers, Designers, Fabricators, and Builders**

(Points are assigned as the work of a master when another feature, such as high artistic value or unusual feature/innovation, is also identified.)

| Name and Location | Bridge Type or Form | Points to assign |
|---|---|---|
| Wolf, Aaron and Henry, Putnam County, Indiana | Timber-covered bridges | 3 |
| Wrought Iron Bridge Company, Canton, Ohio | Metal truss, Metal arch | 4 |
| Youngstown Bridge Co.; Morse Bridge Co., Youngstown, Ohio | Metal | 3 |

**Table C-2**
**List of Non-master Engineers, Designers, Fabricators, and Builders**
(No points are currently assigned.  Points may be assigned if additional information is learned that identifies their work as distinguishable.)

| Name and Location | Bridge Type or Form |
|---|---|
| American Construction Company | Concrete bridges |
| Anderson, H.C.- designer | Concrete bridges |
| Bergen & Bergen | Metal bridges |
| Brackett Bridge Company, Cincinnati, Ohio | Metal bridges |
| Brookville Bridge Co., Ohio | Metal truss |
| CCC & St. Louis Railroad | Concrete bridges |
| CCC, Indiana | Timber, masonry, and concrete bridges |
| Cleveland Bridge & Iron Co. | Metal truss |
| Columbia Bridge Works, Dayton, Ohio | Metal truss |
| Columbus Bridge Co., Columbus, Ohio | Metal |
| Durfee, Josiah, Noblesville, Indiana | Timber-covered bridges |
| Gast, E.A., City Engineer, Cincinnati, Ohio | Concrete arch bridge |
| Grammar, W. H. and Son | Concrete bridges |
| Hackedorn Construction Co. | Concrete bridges |
| Hardman, Thomas A., Ripley County, Indiana | Timber-covered bridges |
| Hardy, Frank Y., ISHC Bridge Engineer, Chief Bridge Engineer, Indianapolis, Indiana | Metal and concrete bridges |
| Illinois Central Railroad | Timber bridges |
| ISHC, Indianapolis, Indiana | Timber, masonry, metal, and concrete bridges |
| Jaap, G., contractor, Fort Wayne, Indiana | Concrete bridges |
| Jones and Bunzendahl | Metal truss |
| Kellam, Fred, ISHC head of Bureau of Materials, Engineer of Design, Chief Bridge Engineer, Chief Engineer, Indianapolis, Indiana | Metal and concrete bridges |
| Kilborn, Hiram L., Lafayette, Indiana | Timber-covered bridges |
| Kress, Joseph, Montgomery County, Indiana | Timber-covered bridges and masonry abutments |
| Maddocks, H.L. | Concrete bridges |
| Mathews, Joseph | Masonry arch |
| Mueller, John W., New Castle | Concrete bridges |
| New Albany & Paoli Pike Company, Indiana | Timber covered bridges |
| Oregonia Bridge Co.; Bradbury and Spencer, Oregonia, Ohio | Metal |
| Severn Bachman, Floyd County | Metal truss |
| Sission, W.L. | Concrete bridges |

**Table C-2**

**List of Non-master Engineers, Designers, Fabricators, and Builders**

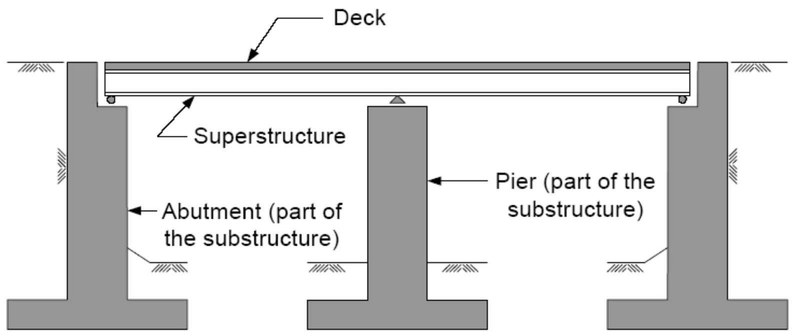
(No points are currently assigned. Points may be assigned if additional information is learned that identifies their work as distinguishable.)

| **Name and Location** | **Bridge Type or Form** |
|---|---|
| Tapp, H.W. Construction | Concrete bridges |
| Titus, William J., ISHC Chief Bridge Engineer, Indianapolis, Indiana | Metal and concrete bridges |
| Wabash and Erie Canal | Masonry arch |
| William Scherzer, Scherzer Rolling Lift Bridge Company | Movable bridges |
| Wright, E.C., ISHC designs | Concrete bridges |
| Wright, James E., Ripley County | Masonry arch |

# Appendix D. Glossary of Basic Bridge Types and Terms

# Glossary of Basic Bridge Types and Terms

**Abutment** – A substructure supporting the ends of a single span or the extreme ends of a multi-span superstructure and, in general, retaining or supporting the approach embankment.




Bridge elements

*Source: Michael Baker, Jr., Inc. Bridge Inspector's Reference Manual, Volume 1 (U.S. Department of Transportation, Federal Highway Administration, 2002).*

**Anchor span** – The span that counterbalances and holds in equilibrium the fully cantilevered portion of an adjacent span.

**Approach span** – A term to designate the spans located on either side of the main span; see main span.

**Arc-welding –** A process by which steel parts are joined in their molten state, thus creating a metallurgical bond. Intense heat is provided to the joint by an electric arc. See welding.

**Arch** – The arch bridge, whose basic technology dates back to ancient Rome, is a semi-circular form that can be composed of masonry, brick, steel, timber, or concrete. The structure converts the downward force of its own weight, and of any weight pressing down on top of it, into an outward force along its sides and base. Variations include deck arch and through arch.

**Arch rib or ring** – The main support element used in open spandrel arch construction; it spans a waterway or roadway and supports the deck.

Stone arch

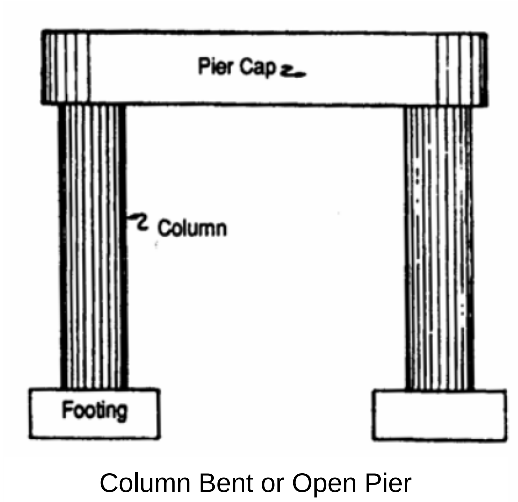
*Source: Mead & Hunt, Inc.*

**Bascule bridge** – A moveable bridge type, constructed mostly from 1900 through the 1930s, which has one or two leaves that open on a hinge to raise the leaf vertically. Various types include Milwaukee, Chicago, Strauss, and Scherzer.

**Beam** – A linear structural member designed to span from one support to another. A rigid and horizontal structural element. The earliest beam bridges consisted of wooden planks set on timber or masonry abutments. As material technology advanced, the favored materials for beam bridges became steel and concrete.

**Bearing** – Mechanical device that transfers the load from the superstructure to the substructure.

**Bent** – Substructure units made up of two or more columns connected at their tops by a cap or other member holding them in place.




Column Bent or Open Pier
*Source: Indiana Department of Transportation, <u>Certified Technician Program Training Manual for Bridge Construction and Deck Repair</u>, 2007.*

**Bolt connections** – A connection system of bolts and nuts, used on trusses and steel beams and girders.

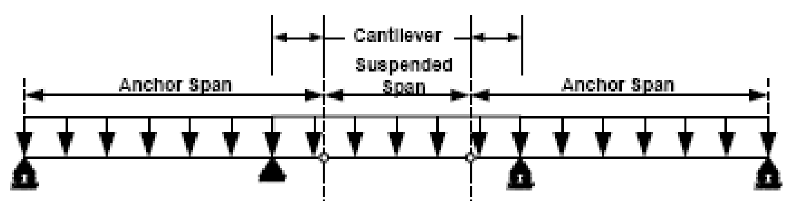
**Box culvert** – A box culvert is cast-in-place or pre-cast reinforced concrete and has a square or rectangular shape. It is typically located under the embankment to drain water from one side of the road to the other.

**Bridge** – A structure, including superstructure, deck and supports, erected over a depression or an obstruction such as water, highway, or a railway and having a track or road for carrying traffic or other moving loads. INDOT and NBI define a bridge as a structure with a length of more than 20 feet (6.1 meters) between abutments or extreme ends of openings for multiple box culverts.

**Cambered girders** – Concrete girders with convex curvatures designed to compensate for dead load deflection.

**Camelback girders** – Concrete through girder bridges with arched tops.

**Cantilever** – A span that projects beyond a supporting column or wall and is counterbalanced and/or supported at only one end. First applied to truss construction, cantilever and continuous support methods were later applied to other bridge types, including concrete girders and steel I-beams. Cantilevered designs were advantageous because of their adaptability to long spans. The cantilever bridge could be erected without falsework and without obstructing the channel.




Cantilever Spans
*Source: Michael Baker, Jr., Inc. <u>Bridge Inspector's Reference Manual,</u> Volume 1 (U.S. Department of Transportation, Federal Highway Administration, 2002).*

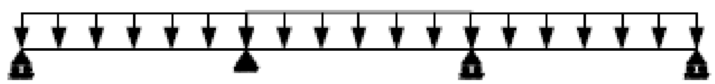
**Cantilevered spans** – A suspended span between adjacent spans with pinned connections, allowing greater lengths to be achieved than could be gained with simple-span construction.

**Catenary arch** – The curve obtained by suspending a rope or cable between two fixed points.

**Compression** – A type of stress involving pressing together.  It tends to shorten a member (the opposite of tension).

**Concrete** – A building material made of sand and gravel bonded together with Portland cement into a hard, compact substance.  Types include unreinforced, reinforced, and prestressed.

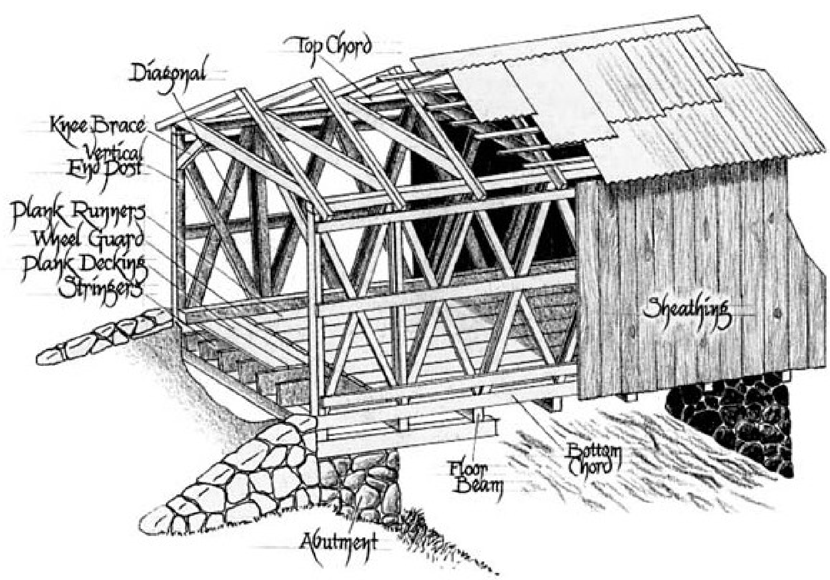
**Continuous support system –** The superstructure spans uninterrupted over one or more intermediate supports.  Continuous designs were introduced in the United States in the late 1870s.  Although first applied to truss construction, continuous and cantilever support methods were later applied to other bridge types, including concrete girders and steel I-beams.  Continuous designs, while statically indeterminate, were advantageous because they required less steel and concrete, produced less deflection, and avoided problematic joints over piers.  Railroad engineers were among the first to design continuous structures, especially for overpasses that elevated roadways over railways.  Because less steel and concrete were required for beams, continuous structures feature greater vertical clearance and less girth than non-continuous spans.



Continuous Spans

*Source: Michael Baker, Jr., Inc.  Bridge Inspector's Reference Manual, Volume 1 (U.S. Department of Transportation, Federal Highway Administration, 2002).*

**Covered bridge** – An overhead truss system, primarily of timber, clad with wood sheathing and a roof to protect the wood superstructure/truss from the elements.

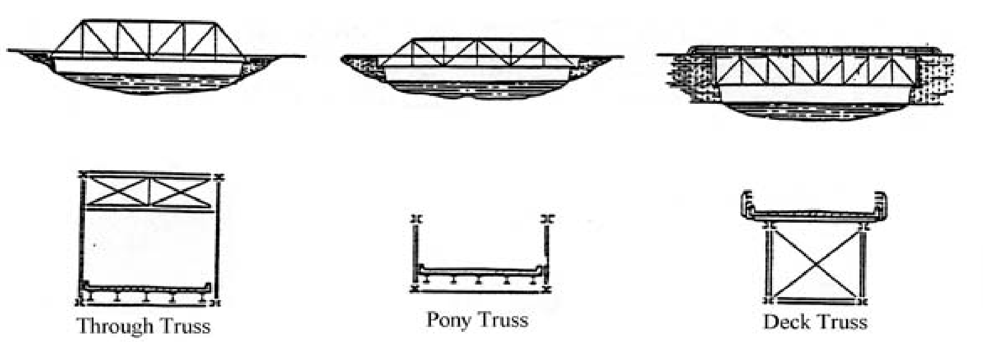



Covered bridge

*Source: Pennsylvania Historical and Museum Commission and Pennsylvania Department of Transportation*

**Culvert** – A short span that carries a road over a small waterway or trail with the structure entirely below the elevation of the road.  INDOT defines it as a structure not classified as a bridge, which provides an opening under the roadway.  Spans of less than 20 feet are not classified in NBI.  Culverts have two basic forms—box and pipe.  They may have single or multiple spans, also called units or cells, and often feature a floor. Culverts may be constructed in the following materials: steel, corrugated metal, concrete, timber or masonry. Timber was not a durable material for culvert construction. Masonry was superseded by concrete in the early twentieth century, but was used for later culverts in cases where stone was readily available and aesthetics were a concern. For example, masonry culverts were built by federal relief program laborers during the Depression.

**Deck** – The roadway surface of a bridge. In a deck-type bridge, the structural system lies beneath the deck (roadway).




Truss configurations

*Source: New York State Department of Transportation, Bridge Inventory Manual.*

**Deck arch** – In a deck arch, the roadway is located above the arch ring and can feature either closed or open spandrels.

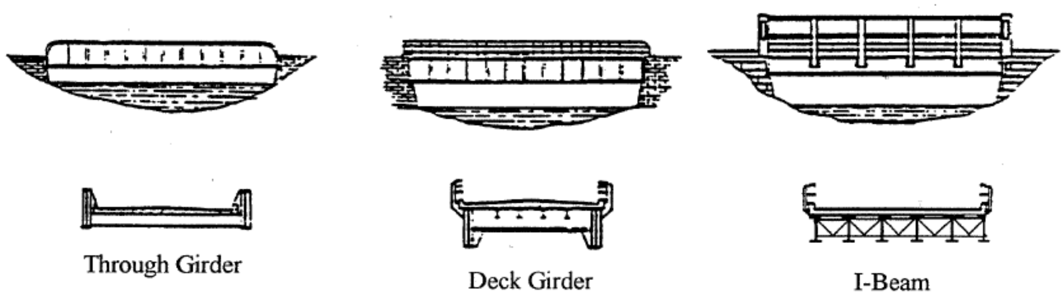
**Deck truss** – A truss that carries its deck on its top chord. See also thru truss and pony truss.

**Diaphragm** – A member placed within a member or superstructure system to facilitate construction, distribute stresses, and improve strength and rigidity.

**Fish-belly beam** – A small, variable-depth beam or girder that is built-up and riveted. It is termed "fish-belly" because it has a deep web in the center and a shallow web at the ends, thus having a bow-shape or profile of a fish--deep or distended at the belly and pointed at the head & tail. As engineer J.A.L. Waddell stated, "a girder having the top flange horizontal and the bottom flange curved in the shape of a fish's belly."

**Grade separation** – A crossing of two highways, or a highway and a railroad, at different levels. The bridge that spans highways or railroad tracks (as in an overpass) is a grade separation structure.

**Girder** – A horizontal structural member supporting vertical loads by resisting bending. The girder bridge is composed of a series of steel or concrete beams placed parallel to traffic, resting on abutments placed on either end of the bridge. The deck is set atop the girders. The use of intermediate piers allows an almost unlimited total bridge length. Girder bridges became a prevalent bridge type in the United States in the twentieth century. The maximum length of a span is determined by the strength of the material and the depth of the girder. A plate girder is composed of built-up and connected steel plates with a deep web and top and bottom flanges.




Girder configurations

*Source: New York State Department of Transportation, Bridge Inventory Manual.*

Plate girder

*Source: Mead & Hunt, Inc.*

**Lateral bracing** – Members used to stabilize a structure by introducing diagonal connections.

**Lift bridge** – A moveable bridge type where the moveable span maintains a constant horizontal position while it rises and descends vertically. The moveable section is situated between two towers that use a system of pulleys to raise and lower the bridge. The vertical lift bridge type was designed to replace the swing bridge and be less obstructive of the waterway.

**Load** – Weight distribution through a structure.

**Low truss** – A truss that carries its traffic near its top chord but not low enough to allow cross bracing between the parallel top chords. The roadway is located between the load-carrying members. This arrangement is also called a pony truss.

**Luten arch-ring reinforcing system** – A patented reinforcing arrangement employed in concrete barrel arch construction, in which the arch ring reinforcing rods are integrated with spandrel walls, piers, abutments, and wingwalls. This system results in semi-elliptical or linear-shaped arch rings and unusually thin bridge members, including arch rings and piers.

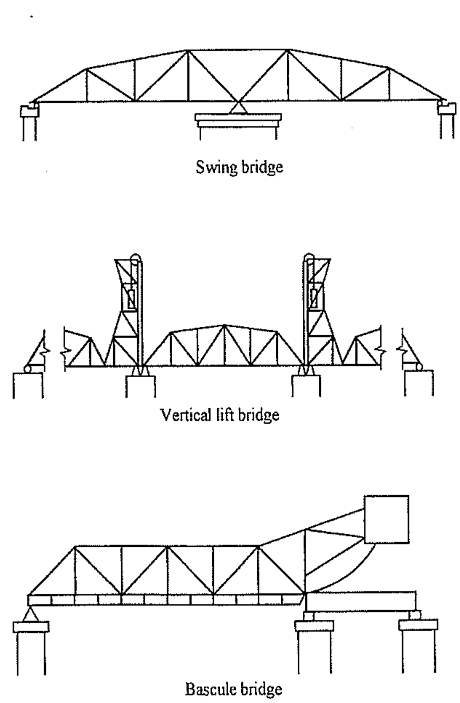
**Luten truss reinforcing system** – A patented reinforcing arrangement incorporated into horizontal bridge forms, such as concrete beams, slabs, and girders, as an economical alterative to traditional reinforced-concrete construction.

**Main span** – Longest span in the structure (can be simple or continuous support system).

**Melan system** – One of the earliest forms of reinforced concrete bridge construction, it consists chiefly of a single set of mill-rolled I-beams bent into the shape of an arch and embedded within concrete. The I-beam is placed close to the lower area of the arch ring so that the top flange of the I-beam is near the upper edge of the ring at the crown.

**Members** – One of many parts of a structure, especially one of the parts that is assembled to form a truss.

**Moveable bridge** – A structure with a deck that can be moved to clear a navigation channel. Depending on its height over the water, a moveable bridge may allow small craft to pass under it while it continues to carry vehicles over the waterway. When larger vessels approach, the bridge simply moves out of the way and then returns to its position after the vessel has passed. Three primary types of moveable bridges are swing, lift, and bascule.




Moveable bridges

*Source: Ann B. Miller and Kenneth M. Clark, A Survey of Movable Span Bridges in Virginia. Charlottesville, VA: Virginia Transportation Research Council, July 1996.*

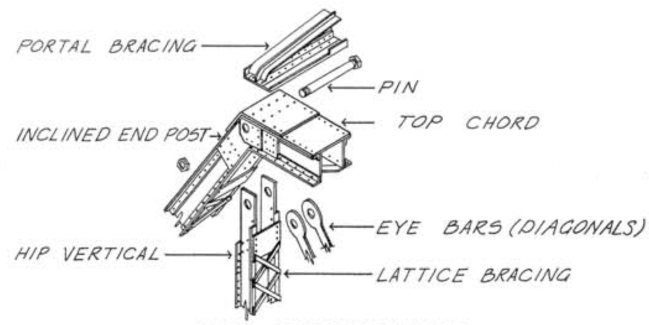
**Overhead truss** – In an overhead truss the roadway is located under and between the load-carrying members with traffic traveling through the truss. An overhead truss features lateral-bracing between the top chords over the deck. Also referred to as a through truss.

**Overpass** – A grade separation where the highway passes over a highway or railroad.

**Pier** – A solid, one-piece superstructure support of stone, concrete, or timber that rests on one large footing.

**Pile** – A column of wood, steel, or concrete that is driven into the ground to provide support for a structure.

**Pinned connections** – A connection type where a cylindrical bar is used to connect various members of a truss; such as those inserted through the holes of a meeting pair of eyebars. Introduced in the 1840s, pin connections are the earliest connection type and were commonly used for trusses built before 1910s. Pin connections allowed for easier erection of bridges, much of which could be completed offsite. Pin connections remained popular until the end of the nineteenth century when they were replaced by riveted connections.




Pin Connection

*Source: Historic American Engineering Record, Trusses, A Study of the Historic American Engineering Record, (National Park Service).*

**Pipe culvert** – A structure not classified as a bridge, which provides an opening by means of a pipe under the roadway.

**Pony truss** – A truss that carries its traffic near its top chord but not low enough to allow cross bracing between the parallel top chords. The roadway is located between the load-carrying members. This arrangement is also called a low truss. See also deck and thru truss.

**Post-tensioned concrete** – The compressing of the concrete in a structural member by means of tensioning high-strength steel tendons against it after the concrete has cured.

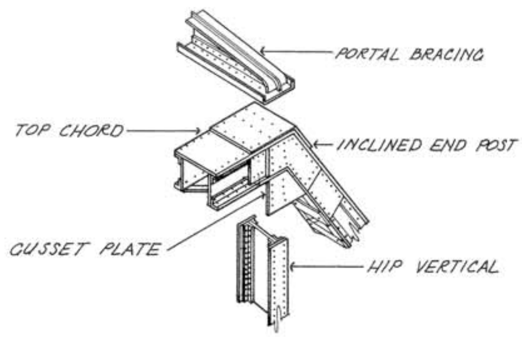
**Prestressed concrete** – A concrete structural member that has had an initial compressive stress applied either by pretensioning or post-tensioning. Prestressed concrete was employed beginning in the 1950s.

**Pretensioned concrete** – The compressing of the concrete in a structural member by pouring the concrete for the member around stretched high-strength steel strands, curing the concrete, and releasing the external tensioning force on the strands.

**Reinforced concrete** – The placement of metal wire or rebar in structural member forms before pouring concrete to provide additional strength.

**Rigid frame bridge** – A type of bridge in which the superstructure and substructure act as a single unit and were built as a continuous form.  Concrete rigid frames were commonly used across the nation for highway and freeway bridge construction and generally have an arched profile.

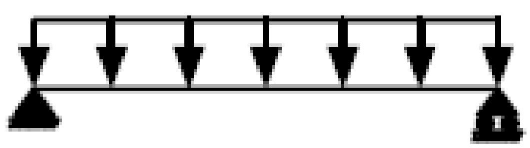
**Riveted connections** – A connection type using a metal shank with a large head on one end that forms its connection by passing the shank through aligned holes in the plates and hammering the second end to form a similar shape.  Riveting is a common connection type for trusses and beam/girders.




Riveted Connection

*Source: Historic American Engineering Record, Trusses, A Study of the Historic American Engineering Record, (National Park Service).*

**Simple span** – Superstructure is completely supported between two supports.

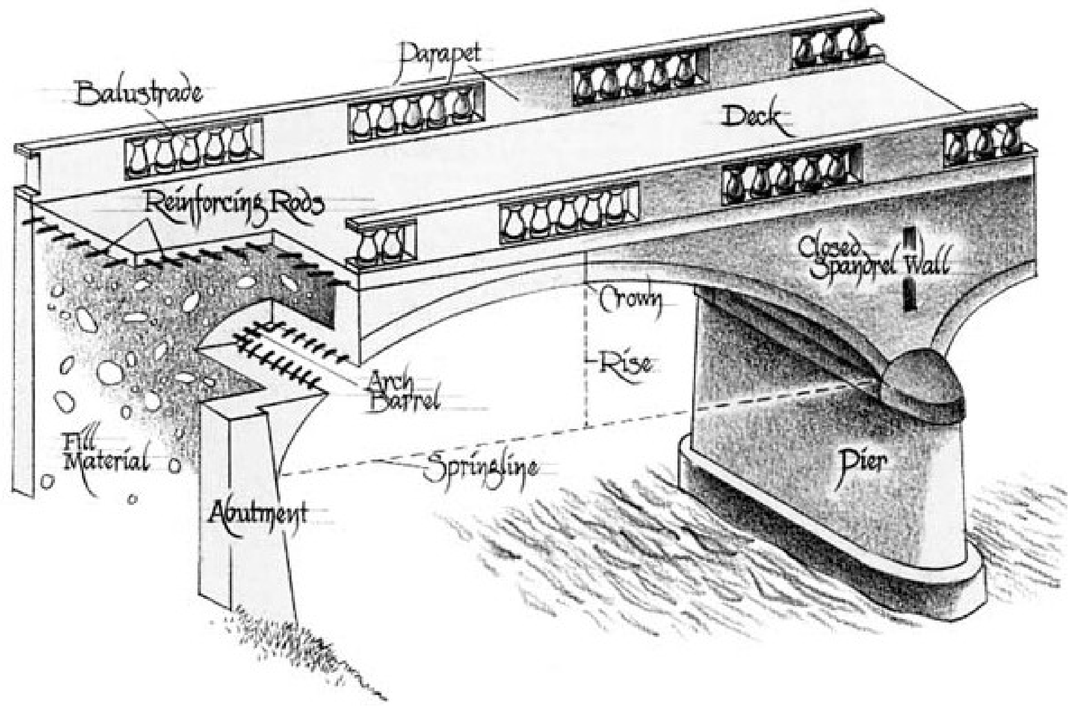


Simple Spans

*Source: Michael Baker, Jr., Inc.  Bridge Inspector's Reference Manual, Volume 1 (U.S. Department of Transportation, Federal Highway Administration, 2002).*

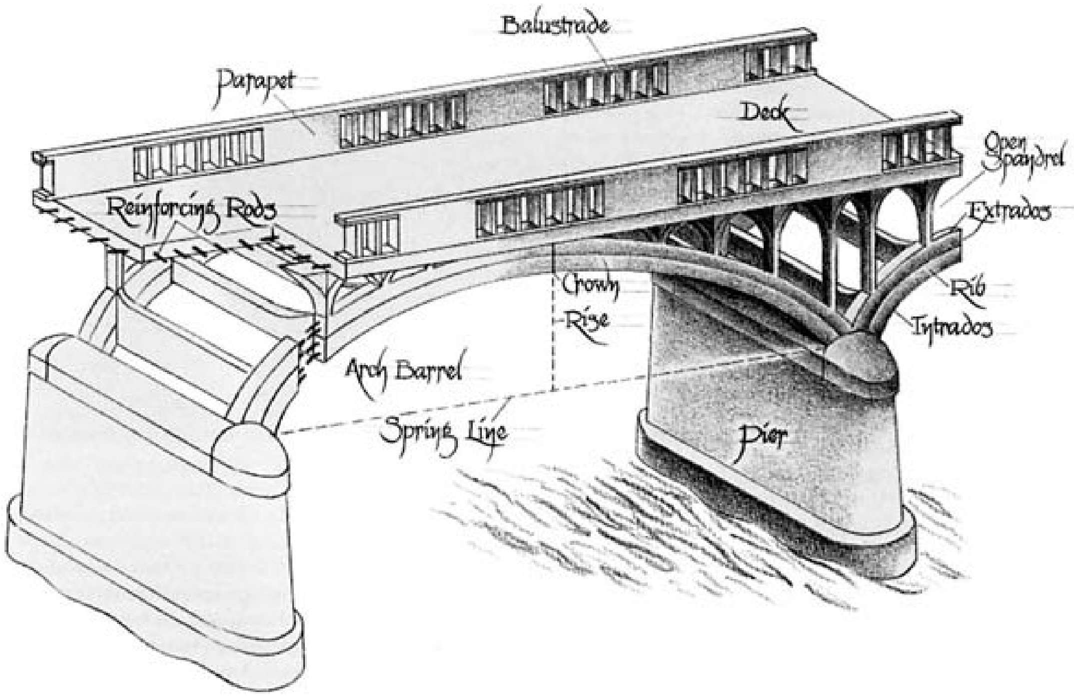
**Span** – The distance between two supports (either abutments or piers) of a structure; also refers to the superstructure itself.

**Spandrel** – The space between the arch ring and the deck on an arch bridge is the spandrel.  The spandrel may be walled and filled, known as a closed spandrel, or it may be open, known as open spandrel.




Closed spandrel bridge

*Source: Pennsylvania Historical and Museum Commission and Pennsylvania Department of Transportation.*




Open spandrel bridge

*Source: Pennsylvania Historical and Museum Commission and Pennsylvania Department of Transportation.*

**Spandrel braced arch** – This method of concrete arch construction is characterized by the absence of a barrel ring and earth-fill to support the deck. In Indiana, this form is largely a product of the influence of engineer Daniel Luten, who used two tiers of longitudinal reinforcing rods in the spandrel braces and cantilevered the bridge deck over the braces. The resulting arch is very light, uses a minimum of steel, and is efficient to construct.

**Specifications** – The standard specifications, supplemental specifications, special provisions, and written or printed agreements and instructions pertaining to the method and manner of performing the work or to the quantities and qualities of the materials to be furnished under contract.

**Standard plan** – A model set of plans prepared for a particular bridge type that can be applied to construct the same structure repeatedly with slight modifications to address particular site conditions. Frequently prepared by state departments of transportation for common bridge types spanning short or moderated distances.

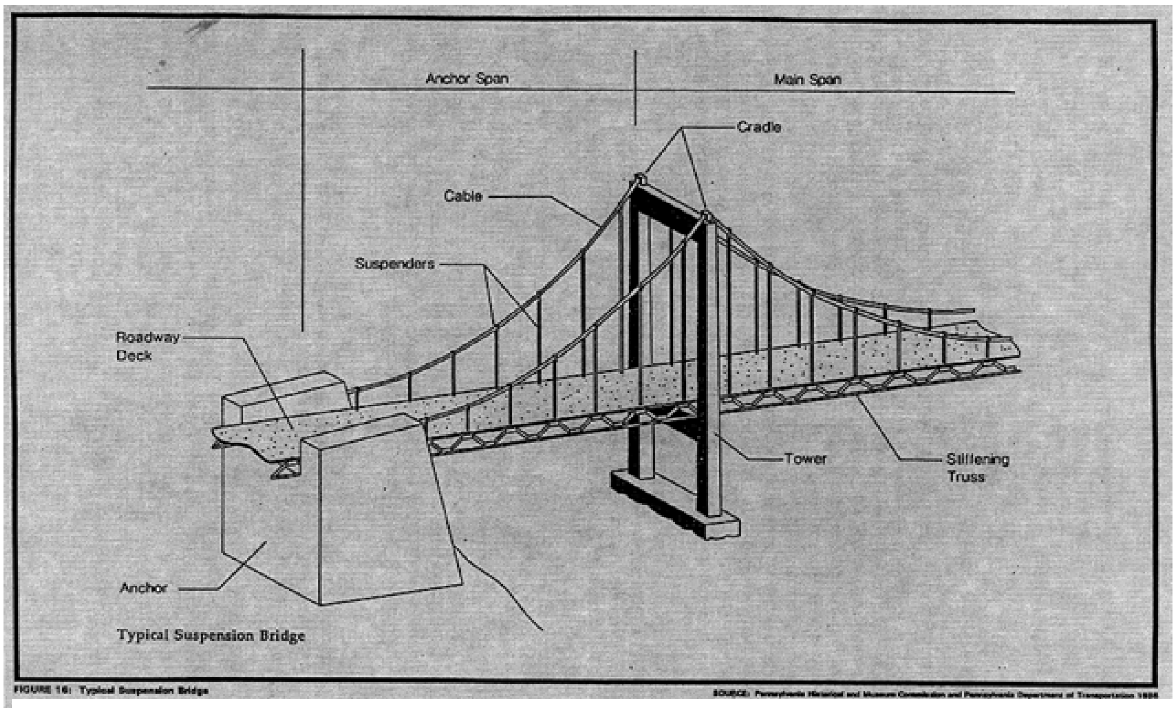
**Steel I-beam** – Rolled steel sections up to 36 inches in depth that support the deck and carry the load to the bearings located on the supports. The I-beam can be encased in concrete.

**Stringer** – A beam aligned with the length of a span that usually extends between floor beams and assists in supporting the deck.

**Substructure** – The abutments at either end of the bridge and, if a bridge has more than one span, intermediate supports called piers or bents that support the superstructure of a bridge.

**Superstructure** – The portion of a bridge structure that carries the traffic load and passes that load to the substructure. INDOT defines the superstructure as the entire portion of a bridge above the abutment and pier seats, excluding the deck.

**Suspension bridge** – The suspension bridge uses towers to provide vertical support for a system of iron chains or wire cables, which suspend the deck of the bridge and are anchored in their extreme ends. The suspension bridge was especially designed to accommodate long spans. The decks were often stiffened by deck trusses to prevent collapse due to external forces induced by traffic and/or wind loads. In wire cable suspension bridges, the main cable runs from the anchorage at the abutments over the tops of the towers for the entire span length. Vertical cables hung from the main cable support the deck system.




Suspension bridge

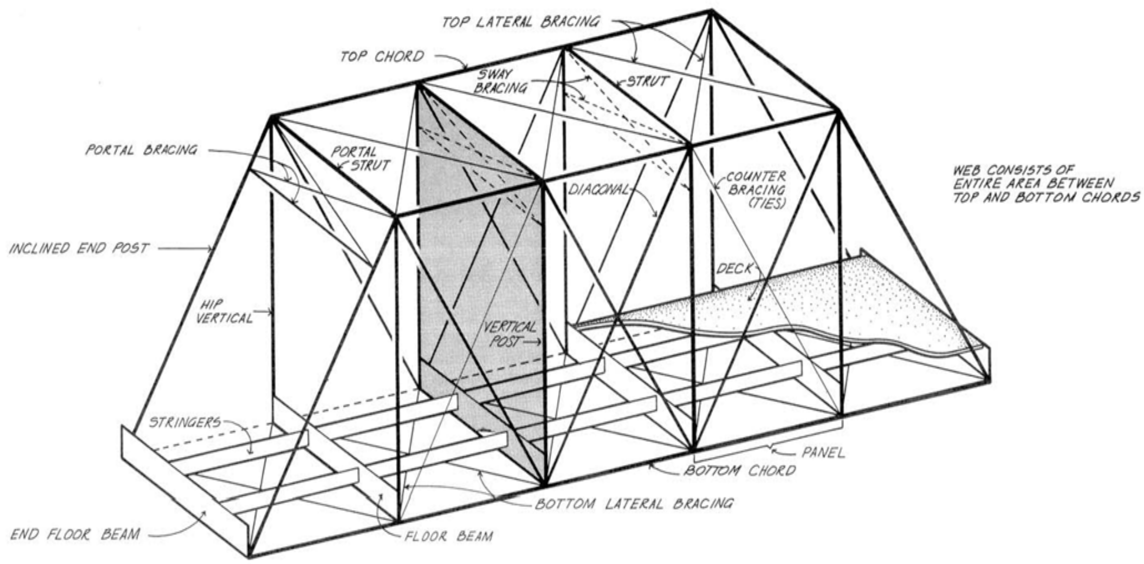
*Source: Pennsylvania Historical and Museum Commission and Pennsylvania Department of Transportation.*

**Tension** – A type of stress tending to elongate a body. It tends to lengthen a member (the opposite of compression).

**Thru arch** – A thru arch has the roadway passing through the arch with the crown of the arch above the deck and the foundations of the arch below the deck suspended by hangers from the arch.

**Thru truss** – A thru truss is most commonly defined as a truss that features lateral bracing between the top chords over the deck. The roadway is located under and between the load-carrying members with traffic traveling through the truss. Also referred to as an overhead truss. See also deck truss and pony truss.

**Truss** – A structural form that is made of a web-like assembly of smaller members usually arranged in a triangular pattern. A truss bridge uses diagonal and vertical members to support the deck loads. The diagonal and vertical members are joined with plates and fasteners (pins, rivets, or bolts) to create several rigid triangular shapes. This configuration allows relatively light units to be created for large spans. There are three basic arrangements of trusses—pony, through, and deck—and a wide variety of subtypes.




Truss members

*Source: Historic American Engineering Record, Trusses, A Study of the Historic American Engineering Record, (National Park Service).*

**Underpass** – A grade separation where the highway passes under an intersecting highway or railroad.

**Unreinforced concrete** – Before reinforcements were used, plain or massed concrete worked solely under compression and was only applicable to the arch form.

**Variable depth** – A slab or girder that is deeper at its ends than at the center to achieve greater span distances than can be achieved with a traditional structural form.

**Viaduct** – A long, multi-span bridge for carrying a road over a valley, another road, or railroad.

**Welded connections** – Introduced by 1930, welded connections are created by heating and melting two pieces of metal together to form a “bead” of molten steel. Used for trusses and beam/girder bridges.