

The Concrete Arch Supplement To The Ohio Historic Bridge Inventory, Evaluation and Preservation Plan



The Ohio Department of Transportation in cooperation with the Federal Highway Administration 1994.

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This project was undertaken and completed by the Office of Planning and Environmental Services of the Ohio Department of Transportation (ODOT) in compliance with federal regulations with the cooperation of the Ohio Historic Preservation Office.

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Acknowledgments

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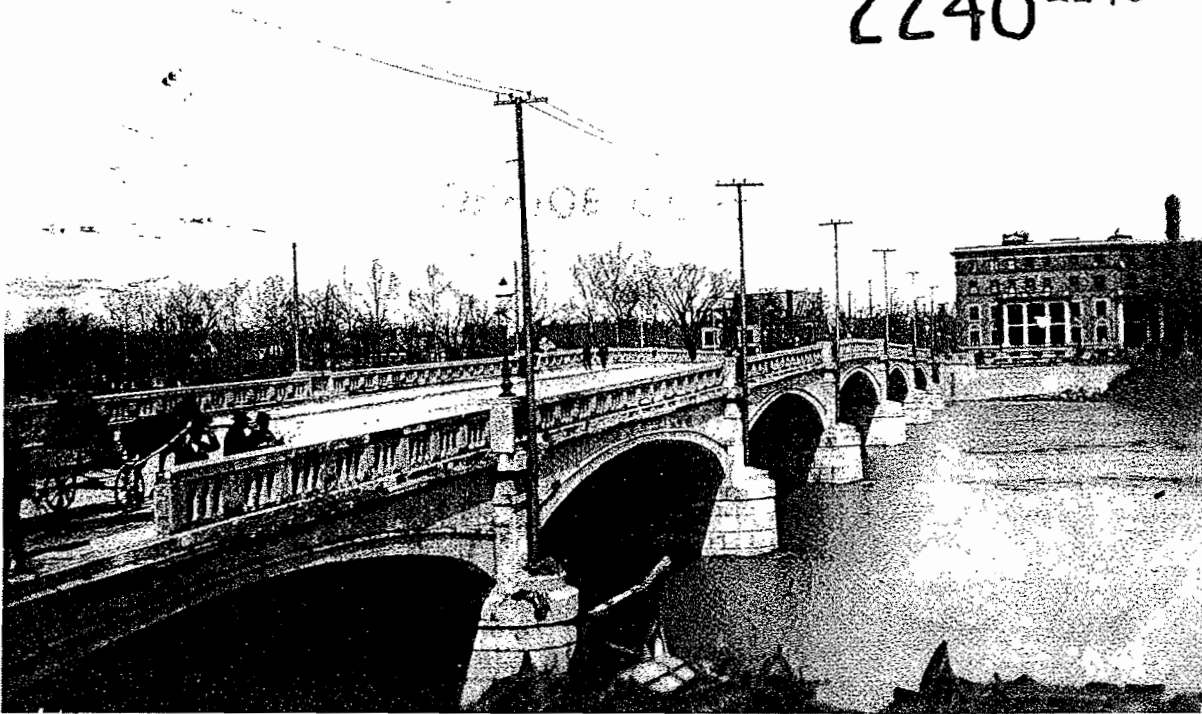
Special thanks are due to Martin Burke for his extensive research on ODOT's Bridge Bureau, Barbara Powers for her presentation of the application of the National Register Criteria in Chapter 4, ODOT Librarian Ellen Haider for her help and cooperation in obtaining books and documents for research, and to David Simmons for research on Daniel Luten and several of the individual concrete arches.

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Preface

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The Main Street bridge in Dayton at the time of the 1913 flood, note the damaged railing in the left foreground. The bridge was replaced in 1956.

The Second Ohio Historic Bridge Inventory, Evaluation and Preservation Plan (1990) included an agreement to re-analyze the inventory of concrete arch bridges in Ohio built prior to 1941 to provide a technological basis for evaluating concrete arches. This supplement to the 1990 publication is the result. It was based on the format of the National Register of Historic Places Multiple Property Documentation Form (NPS 10-900-b). This approach provides a system for determining the National Register eligibility of related properties, in this case concrete arches.

The purpose of this document is to provide the background and standards to evaluate and preserve significant concrete arch bridges.

An Advisory Committee with engineers and

historians from state and federal levels participated in the re-evaluation.

Acknowledgment of their efforts, as well as those of all individuals and agencies involved, should be noted. Members of the Advisory Council are listed below:

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Executive Summary



Distribution in Ohio of concrete arch bridges eligible for the National Register.

In 1980 the Ohio Department of Transportation (ODOT), in cooperation with Federal Highway Administration (FHWA), and the State Historic Preservation Office (SHPO), initiated a study to evaluate the significance of metal truss, stone and concrete arch bridges built before 1941. In 1990, the study was updated to include metal truss, stone and concrete arches built prior to 1951.

At the time of the update ODOT, FHWA, and

the SHPO reviewed the results of the 1980 study and decided to develop specific evaluation criteria for concrete arches built before 1941. Initiated in 1991, the re-evaluation was completed in 1992. This report presents the revised evaluation criteria and the results. Fifty-two structures were identified as eligible for the National Register of Historic Places, including a number initially identified as eligible in the 1980 study.

Part 1

Context for Evaluating Concrete Bridges



Constructing the "humpback bridge," Orwell, Ashtabula Co.



The "humpback bridge" after construction, about 1907.

Photographs from Marguerite McElroy collection

Chapter One: Theme, Period, Areas



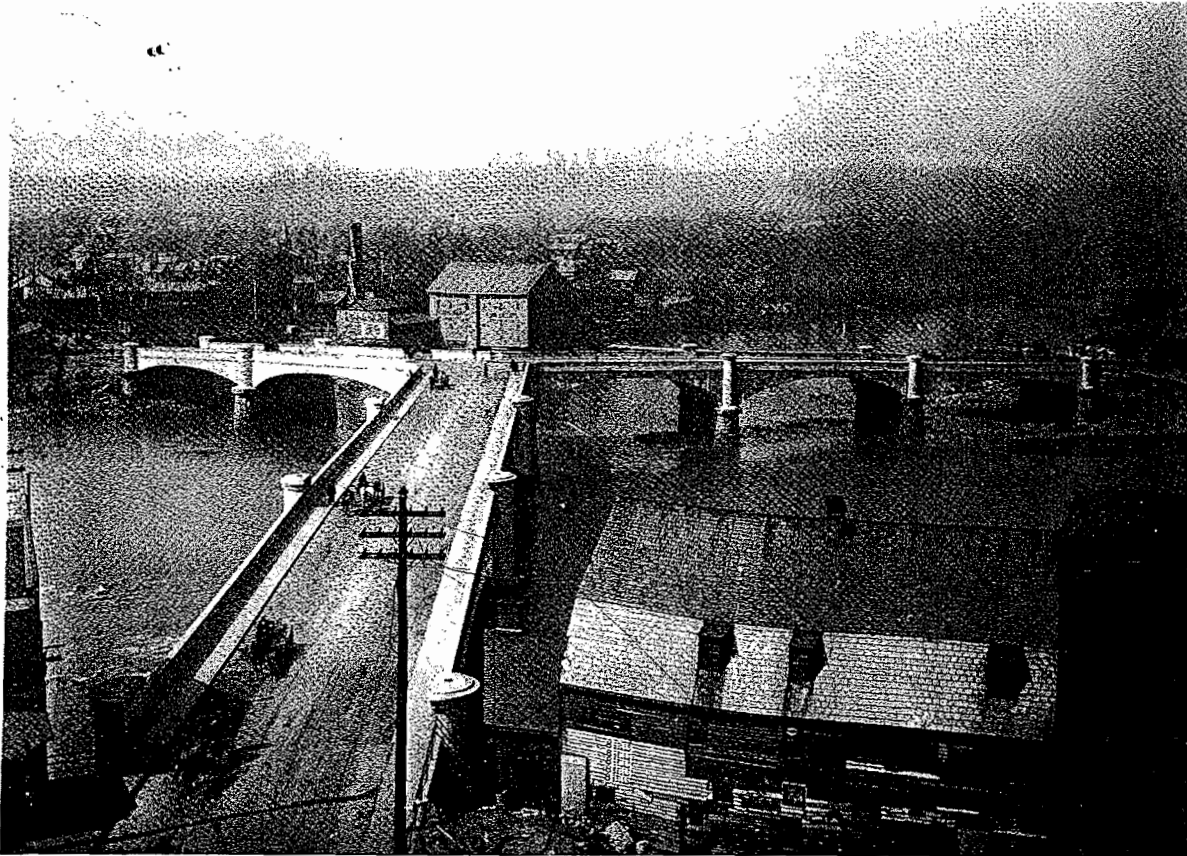
The Main Street bridge, Dayton, under construction, 1902-03. The bridge was replaced in 1956.
Photograph from the Dayton-Montgomery County Public Library Collection.

This study focuses on concrete arch bridges constructed in Ohio from the late nineteenth century until 1940. It is based on a format developed by the National Park Service termed the Multiple Property Documentation Form that facilitates the evaluation of individual properties by comparing them with resources that share similar physical characteristics and historic associations.(1)

Information on the transportation history of

the geographical area (Ohio) was collected at the time of the first historic bridge inventory.(2) This information was presented in Chapters 4 through 9 of that publication and was the basis for the development of the chronological periods identified in the initial historic bridge inventory. These chronological periods, based on the history of Ohio and engineering developments were further refined to more closely address developments in Ohio's concrete bridge industry.

Chapter Two: History, Time Periods



The concrete Y bridge built between 1900 and 1902 in Zanesville.

Photograph from the Ohio Historical Society.

Historical Overview of Concrete

The introduction to this section is adapted from a paper by Emory Kemp. (Kemp, Emory, "Structural Evaluation of Historic Concrete Bridges, Proceedings of the Third Historic Bridge Conference, Columbus, Ohio, October, 1990, Pages 7- 16.)

The use of hydraulic cement to produce concrete is an ancient building practice, associated with the Hellenistic period in Greek engineering and later with the Roman

engineering works, where it was used as an infill in columns and bridges. After the fall of the Roman Empire it apparently ceased to be used and was not revived to any extent until the Industrial Revolution in Europe in the middle of the eighteenth century.

In the United States natural cement is associated with the canal age in the early nineteenth century. Cement mills along the canals provided cement used as mortar in the construction of locks, dams, weirs, and hydraulic structures. In addition these mills produced cement for plain concrete (concrete

without metal reinforcement). Many of the nineteenth and early twentieth century government buildings in Washington, D.C., were built of this material.

The first concrete arch bridge in the United States was the Cleft Ridge Span, built in 1870-71 of plain concrete in Prospect Park in Brooklyn, New York. Many of the early concrete bridges were treated on the exterior to imitate stone. The plastic nature of concrete allowed for the decorative treatment such as recessed panels, elaborate railings, moldings, and rusticated spandrel walls.

Plain concrete has the same properties as stone masonry, strong in compression and relatively weak in tension. Therefore it was a logical extension to use concrete for massive structures like the monumental stone masonry bridges and viaducts. These massive plain concrete structures had sufficient deadload to minimize tension stresses and ensure stability.

The use of plain, or unreinforced, concrete required such large quantities of material that the creation of longer span structures was prohibitively expensive. Steel reinforcing permitted much more efficient use of concrete and thus a savings in materials.

It was the blend of steel and concrete that allowed bridge construction to add new dimensions and designs. The plastic characteristics of fresh concrete combined with the strength of steel provided engineers a new building material. Providing reinforcement in concrete meant that traditional building components such as beams and columns subject to bending could be formed of concrete in imitation of stone, timber and iron structures.

There were numerous systems developed, both in Europe and the United States, utilizing

steel and concrete. Agents for some of these European systems came to the United States and supervised the constructions of these new concrete-steel bridges. In the United States several patents were issued for concrete reinforcing systems.

The first American patent for concrete-steel appears to have been granted in 1884 when Ernest L. Ransome received one for a square twisted reinforcing bar. Twisted reinforcing bars were used in Ransome's 1889 Alvord Bridge in Golden Gate Park, the first reinforced concrete bridge in the United States. After obtaining experience in England, Ransome immigrated to California where he pioneered the use of his proprietary reinforcement system.

In addition to Ransome, William M. Thomas of California and Daniel Luten of Indiana, actively secured concrete bridge patents. Luten was one of the nation's most influential concrete bridge engineers in the early twentieth century, and he had a major impact in Ohio. By the beginning of the twentieth century reinforced concrete was becoming an important factor in bridge building in Europe and in the United States. As Fritz von Emperger wrote in 1904:

"Ten years ago the number of concrete-steel bridges was so small that there would have been no difficulty in giving a complete list, whereas now it would be quite impossible to give such a list..."(3)

Pre 1903

Ohio's Earliest Concrete Arches

The first concrete arch bridge in Ohio was built in Cincinnati's Eden Park in 1895. It was a reinforced structure and continues to be open to vehicular traffic. (See page 34 for a detailed discussion of this structure.)

Advocates of concrete in this early period met with some suspicion. Fabricating a permanent structure from stream bed gravel led some to denigrate the new technology as nothing more than "mud bridges." But more influential than these philosophical considerations was the opposition to concrete centered in the "steel trust." It was widely and popularly believed at the time that monopolistic forces were actively controlling the metal bridge business. It seems likely that agents of the various steel bridge companies operating throughout the state were important in orchestrating some of the local resistance to adopting concrete.

The more clever concrete bridge builders, like Daniel Luten, picked up on this popular resentment of the steel trust in advertising their own structures. At every possible opportunity and with the aid of hundreds of "colored stereopticon views of bridges," he explained to all listeners how the erection of concrete bridges was "just plain common sense." Playing off the early twentieth century perception of the disadvantages of steel and wood, Luten noted that concrete bridges had the "permanence of stone," were "rust proof," did not require painting, and became stronger through time, thereby anticipating increases in loading and traffic. Perhaps most important to public officials was his assertion that concrete bridges, in contrast to steel, used labor and materials, aggregate and formwork, from the locality, instead of sending taxpayers' money to a distant and powerful steel "trust." Similar claims were laid out by Luten in innumerable articles in popular and technical journals.(4)

As concrete arches were constructed throughout the state, a wider audience was exposed to this new technology, making it more generally acceptable. An example of this new acceptance of concrete was the replacement, between 1900 and 1902, of the famous covered wooden Y Bridge at the confluence of the Muskingum and Licking

Rivers in Zanesville, Ohio, with a concrete Y structure.

The erection of the concrete Y bridge proved critical in precipitating a landmark decision in the Ohio courts that eliminated a potential legal problem for concrete bridge construction in the state. A suit was brought against the Muskingum County Commissioners claiming that by granting the contract to build the Y bridge to a single firm they had violated an 1888 statute that required separate contracts for building bridge substructures and superstructures. A judge sympathetic to the new technology ruled that the law was not applicable in this case. Without this decision, it would have been impossible to build a concrete bridge under Ohio law.(5)

Coinciding with the introduction of this new technology was the development of the City Beautiful Movement as a major influence in American urban design. At the turn of the century, many Ohio communities were experiencing the impact of increasing industrialization, with an expansion of railroads, retail centers, rising population, air, water, and noise pollution, and an overall increase of congestion, disorder, and deterioration. The City Beautiful Movement was seen as a solution to many of these urban ills. It was linked to Progressivism by combining social reform with public aesthetic improvements creating a new sense of civic grandeur.

City Beautiful projects often possess similar defining characteristics. Project scales ranged from civic center plans with grouped buildings, boulevards, and monuments anchoring grand perspectives to small, piecemeal type projects such as a single building or bridge, or street paving and lighting. The projects often required political and local citizen involvement led by influential middle-class civic-minded citizens, professionals, and

elected officials. The project's aesthetics reflected classical design principles of beauty, order, and harmony through the use of Neoclassical style details such as columns, balustrades, pediments, monumental stairs, and round arches. Many of the same details were used to decorate concrete bridges of the period. The collaboration of architects, engineers, sculptors, and artists contributed towards a unified design.

The 1890s were seen as the formative years of the City Beautiful Movement as interest in municipal art, village and civic improvement, and outdoor art found organized expression. The World's Columbian Exposition held in Chicago in 1893, often viewed as the beginning of the City Beautiful Movement, actually helped to crystallize many of these already existing trends.

1903-1912

Ohio Experiments with Concrete

Experimentation with both materials and techniques characterized this period of concrete bridge building in the United States and in Ohio. Americans slowly began to investigate the technology that had been developed and refined in Europe in the second half of the previous century. Significant numbers of patents were issued during this period.

Perhaps more than any other concrete bridge designer, Daniel Luten took full advantage of the U.S. patent system. He realized that he could not lay claim to a "standard design" but he did not hesitate to file for patents on more than forty "cost-saving improvements" in design or erection. His first patent was granted in 1900, and many others were issued to him over the next sixteen years. He received so many patents that some critics wondered if it

was possible to erect a concrete bridge that did not entitle Luten to some royalties. But many factors besides patents influenced the evolution of concrete bridge design. Governmental agencies began to examine highway and bridge construction more closely. In Ohio, government funding of highway construction was minimal until 1904 when the Department of Highways was established and funds were appropriated to develop and construct a variety of pavement types.

In accordance with the act organizing this department and passed May 31, 1911, the Bureau of Bridges was established with a Deputy and one division engineer. Towards the end of this period general specifications were prepared and distributed for steel highway bridges including provisions for piers, abutments, concrete, and concrete reinforced structures. Towards the end of this period, the use of reinforced concrete for highway structures increased steadily. By 1912, it was particularly popular for short spans of about 20 feet because of its adaptability, strength, and durability. It was also replacing wood for the flooring in longer steel structures.

In order to learn the mode of distribution of stress on the short span slabs, in 1912 the Department cooperatively tested existing bridges with Ohio State University in laboratory experiments.

The first decade of the twentieth century was also characterized as a time of consolidation and standardization in the bridge industry. The small, local bridge companies which had flourished in the previous two decades were being absorbed into larger companies such as the American Bridge Co.

Reinforced concrete gave engineers the opportunity to work with a new material.

1913-1920

Concrete Comes Into Its Own In Ohio

The year 1913 may be seen as a turning point in the evolution of transportation both in Ohio and in the nation. Around the country, demand for better roads was growing and, in response, plans were developed to build a road system that would link the nation.

In Ohio, plans to build new roads and improve those already in existence received a major setback in March of 1913 when Ohio was hit by the worst flood in its history. All the major rivers in the state flooded, damaging or destroying hundreds of bridges. The disaster required a major rebuilding campaign that signaled the start of the next era of bridge building in Ohio. Standard specifications were re-examined in order to improve on designs that failed during the flood. Testing equipment and building techniques improved and the importance and efficiency of standardization became evident as the Department struggled to replace the lost bridges quickly and efficiently.

Because a number of Luten-designed bridges had successfully withstood the pounding of the 1913 flood, Luten worked the flood to his advantage, producing a special pamphlet "Reinforced Concrete Bridges in the Easter Flood of March 1913," with photographs of these structures taken during the flood. Luten had a growing reputation for designing "flood-proof" bridges. Communities in all parts of the state were thus encouraged to select concrete for their replacement structures.(6)

For many Ohio communities the devastating 1913 flood linked bridge replacements with the City Beautiful Movement's classical design approach. Similarly, many of the Federal and State funded back-to-work efforts during the

Depression resulted in labor intensive bridge designs with much attention to details and aesthetics. In many examples, these factors helped to extend the design philosophy and classically detailed public works associated with the City Beautiful Movement into the 1930s.

Enthusiasm for concrete grew gradually throughout Ohio during this period. Statistics show that nearly three quarters of short-span structures (10-19 feet) built during this time period and one third of the bridges longer than 20 feet were concrete.

Between 1915 and 1918 some judges declared a significant number of Luten's patents void, insisting that "mere mechanical skills" had been used to properly place the reinforcing bars and that no evidence of "inventive genius" had been displayed.

World War I caused the prices of and demand for structural steel to increase greatly. By 1916 the inability to procure the steel within the usual time delayed many projects or led to the use of alternate materials such as wood or concrete. Much construction was deferred until after the War.

The Federal Aid Highway Act was passed in 1916. A little more than \$10 million was set aside in 1918 for highway improvements in Ohio, to be matched by the state 50-50. The state legislature responded by doubling the annual highway appropriations (still falling far short of the federal funds) and by creating a four-member State Highway Advisory Board to approve contracts and apportion money to the counties. Private consulting engineers, such as Daniel Luten in Indianapolis and Wilbur Watson in Cleveland, continued to develop a market for their services at the county and municipal levels.

1921-1930

Ohio's Decade of Arches

The increasing acceptance of the reinforced concrete arch bridge was the significant trend of this era in Ohio bridge building. Long-span bridge designs were no longer automatically restricted to steel, but depended on a case-by-case assessment of comparative costs for concrete and steel. Older engineering designs could also be adapted to the newer material. A concrete filled arch could be used in much the same situation as a stone structure and to achieve the same engineering effect.

Several factors at both the state and federal levels combined in the 1920s to expand the authority and power of the Ohio Department of Highways. The decade began with public attention focused on the Department during the fall 1920 gubernatorial campaign and led to a significant increase in both funding and staffing. This was demonstrated in 1921 with a dramatic increase in road mileage and bridge construction completed by the Department.

Actions by the federal government and its agent, the Bureau of Public Roads, early in this time period also had positive effects on the Department. The Federal Highway Act of 1921 established the basic Federal Aid Program that exists today. A system of highway classification, designating primary and secondary roads for a federal network, was created.

The Department received another economic boost with the implementation of two major federal gasoline taxes in 1925 and 1927. These taxes provided another source of funding for highway and bridge construction. The Norton-Edwards Bill became law on January 2, 1928, making the Department of Highways responsible for constructing, maintaining and repairing all roads and bridges on the state system. Large numbers of these bridges were

previously the responsibility of the counties.

Armed with state and federal authority and financing and with increased responsibility, the Department's Bureau of Bridges began to shape state bridge construction to an unprecedented degree. Through the efforts of Bridge Bureau personnel, reinforced concrete was fully accepted as an alternative to, or even preferred material over, steel.

Figures published for the Department's work in 1925 showed that of the 164 highway bridges built that year, over eighty percent were concrete.(7)

During this time period, Ohio engineers investigated the form which eventually characterized long-span concrete bridges: the open spandrel arch bridge. For spans greater than 100 feet, this was the most economical use of materials, since it minimized the size and number of members needed to support the bridge roadway. This material savings sometimes was off-set by the increased costs of additional formwork for the spandrel arches.

This era of bridge building closes with the collapse of the stock market and the beginning of the Great Depression, events that had a profound effect upon bridge building in the state.

1931-1940

Ohio's Age of Decorative Arches

In spite of the economic effects of the Depression, the overriding characteristic of this period was its concern for aesthetics. This decade saw the construction of some of the more decorative structures in the entire history of bridge building in Ohio. The plastic nature of concrete offered almost limitless possibilities for decorative treatment. Bridge designers had to be artists as well as engineers since their structures had to harmonize with

The arch has a span of 70 ft., a rise of 10 ft. and carries an 18-ft. roadway and two concrete sidewalks of 5 ft. each, the whole width of the bridge, including railing, being 32- 1/2 ft. The concrete is 15 ins. thick at the crown and 48 ins. at the haunches. It is built according to the Melan system, being reinforced with 9-in. I-beams weighing 21 lbs. per ft., spaced 36 ins. apart, and supported by a cross channel at each end. The foundations are bedrock limestone, with a few layers of decayed, clay-like material, but altogether solid enough to justify very small abutments.

The spandrel walls on top of the arch were continued as wing walls, according to the profile of each hill, and were reinforced by pilasters as shown. This, as well as all the other detail of the facade was attained by constructing a corresponding wooden molding, behind which concrete of 1 cement, 3 sand and 6 stone was rammed in 6-in. layers, with colored face mortar at least 2 ins. thick on the outside. When these moldings are removed early, it is comparatively easy to make a smooth finish; but in some instances, for example, in the sudden snowstorm of Dec., 1894, we were compelled to leave part of the molding on the work to protect the newly-set concrete. As some parts could not be finished for some months afterwards, it then required considerable work to do the finishing on account of all the hardened irregularities which must always be expected from board lines and the like; but the snow and frost themselves did no damage, except to the ornamental key piece, a few of the projecting leaves of which required some repair. For forming this piece a casting of plaster of paris was used, made from a wooden model, and this, on account of its hygroscopic qualities, required to be removed as soon as the concrete had set. The concrete casting should have had very careful and continuous wetting for a couple of days afterwards but this naturally had to be neglected on account of the frost and storm.

To avoid a misconstruction of this statement, I want to say that in my opinion, under the average circumstances, concrete work is more easily performed during the cold than in the hot months, but the site of this bridge is such that even the workmen refused to work if the weather grew colder. I succeeding [sic] in completing the main part of the work before the winter (only one face wall had to be built during some warm days in January under the supervision of Mr. Ludwig Eid, of Cincinnati, who also had charge of the rest of the work.)

There are many engineers who do not admit that well-made concrete work is weather-proof notwithstanding the fact that most American cities have concrete sidewalks to prove it.

For this reason the position taken by Mr. Warder, the Superintendent of Parks, who supported and favored this style of bridge, deserves full credit, especially as he is not an engineer by profession.

Plans for both stone and concrete arches were submitted to competition in the letting, and it was required of the latter that everything should be made of concrete. It was not even permitted to make the arch imitate stone by making fancy joints, such a design being branded as an architectural lie. This explanation is made to show how the present design originated. The bids for a stone arch ranged in the neighborhood of \$12,000, while the bridge as it now stands was contracted for by the writer at \$7,130.

To remove the grayish and lusterless cement color, the specifications prescribed that colored mortar should be used in making the face. The colors at our disposal were yellow, black, and red. The latter and dark green are advantageously used where concrete has to imitate stone. In the concrete arch at Munderkingen (Germany), for instance, the arch stones were colored red, while the

spandrels were colored dark green. For this reason, the black and the red were declared out of the question, and there remained only yellow, which was added at the rate of 10%, the limit to which color should be used. The coping, railing and the arch proper are not colored.

After the excavation was done and the falsework erected, the bent ribs were laid, splices and cross angles fastened and the concrete in the abutments started, so as to enclose the ends of the iron ribs. Then some of the wingwalls and pillars were built, just to train the workmen, which were common laborers paid at the rate of 13-1/2 cts. an hour. The arch was built in two longitudinal halves, each of them started on both sides, and closed up to the center in one day of 12 working hours with a force of 40 men mixing, wheeling and ramming 80 cu. yds. of concrete. The concrete in the arch was in the proportion of 1:2:4 (which had to be increased to 1:4, as the broken stone furnished was too small, and there was no time to substitute larger.)

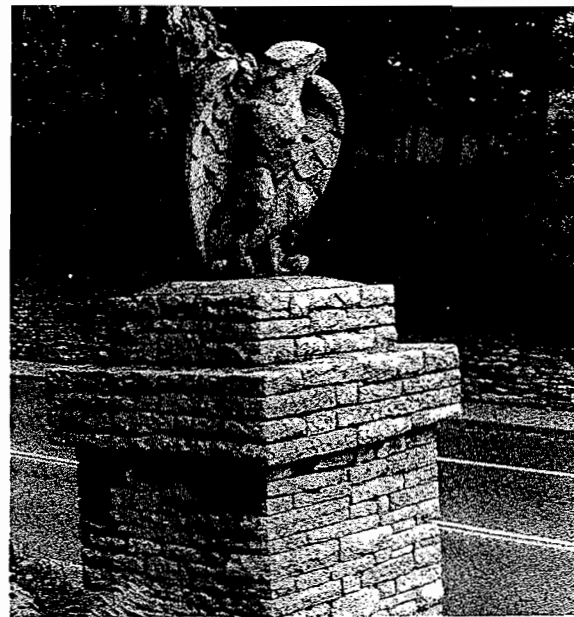
After this the above-mentioned molding of the center ornament was set in place and the facewalls completed as described. Immediately after the removal of the boards placed on the inside of the facewalls, the filling of the bridge was put in and completed to the level of the coping-stone, where the work was stopped during the winter. The artificial stone for the railing and coping were cast during that time and were stored near the bridge. In the spring the falsework was struck and the work completed.

After removal of the falsework the filling was compressed with a 15-ton steam roller, which was a very trying test, as the filling at the crown is not more than 6 ins. thick over the concrete, and the specifications only require the finished bridge to carry this load. There is no necessity to explain what the difference is in

the distribution of the load if such a steam roller is used on an asphalt pavement with a solid foundation or on the bare concrete arch. Although they were not entitled to such a test, I was glad to comply with the desire of the city authorities, feeling confident that such a load could do no harm to the bridge.

Very careful measurements were taken after the removal of the falsework and on other occasions, and did not show any measurable settlement or deflection, which was partly due to the heavy dimensions, but also to the very long settling time given to the bridge before striking centers.

The cement used was "Porta" cement, from Bremen, Germany, and tests of the same made by the writer and the city gave satisfactory results. The stone used was crushed limestone, was hard as it was possible to get in the neighborhood. For the exterior of the bridge and the artificial stonework mortar made (of) a fine, sharp sand, carefully sifted, was used in the proportion of 2 cement to 3 sand.



Stone eagles from the burned Chamber of Commerce Building were added to both ends of the bridge in 1911.

their settings and be visually appealing to the traveling public.

The Great Depression of the 1930s resulted in an emphasis on utilizing local workers and local resources. Increasing employment and, therefore, revenue in an area was seen as a way of staving off the effects of the economic collapse.

The Department was faced with newly acquired deficient structures and the responsibility for maintaining a larger highway system. In 1930 the Bureau of Bridges initiated a statewide condition survey of all state bridges and culverts, thereby targeting unsafe structures for replacement or renovation.

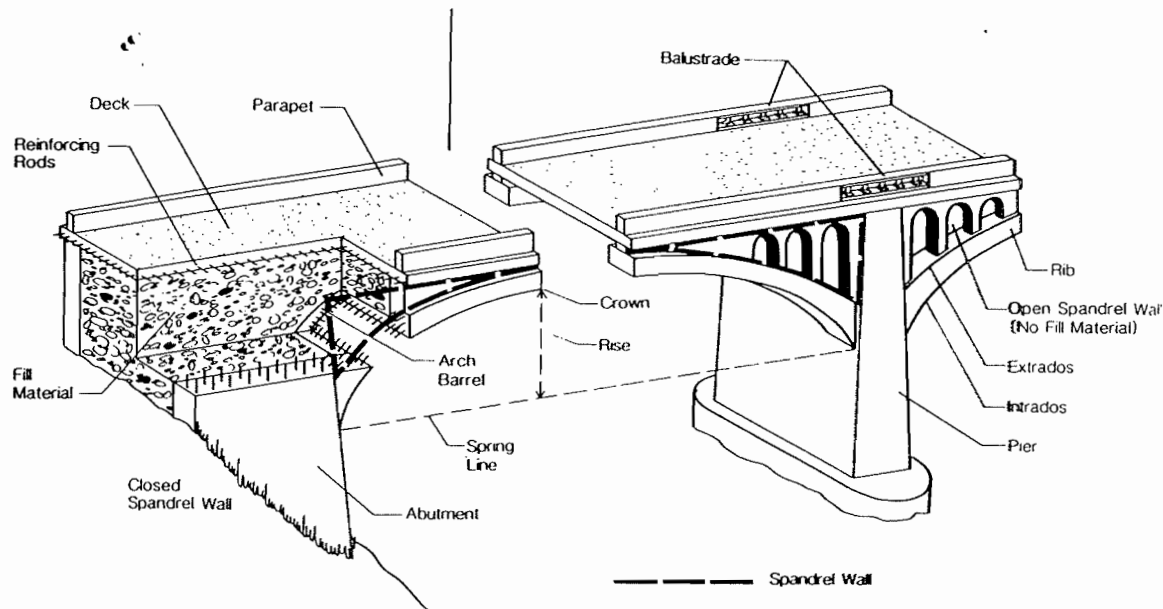
In the fall of 1931, the "Winter Relief Bridge Program" was organized. This was seen as an opportunity to put men to work immediately. It was replaced by federally aided programs like the Civil Works Administration (CWA) in 1934 and Works Progress (later Programs) Administration (WPA) in 1935. After 1930, local appropriations were funneled increasingly into relief work while state-employed

engineers, now assisted by federal funds, assumed the roles formerly held by private consultants.

Private builders and designers like Luten were drastically affected as the Depression forced local funds out of the bridge market and federal public works programs picked up the slack. Luten officially retired from bridge work in 1932 and operated a broom and mop factory in Indianapolis for the remainder of his working life.

The large labor pool available, federal employment programs, and a general public awareness of aesthetics led, in the 1930s, to the construction of some of the more decorative structures in Ohio's entire history of bridge building. Many of the bridge designed in the 1930s by engineers in the department were among the most ornamental built in the state. James R. Burkey, head of the Bureau of Bridges during this time period, encouraged this attention to what he termed the "cultural aspects" of bridges. The artistically- styled concrete arches of this period were the joint efforts of artists, architects, and engineers.

Chapter Three: Structural Property Types



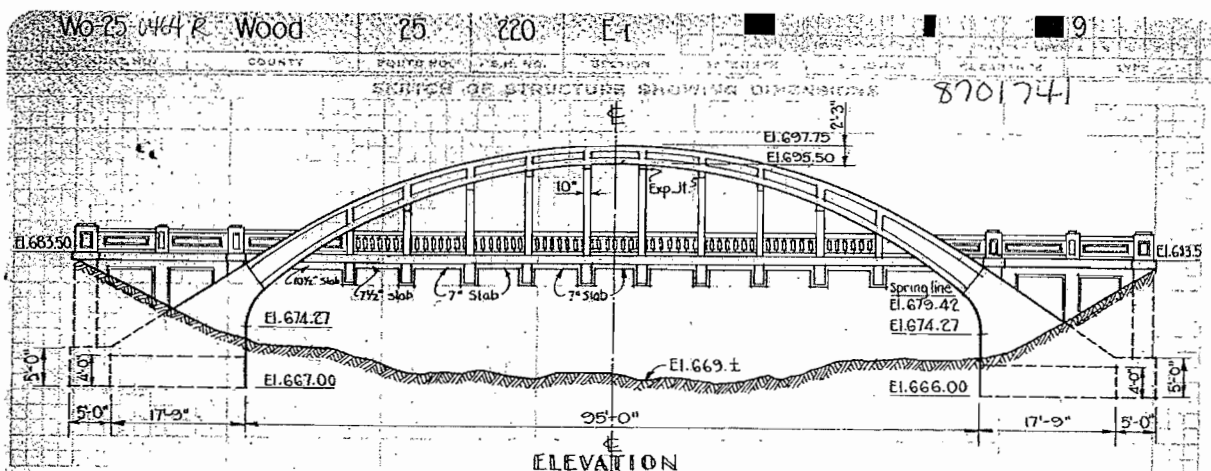
On the-left is a typical concrete closed spandrel filled arch with fill material. On the right is a typical open spandrel rib arch.

Drawing taken from Historic Bridges in Pennsylvania, a publication of the Pennsylvania Historical and Museum Commission and the Pennsylvania Department of Transportation.

For purposes of the re-evaluation, concrete arch bridges were divided into six categories: Closed Spandrel Filled Arch, Open Spandrel Rib Arch, Closed Spandrel Hollow Arch, Through Open Spandrel Rib Arch (Rainbow Arch), Closed Spandrel Rib Arch, and Open Spandrel Slab Arch. (Definitions prepared by Martin Burke.)

Closed Spandrel Filled Arch

This structure consists of arched slabs and solid spandrel walls which confine a superimposed soil fill upon which is placed the roadway pavement.



Reproduced from an ODH bridge card, c. 1930, the above drawing shows a concrete rainbow arch located in Wood County.

Open Spandrel Rib Arch

This structure is similar to the closed spandrel rib arch except that the spandrels are pierced exposing the transverse walls or multiple columns.

Closed Spandrel Hollow Arch

This structure is similar to the closed spandrel filled arch except that instead of an earthen fill, transverse walls or multiple columns are employed to support a continuously reinforced concrete deck slab. This slab serves as the roadway surface or as a base for a separate wearing surface.

Through Open Spandrel Rib Arch (Rainbow Arch)

This structure is similar to the open spandrel rib arch except that the bridge roadway passes between or "through" the arch ribs and is suspended from the ribs by means of column

type hangers. There are two types of rainbow arches; fixed and tied. In the fixed design, the arch thrust is resisted by massive abutments founded on piling or rock. In the tied design, the ends of the arch ribs are tied together either at the level of the deck slab or below the stream bed.

Closed Spandrel Rib Arch

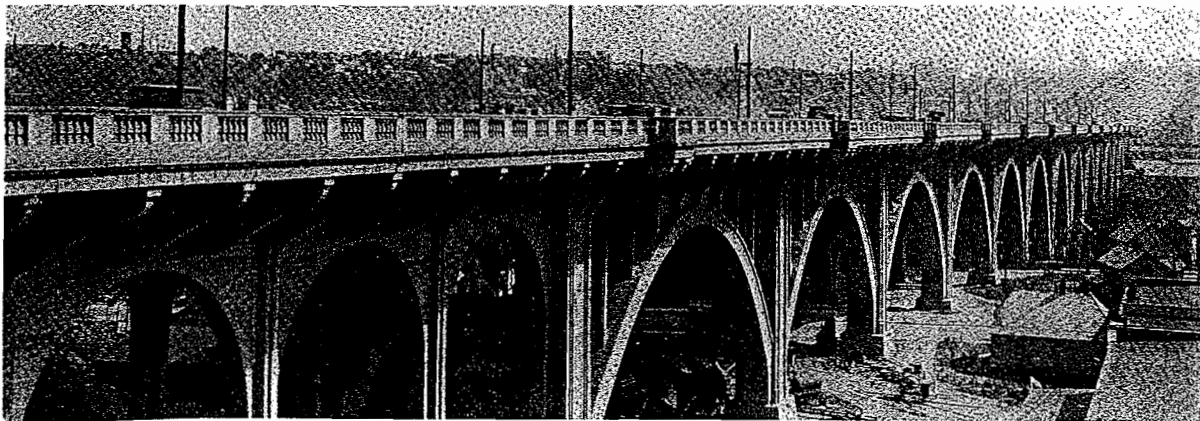
This structure consists of multiple arch ribs, solid spandrel walls, and transverse walls or multiple columns which support a continuously reinforced deck slab. This slab serves as the roadway or as a base for a separate wearing surface.

Open Spandrel Slab Arch

This structure is similar to the closed spandrel hollow arch except that the spandrels are composed of multiple columns instead of solid walls.

Chapter Four:

Applying National Register Criteria



North Hill Viaduct, Akron, built in 1921 and removed in 1979.

These guidelines apply the National Register criteria A, B, C, and D to the evaluation of Ohio's concrete arch bridges; and are based on the historic contextual information presented in Chapter 3. (The complete National Register of Historic Places criteria for evaluation are found in Appendix B of this document.)

The National Register criteria are standards to evaluate the significance in American history, architecture, archaeology, and culture of structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association at the national, state, or local level, and;

A. That are associated with events that have made a significant contribution to the broad patterns of our history.

Structures that meet Criterion A might include:

-Bridges associated with the history and policies of Ohio's Department of Highways and the Bridge Bureau;

-Bridges associated with political decisions and legislation that influenced bridge building and funding throughout the state;

-Bridges reflecting specific changes in federal, state, county, or local policies concerning bridge construction and funding;

-Bridges associated with legal decisions and court cases impacting bridge construction;

-Bridges associated with labor issues, bridge company policies, business competition or other industrial relations impacting bridge construction, design, and funding;

-Bridges reflecting federal and state legislation impacting bridge construction and funding;

-Bridges reflecting the beginning of federal-aided bridge construction in Ohio;

-Bridges reflecting the federal-state cooperation concerning bridge construction and funding;

-Bridges reflecting the influence of other

transportation-related industries such as railroads;

-Bridges reflecting the influence of natural disasters;

-Bridges reflecting the impact of World War I on bridge construction and funding;

-Bridges associated with policies and programs geared to counter the effects of the Great Depression;

-Bridges influenced by urban aesthetic concerns and community planning.

B. That are associated with the lives of persons significant in our past.

Structures that meet Criterion B might include:

-Bridges reflecting the specific contributions of individuals associated with the Ohio Department of Highways and the Bridge Bureau;

-Bridges associated with the career history of an important bridge designer or engineer;

-Bridges associated with important contributions of politicians impacting bridge construction and funding.

C. That embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity where components may lack individual distinction.

Structures that meet Criterion C might include:

-Bridges reflecting the distinctive types, styles and methods of construction for concrete arch bridges;

-Bridges reflecting trends in concrete arch bridge construction and engineering;

-Bridges reflecting the standardization of plans and construction techniques associated with concrete arch bridge construction, materials and engineering;

-Bridges displaying the distinct characteristics of the work of specific bridge designers, engineers, and companies;

-Bridges reflecting a high degree of workmanship, stylistic details, and aesthetic qualities;

-Bridges with details reflecting the collaborative efforts of bridge designers, artists, architects, and engineers, and displaying unity with other landscape features;

-Bridges reflecting the City Beautiful Movement qualities and aesthetics through their design, details, and unity with other landscape features;

-Bridges representing a carefully planned part of a larger urban environment;

-Bridges contributing to historic districts through their spatial relationship to other resources, materials, proportions, scale and historical associations.

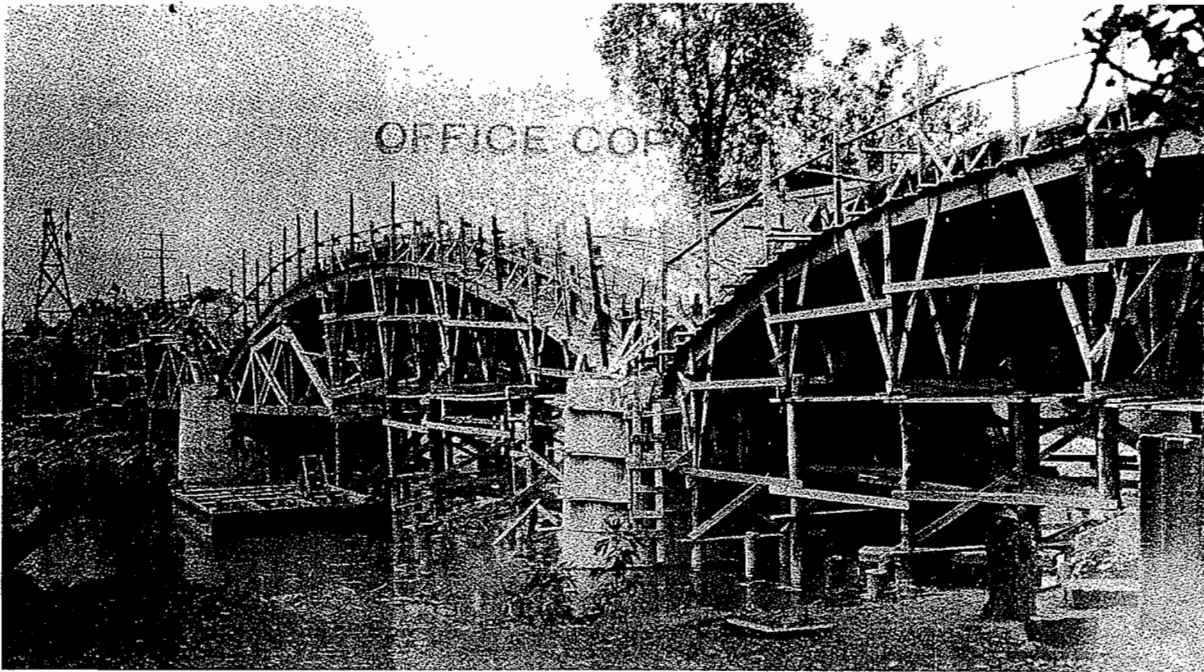
D. That have yielded or may be likely to yield information important in history.

Structures that meet criterion D might include:

-Bridges displaying information important to understanding specific aspects of construction techniques or technological advancements associated with concrete arch bridge design and engineering.

Part 2

Summary of Methodology and Evaluation

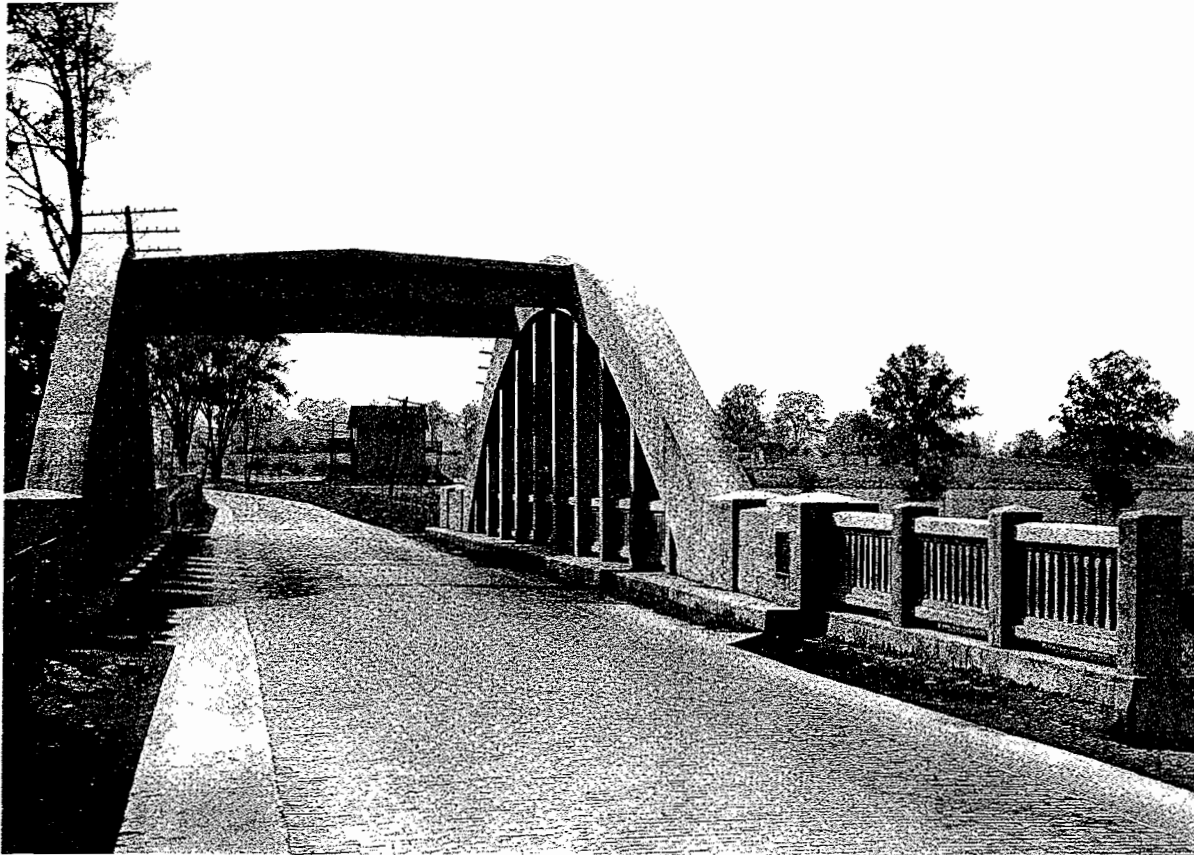


Taken in June 1912, this photograph shows a three-span concrete arch bridge being constructed on State Route 772 over Paint Creek in Ross County.



The bridge as it appeared prior to removal in the mid-1980s.

Chapter Five: Methodology



A concrete through or rainbow arch in Trumbull County, replaced in 1937.

Phase I: List of Bridges to be Evaluated

ODOT maintains a computerized, continually updated listing of all bridges on federal, state and local systems within Ohio. This listing includes data necessary for developing, planning and programming bridge maintenance and construction. Information from this listing relevant to concrete arch type and date of construction was used by the ODOT staff in identifying bridges to be evaluated.

Phase II: Field Inspection of the Bridges

The form used in the 1980 survey and in the 1990 update also was used for the present re-evaluation. It was developed by the BES staff and David Simmons, based on the form used by the state of Virginia for its historic survey and the OHPO's bridge form. ODOT staff conducted the field survey from the winter of 1990 to spring of 1992.

Phase III: Développement of the Numerical Rating System

ODOT's initial evaluation system and the National Register's Multiple Property Documentation format was used by the Advisory Committee to develop a numerical system for rating concrete arches: documentation, technological, and general significance.

Phase IV: Evaluation Process

The final evaluation process was initiated in 1992 by four teams composed of staff members from ODOT, the OHS and the OHPO. Each team was responsible for rating a specific element of the evaluation criteria. The aesthetic and history teams evaluated every bridge and awarded each a numerical value in these two categories. The third team awarded each bridge points for documentation and technological significance. The results of these team evaluations were tabulated by ODOT staff members. The fourth team then evaluated each bridge for integrity. The results of the evaluation process were presented to the Advisory Committee for members' review, comment and approval.

The Advisory Committee reviewed the results and determined that because there are fewer than 20 bridges in four of the six categories - open spandrel slab arch, closed spandrel hollow, rib arches and rainbow arches - all of these bridges should be considered eligible for the National Register of Historic Places (Selected).

In the remaining two categories - open spandrel rib arch and closed spandrel filled arch - the Advisory Committee established numerical cutoff points for both categories. Those bridges that scored at or above the

cutoffs were identified as eligible for the National Register of Historic Places (Selected). Those that scored just below the cutoffs were reviewed by the Committee. Several of these bridges were re-evaluated by the Advisory Committee and felt to be eligible for the National Register (Selected) or were identified as Reserve Pool structures (eligible for future re-evaluation for the National Register).

Phase V: Report

This report documents the entire project and has been written by staff members in ODOT with contributions from Advisory Committee members Martin Burke, Barbara Powers and David Simmons. The draft was circulated to FHWA, OHPO and the members of the Advisory Committee. Their comments on the draft were requested and incorporated into this final report. The recommendations in this report have been accepted by the Ohio State Historic Preservation Officer and will become the basis for future decisions for the preservation of the concrete arch bridges in Ohio.

Phase VI: Programmatic Agreement

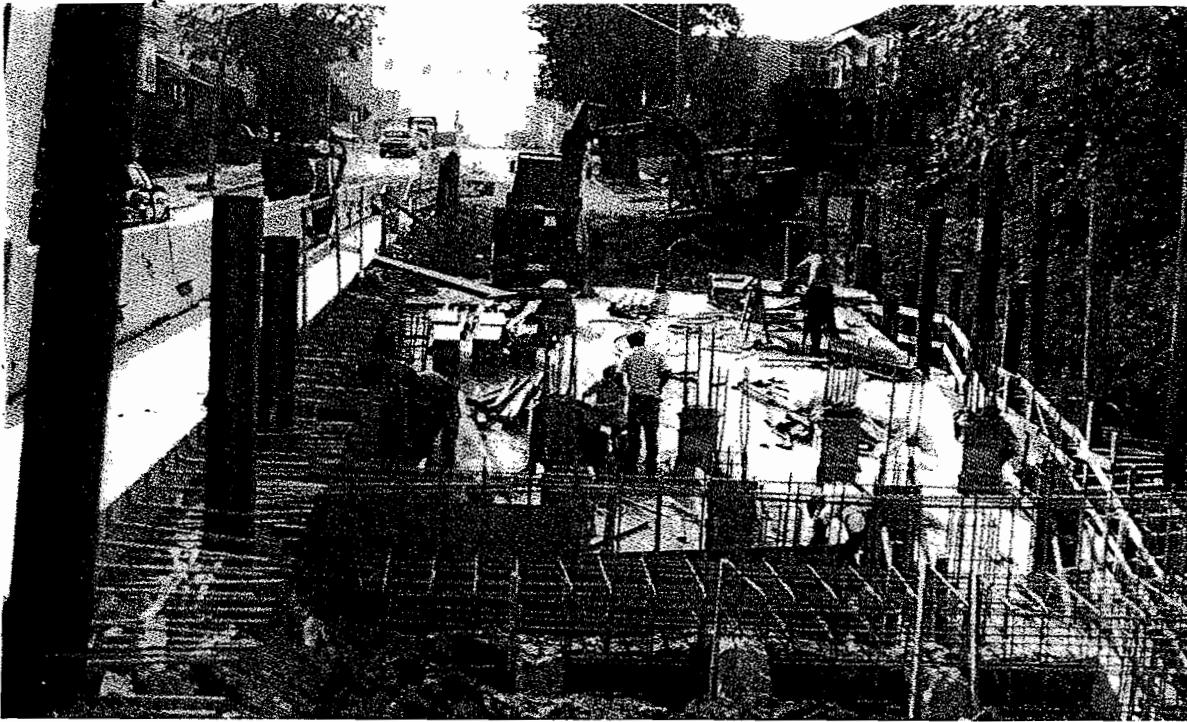
The process of evaluation and preservation is a continuing and constantly changing one. Attitudes toward reuse, rehabilitation and preservation are not static but contingent upon public perceptions, technological advances and availability of funds. Structures selected for preservation may be destroyed through unforeseeable events such as natural disasters or accidents.

Recognizing these contingencies, ODOT, in cooperation with the Ohio Historic Preservation Office, developed a Programmatic Agreement (PA) for the federally funded or approved bridge projects in Ohio. This PA

establishes the priorities and procedures which ODOT and the OHPO will follow on future bridge projects and outlines both the individual and joint responsibilities of FHWA, ODOT and

OHPO. The PA, executed by the Advisory Council July 28, 1993, is presented in Part 4, Chapter 12, of this report.

Chapter Six: Evaluation



Phase II of rehabilitation work on the Broadway Street Bridge (pg. 43).

The purpose of this update is to document the re-evaluation of the concrete arch bridges built before 1941 that are still intact. Concrete arch bridges determined eligible for inclusion in the National Register of Historic Places represent the development of the bridge industry and the history of concrete bridge technology in Ohio from the late 19th century to the beginning of this country's involvement in World War II.

The Advisory Committee developed the evaluation criteria based on the National Register's criteria for historic structures. For this update the criteria were divided into three major sections: Documentation (5 points), technological significance (12 points) and general significance (15 points). A detailed

outline of the accepted rating system is provided on the following pages.

Rating System for Ohio's Concrete Arch Bridges Built:

Pre 1903
1903-1912
1913-1920
1921-1930
1931-1940

Each bridge was evaluated within the context of its own time period. In other words, a bridge built before 1903 was not rated against one built between 1903 and 1912 or during any other time period.

A. DOCUMENTATION (Maximum Points 5)

1. Designer/Builder

- | | |
|---|---|
| a. Known designer/builder/technological contributions determined | 5 |
| b. Known designer/builder/technological contribution undetermined | 3 |
| c. Unknown | 0 |

B. TECHNOLOGICAL SIGNIFICANCE (Maximum Points 12)

1. Length of individual spans (Does not apply to Pre 1903)

Time Period	Good (3 pts. per span)	Exceptional (4 pts. per span)
1903-1912	100 - 124 ft.	125 ft. or more
1913-1920	115 - 164 ft.	165 ft. or more
1921-1930	115 - 164 ft.	165 ft. or more
1931-1940	140 - 189 ft.	190 ft. or more

2. Special Features

- | | |
|---|---|
| a. Artistic treatment (non-structural) | 1 |
| b. Decorative elements (non-structural) | 1 |
| c. Artistic treatment of structural elements | 1 |
| d. Builders'/designers' distinctive structural elements | 1 |
| e. Builders'/designers' distinctive decorative elements | 1 |

C. GENERAL SIGNIFICANCE (Maximum Points 15)

1. Aesthetics

- | | |
|--------------|---|
| a. Excellent | 5 |
| b. Good | 4 |
| c. Fair | 3 |
| d. Poor | 0 |

2. History-Site

- | | |
|-------------|---|
| a. National | 5 |
| b. State | 4 |
| c. Local | 3 |
| d. Unknown | 0 |

3. History-Bridge

- | | |
|-------------|---|
| a. National | 5 |
| b. State | 4 |
| c. Local | 3 |
| d. Unknown | 0 |

D. INTEGRITY Yes No

General Significance

General significance deals with the bridge's historic and aesthetic value and contains the largest share of points in the evaluation. In this section the bridges are evaluated for their aesthetic qualities and involvement in historic events.

Aesthetics

a.Excellent	5
b.Good	4
c.Fair	3
d.Poor	0

Engineering publications, including those of the highway department, often addressed the visual appearance of bridges. Engineers were concerned not only with the strength and simplicity for the sake of economy, but also with proportion and balance of detail to give the structure a pleasing and striking appearance.

For the purpose of the evaluation, aesthetics were defined as the visual effect of a bridge on a viewer. That effect was not to be contingent upon an awareness of engineering requirements in bridge structures. However, at the same time, the aesthetics evaluation had to be codified for use by a variety of evaluators, standardized for consistent application to the entire set of bridges and quantified for inclusion in the overall evaluation score.

By dividing the overall aesthetics rating into a series of separate judgments on discrete aesthetic qualities, the tendency for an evaluator to make a judgment based on an unconsidered initial impression was diminished. But the aesthetics rating still contained the greatest vulnerability to individual bias in the entire evaluation process. At the time the first Ohio Historic Bridge Inventory, Evaluation and Preservation Plan was being prepared in 1982, a set of aesthetic guidelines was tested on a

sample set of bridges by a diverse group of evaluators. The criteria were reformulated and rewritten and the scoring system was changed.

After testing these changes and continuing the process of refinement, an aesthetic rating system evolved which produced consistent evaluations of the bridges. This system has been used for both the first and second Ohio Historic Bridge Inventory, Evaluation and Preservation Plans and, with only minor changes, was used for the present supplement. The system is divided into four categories. The first two categories consider the relationship of the bridge to its setting and location. The last two consider the aesthetic aspects of the bridge itself.

1. CONTEXT:

Do the overall dimensions of the bridge relate well to the surrounding natural and/or man-made environment? Does the bridge fit coherently with the valley width and depth and the approach landscape? Does the bridge fit coherently with the stream width?

2. DETAIL:

Does the texture and massing of the bridge relate well to the details of its natural setting? Does the style of the bridge relate well to the architectural style in adjacent areas?

3. PROPORTION:

Do the various elements of the bridge relate well to each other in size, spacing, height and width? Are the decorative elements appropriate in size, distribution and character for the structure?

4. BALANCE:

Does the overall shape of the bridge function as a cohesive visual entity? Is its symmetry/asymmetry well-suited to the shape?

Scoring for these categories awarded 1-5 points for each item, with 0 being Poor, 3

being Fair, 4 being Good and 5 being Excellent. The total score was then translated into the aesthetic scale as follows:

17-20 points = 5 points

13-16 points = 4 points

9-12 points = 3 points

4-8 points = 0 points

History - Site

a. National 5

b. State 4

c. Local 3

d. Unknown 0

History - Bridge

a. National 5

b. State 4

c. Local 3

d. Unknown 0

Historical significance was rated for both the bridge site and the structure itself in terms of the levels used on the National Register nomination for: national, state, and local, with national receiving the most points and local the least. The site of a bridge was a factor in its original design and was, therefore, incorporated into the evaluation criteria. Because of the important interplay between highways and railroads, especially during the 1920s and 30s when the Ohio Department of Highways had a bureau specifically for Bridges and Grade Separations, a bridge automatically received a level of local significance if it intersected a rail line. The historical significance of the design or construction of a particular bridge also was evaluated. The Conneaut Viaduct, for example, the largest structure ever built on a state highway in Ohio at the time of its completion in

1924, received a state level of significance. The Shawnee Bridge in Piqua, the first bridge erected in that city in the aftermath of the 1913 flood and a structure in which concrete was used because of its perceived greater resistance to flood damage, was accorded a local level of significance.

Integrity - Yes No

Integrity relates to a structure's physical ability to convey its significance. Assessing integrity involves determining the physical features of a structure that are important to understanding its significance and then assessing the condition of these features.

Integrity must be evident through historic qualities that include location, design, setting, materials, workmanship, feeling, and association.

A structure either possesses integrity or it does not.

Steps in assessing integrity:

1. Identify essential physical features that make up character and appearance of the structure at the time it achieved significance.
2. Check if essential features are still present.
3. Determine which aspects of integrity (location, design, setting, materials, workmanship, feeling and association) (Appendix D) are vital to understanding the structure's significance.

Technological Significance (12 Points)

Length of individual spans (Does not apply to Pre 1903)

Time Period	Good (3 pts. per span)	Exceptional (4 pts. per span)
1903-1912	100-124 ft.	125 ft. or more
1913-1920	115-164 ft.	165 ft. or more
1921-1930	115-164 ft.	165 ft. or more
1931-1940	140-189 ft.	190 ft. or more

Since bridges are practical structures intended to carry traffic over impediments to travel, it is appropriate that the evaluation recognizes bridges as engineering accomplishments and examples of developments in industrial history. By awarding points for increasingly longer span lengths, this category recognizes bridges which exhibit more than minimal applications of money and engineering skills. Span length was not a factor in judging concrete arches built prior to 1903. From 1903 to 1912 spans of 100 to 124 feet were considered good (3 points per span), 125 feet or more was judged to be exceptional (5 points per span). For bridges built between 1913 and 1920, 115 to 164 feet was considered good and 165 or longer exceptional. The same criteria applied to bridges built between 1921 and 1930. For bridges built between 1931 and 1940, 140 to 189 feet per span was considered good, 190 or longer, excellent.

Special Features

- | | |
|---|---|
| a. Artistic treatment (non-structural) | 1 |
| b. Decorative elements (non-structural) | 1 |
| c. Artistic treatment of structural elements | 1 |
| d. Builders/designers distinctive structural elements | 1 |
| e. Builders/designers distinctive decorative elements | 1 |

The special features portion of the criteria was designed to give proper emphasis to elements that were unique to a particular structure or a distinctive characteristic of an individual contractor or designer. Equal weight was given to applied features, labeled "non-structural," and those manifested in the structure itself.

A bridge receiving a point for artistic treatment might have a "neo-classical" balustrade-type railing that featured urn-shaped banisters. The most common type of non-structural decorative element meriting a point was lamp posts or lenses for indirect lighting. The artistic embellishment of the arches and columns - structural elements - of certain bridges reflect their designers' aesthetic sensibilities and warranted one point. The "close-ribbed" design developed by Daniel B. Luten is an example of a distinctive structural element. This same design also used a specific railing that received one point as a distinctive structural element.

One point was awarded for each of the following special features: artistic treatment of non-structural elements (Figure 1), non-structural decorative elements (Figure 2), artistic treatment of structural elements (Figure 3), distinctive structural elements of the builders/designers (Figure 4), and distinctive decorative elements of the builders/designers (Figure 5).



Figure 1. Balustraded railing, artistic treatment of a non-structural element.

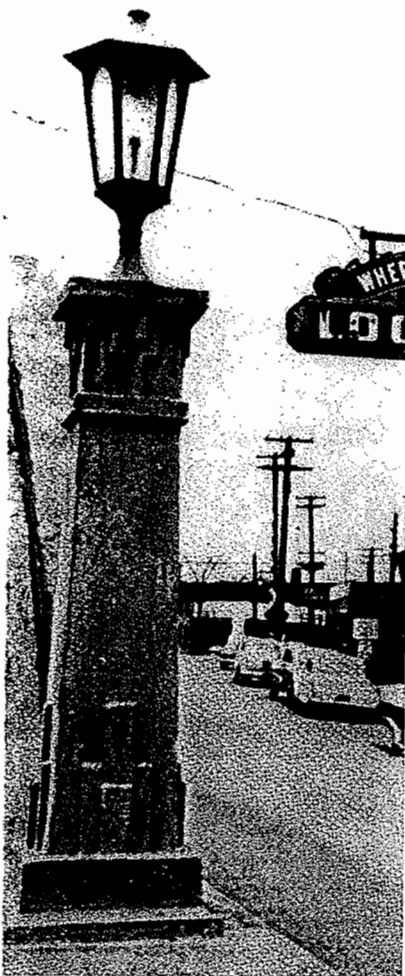


Figure 2. Lamppost, non-structural decorative element.



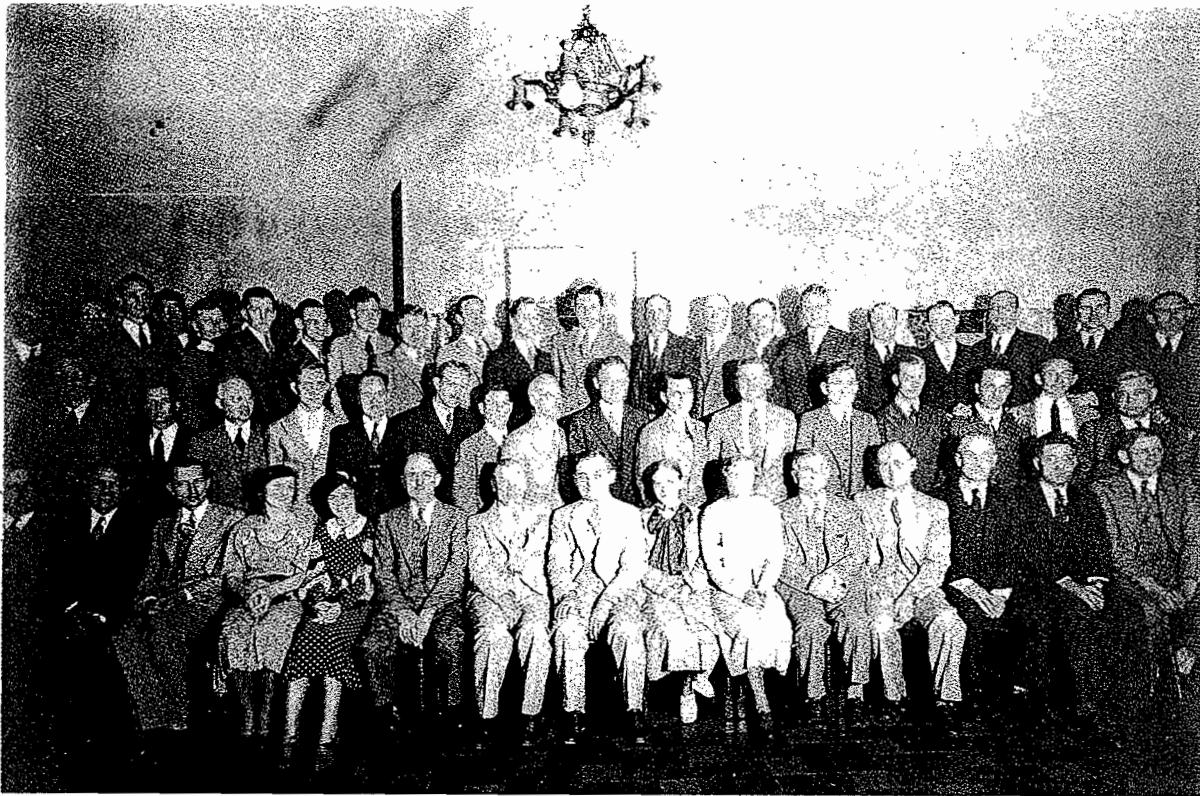
Figure 3. Decorative columns, artistic treatment of a structural element.



Figure 4. Luten ribbed arch, distinctive structural element.



Figure 5. Castellated stone railing typical of D.H. Overman's stone-faced arches.



Bridge Bureau personnel about 1932:

Top row from left - Paul Pletcher, L.W. Curl, L.J. Ucker, J.P. Noble, R.K. Clark, W.S. Gould, R.T. Ziegfield, W.G. Smith, Jr., Sam Pritchard, C.P. Smith, W.T. Halligan, S.R. Rudin, W.S. Hindman, Bob Keller, H.H. Hawley, R.R. Cutler, A.W. Connar, R.L. Larimer, F.C. Nesbitt, W.E. Burroughs, K.E. Dumbauld

Second row - R.B. Kruger, C.E. Osborn, D.O. Stone, W.E. Buerk, M.E. Bollerer, R.H. Liber, Sid Rockoff, C.S. Demos, R.W. Schepers, W.D. Arnold, J.J. Heier, Earl Sanderson, G.W. Shuff, K.V. Taylor, Clark Allen, W.W. Fleming

Bottom Row - A.J. Friemoth, J.C. Merrell, D.H. Overman, Jessie B. Grimm, Elaine A. Harvey, J.R. Burkey, O.W. Merrell (Director), W.H. Rabe, Mary D.L. Carver, Josephine Powers, M.X. Wisda, Adolf Eiselt, V.A. Eberly, G.J. Kane, W.G. Smith, Sr.

Documentation (Maximum Points 5)

Documentation was considered to be an important quality in bridges for preservation and was awarded a maximum of 5 points. Documentation allowed a bridge to be traced to a specific time, builder and place of origin. For the purposes of this evaluation, hard

evidence was required for a bridge to be considered documented. As in the previous evaluations, all the dates and builders were based on records or written material on the bridges themselves rather than attributions based on appearance. Appearances did not necessarily provide the clear-cut evidence required for firm historical documentation.

Designer/Builder

- | | |
|--|---|
| a. Known designer/builder technological contributions determined | 5 |
| b. Known designer/builder technological contributions undetermined | 3 |
| c. Unknown | 0 |

For the first historic bridge inventory the term "prolific builder" was used to identify a company that had both broad distribution and high numbers of structures built in Ohio. The prolific builders were awarded additional points to recognize the effect those bridge companies had upon the bridge industry in Ohio.

In developing the criteria for this survey the Advisory Committee concluded that the prolific bridge companies identified in the first historic bridge inventory were still sufficient for evaluating metal truss bridges. However, the prolific bridge companies identified in the first survey were not as significant in the development of the concrete bridge industry in Ohio. As a result, the Advisory Committee developed a system to evaluate the concrete bridge builders in Ohio.

The criteria developed in the first inventory, broad distribution and high numbers, were useful in identifying companies whose technological contributions were significant in the development of the concrete bridge industry in Ohio. In addition, a review of patents issued for concrete bridge construction during the late 19th and early 20th centuries also was helpful in determining the significant companies. Based on this criteria the Melan Arch Construction Company; The Luten Bridge Company of York, Pennsylvania;

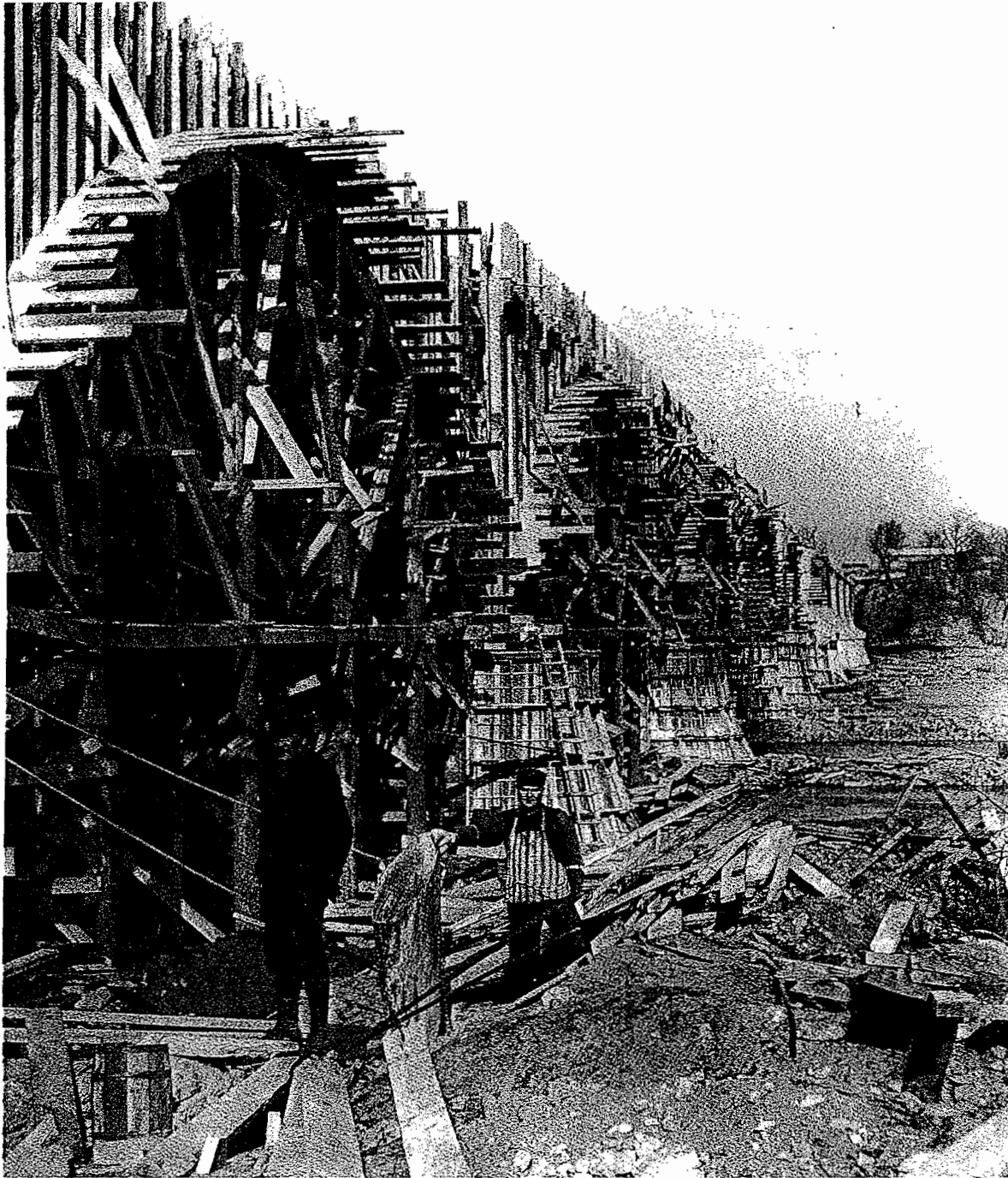
Watson Engineering of Cleveland, Ohio; and Concrete Steel Engineering Company of New York, N. Y.; were identified as companies whose contributions were significant in the development of the concrete bridge industry in Ohio. Bridges built by these companies were awarded five points.

The research also revealed that during the 1920s and 1930s several individuals in the Ohio Department of Highways Bureau of Bridges and Grade Separations were influential in the development of concrete bridge design. The research identified the creative engineering contributions of J. R. Burkey, Chief Engineer of the Bridge Bureau from 1925 to 1942; William H. Rabe, Chief Designing Engineer of Bridges 1923-1942; and D. H. (Henry) Overman, Principal Designing Engineer of Bridges from 1930 to 1942. Bridges designed by these individuals were awarded five points.

Builders and designers whose technological contributions were undetermined in the development of the concrete bridge industry in Ohio were awarded three points. Bridges built by companies such as Buckeye Portland Cement, C. A. Warner, Gephart & Kline Engineering, D.P. Foley, Roberts Supply Co., Wendell Brown Co., Wiley Construction, J.H. Jones, Newton Baxter Co., Standish Engineering Corp., Hereth Construction, Highway Construction Co., E.H. Latham and Hecker-Moon Co. were awarded three points. In addition to awarding identified companies three points, bridges designed by engineers in the Bureau of Bridges and Grade Separations whose technological contributions are undetermined were awarded three points. These designers included Kiser Dumbauld, Harry Hawley, Martin Ward, William Hindman, Charles Smith, William Freeman and C.E. Nofer.

Part 3

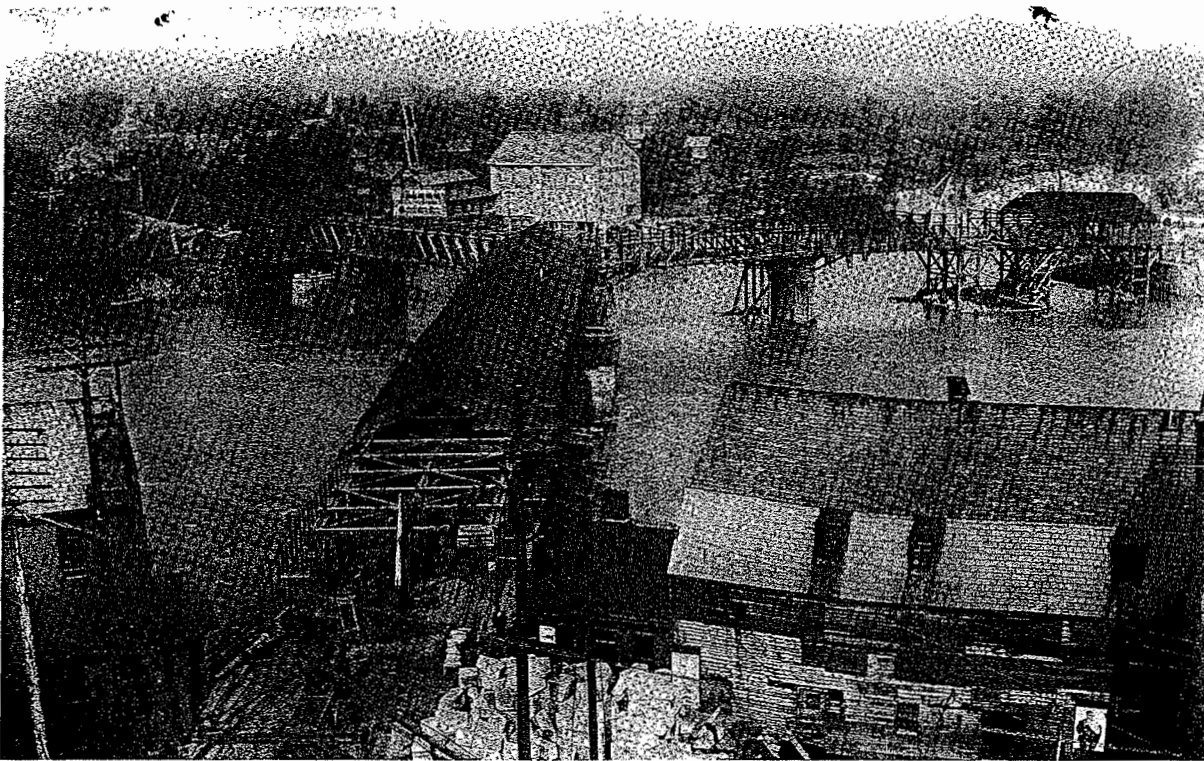
Concrete Bridge Structural Types



The construction of early concrete arch bridges required the erection of elaborate falsework.

Photograph from Toledo Public Library collection.

Chapter Seven Pre-1903: Ohio's Earliest Concrete Arches



Taken in the spring of 1901, this photograph shows the covered Y bridge in Zanesville being used as a work platform to build piers for the concrete Y bridge which replaced it. The concrete Y bridge was replaced in 1984.

Ohio Historical Society, Norris Schneider Collection.

The presentation by the Austrian civil engineer Fritz von Emperger on reinforced concrete bridges made to the April 1894 meeting of the American Society of Civil Engineers in New York was received with some skepticism. Von Emperger acknowledged that the use of concrete for bridges was commonplace in France and Germany, but that in America it was still necessary to build public confidence in the method. German concrete arches at this time were known for their thinness and flatness, and several of the American engineers who commented on von Emperger's paper questioned whether the quality of materials available and variability of temperatures in

North America would allow widespread use of reinforced concrete.

The historic bridge survey identified three bridges intact from this time period, all built in the 1890s. The two oldest bridges, the Melan Arch in Cincinnati and the Fredericktown bridge in Knox County, are reinforced concrete structures. Both reflect the influence of European technology. The third, the South Broadway bridge in Lebanon, is the oldest known unreinforced (plain) concrete bridge in the state. It was built from stream gravel and is an excellent example of what some at the time referred to as a "mud bridge."

Eden Park Bridge
Cincinnati, Hamilton County
In Eden Park
Crosses Eden Park Drive
UTM Coordinates-16/717080/4332560

Closed spandrel filled arch
Builder: Melan Arch
Construction Co., N.Y.
Designer: Fritz von Emperger
Constructed: 1895
Structure File No. 3160726



Built in 1895, this is the oldest remaining concrete bridge in Ohio and also was the state's first reinforced concrete arch.

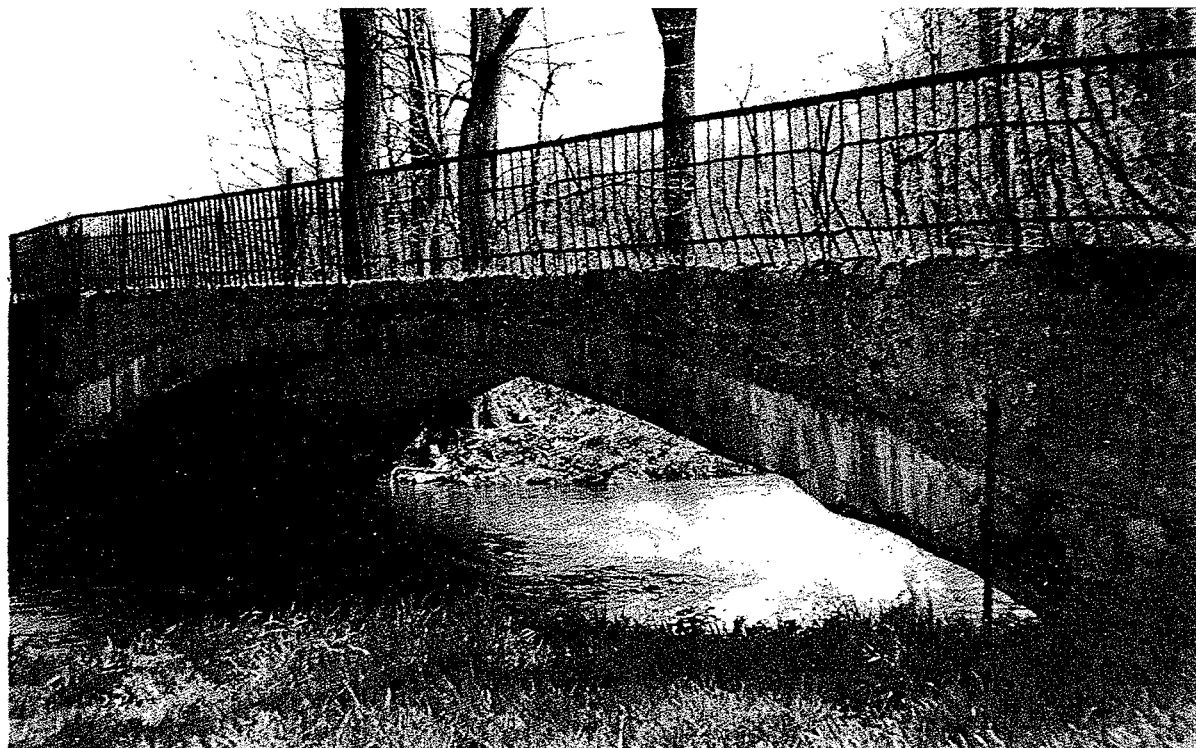
The following is the text of an article on the design and construction of this bridge written by Fritz von Emperger, Melan's agent in the United States. It was published in the Engineering News, Oct. 8, 1895, under the title "A Melan Concrete Arch in Eden Park, Cincinnati, O."

The concrete arch illustrated in the accompanying engravings is located in picturesque Eden Park, the pride of Cincinnati, and crosses Park Ave., the main thoroughfare of the Park. It connects two hills, on one of

which the city water tower is situated, while the other promontory skirts the Ohio valley and commands a splendid view of the suburbs of Cincinnati and the Kentucky border up to Fort Thomas. The beauty of the landscape was lost on me when I commenced concrete work on this bridge in the middle of November, 1894, with the intention of finishing it before the ensuing winter. It is not only far colder on these hilltops than in the city below, but there is always at this season of the year a fierce wind blowing through Park Ave., and the idea of working concrete at temperatures below 26 degrees F. (up to which limit it can be done with no great precaution) had better be abandoned.

Middlebury Township Bridge
N.W. of Fredericktown, Knox County
Township Road 369
Crosses Tributary of North Branch
of Kokosing River
UTM Coordinates-17/363200/4485640

Closed spandrel filled arch
Builder: Buckeye Portland
Cement Co.
Designer: W.H. Pratt
Constructed: 1896
Structure File No. 4236580



The concrete bridge in Middlebury Township near Fredericktown was built in 1896 by the Buckeye Portland Cement Company of Bellefontaine, Ohio. This firm began operations in 1888, and was the earliest producer of portland cement in the state. The cement for what is generally considered the first concrete street in America was poured in Bellefontaine in 1893 from cement produced by this company. The ruins of the company works can still be found just south of Rushsylvania in northeastern Logan County.

Many American engineers favored heavy, round arches that imitated the shape and design of stone arches. Despite this the bridge built by

Buckeye Portland Cement closely followed the lines of the thin and flat German arches of the period. The company was known to be a proponent of German concrete technology, since it was widely regarded as "the best." In fact, some of Buckeye's products were given German names to imply a high quality. Following von Emperger's example, W.H. Pratt, designer of the bridge, included 52-pound railroad rails on two-foot centers as reinforcing.(8)

By constructing the Middlebury Township bridge the Knox County Commissioners were taking advantage of the latest European technology, although the fact that they built it

South Broadway Street Bridge
Lebanon, Warren County
South Broadway
Crosses Turtle Creek
UTM Coordinates-16/740295/4369150

Closed spandrel filled arch
Builder: Emerson & Jones
Designer: P.O. Monfort
Constructed: 1897
Structure File No. 8360081

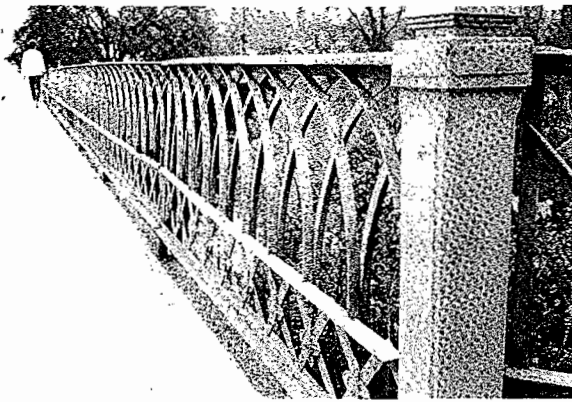


The following is adapted from an article by David Simmons that appeared in Ohio County Engineer, Feb., 1986.

The South Broadway Street bridge in Lebanon is noteworthy as one of the earliest concrete arch bridges in Ohio and for the remarkable story of neighborhood involvement in its construction. This residential neighborhood, known as Floraville, with substantial Greek Revival and Italianate homes developed south of the city's business district in the years before the Civil War. A spring flood in 1897 washed out a number of bridges and the county commissioners sold bonds to finance their repair or replacement. Part of these funds was

designated for the erection of a bridge over Turtle Creek between the business district and Floraville. When the commissioners advertised for a new bridge in Lebanon that spring, they requested bids for a stone or concrete bridge as well as for a low steel truss.

The residents of Floraville were determined to have nothing to do with a metal truss bridge. They considered the location of the bridge to be the most prominent in town and presented the commissioners with a petition requesting a stone or concrete bridge which they were convinced would be more durable and more attractive.



So, while concrete bridge construction was still

in its infancy in the state, the bridge chosen was a two-span concrete arch designed by P.O. Monfort, Warren County Surveyor and Civil Engineer. County records suggest that the bridge was built of "plain" (unreinforced) concrete. The nearly semicircular shape of the 37-foot arches also suggests this shape would minimize or eliminate tensile strains. The bridge was built by Emerson & Jones, a construction company from Lebanon that specialized in concrete construction. The Broadway Street bridge is listed on the National Register of Historic Places as part of the Floraville Historic District.

Chapter Eight 1904-1912: Ohio Experiments With Concrete



Construction of the Third Street Bridge, Dayton, began in 1905. The bridge was replaced in 1949.

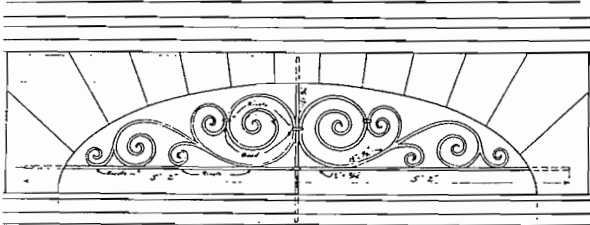
Photograph from the Dayton-Montgomery County Public Library Collection.

This was an era of experimentation as many designers and builders explored the possibilities of the new material. During this period, Americans slowly began to investigate concrete technology that had been developed and refined in Europe throughout the second half of the previous century. In 1904, many believed that concrete offered certain advantages but were still unsure of how to use it in new design. By 1912, concrete technology was becoming widely accepted and used.

Beginning in this period, eastern consulting engineers came into the state to handle jobs that previously were done locally. Typical was the completion in 1903 of the Main Street bridge over the Great Miami River in Dayton, Ohio. This was followed by the construction of the Third Street bridge in 1905 and the Washington Street bridge in 1906. All three of these structures were based on the designs of the Concrete Steel Engineering Company of New York. These bridges utilized the Melan system of reinforcing, with the upper and lower

reinforcing connected by latticework trussing. The Third Street bridge was replaced in 1949 and the Main Street bridge in 1956. The Washington Street bridge remains in service and is a Selected bridge (pg. 44).

Ohioans figured prominently in the use of the three-hinged arch form devised in Germany to prevent cracks from developing due to uneven settlement of foundations, changes in temperature, or uneven loading. The first two bridges of this type built in the United States were erected in Ohio, one in Mansfield in 1904 and one in Brookside Park, Cleveland, in 1906. Both of these bridges have since been replaced. Because many American engineers felt the hinges detracted from the overall aesthetics and appearance of rigidity that recommended the use of concrete in the first place, this technique never gained the popularity it had in Europe and the number of such bridges remaining today is small. Two three-hinged arches built in 1909 remain: the Broadway Street bridge in Darke County (pg. 46) and a second bridge built in Brookside Park (pg. 53). They are the



Detail of railing of Brookside Park bridge.

only known examples of this type of construction remaining in Ohio.

In this era of experimentation the Ohio Department of Highways was exploring the use of concrete for roadways. In 1907 James C. Wonders, known as the "father of concrete" for first using concrete paving in Bellefontaine in

1893, was appointed the second State Highway Commissioner. Under his leadership, the department began testing a wide range of construction methods for road building including the use of reinforced concrete pavement. The idea of testing was encouraged under his administration and by 1909 the department, in cooperation with the Ohio State University, established an investigative laboratory for roadway materials.

By 1911, the department offered printed standard specifications for concrete and concrete reinforced structures. Notification that these specifications were available was sent by circular letter to each county surveyor in the state. In two months, eight counties had requested specifications for 18 concrete bridges and wingwalls.

Cincinnati and Hamilton County continued to be a "hot-bed" of concrete enthusiasts, where the county commissioners made it their policy to use concrete for all bridge replacements in the early twentieth century. What is believed to be the first concrete through or "rainbow" arch in the nation was designed and built under the guidance of the Hamilton County Surveyor (pg. 54).

The selected bridges from this time period include eight closed spandrel filled arches, two open spandrel slab arches, and one rainbow arch. Those designers with structures represented in this period include Concrete Steel Engineering Co., E.A. Gast and Hugo Eichler, Walter P. Rice, Wilbur Watson, and Albert Zesiger. Builders with structures represented in this period include Burnett Construction, W. M. Brode & Co., and E. M. Gephart and R.E. Kline.

New Hudson Road Bridge
Orwell Township, Ashtabula County
County Road 6 (New Hudson Road)
Crosses Grand River
UTM Coordinates-17/508330/4599570

Closed spandrel filled arch
Builder: Burnett Construction
Designer: Unknown
Constructed: 1906
Structure File No. 0430056



Inset photograph from Marguerite McElroy collection.

Known locally as the New Hudson Road bridge, "the humpback bridge" or "the Roman Arch," this single-span filled arch over the Grand River in rural Ashtabula County is 170 feet in length with a clear span of 110 feet. The construction date, 1906, is formed in concrete on the parapets. It replaced a covered timber truss. At the time it was built, it was the longest concrete bridge in the county, according to County Commissioners' journals. The original construction bid was \$11,607. The inset shows the bridge at the time it was built.

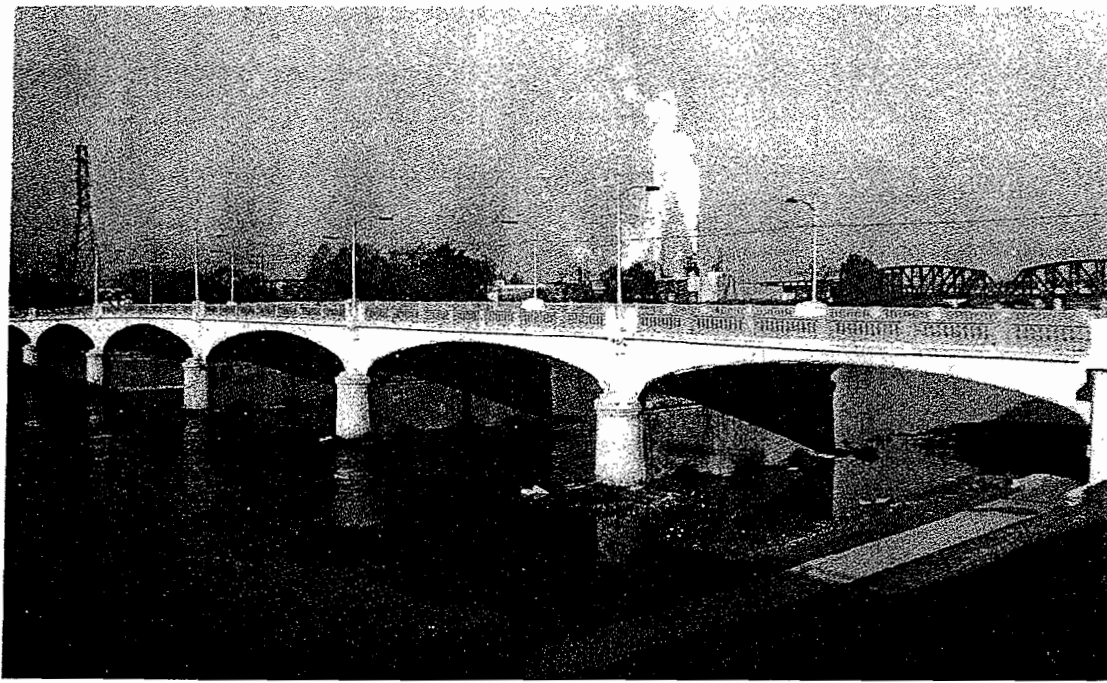
Neither the designer or his exact intentions in creating such a high arch are known.

Some have suggested that adequate clearance was being provided for river craft. Such deep arches are typical of the early period of concrete construction and may represent the designer's attempt to reduce tensile strains and increase the load capacity of the bridge.

Approach curves at both ends have led the county to post the bridge with signs requesting drivers to sound their horns before they cross. Because of these safety hazards and the deteriorated state of the concrete, the county plans to replace the existing structure with a new bridge.

Washington Street Bridge
Dayton, Montgomery County
Washington Street
Crosses Great Miami River
UTM Coordinates-16/740090/4403610

Closed spandrel filled arch
Builder: F.J. Cullen
Designer: William Mueser of Concrete
Steel Engineering Co., N.Y.
Constructed: 1906
Structure File No. 5760062



This bridge "replaced an old iron bowstring bridge that was too light for the heavy car traffic." (10) Each of the seven spans measures 90 feet and the total length of the bridge is 630 feet. It is one of at least five concrete arches designed by Concrete Steel Engineering Co. built in Dayton between 1902 and 1911. At the time concrete was still in its infancy making the Dayton bridges among the largest in the state and noteworthy for that reason alone. They required the contractor to devise special concrete mixing plants, perhaps the first time this had been done in the state. This series of Dayton bridges provided an important body of experience as each

project was modified to account for the lessons learned from the previous project.

Although the city of Dayton sustained very heavy damage all five of the concrete bridges survived the Great Flood of 1913 with little or no damage. Communities such as Piqua and Troy located upstream from Dayton on the Great Miami lost bridges to the flood water. As the Great Miami reaches Dayton, it takes on the flow from the Stillwater and Mad Rivers and Wolf Creek and its channel narrows progressively from eight hundred feet at the confluence with the Stillwater to five hundred feet at the southern edge of

Dayton so an increasing amount of water was funneled into an increasingly narrow channel.

The survival of the concrete bridges, all based on the Melan system from plans drawn up by the Concrete Steel

Engineering Co., William Mueser, engineer, was testimony to the concrete design expertise of this company and the durability of concrete. As a result, many of the communities affected by the flood requested concrete for their replacement bridges.

Broadway Street Bridge
Greenville, Darke County
State Route 49
Crosses Greenville Creek
UTM Coordinates-16/701230/4441670

Open spandrel slab arch
Builder: A.W. Yawger
Designer: W. P. Rice Engineering and
Albert Zesiger
Constructed: 1907-09
Structure File No. 1901176



The following is an excerpt from an article written by David Simmons Ohio County Engineer, 1984.

The Broadway Street bridge over Greenville creek in Greenville is one of the very few three-hinged arches built in the United States. This type of technology, with a hinge at the crown and one at each springing line, was developed principally in Germany, in the 1880s and 1890s, to prevent cracks from occurring in the concrete arch due to uneven settlement of

the foundations, changes in temperature, or uneven loading. According to L.A. Keith, Mansfield City Engineer, who designed a 40-foot span three-hinged arch built in Mansfield in 1904, the design eliminated the possibility of temperature stresses. It also permitted a lighter design than otherwise was possible resulting in a savings of materials. In this country, labor was more expensive than materials, so a bridge that minimized labor costs was more desirable than one which reduced expenses. Many American engineers felt, too, that the

hinges detracted from the aesthetic quality of the structure and lessened the appearance of solidity and rigidity which recommended a concrete arch in the first place. Consequently, the three hinged concrete arch never gained the popularity in the United States that it had in Europe and only a few of these bridges remain today. The 100 foot span of the Broadway Street bridge is plain concrete without reinforcing steel. The bridge's designer, Walter P. Rice of Cleveland, was a specialist in foundation work and chose the hinge design to accommodate soil conditions caused by springs at the site.

The bridge was locally controversial from the start. The cost was thought to be excessive and the technology too new to risk building a bridge of that length without reinforcing steel. Hinged concrete arches exceeding 100 feet had been built in Germany but most structures of this type in this country had been of more modest length. At least two years preceding construction were tied up in a sequence of local lawsuits and political controversy.

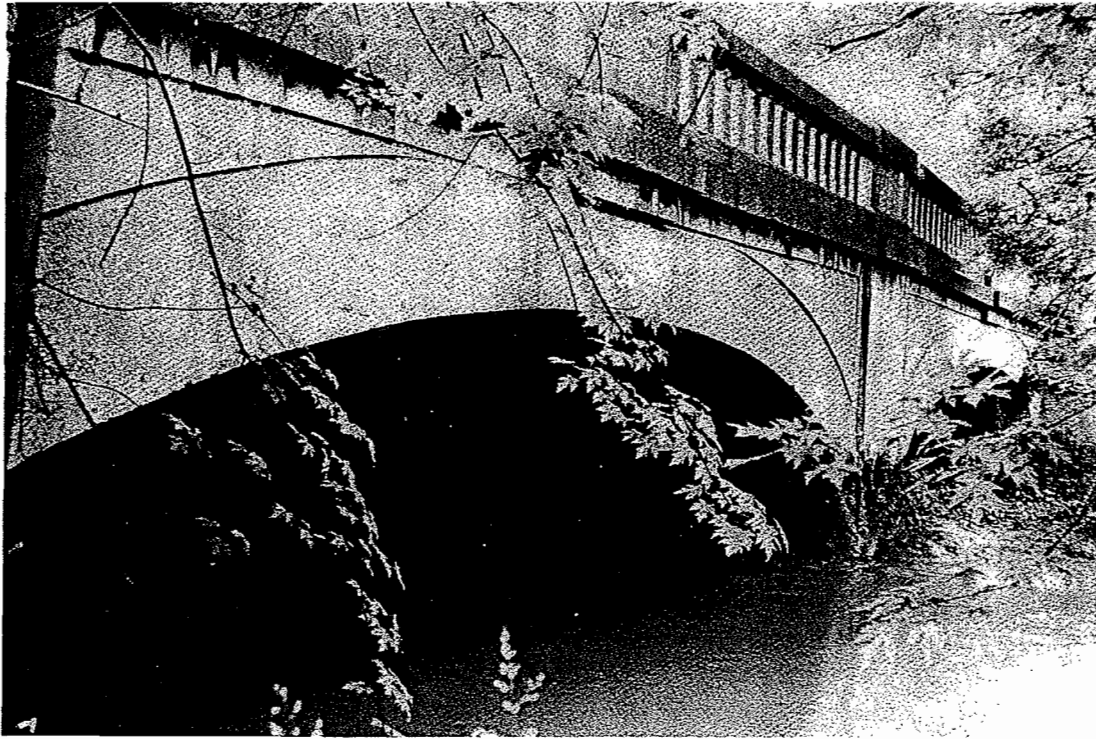
The bridge was completed in 1909. The original stone railings, balusters and railing posts were removed and replaced with cast-in-place concrete panel and post railings in 1938.

In 1983, the bridge was scheduled for replacement. Original plans for the structure could not be located so the office of Darke County Engineer James Surber conducted an independent analysis of the arch and proposed rehabilitation. Work began on November 29, 1989, and was completed December 15, 1990, by Beaty Construction, Boggstown, Indiana.

The rehabilitation included repair of the arch barrel, replacement of the reinforced concrete deck and support members and of the balustrade and urn-shaped balusters. The original appearance of the bridge was duplicated by using precast concrete balusters and cast-in-place railing posts and handrails. To permit use of concrete balusters and baluster railings cast in the style of the originals, unmountable curbs were installed to meet federal safety standards. Since this historically significant bridge was rehabilitated, it has become a center of local pride. The bridge now serves as the focal point of a scenic walkway along Greenville Creek connecting the site of historic Fort Greene Ville with a new public park. (11) The project received the Ohio Department of Transportation's annual Historic Bridge Preservation Award in 1992 in the rehabilitation category.

East 4th Street Bridge
Uhrichsville, Tuscarawas County
East 4th Street
Crosses Little Stillwater Creek
UTM Coordinates-17/471300/4471240

Closed spandrel filled arch
Builder: W.M. Brode & Co.
Designer: Unknown
Constructed: 1908
Structure File No. 7960298



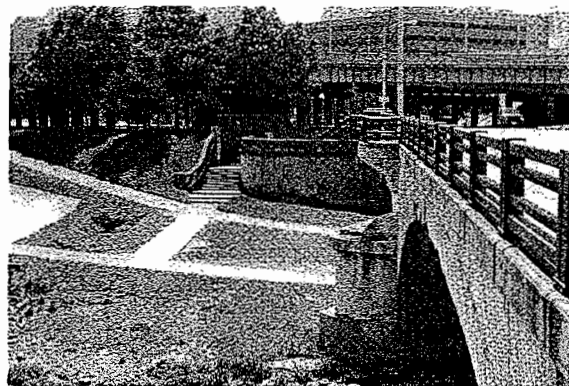
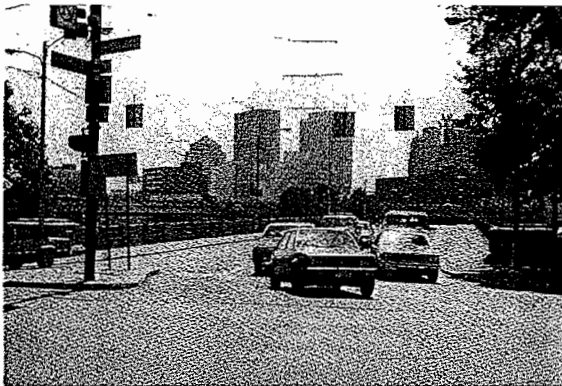
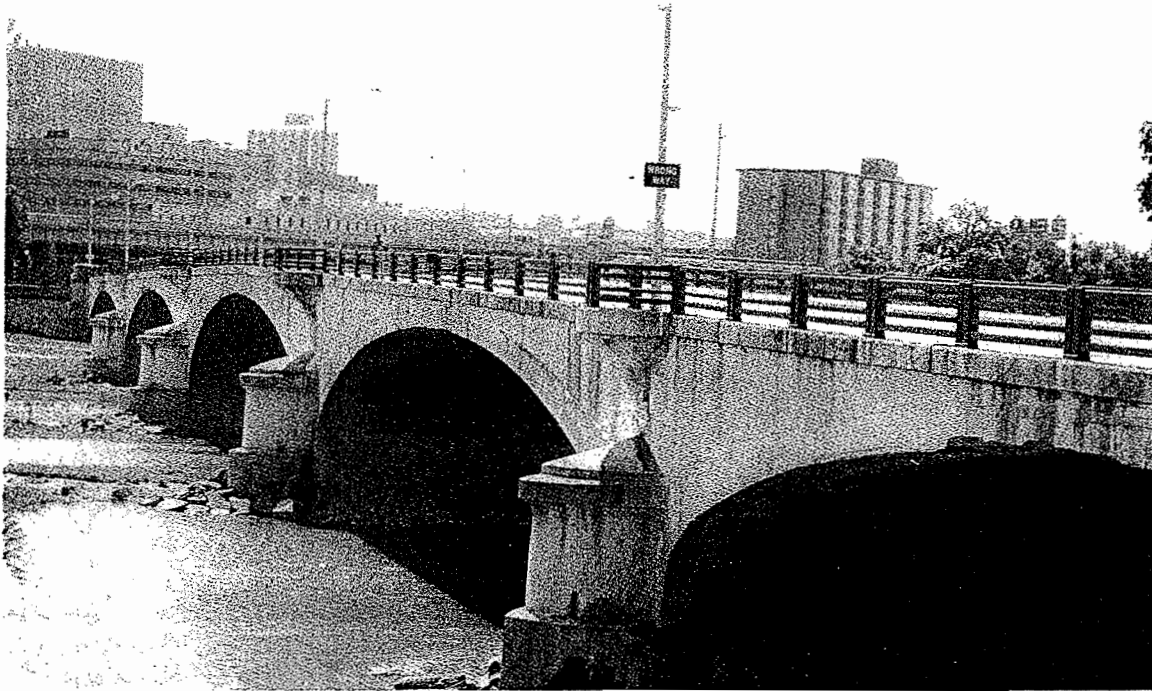
The two 50-foot elliptical arches of this 1908 bridge span Little Stillwater Creek in Uhrichsville. The structure is 126 feet in overall length and 40.2 feet wide. The concrete railings are open and the date of construction is formed in concrete on the northwest corner.

Although the designer of this bridge has not

been documented, the details of the arches their flatness, date, and location - all suggest that it was the work of E.J. Landor, designer of the concrete Y Bridge built in Zanesville in 1902. He also designed a four-span concrete arch bridge at nearby Canal Dover in 1905 that was very similar in appearance to the Uhrichsville structure.

Monument Avenue Bridge
Dayton, Montgomery County
Monument Avenue
Crosses Great Miami River
UTM Coordinates-16/739660/4405010

Closed spandrel filled arch
Builder: E.M. Gephart & R.E. Kline,
Dayton
Designer: William Mueser, Concrete
Steel Engineering Co., N.Y.
Constructed: 1908-09
Structure File No. 5704030



Constructed in 1908-09 by E.M. Gephart and R.E. Kline of Dayton, this bridge features steps leading to the Great Miami River from the northeast and northwest portals. It is one of at least five concrete

arch bridges designed by the nationally prominent Concrete Steel Engineering Co. of New York and built in Dayton between 1902 and 1911. Together they represent the state's earliest group of large-scale

concrete bridge designed specifically for an urban center by a single engineering firm. All five of these bridges survived the devastation of the 1913 flood. Two have since been replaced. The others are included in this chapter - the Washington Street bridge (pg. 44), the Stewart Street

bridge (pg. 58) and the subject bridge. Dayton contractor Kline was involved in the construction of several major concrete arches over the Great Miami River within the Gem City during the early years of the twentieth century.

Cuyahoga County
Conrail
Crosses County Road 178 (Barrett Rd.)
UTM Coordinates-17/427640/4580640

Open spandrel slab arch
Builder: Unknown
Designer: Unknown
Constructed: 1909
Structure File No. 1840053



Early in the 20th century, the chief engineer of one of the greatest American railroad systems was quoted as saying that concrete would not be used by that company because he did not believe, and no one could make him believe, that man could make as good a building stone as that made by the Creator. But concrete soon became a standard building material for railroad systems, where it was used to construct bridges which formerly would have been built of cut stone. Though concrete bridges were thought by some to lack the charm of stone work, many of them had their own

aesthetic appeal. Engineers and architects collaborated in designing and building concrete railroad and highway bridges of pleasing forms appropriate to the new material.

This railroad bridge located in Berea carries Conrail over County Road 178 (Barrett Road).

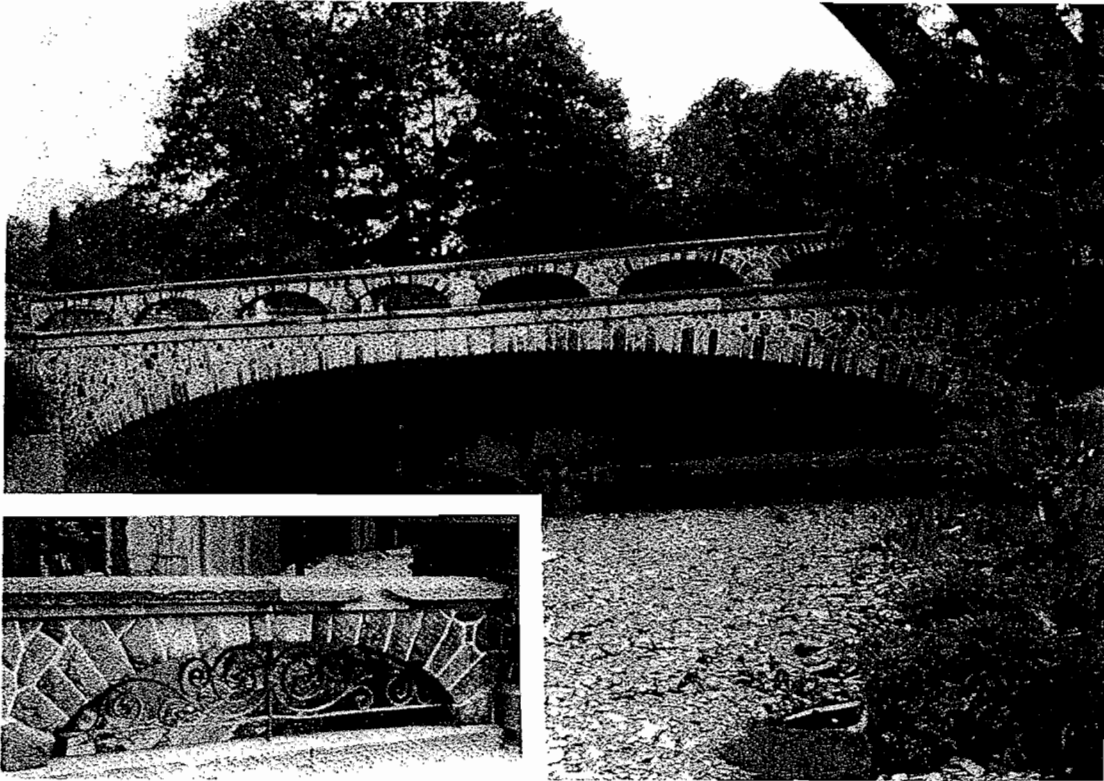
The date of its construction, 1909, is engraved on the piers of the three-span structure. The center span measures 134 feet and is flanked by two 64-foot spans.

For spans of greater than 100 feet, open spandrel construction, either columnated or arched, was used in place of solid spandrel walls. Although this increased the amount of formwork necessary, it reduced the quantity of both concrete and fill, thereby resulting in a more economical structure.

The open spandrel configuration used by the designer of this bridge is distinctive in its mass and semi-circular arcading that contrasts with subsequent examples. Dating to the earliest period of this structural type, it may represent the novelty of the technology for the designer and an attempt to "overdesign" and compensate for uncertainty.

Brookside Park Big Creek Bridge
Cleveland, Cuyahoga County
Brookside Park Drive
Crosses Big Creek
UTM Coordinates-17/440100/4588630

Closed spandrel filled arch
Builder: Unknown
Designer: A.W. Zesiger and W.A.
Stinchcomb
Constructed: 1909
Structure File No. 1867318



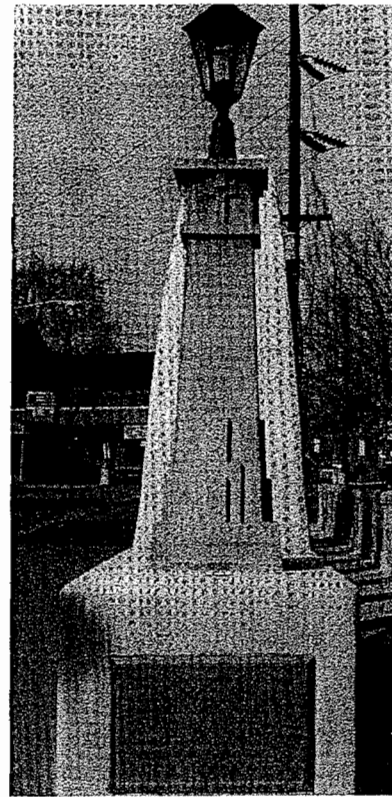
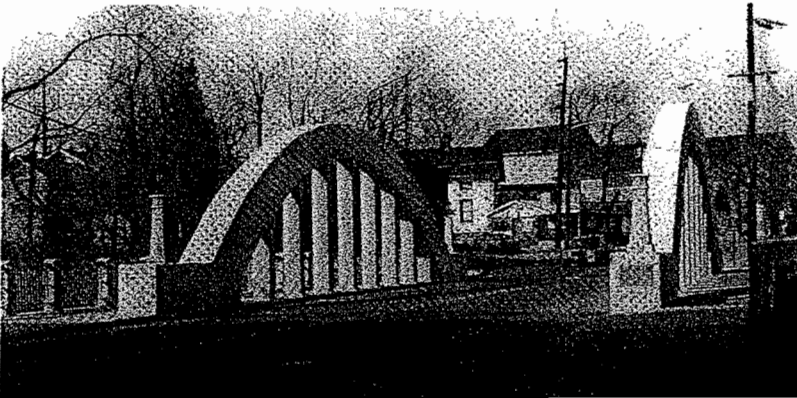
The following information is adapted from HAER Inventory Form P. 404 205.

The three-hinged concrete arch in Brookside Park, designed in 1906 by assistant Cleveland park engineer A.W. Zesiger, was one of the first of its kind in this country. It carried pedestrians over Big Creek. Subsequent construction in the area required that it be removed. Zesiger co-designed this identical 1909 park structure with W.A. Stinchcomb, Chief Engineer of the Park Commission.

One of numerous stone or stone-faced bridges in Cleveland's park system, this bridge was constructed of unreinforced concrete. Its hinges are built up of plates, angles, steel shafting, and cast iron bearing plates embedded in concrete. Faced with rubble stone, the bridge arches 66 feet over Big Creek and is positioned at a slight skew to the creek bed. The parapet is formed of a series of arches which are filled with wrought iron scrollwork, the bridge now serves as a pedestrian walkway and service road.

Benson Street Bridge
Lockland & Reading, Hamilton County
Benson Street
Crosses W. Fork of Mill Creek
UTM Coordinates-16/719729/4336870

Rainbow arch
Builder: Unknown
Designers: E.A. Gast and
Hugo Eichler
Constructed: 1909
Structure File No. 3137600



Top photograph from the collection of the Hamilton County Engineer.

The top photograph shows the bridge in the 1930s, the bottom shows the bridge after rehabilitation, on the right is a new lamppost.

The following is adapted from an article by David Simmons that appeared in Ohio County Engineer, Summer, 1985, and an article by E.A. Gast that appeared in Good Roads, May, 1911.

The Benson Street bridge is the first rainbow arch bridge built in Ohio and is believed to be the first of this type constructed in the country.

Connecting Lockland and Reading, the bridge rests on stone abutments that were built in the 1860s for its metal truss predecessor.

The concrete bowstring bridge design originated in Europe in the early years of the 20th century. The first recorded example of this type of bridge was designed and built by M.A. Considere in France in 1904. The structure essentially duplicated in reinforced concrete the lines of a 19th century bowstring metal truss with its main arches, diagonal braces and verticals comprising the "bow" and

the horizontal lower chord in tension as the "string." Apparently the first American example of what has become known as a "rainbow concrete arch" was built in 1908 in Nashville, Tennessee, after a design by Howard M. Jones, engineer for the Cumberland River Bridge Commission, as a deck truss. The design was criticized by the engineering establishment. The editors of the Engineering News were particularly critical of the design for its creation of secondary stresses. They also expressed doubts that a concrete truss could withstand the repeated vibration of heavy traffic use. The bridge, however, still stands in Nashville.

Hamilton County, Ohio, was a place where concrete technology was readily accepted. The Melan Arch (pg. 34) in Cincinnati was one of the first concrete bridges built in the country. As the discussion of the merits of concrete bowstring bridges was occurring in engineering literature, it became necessary to replace the bridge between Lockland and Reading. Because of the flood potential of the waterway, a more typical filled concrete arch was not practical at this location. The design of the new bridge was conceived by E.A. Gast, the Hamilton County Deputy Surveyor at the time. The bridge was featured in an article published in May, 1911, in Good Roads, the national magazine of the Good Roads Federation. The following description of the bridge is adapted from that article.

It was decided to construct a bridge of 73 feet span, carrying a 31 foot roadway and two 9-1/2 foot sidewalks, and estimates were made for a steel girder bridge and for a reinforced concrete structure. The estimated cost of the former was \$11,000 and that of the concrete bridge \$8,600. The commissioners decided in favor of the concrete bridge, plans were prepared, and the present structure erected.

Two hingeless reinforced arch ribs rise above the roadway. The floor is hung from them by

eighteen hangers of reinforced concrete. The thrust is taken up by steel rods in the plane of the floor between the ends of the arches and tied to the steel in the ribs. Thus only the vertical load is carried by the abutments. The bridge floor is of the slab and transverse girder design, with cantilevered sidewalks. Each girder is attached to the two transversely opposite hangers, the hanger reinforcement is tied at top and bottom to the steel in the ribs and in the girders.

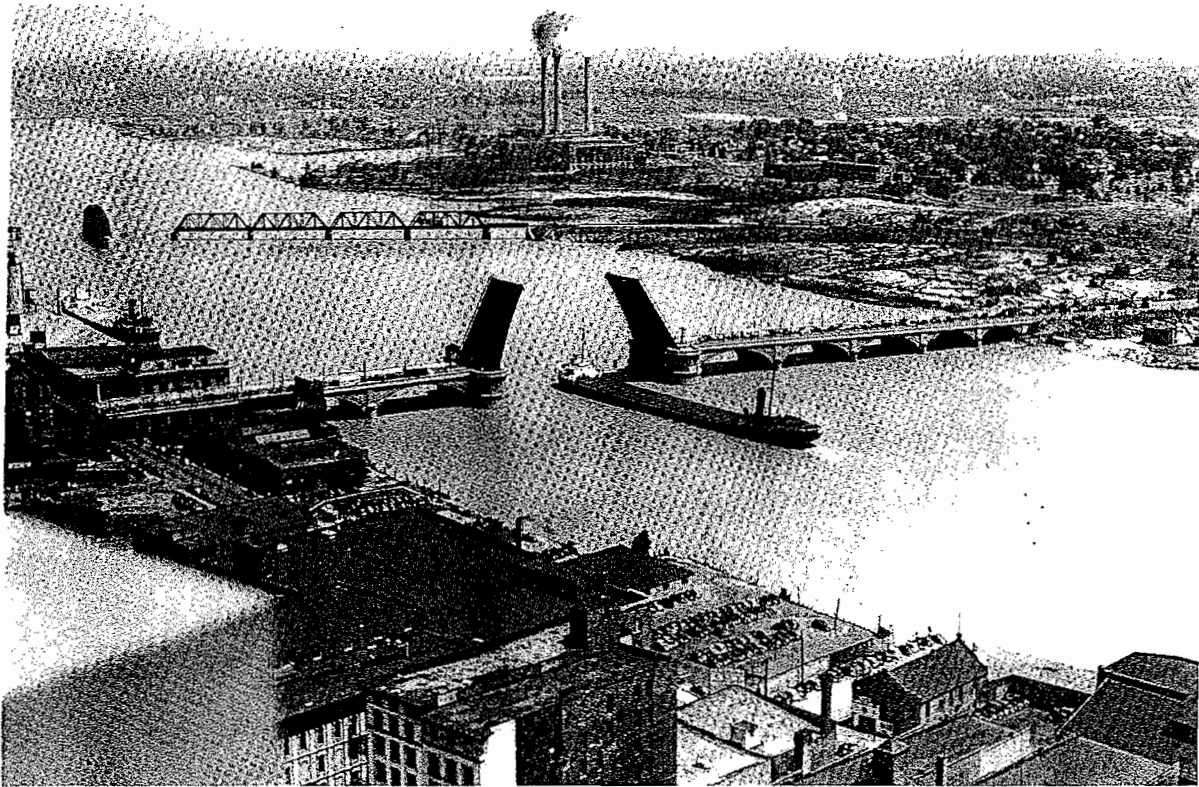
The concrete rainbow design gained popularity among state highway bridge builders and significant numbers were built in Ohio in the 1920s. The Department of Highways developed standard plans for this design.

In the mid-1970s, the deck of the Benson Street bridge was replaced. By the mid 1980s, the bridge was again in need of repair and a proposed Army Corps of Engineers project to widen the channel of Mill Creek to 100 feet also threatened complete removal. Local sentiment favored keeping the bridge, which is a popular landmark. The Corps' first rechannelization plan proved unrealistic and the decision was made to widen the channel to 75 feet and deepen it by several feet. The project began well downstream of the bridge and is proceeding slowly upstream, delayed by problems with hazardous waste in this heavily industrial area. If the project reaches as far upstream as the bridge, an abutment will be moved back to give the required two feet.

The 1992 rehabilitation project included removal and replacement of the deck and floor beams, including reinforcing steel. The deteriorated concrete on the arches and buttresses was removed, to a depth of two feet in some places, replaced and sealed. The precast concrete handrail posts and lampposts were installed last. A plaque at either end of the bridge commemorates its history as a link between neighboring communities.(12)

Cherry Street Bridge
Toledo, Lucas County
Cherry Street
Crosses Maumee River and Water Street
UTM Coordinates-17/289490/4614060

Closed spandrel filled arch
Builders: C.H. Fath and Son Construction and National Foundation and Engineering Co.
Designer: Wilbur Watson, Osborn Engineering Co.
Constructed: 1910-14
Structure File No. 4860004



The Cherry Street bridge is significant as an example of the work of Wilbur Watson and for its extensive use of neo-classical detailing. Built in downtown Toledo, it shows the attention to detail typical of urban structures of the period.

The following is an excerpt from Paper No. 1362 Presented Dec. 1915 and published in Transactions, American Society of Civil Engineers, Dec., 1915; and from Bridge Architecture, by Wilbur Watson.

The 17 spans of the Cherry Street bridge in

Toledo cross the Maumee River and Water Street. Its overall length is 1,217 feet. The western approach to the bridge is a concrete beam, the river spans are elliptical concrete arches and the main span is a double leaf Sherzer bascule which provides a 200 foot clear opening for the passage of boats. Construction of the bridge began in 1910 and was completed in 1914. The bridge was constructed in longitudinal halves. The north portion was completed first, paralleling the old bridge - a metal truss - which was removed. The arches then were extended to their full

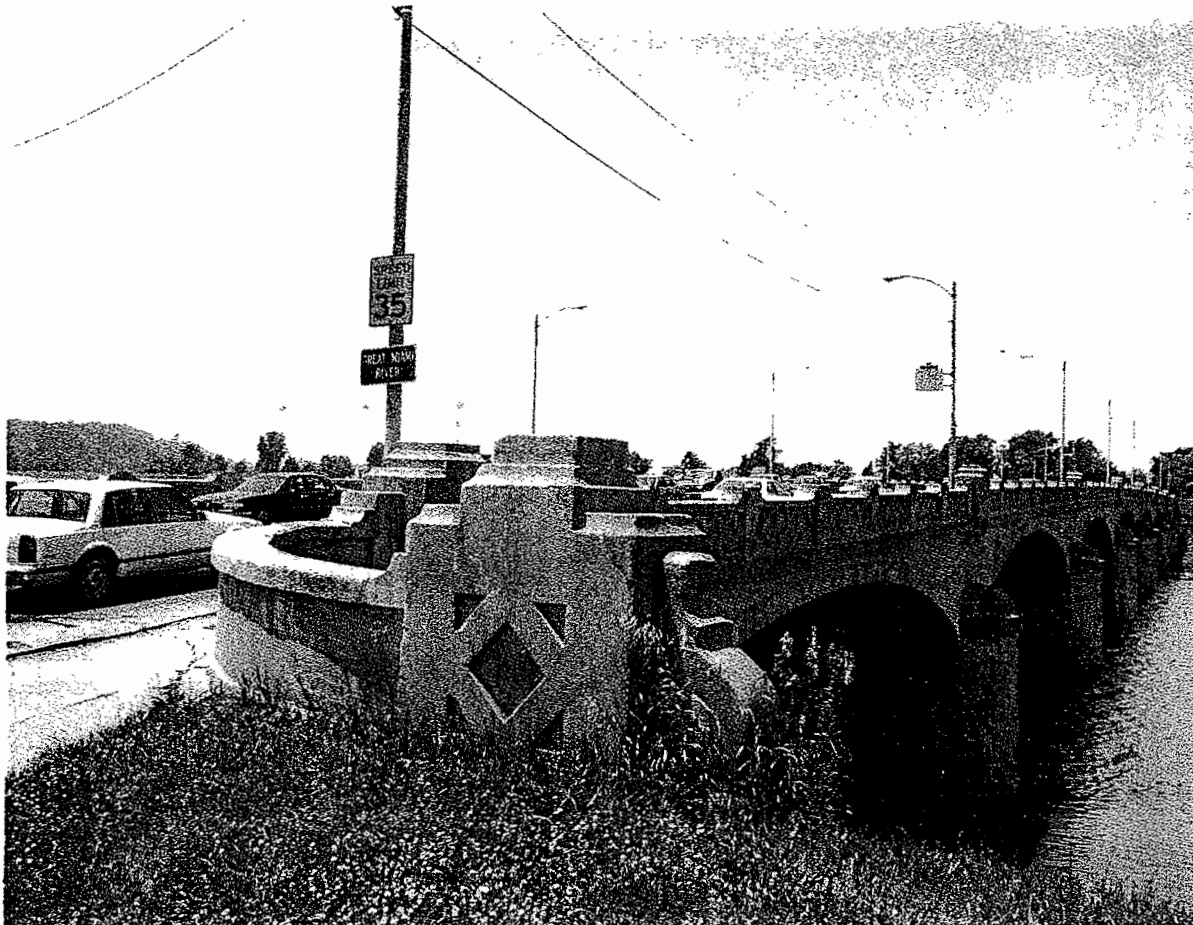
width of 73 feet, 10 inches. The construction of the bridge in longitudinal halves necessitated a central spandrel wall to retain the fill in the north half until the completion of the whole bridge. For this, a reinforced concrete wall, 18 inches thick, was designed. Maintaining river traffic through both bridges during the construction of the new one required the layout of a new channel so the old draw bridge might be swung one way until the new bridge went into use.

To the east of the channel there are five spans, decreasing in length from 108 feet to 66 feet 6 inches and in rise from 28 feet 6 inches to 16 feet, in order to conform to the grade. To the west there are two more of the 108 foot arches - the grade here being taken care of by dropping both ends of the arch nearest the shore by 1-1/2 feet. The original design of the

Cherry Street bridge was made by the Osborn Engineering Company of Cleveland under the direction of Wilbur J. Watson, Bridge Engineer of that company, and modified by Ralph Modjeski. The massive abutment piers which carry the bascule span have octagonal ends intended to carry ornamental towers designed by Arnold W. Brunner. These towers were never built because of lack of funds. The main construction contract, except for the bascule span, was in the hands of the C.H. Fath and Son Construction Company until the season of 1913 when the National Foundation and Engineering Company was organized to complete the work. The contract for the Scherzer span was assigned to the Toledo Bridge and Crane Company and the steel was erected by the Kettler-Elliott Erection Company.

Stewart Street Bridge
Dayton, Montgomery County
Stewart Street
Crosses Great Miami River
UTM Coordinates-16/740520/4402470

Closed spandrel filled arch
Builder: E.M Gephart and R.E. Kline
Designer: Concrete Steel Engineering
Co., N.Y.
Constructed: 1911
Structure File No. 5760003

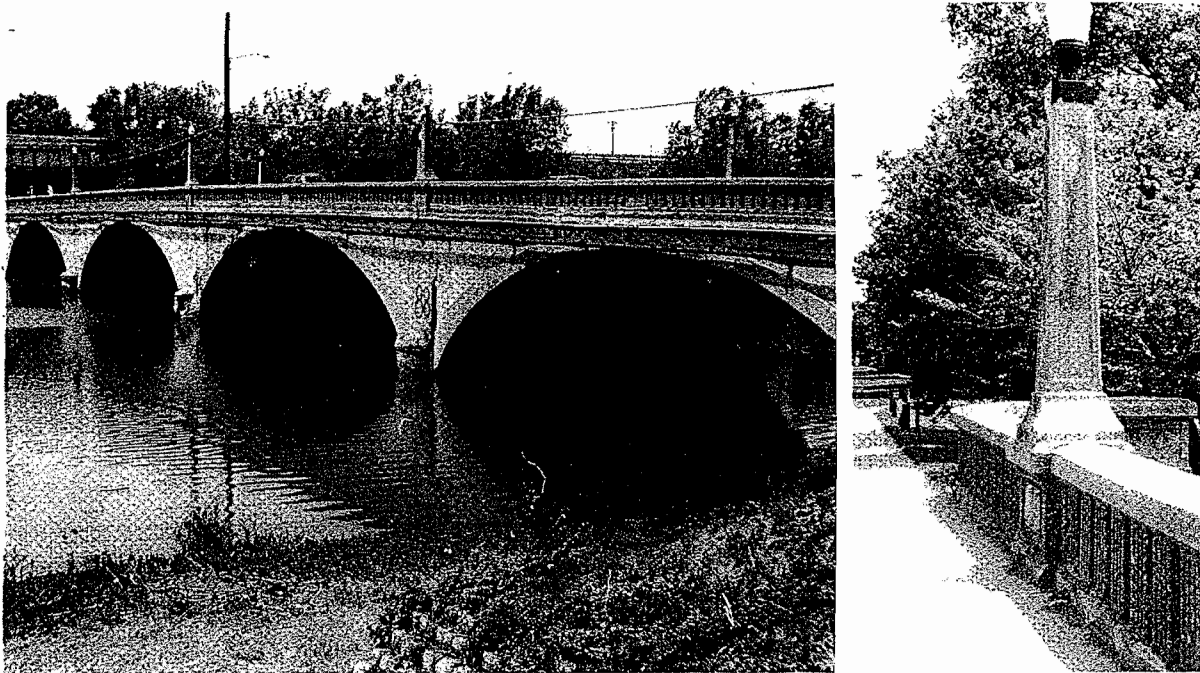


The seven spans of this filled arch carry Stewart Street in Dayton over the Great Miami River. Each of the spans measures 86 feet. The bridge was built in 1911 by E.M. Gephart and R.E. Kline of Dayton and designed by Concrete Steel Engineering Co., New York. The cast concrete railings feature an unusual

lattice-like pattern. Like the other two remaining concrete arch bridges built in Dayton during this period - Washington Street (pg. 44) and Monument Avenue (pg. 49) - its survival of the destructive 1913 flood is a testimony to the expertise of the designers.

King Avenue Bridge
Columbus, Franklin County
King Avenue
Crosses Olentangy River
UTM Coordinates-17/327180/4428485

Closed spandrel filled arch
Builder: Unknown
Designers: Wilbur Watson and Walter Braun
Constructed: 1912-13
Rehabilitated: 1971
Structure File No. 2531658

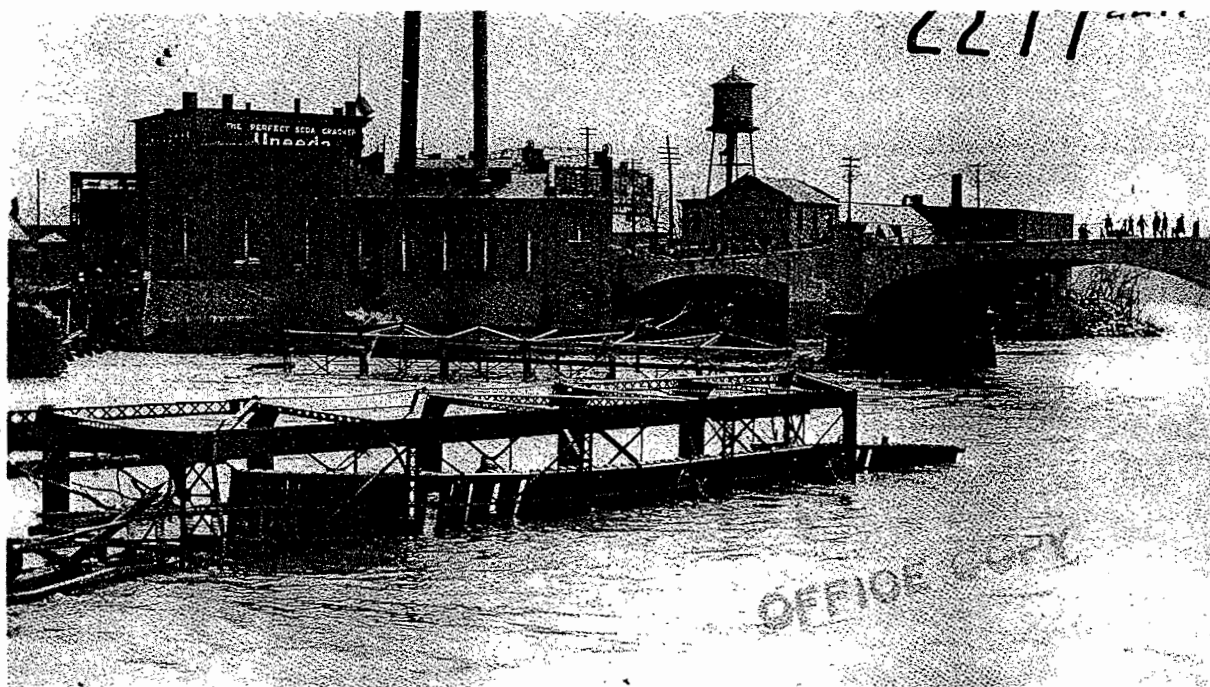


Significant as an example of Wilbur Watson's work, the King Avenue bridge comprises four elliptical arches. The 110 ft. arches have a clear opening of 85 feet. The overall length is 415 feet and the width is 47 feet. Watson considered this bridge typical of its kind, although greater pains were taken to obtain pleasing lines. He described the bridge in a 1927 publication as follows:

The essential features of this bridge may be described as the use of perfect ellipses for the intradosal curves, curved cutwaters for the

piers, curved retaining walls at the abutments and a carefully executed parapet. Another feature of this bridge is the light color, almost white, obtained by the use of selected aggregates (white limestone) for the concrete. No attempt to imitate cut stone masonry is made. The slight projection of the pilasters, only a few inches, is enough to provide a line for the necessary expansion joints. The treatment of the wing walls at the abutments, which are curved, instead of straight, is a detail not expensive to carry out in concrete.(13)

Chapter Nine 1913-1920: Concrete Comes Into Its Own In Ohio



This 1913 photograph shows the concrete Y bridge in Zanesville, built 1900-1902. In the foreground are two metal truss bridges which have fallen victim to the 1913 flood.

The spring floods of 1913 which destroyed bridges across the state mark the beginning of this era of bridge building in Ohio.

Meteorological forces converged in March of that year to produce the worst flooding ever recorded in some parts of the state. All major rivers in Ohio overflowed their banks.

Particularly hard-hit were communities in the valley of the Great Miami River.

In the aftermath of this natural disaster, state and local governments recognized the need for flood control measures. In 1914, the Ohio legislature provided for establishment of conservancy districts to prevent floods and protect cities, villages, farms and highways from inundation. A few of these were large, multiple county agencies but more commonly they were one or two-county organizations

with responsibility for local flood control projects.

Despite litigation and constitutional challenges, the Miami Conservancy District was organized in 1915 with the city of Dayton taking the lead in forwarding this flood control program for the Miami Valley.

By early the next year, the engineering department of the District had prepared an official plan for construction of five earthen dams across the Great Miami River and its tributaries. The plan also detailed proposals for local flood protection including the building of levees and revetments along river banks, widening and deepening of channels, and raising and lengthening bridges to permit greater flow around them.



This pontoon bridge was erected in Hamilton to replace a metal truss bridge lost in the 1913 flood. The present High-Main Street bridge (facing page) now carries traffic at this location.

Early in 1917, while the state was still addressing the aftermath of the 1913 flood, the United States declared war on Germany. This declaration had a marked effect in shaping the program of the Department of Highways for several years.(14) In addition to the immediate effect of making the improvement of routes affecting war operations the Department's first priority, the war increased the cost of steel and caused delays in obtaining it.

A significant trend of this era in Ohio bridge building was the increasing acceptance of the reinforced concrete bridge. The design of any long-span bridge was no longer automatically restricted to the use of steel, but rather dependent on a case-by-case assessment of comparative costs for concrete and steel.

Instead of concentration in isolated locations in Ohio, enthusiasm for concrete grew gradually throughout the state during this period. Statis-

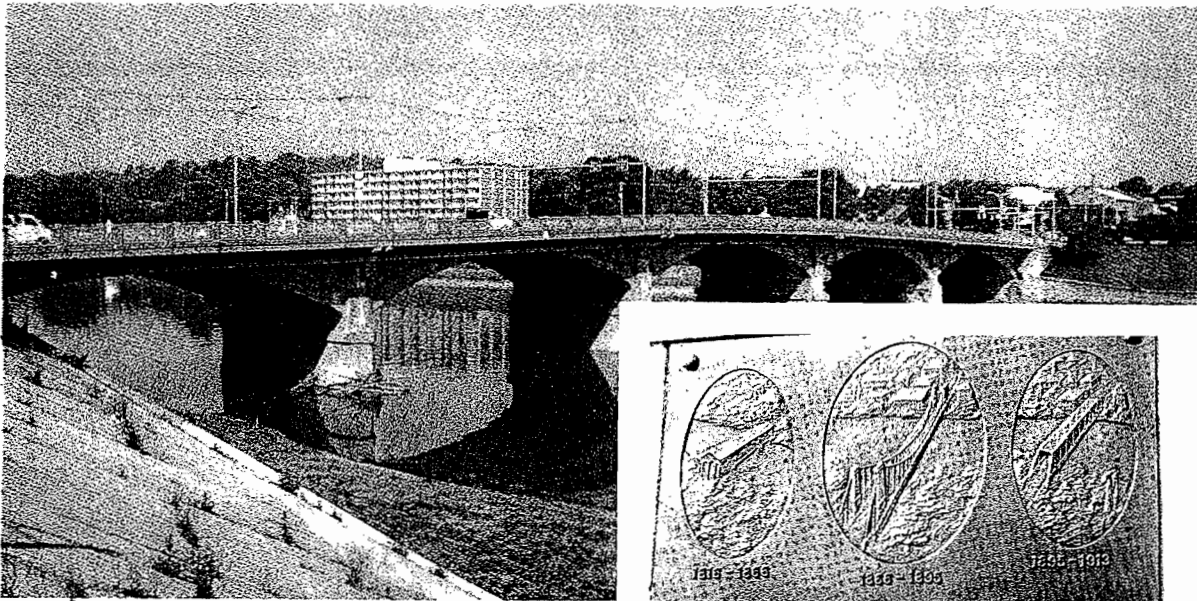
tics indicate, however, that concrete was used for nearly three-fourths of the short-span structures (those 10 to 19 feet in length) during these years, while only a third of the bridges longer than 20 feet were built of concrete. This would suggest that many engineers and/or public officials still felt the material required more testing before general adoption.

Private consulting engineers such as Daniel B. Luten in Indianapolis and Wilbur Watson in Cleveland continued to develop the market for their services at the county and municipal level.

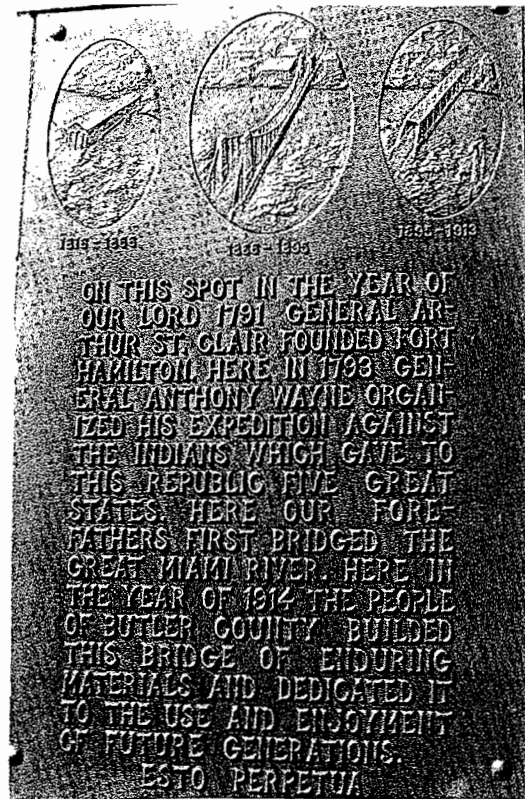
Among the Selected bridges in this time period are two of the oldest remaining open spandrel rib arches - the Park Avenue Bridge in Cincinnati, Hamilton County; and the Lanterman Falls Bridge in Youngstown, Mahoning County. The other Selected bridges from this period are three closed spandrel filled arches.

Hamilton, Butler County
State Route 129 (High-Main Street)
Crosses Great Miami River
UTM Coordinates-16/709640/4363940

Closed spandrel filled arch
Builder: A.W. Yawger & Co.
Designer: Unknown
Constructed: 1914
Structure File No. 0903361



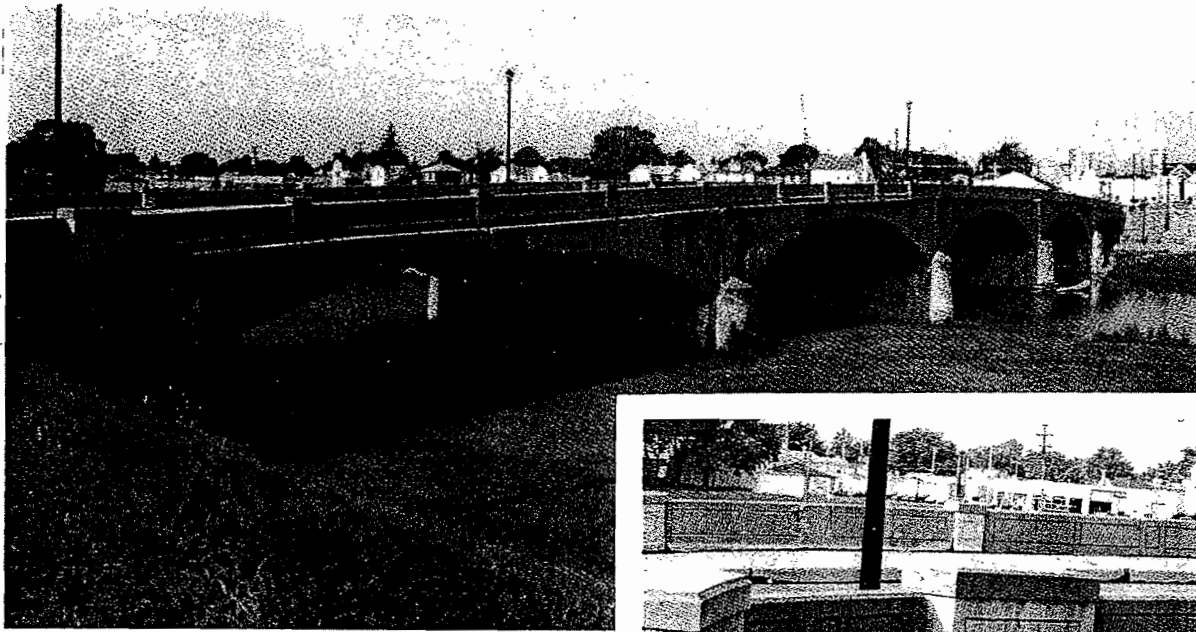
The High-Main St. bridge stands at the site of the first bridge built over the Great Miami River in Hamilton. The first bridge, a covered timber truss, was built in 1819. That bridge linked the site at Fort Hamilton (1791-1797) on the east side of the river, with Rossville on the west bank. A suspension bridge replaced the covered bridge in 1867 and, in turn, was replaced by a metal truss in 1896. The metal truss bridge was destroyed by the 1913 flood which swept away all four of Hamilton's bridges. Construction of the High-Main Street bridge began in 1914 and the new bridge was dedicated May 6, 1915. Each of the five spans measures 95 feet. Special pains were taken to design and fabricate piers that would not be undermined by future floods and to add decorative detailing to the spandrel walls and railings that would complement its urban setting. The Soldier's and Sailor's Monument stands near the southeast corner of the bridge.



The bridge is located within the boundaries of the proposed Historic Hamilton Civic Center historic district that includes municipal and other public buildings and a commemorative park reflecting the City Beautiful movement philosophy of civic improvements and public works.

Shawnee Bridge
Piqua, Miami County
East Main Street
Crosses Great Miami River
UTM Coordinates-16/735200/4446440

Closed spandrel filled arch
Builder: Hackedorn
Contracting Co.
Designer: Daniel B. Luten
Constructed: 1914-15
Structure File No. 5535972



The following is adapted from an article by David Simmons that appeared in Ohio County Engineer, Spring, 1993.

Piqua's Shawnee bridge, built following the 1913 flood, represents the community's efforts to rebuild in the wake of this natural disaster and demonstrates the increasing credibility given to concrete structures after the flood. All of Piqua's bridges were damaged by the water and debris that roared down the Miami Valley but only two - the Shawnee bridge, an 1886 iron through truss, and another metal truss located south of the Shawnee bridge - had spans that were actually destroyed.

Although Miami County lost more than three dozen bridges to the flood, the county commissioners identified repair or replacement



of the Shawnee bridge as their first priority. Within a month they had hired a contractor to use county materials to build a temporary trestlework to replace the two spans that were washed out.

Public sentiment favored erection of a new concrete bridge at the site as a permanent replacement for the metal truss. Two concrete bridges had just been built in nearby Troy and their survival of the flood was taken as testimony of their durability. One bridge, the Adams Street bridge, was so new it still had the piling in place. This transformed the bridge into a dam during the flood, further testifying to the strength of such structures.

The crusade for a concrete bridge was led by local inventor and manufacturer G.W. Lorimer, a strong proponent of the use of concrete. He worked so tirelessly to promote the bridge that it became known as the "Lorimer bridge."

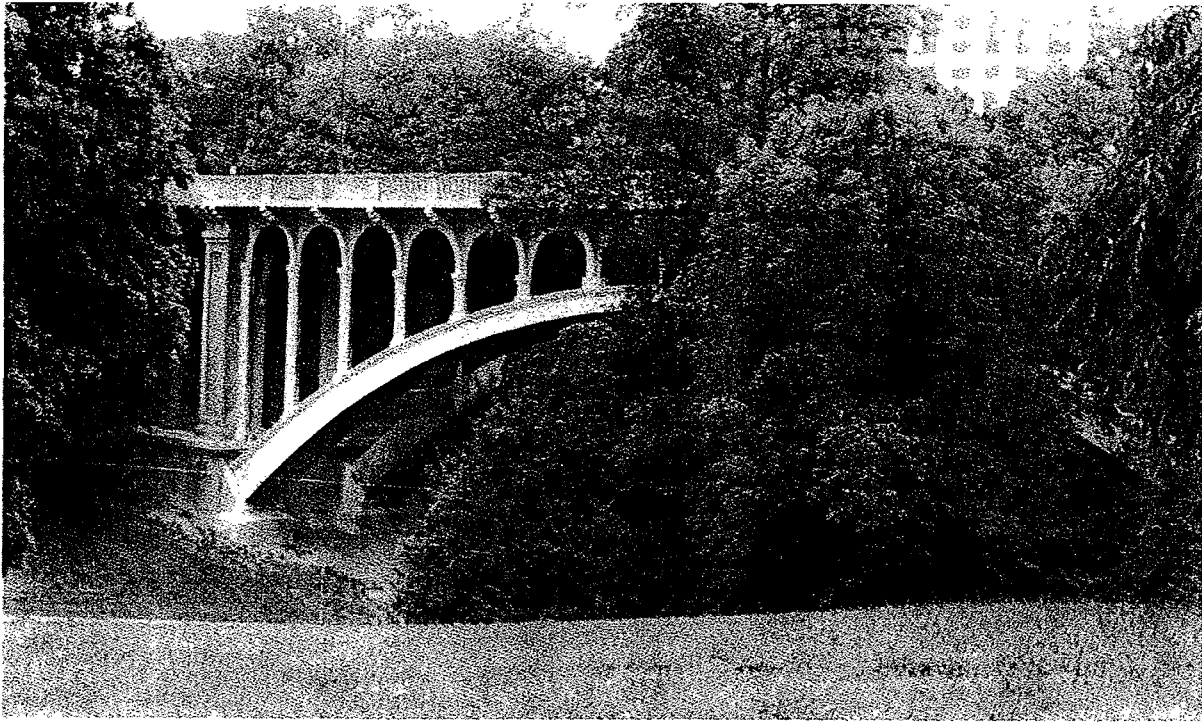
Because a number of bridges designed by Daniel Luten had survived the 1913 flood, the

commissioners hired him to design the new bridge. The design was coordinated with the new Miami Conservancy District plans. Both ends of the bridge had to be substantially raised to accommodate the elevated levees proposed by the district engineers. The county must also have taken advantage of hydraulic studies performed by district personnel, because a report published in 1916 stated that the new bridge would "not be interfered with during maximum high water."

The Shawnee or "Lorimer bridge" was opened in June of 1914, one of a handful of concrete bridges built in Miami County to replace metal truss bridges lost in the flood. Most of the destroyed bridges were replaced by metal trusses.

Park Avenue Bridge
Cincinnati, Hamilton County
Victory Parkway
Crosses Kemper Lane
UTM Coordinates-16/717240/4332840

Open spandrel rib arch
Builder: D.P. Foley
Designer: J. Robert Biedinger
Constructed: 1917
Structure File No. 3160777



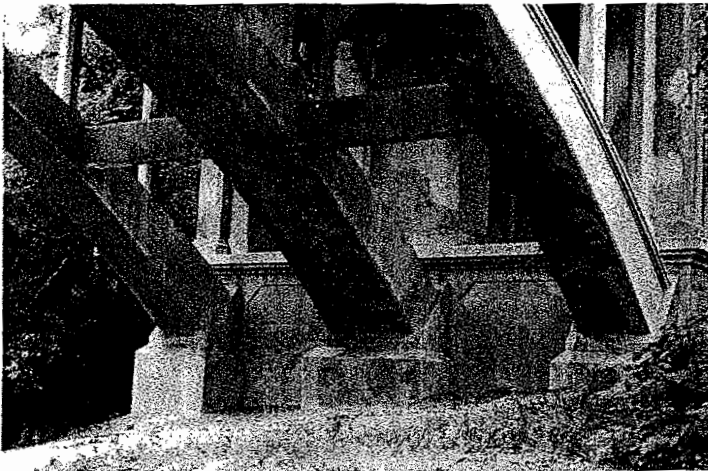
Portions of the following are adapted from an article by David Simmons, Ohio County Engineer, Summer, 1993.

The Park Avenue bridge consists of one main 180-foot arch over Kemper Lane with symmetrically placed smaller approach arch structures on either side. The height of the main arch is 31 feet from the center of the top portion of the arch to the center of the bearing. The deck slab is supported by fifteen smaller continuous arches which bear directly on the larger arch.

When the staff of Cincinnati's Engineering Department decided to replace the iron truss bridge that carried Park Avenue over a ravine at the north end of Eden Park, they wanted an

"ornamental design" that would complement the park setting.

Following construction of Ohio's first concrete bridge in Eden Park in 1895 (pg. 34), Cincinnati had been a "hotbed" of construction activity in the new material. By the time the decision to replace the Park Avenue bridge had been made, it had become city policy to replace a few wooden and metal bridges each year with the goal of eventually having "none but concrete bridges." (15) The Park Avenue bridge was designed by J. Robert Biedinger, an assistant engineer in the city's Engineering Department. Little is known about his specific inspiration for this design, but its attention to detail shows a sensitivity to architectural design and embellishment. The



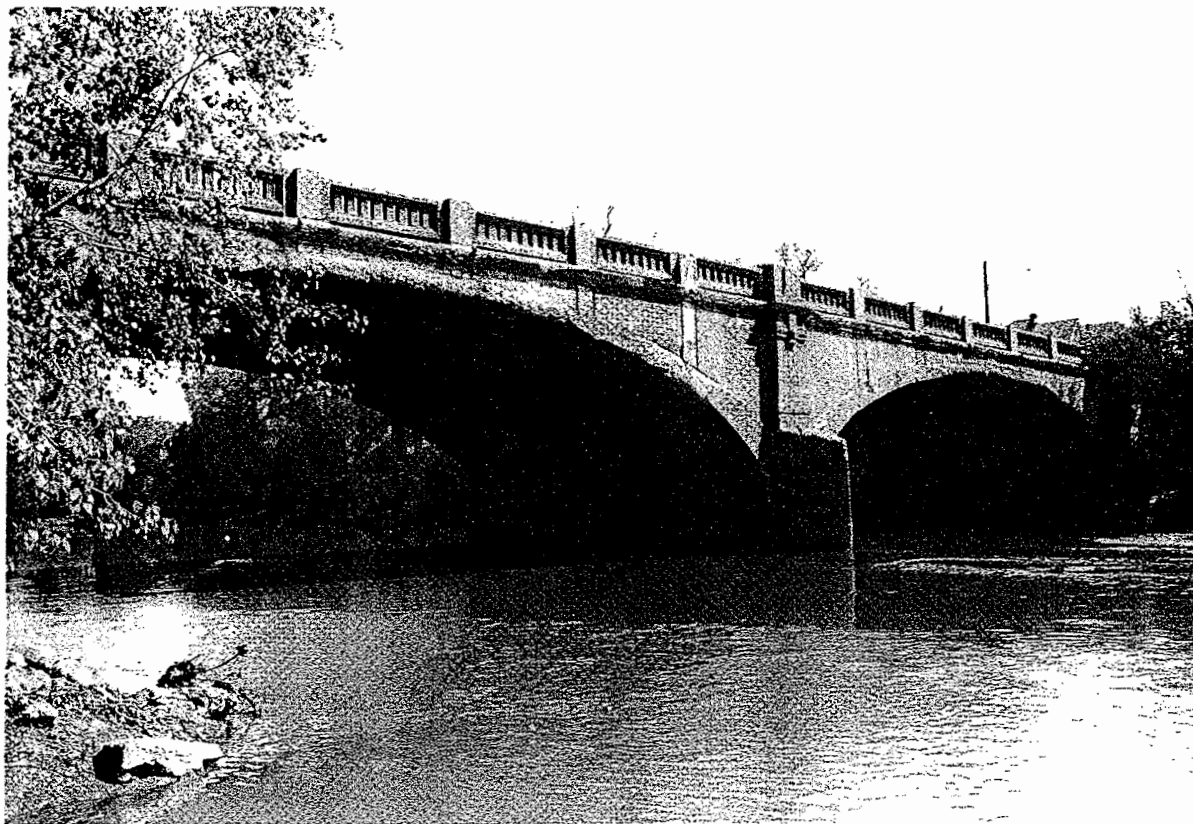
round arch arcade created within the open spandrel, the hexagonal shaped columns with capitals and bases, and the moldings give the bridge the overall feeling of a Romanesque structure. As was typical, massive skewbacks and abutments for the main arches provided the sense of solidity, especially in arch footings, sought by American engineers. This was primarily done in the interest of aesthetics, for the interior of what appeared to be solid concrete abutments were actually divided into cellular ribs. As always in America, final design decisions were heavily influenced by economics. Biedinger's own difficulty in using the elastic theory was shown in his revelation in an article in Engineering Record, that the spandrel arches were designed as beams and

not true arches, although the latter should have allowed for a "lighter" design. If Romanesque structures and stone arch bridges were his models, the engineer would have had little interest in that possibility.(16)

The bridge has undergone repairs several times since its construction. In 1935, the concrete sidewalk slabs and concrete railings were replaced. The roadway structural slab and top portion of the concrete support beams were replaced in 1939. Guniting repairs were performed on the substructure in 1944 and again in 1990. In 1988, the wearing surface and walks were overlayed with latex modified concrete and a cathodic protection system was installed.

West Third Avenue Bridge
Columbus, Franklin County
West Third Avenue
Crosses Olentangy River
UTM Coordinates-17/327420/4427730

Closed spandrel filled arch
Builder: Robert H. Evans & Co.
Designer: Wilbur Watson & Co.
Constructed: 1919
Structure File No. 2531844

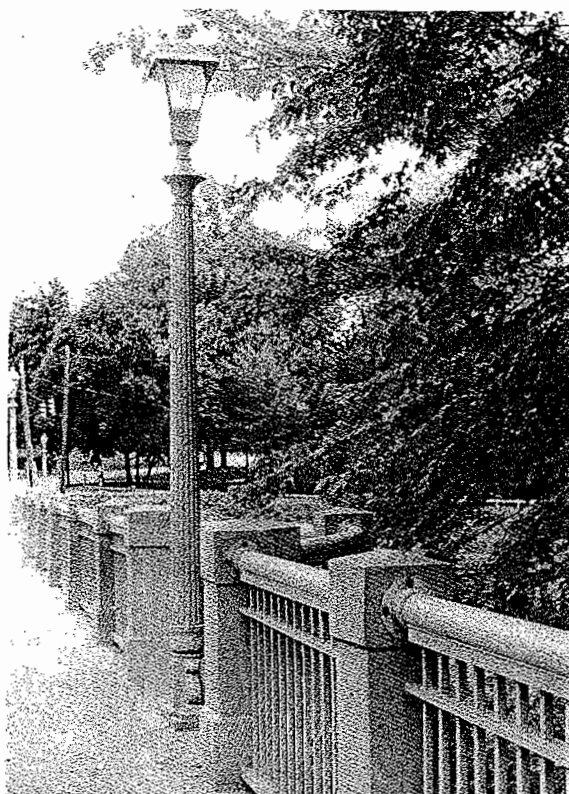
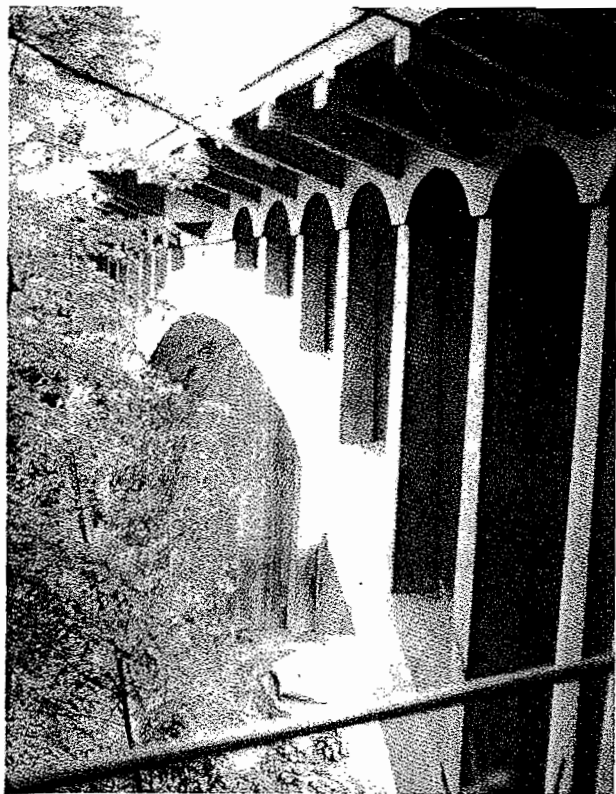


Robert H. Evans & Co. built the West Third Avenue bridge over the Olentangy River in 1919. The structure was designed by Wilbur Watson and is a good example of his theory that proper ornamentation emphasizes structural members and calls attention to the

design. It is 369 feet in overall length with each of the four spans measuring 90 feet. Decorative touches include exposed aggregate on the parapet, decorative railings and curved wing walls on the approaches.

Lanternman Falls Bridge
Youngstown, Mahoning County
U.S. 62 (Canfield Road)
Crosses Mill Creek
UTM Coordinates-17/526640/4546020

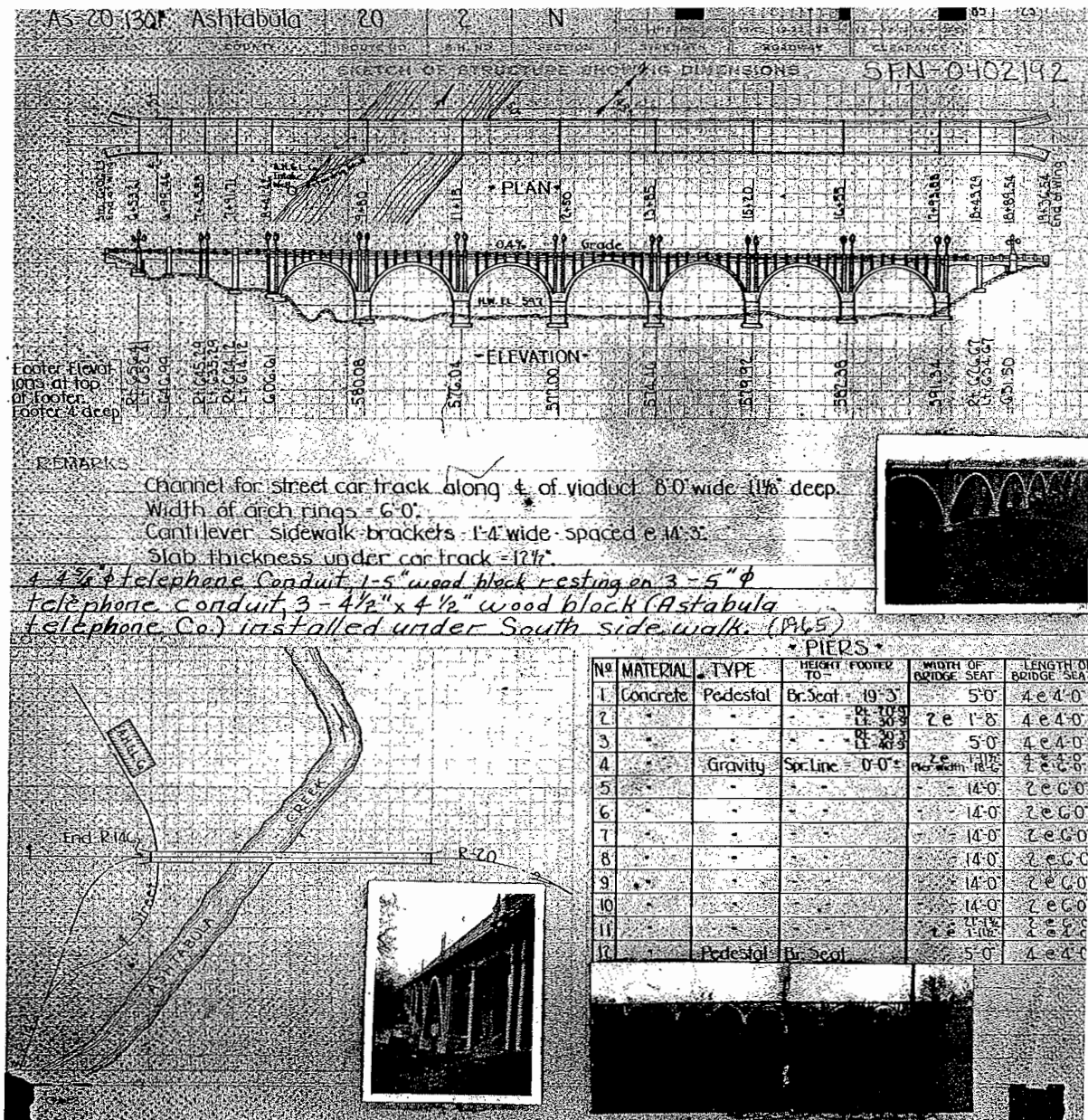
Open spandrel rib arch
Builder: N.R. Porterfield, Inc.,
Youngstown
Designer: Unknown
Constructed: 1920
Structure File No. 5001951



The main span of this open spandrel reinforced concrete arch, known locally as the Lanternman Falls Bridge, is 165 feet. Aesthetics were an important design consideration for this bridge because of its location at the southern edge of Mill Creek Park. Besides the open arcade of the spandrel walls, iron railings and observation platforms were incorporated in the center of the cantilevered sidewalks. The structure was built by N.R. Porterfield, Inc., of Youngstown. In 1918, this company was responsible for the

construction of the Sebring Rd. bridge, a concrete rainbow arch that spanned the Mahoning River and connected the city of Alliance with the villages of Sebring and Beloit. The Lanternman Falls bridge was rehabilitated in 1989 when the deck, sidewalk and railings posts were replaced. Roadway barriers, decorative metal railing and lampposts were added at that time. W.E. Quicksall and Associates were consultants on the rehabilitation project.

Chapter Ten 1921-1930: Ohio's Decade Of Arches



The bridge card shown above, giving detailed information on the Astabula Viaduct, is representative of the records kept by the ODH's Bureau of Bridges from 1930 through 1972.

Reinforced concrete was increasingly accepted for Ohio bridges throughout the 1920s. As large-scale viaducts of unprecedented size were

erected, Ohio engineers became more familiar with the form that eventually characterized long-span concrete bridges: the open spandrel

arch. It also was during this decade that through or rainbow arches began to be widely built in Ohio and became a standard type throughout the state. Ohio highway engineers also developed designs for standard railings for concrete bridges during this decade.

Several state and federal factors combined in the 1920s to expand the authority and power of the Ohio Department of Highways (ODH). Bridge Bureau personnel obtained greater control over the types and materials used for bridge construction in the state. Through their efforts concrete was fully accepted as an alternative to, or even preferred material over, steel. The decade began with public attention focused on the department during the fall 1920 gubernatorial campaign. Harry L. Davis "made the efficient administration of the state highway work one of his main issues." (17) The large balance in the highway fund was criticized as the consequence of "the extensive retardation of highway work in recent years." (18) The legislative response included the passage of an emergency "Reorganization Bill" that abolished the departmental oversight by an outside advisory board and established the system of regional highway districts that exist today in only slightly modified form. (19) While reorganizing the department, Governor Davis had consulted with General George Goethals, who as chief of the Panama Canal construction had gained a work-side reputation as an engineer. The end result of the increased attention on the department was a significant increase in both funding and staffing. This was demonstrated in 1921 with a dramatic increase in road mileage and bridge construction completed by ODH. (20) Another important factor in expanding the influence of ODH came from the federal government and its agent, the Bureau of Public Roads.

The Federal Highway Act of 1921 established the basic federal aid program that exists today. A system of highway classification, designating

primary and secondary roads for a federal network, was created, and states, not counties, were designated to maintain these roads. This action greatly strengthened the status of the ODH. In addition, Thomas H. MacDonald, the head of the federal bureau during this period, actively promoted federal-state cooperation. (21)

Doubly armed with state and federal authority and financing, the ODH Bridge Bureau began to shape state bridge construction to an unprecedented degree. Key personnel in the bureau throughout the 20s, men such as William H. Rabe, Joseph R. Burkey, and D. Henry Overman, showed a special affinity for concrete. Figures published for the department's work in 1925 showed that of the 164 highway bridges built that year, almost ninety percent were concrete. (22) So much of the work was federally-aided that a "Federal Projects Engineer" was identified on the ODH roster in 1923. (23)

One of the major structures completed during this decade was the Conneaut Viaduct, the largest structure ever built on the state highway system at the time of its completion in 1924 (24). This construction project also exemplified the cooperative testing and research efforts between ODH, the Engineering Experimental Station at Ohio State University, and the U.S. Bureau of Public Roads.

In 1927 a major program of railroad grade separation projects received a special appropriation from the General Assembly. Completed in conjunction with the counties and railroad companies, many of these structures were made of concrete.

The Norton-Edwards Highway Bill that became law on January 2, 1928, further expanded the authority of the ODH engineers by making them responsible for constructing, maintaining, and repairing all roads and bridges

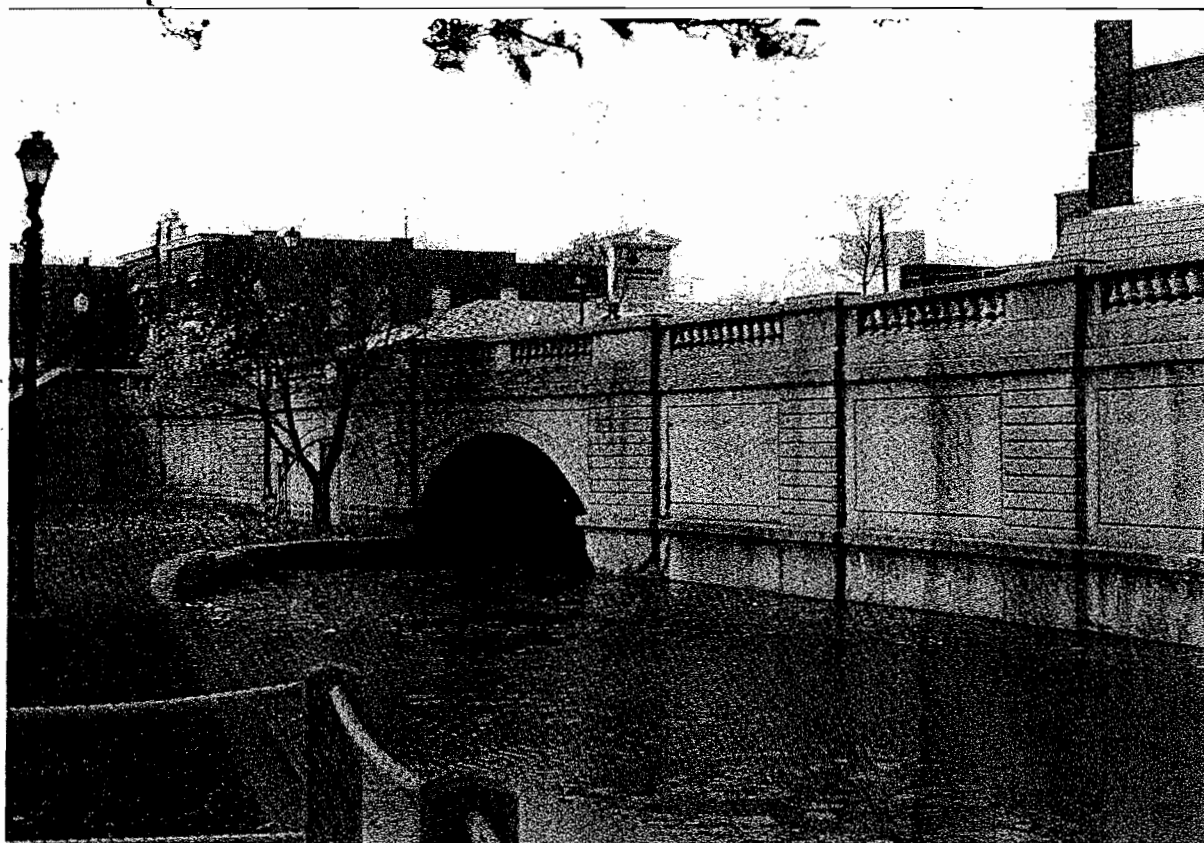
on the state system.

The Miami Conservancy District, established following the floods of 1913, continued its mission of flood protection in the Miami Valley. Two of the bridges included in this section reflect the District's efforts - the Black Street bridge in Hamilton and the Adams Street bridge in Troy. Other selected bridges from this

time period include closed spandrel filled arches in Auglaize, Montgomery, Noble, Allen, Shelby and Sandusky Counties; open spandrel rib arches in Ashtabula, Athens, Cuyahoga and Summit Counties; and closed spandrel rib arches in Geauga, Belmont, Jefferson, Lucas, and Monroe Counties. Concrete rainbows from this period are found in Wood, Meigs, and Ashtabula Counties.

St. Mary's, Auglaize County
State Route 29
Crosses Miami & Erie Canal
UTM Coordinates-16/721250/4491230

Closed spandrel filled arch
Builder: Roberts Supply Co.
Designer: Unknown
Constructed: 1921
Structure File No. 0600067

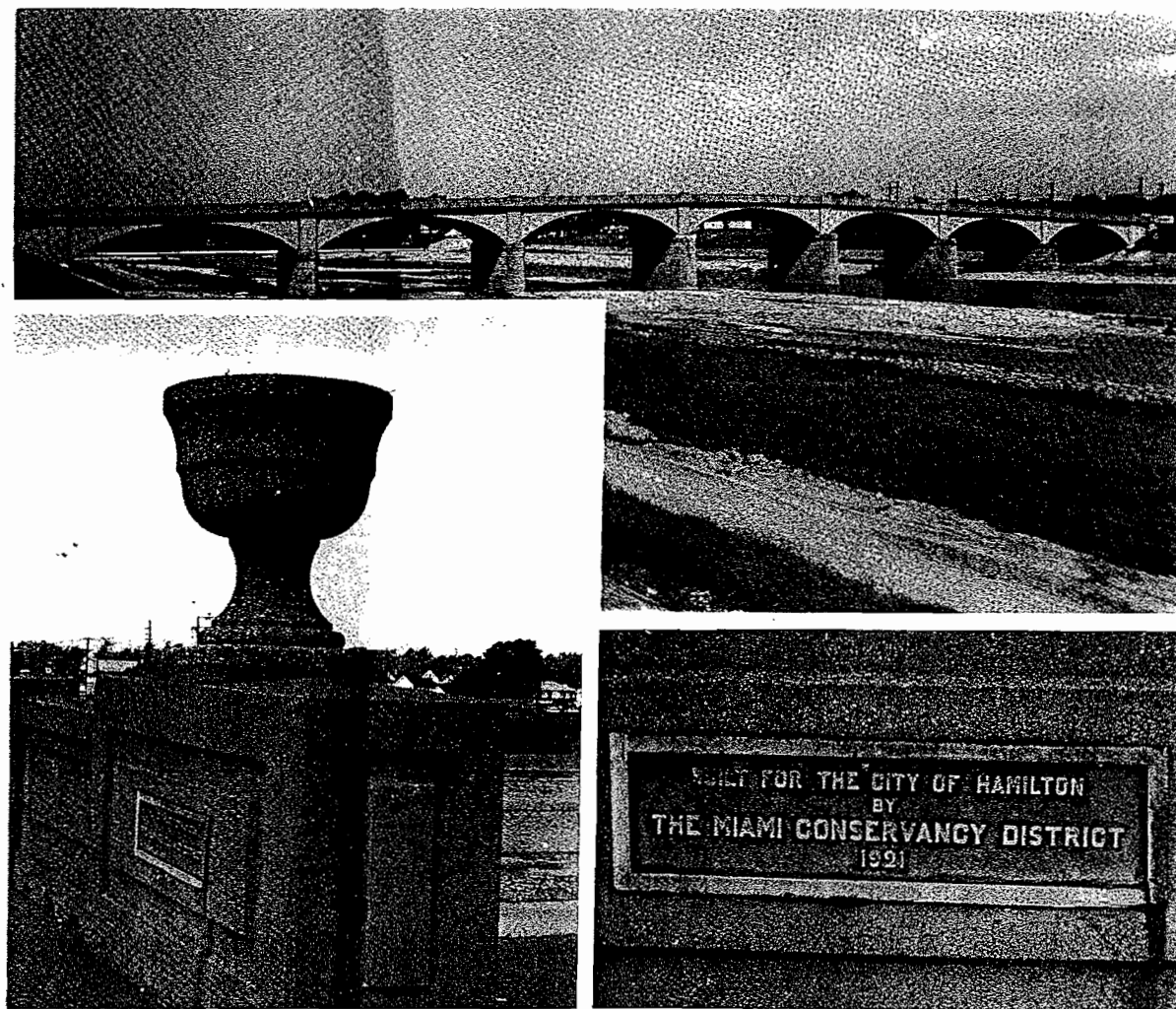


This concrete filled arch had two clear spans but one has been closed in with concrete blocks. The single remaining arch is 26 feet long. The overall length of the bridge is 54

feet. Designers of the bridge made an effort to complement its urban setting with the use of incised spandrel walls, urn shaped balustrates and rusticated pilasters.

Black Street Bridge
Hamilton, Butler County
Black Street
Crosses Great Miami River
UTM Coordinates-16/710210/4364840

Closed spandrel filled arch
Builder: Miami Conservancy
District
Designer: Unknown
Constructed: 1921
Structure File No. 0960020



The Great Flood of 1913 swept away three of the four bridges in Hamilton within two hours on March 25. It claimed the fourth bridge a few hours later. The first of these bridges to fall was the Black Street bridge, followed by the High-Main Street bridge (pg. 63), and the C.,H.&D. railroad bridge. The Columbia bridge fell early on the morning of March 26. The seven-span, 708-foot bridge which now

carries Black Street over the Great Miami River was built by the Miami Conservancy District to replace the bridge lost in the flood. Special attention was focused on the foundations of the piers to insure their proof against future floods. It has decorative concrete urns at each portal corner, lampposts and recessed panels in the concrete railing.

Adams Street Bridge
Troy, Miami County
County Route 14 (Adams Street)
Crosses Great Miami River
UTM Coordinates-16/738340/4436160

Closed spandrel filled arch
Builder: Miami
Conservancy District
Designer: Unknown
Constructed: 1922
Structure File No. 5537126



The following article by David Simmons appeared in Ohio County Engineer, Nov., 1983.

The Miami Conservancy District was the first flood control project of its kind in the country and resulted in one of the largest public works projects of the 20th century. Because it involved rechannelization of many of the urban portions of the Great Miami River, the District was involved in the construction of several long bridges across the valley during the early 1920s. One of the most interesting of the bridges built by the District was the Adams Street bridge constructed in 1922 in Troy, Miami County.

In the aftermath of the 1913 flood engineers became far more conscious of how bridges affected and were affected by hydraulic flow and scouring. Adequate openings for high water were to be provided beneath the bridges, and greater consideration given to the type of substructures used for abutments and piers with the general goal of increasing their depth.

The existing Adams Street bridge, a three-span concrete structure built in 1913, was criticized by the Conservancy District's engineering staff for these very reasons. Instead of immediately "wrecking" and replacing the old bridge however, they decided to use it as support for the falsework of a new concrete bridge which also had additional arches added to one end to

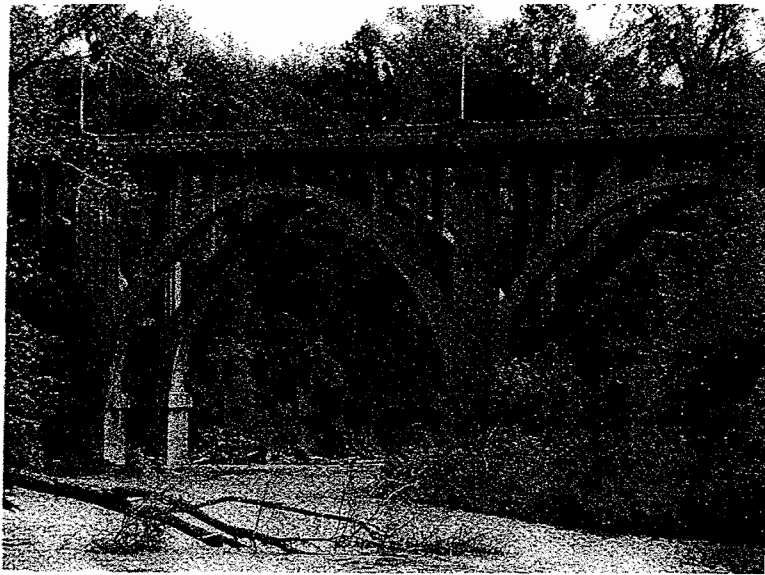
account for the widened channel. The greatest advantages of this process were that it eliminated the danger of a flood washing out a more conventional timber falsework, it reduced the labor involved in the falsework fabrication, and because it incorporated the existing piers into the new bridge it reduced the amount and cost of concrete needed. The major disadvantages involved the difficulty of reinforcing and expanding the underpinnings of the old piers. In addition and even more critical, was the problem of demolishing the old arches once the new bridge had been constructed over them. Since both the pier work and demolition were being attempted without known precedent, the chief engineer indicated that "the greatest care and thought was necessary to insure success." The scheme of utilizing the old bridge in the construction of the new structure was the brainchild of J.H. Kimball, the assistant chief engineer of the District. He was an 1894 graduate of the Massachusetts Institute of Technology and had specialized in sanitary and local flood protection projects prior to joining the District staff.

The demolition of the old arches was "ticklish" since, as with the recent demolition of the Y-Bridge in Zanesville, the balance of forces had to be maintained on the old piers to prevent their being pushed over. Rather than attempt the simultaneous demolition of the old arches, a difficult endeavor even today, the District engineers decided to do it in a piecemeal manner with small charges of dynamite that "nibbled away" at the arches, again much as the modern work in Zanesville was originally conceived.

The new bridge was finished off with reinforced concrete railings of solid posts and panels that were "strong enough to withstand the shock of a runaway automobile," at that time a new concept. It was intended as a serviceable railing that maintained the "good appearance" of the rest of the structure, but was not "extreme" in decorative treatment. Today the Adams Street bridge occupies an important place in Troy's new focus on the riverfront during their annual Strawberry Festival.

Conneaut Viaduct
Conneaut, Ashtabula County
U.S. Route 20
Crosses Conneaut Creek
UTM Coordinates-17/537250/4643140

Open spandrel rib arch
Builder: Pitt Construction Co.
Designer: Wendell P. Brown Co.
Constructed: 1922-24
Structure File No. 0402281



This high level bridge was the largest structure ever built on the Ohio highway system at the time of its completion in 1924. It consists of seven open-spandrel arch spans, 119 feet center to center of piers, together with six approach spans of arched deck-girders, four at the west and two at the east. The total length of the structure is 1,189 feet. The roadway is 32 feet between curbs, with two 5-1/2 foot sidewalks. The Conneaut Viaduct was designed by the Wendell P. Brown Company of Cleveland for Ashtabula County before the state became financially interested in the project. It was constructed in 23 months by the Pitt Construction Company of Pittsburgh at a cost for the structure proper of \$384,034.50; approach construction cost of \$31,508.21 and new right-of-way purchase and removal of structures an additional \$85,000. Ashtabula County paid all right-of-way costs together with fifty percent of the cost of the structure and approaches. The remainder was borne by

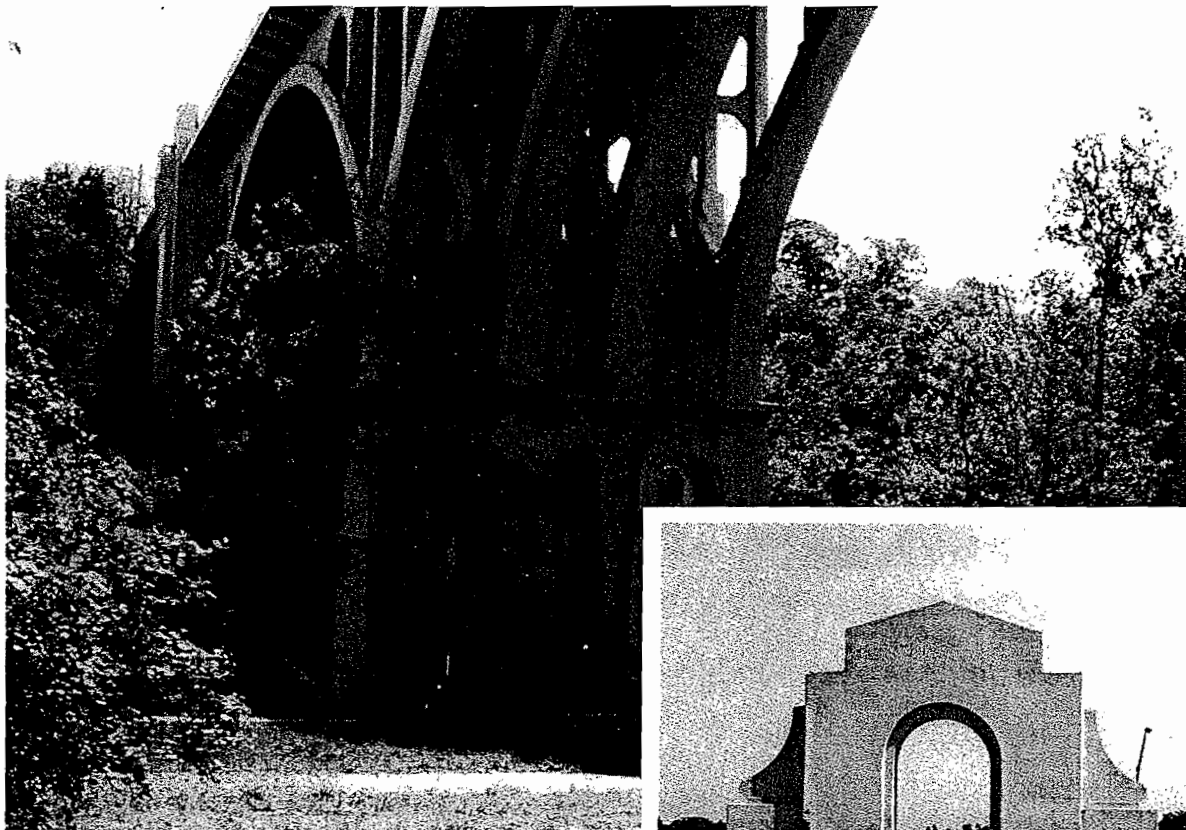
the State with the use of federal funds, this being a Federal Aid Project. J.R. Burkey was in charge of construction.

The ODH and the National Committee of the American Society of Civil Engineers on "Concrete and Reinforced Concrete Arches" monitored the bridge during construction, taking measurements showing movement of piers and arch ribs. The purpose was to assist in the study of the behavior of arches and their supporting piers under varying temperatures, loads and foundation conditions. Also included in this study were the Shawnee bridge (pg. 64) over the Miami River at Piqua and the Ashtabula Viaduct (pg. 84).(25)

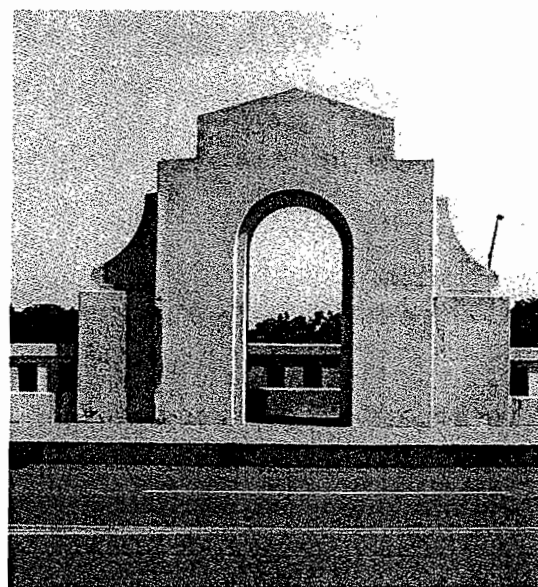
The Conneaut Viaduct connects downtown Conneaut with commercial and residential areas on the east bank of Conneaut Creek. Its completion eliminated the last toll bridge operating in Ohio.

Hilliard Road Bridge
Cuyahoga County
State Route 69 (Hilliard Road)
Crosses Rocky River
UTM Coordinates-17/431200/4591220

Open spandrel rib arch
Builder: The Walsh Construction Co.
Designer: Alfred M. Felgate
Constructed: 1925
Structure File No. 1830147



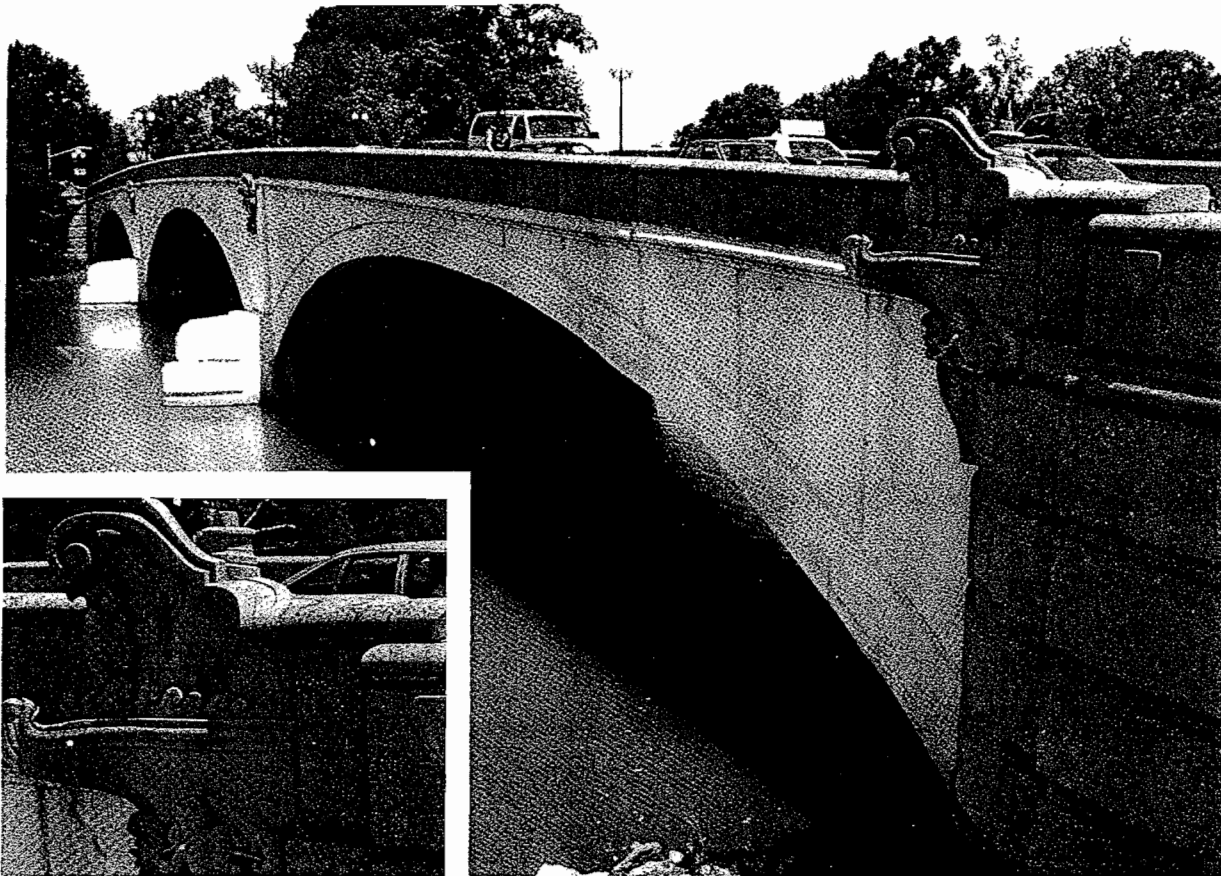
The Hilliard Road Bridge in Cuyahoga County spans the scenic valley of the Rocky River with a total of eight open spandrel arches. At street level, there are four decorative viewing platforms for pedestrians and a decorative open railing. A notable feature of the bridge is pronounced batters on the piers. It was designed by Alfred M. Felgate, county bridge engineer, and rehabilitated in 1983. Felgate was



among the state's more imaginative concrete bridge engineers during the first decades of the 20th century.

Island Park Bridge
Dayton, Montgomery County
Helena Street
Crosses Great Miami River
UTM Coordinates-16/739960/4406560

Closed spandrel filled arch
Builder: Wiley
Construction Co., Dayton
Designer: E.R. Smith &
J.J. Chamberlain, Architects and
Engineers
Constructed: 1925
Structure File No. 5760437



The portal approaches of this three span bridge have decorative seating areas and concrete capitals of the Ionic order. There also is decorative concrete work over each pier. The bridge is 308 feet in total length, each span measuring 97 feet.



Portage, Wood County
State Route 25
Crosses N. Branch of Portage River
UTM Coordinates-17/278160/4577580

Rainbow arch
Builder: Unknown
Designer: ODH standard design
Constructed: 1925
Structure File No. 8701830

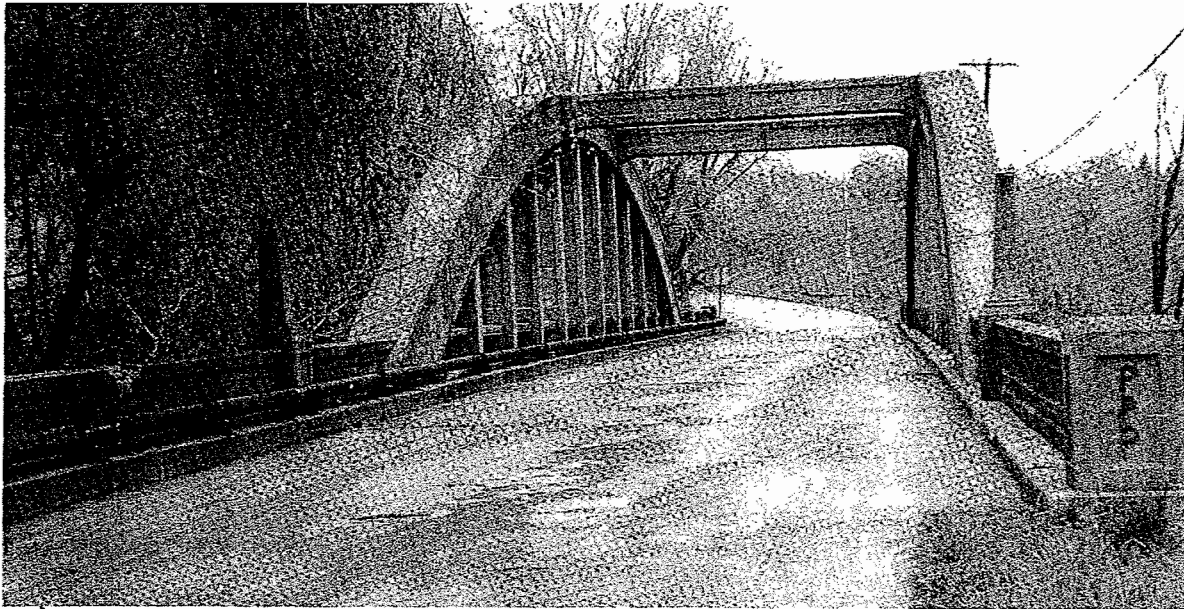


The concrete bowstring or rainbow design became an accepted design among Ohio's state highway bridge builders and a considerable number were built in the 1920s. This 89 foot bridge has a 65 foot clear span and a 28 foot

roadway width. By the 1920s, the Ohio Department of Highways received national attention for these concrete arch bridges after they became a standard design.

Mill Street Bridge
Conneaut, Ashtabula County
Old State Route 7 (Mill Street)
Crosses Conneaut Creek
UTM Coordinates-17/464270/536200

Rainbow arch
Builder: Unknown
Designer: ODH standard plans
Constructed 1926
Structure File No. 0432156



The following is an excerpt from an article by David Simmons that appeared in the Summer, 1989, issue of Ohio County Engineer.

There are thousands of stream crossings in Ohio where a covered bridge was once located. A 150-foot covered bridge was built over Conneaut Creek on Mill St. in Conneaut in 1857. It was a Howe truss with a laminated arch and served adequately until a windstorm in June 1924, tore the roof off and left the truss badly bent.

Virtually since the founding of the Ohio Department of Highways in 1904, the idea of standardized plans had been promoted. In 1921, bridge bureau engineers developed a standard concrete through arch or "rainbow arch" design. Concrete bridges of this type gained two major advocates when J.R. Burkey was named chief of the bridge bureau and W.H. Rabe became its chief designing

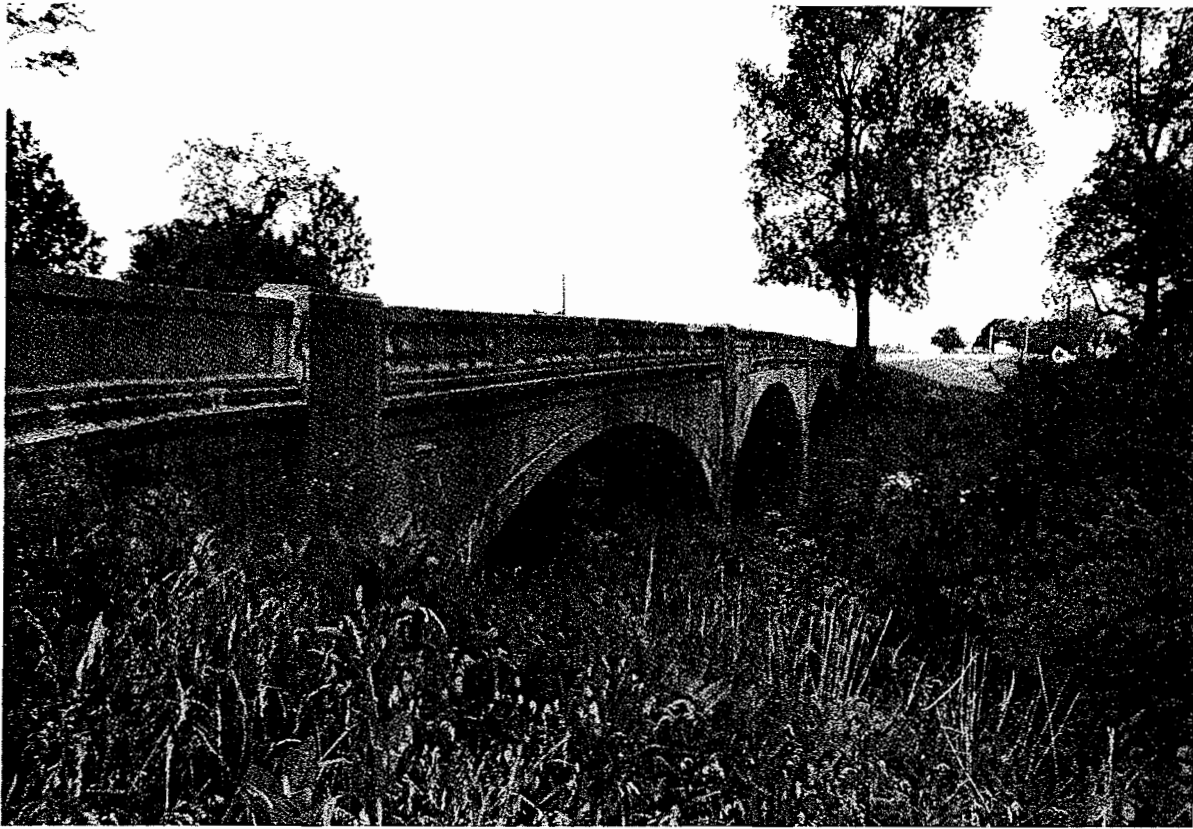
engineer. Burkey claimed that by the mid-1920s, concrete rainbow arches were already popular with Ohioans.

Local conditions at the Mill St. site were ideal for a rainbow arch since the large arches could be founded directly on the shale bedrock that lay very near the surface. The high arch design also allowed more than adequate clearance for future high water in Conneaut Creek, something not true of a more traditional filled arch.

Rabe is believed to have been the designer of the new Mill St. bridge. The plans are unsigned, suggesting their hasty creation to accommodate the urgency of the local need. Ten months were necessary for the design and bidding, and the project was not sold until May 1925. When it was completed, the 150-foot span was the longest concrete rainbow arch in Ohio. It still is.

Allen County
State Route 88, Lincoln Highway
Crosses Ottawa River
UTM Coordinates-16/736520/4525410

Closed spandrel filled arch
Builder: Unknown
Designer: Charles Ash
Constructed: 1926
Structure File No. 0254096



This three span filled arch was designed by Charles Ash of the Highway Department's Bureau of Bridges and built in 1928. It spans the Ottawa River in Allen County seven and a half miles east of Delphos.

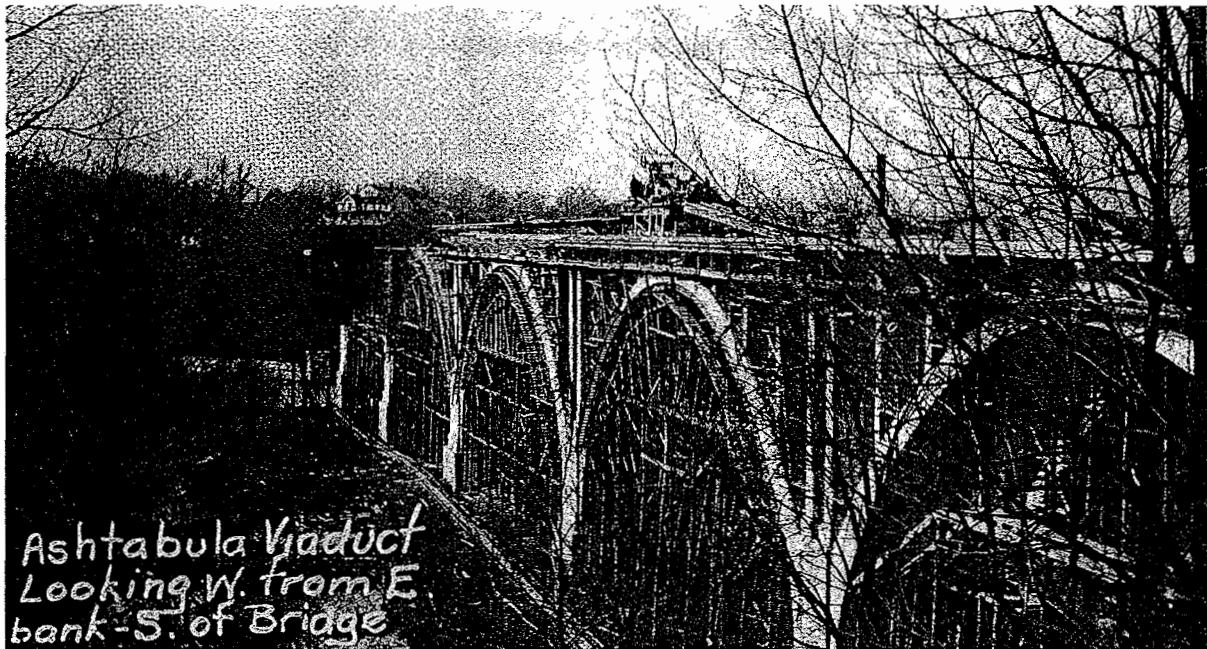
Balustraded railings were selected to be used over the arches but solid panels were used on the approaches. These are standard railing types developed by the Bureau of Bridges during the 1920s to be used with all types of concrete bridges. The design drawings were

approved by J.R. Burkey and, in keeping with his known concern for the aesthetics of bridge design, included comments on their use. For example, one plan note reads "End posts and posts over piers should be designed to harmonize with the entire railing and structure." Another states, "The use of variety of railing types on a single road project is encouraged."

Each of the bridge's three arches measures 87 feet.

Ashtabula Viaduct
Ashtabula, Ashtabula County
U.S. Route 20
Crosses Ashtabula River
UTM Coordinates-17/518380/4653840

Open spandrel rib arch
Builder: Standish Engineering Corporation
Designer: J.R. Burkey,
Constructed: 1926-28
Structure File No. 0402192



This high level, concrete viaduct was placed under contract in 1926 and completed in 1928. It consists of seven open-spandrel arch spans of 135 feet center to center of piers. These are flanked on the ends by six spans of arched deck-girders, four on the west end and two on the east. The overall length of the bridge is 1,230 feet. The structure rests on bedrock. The roadway is 32 feet wide between curbs with 5-1/2 foot cantilevered sidewalks on either side.

J.R. Burkey was the ODH's special designing engineer assigned to this project and a great part of the design was done in the office of D.W. Leggett, Resident Engineer for the State in Ashtabula County.

From an engineering perspective, the

outstanding feature of the design for this bridge was the complete separation of superstructures at the end of each span using only abutting expansion joints. To accommodate the deck movement, long columns were used with a slenderness especially adapted to flexure. These columns have ornamental recessing on the east and west facings and chamfered corners. The railing consists of concrete rails, spindles and posts of various sizes.

The structure was built for a cost of \$378,124.30 for the viaduct proper and \$61,863.73 for the approach construction. Construction of the viaduct was a Federal Aid Project, fifty percent of the cost having been assigned from Federal funds and 50 percent being provided by Ashtabula County. The cost



of the approach work, with the exception of right-of-way, was shared equally between the state and the county. Ashtabula County provided the necessary right-of-way.

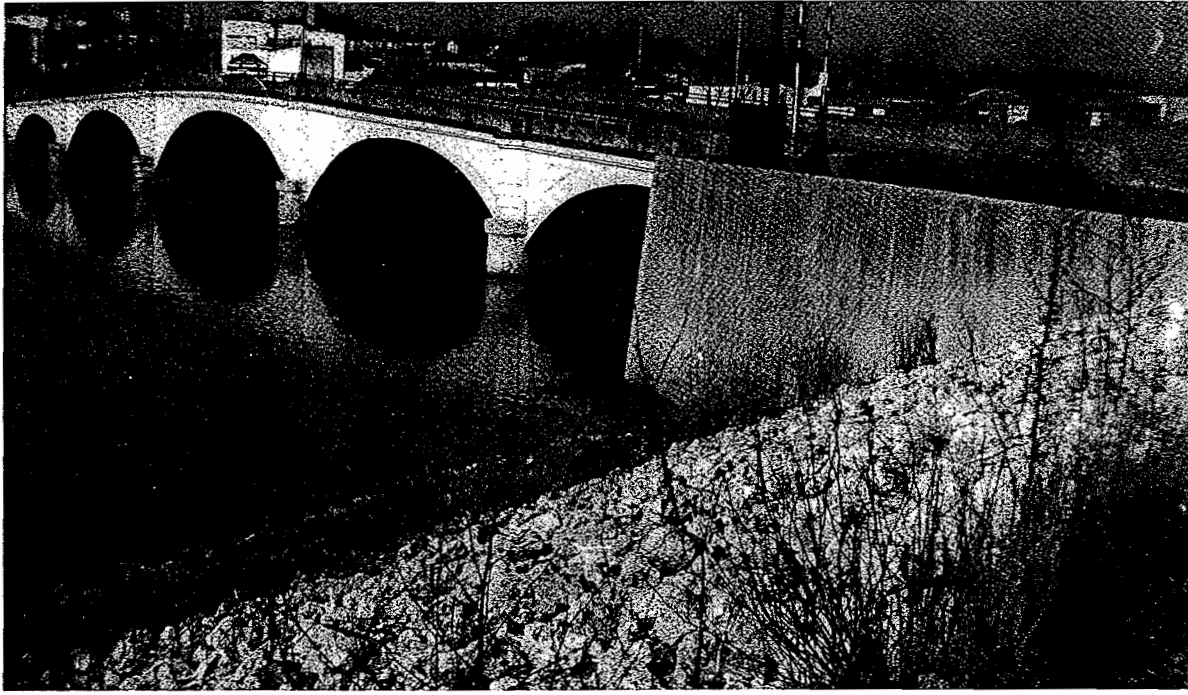
The Ashtabula Viaduct was one of several bridges monitored by ODH Bridge Bureau engineers and the National Committee of the American Society of Civil Engineers on "Concrete and Reinforced Concrete Arches." Cardboard models of the bridge were made, both with and without the spandrel columns and deck, and microscopic deflections were measured to determine the effect of the floor system on the arch ribs when acting monolithically. These observations indicated that the floor system materially affects the behavior of the arch ribs on a structure.(26)

The viaduct was originally constructed to carry a trolley car down the middle with vehicle traffic on either side. In 1949 the original brick and sand riding surface was removed. At this time the trough on the bridge deck used by the trolley was filled in with concrete and 2-1/2 inches of asphalt wearing surface was applied to the deck. A steel plate over expansion joints was added, embedded in the asphalt. Bridge lighting and drainage also were replaced at that time.

In 1971 the asphalt wearing surface was removed and replaced with a 5-inch reinforced concrete overlay. The expansion joints were replaced with sliding plate type joints with copper troughs. Additional scuppers were added and existing deteriorating scuppers and downspouts were replaced.

State Street Bridge
Fremont, Sandusky County
20th Street
Crosses Sandusky River
UTM Coordinates-17/323310/4579200

Closed spandrel filled arch
Builder: J.H. Jones
Designer: Walter Braun
Constructed: 1926
Structure File No. 7242298

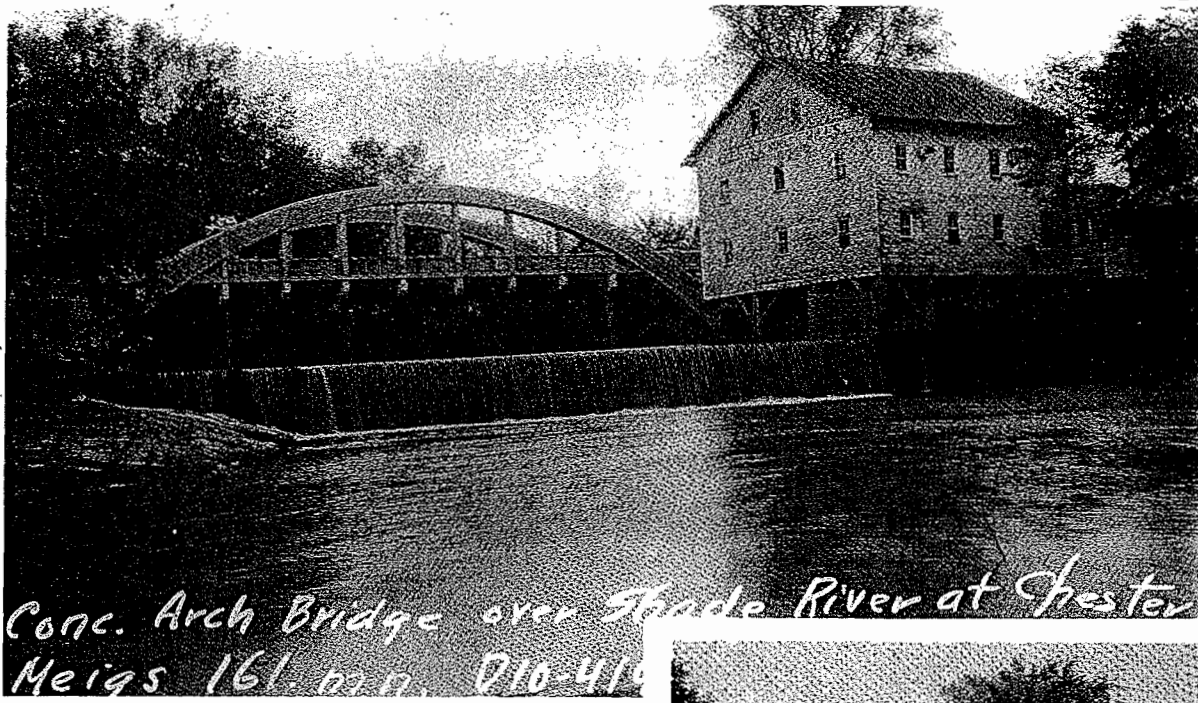


The State Street bridge in Fremont over the Sandusky River was built between 1923 and 1926 by J. H. Jones, Contractor. A river crossing in the center of the county seat, the rusticated spandrel and pier treatment reflect

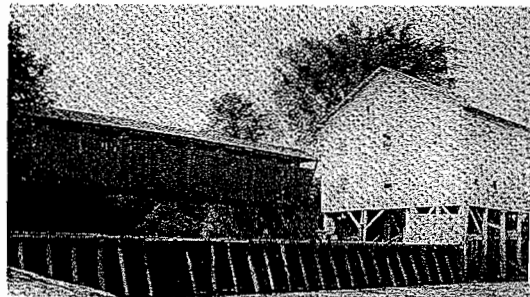
the influence of the City Beautiful Movement on urban structures. The five 88-foot spans were extensively rehabilitated in 1981. The roadway was totally replaced as were the sidewalks and railings.

Chester, Meigs County
State Route 248
Crosses Shade River
UTM Coordinates-17/419950/4326660

Rainbow arch
Builder: Unknown
Designer: W.H. Rabe and V.E. Schuler
Constructed: 1926
Structure File No. 5302587



According to Walter Smith, state highway engineer in the 1930s, "Quite a few through (rainbow) arch structures of from 60 feet to 120 feet span with roadways of from 18 to 24 feet were built by the state from 1919 to 1929." He indicated that the type lost favor because the superstructures had no salvage value in case the structure must be widened.(27) A typical concrete through arch built by the state in the 1920s, this bridge replaced a covered bridge. It has a clear span of 110 feet and a 24 foot roadway and was built for \$16,000, including Federal funds.



Belmont County
County Route 5
Crosses Williams Creek
UTM Coordinates-17/508840/4427980

Closed spandrel rib arch
Builder: Luten Bridge Co.
Designer: Daniel B. Luten
Constructed 1927
Structure File No. 0730610



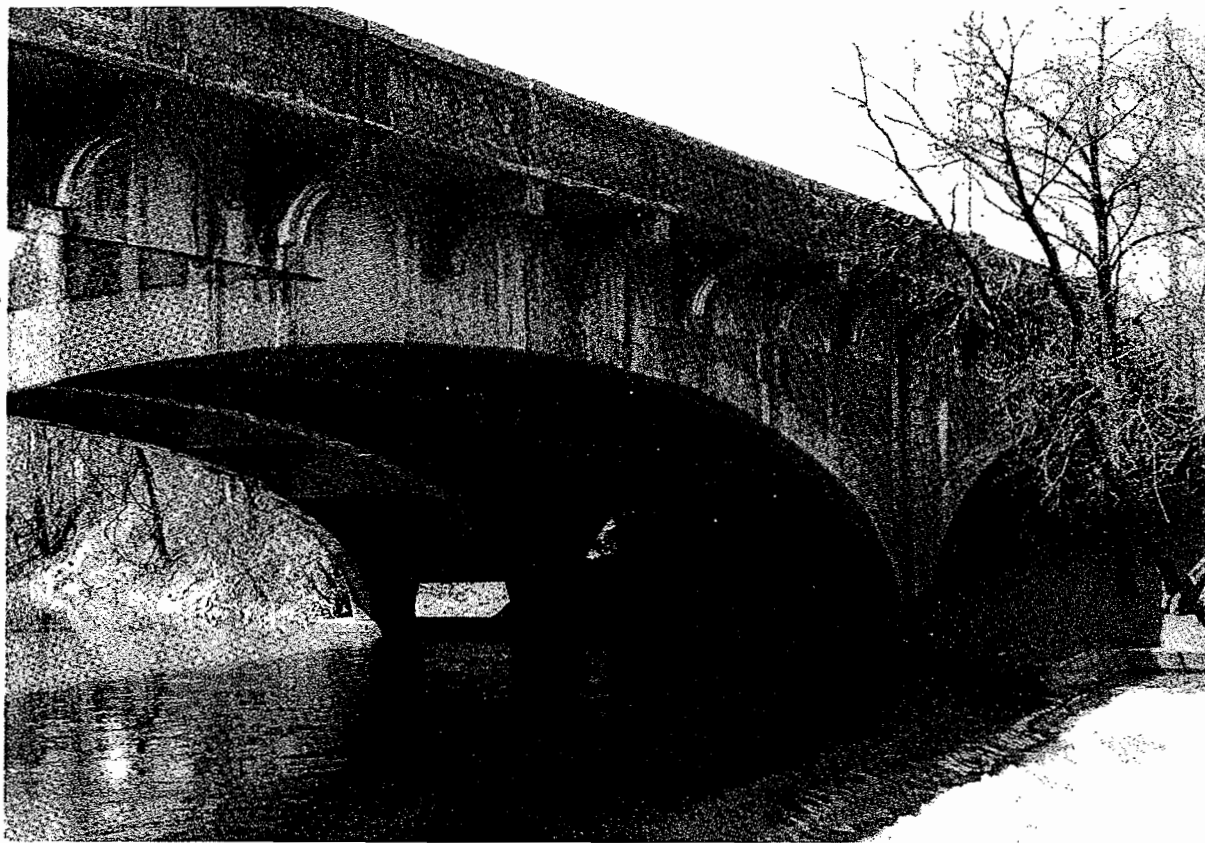
An important design devised by Daniel Luten during this decade was the "solid-rib or closed-rib" design. Developed about 1926, it consisted of a pair (or more if necessary) of twelve-inch wide arched ribs tied together with a solid concrete deck. Conceived so that the solid ribs, deck and abutments were a unit, Luten saved on both reinforcing rod and concrete. Furthermore, he eliminated the need for fill

and, unlike traditional filled concrete arches, provided a solid surface for traffic as part of the structure itself. The use of "standardized" solid ribs allowed contractors to recycle formwork and further reduce costs.

The rusticated concrete railings on this Luten bridge in rural Belmont County are an example of a standard style used by this bridge company.

South Avenue Bridge
Toledo, Lucas County
South Avenue
Crosses Swan Creek
UTM Coordinates-17/284450/4611790

Closed spandrel rib arch
Builder: Newton-Baxter Co.
Designer: Unknown
Constructed 1927
Structure File No. 4860349

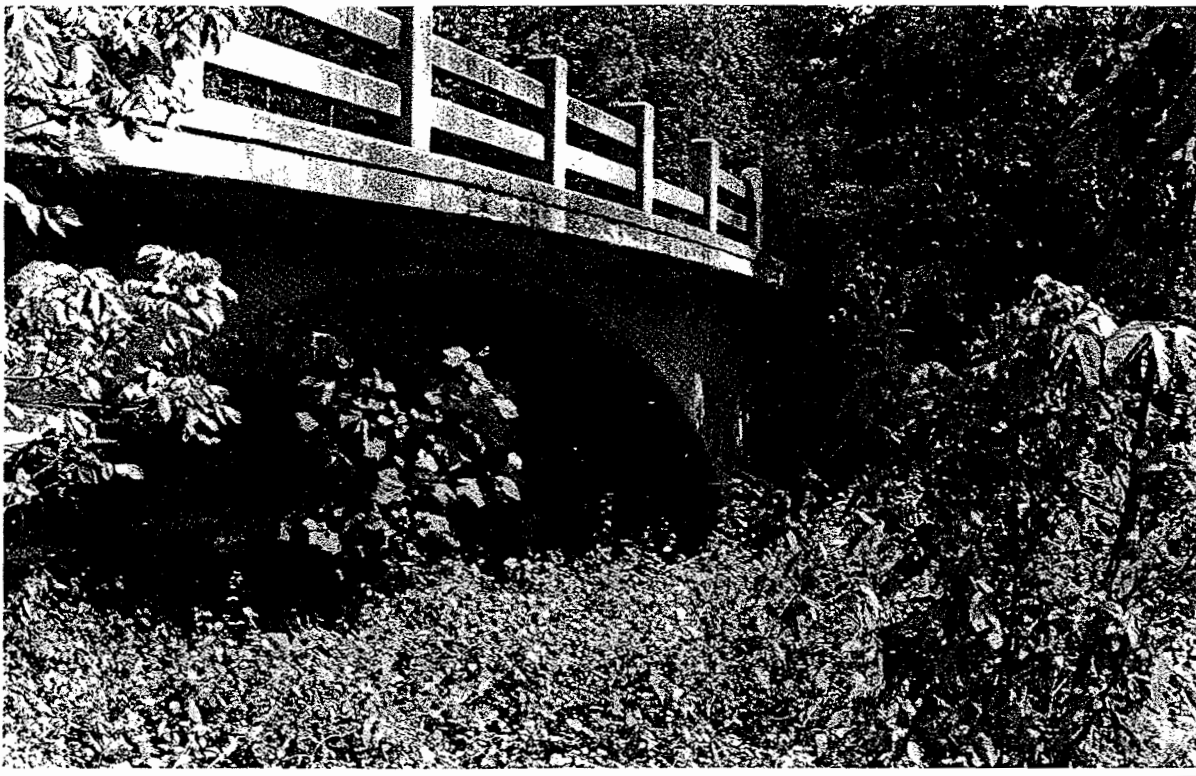


Built on the southern edge of Highland Park, it reflects the aesthetic treatment given to bridges in a planned urban setting. The builders of this closed spandrel rib arch in Toledo utilized two ribs under each driving lane of the roadway to carry the bridge's three spans over Swan Creek.

Transverse beams between the ribs add lateral bracing. The cantilevered sidewalks have recessed panel railings. The bridge is 189 feet in total length with a maximum span of 106 feet.

Marr, Monroe County
Township Road 313
Crosses Little Muskingum River
UTM Coordinates-17/481490/4386340

Closed spandrel rib arch
Builder: Luten Bridge Co.
Designer: Daniel B. Luten
Constructed: 1927
Structure File No. 5634555



Daniel Luten was the Midwest's most tireless promotor of reinforced concrete bridges. At every possible opportunity he encouraged the erection of concrete bridges.

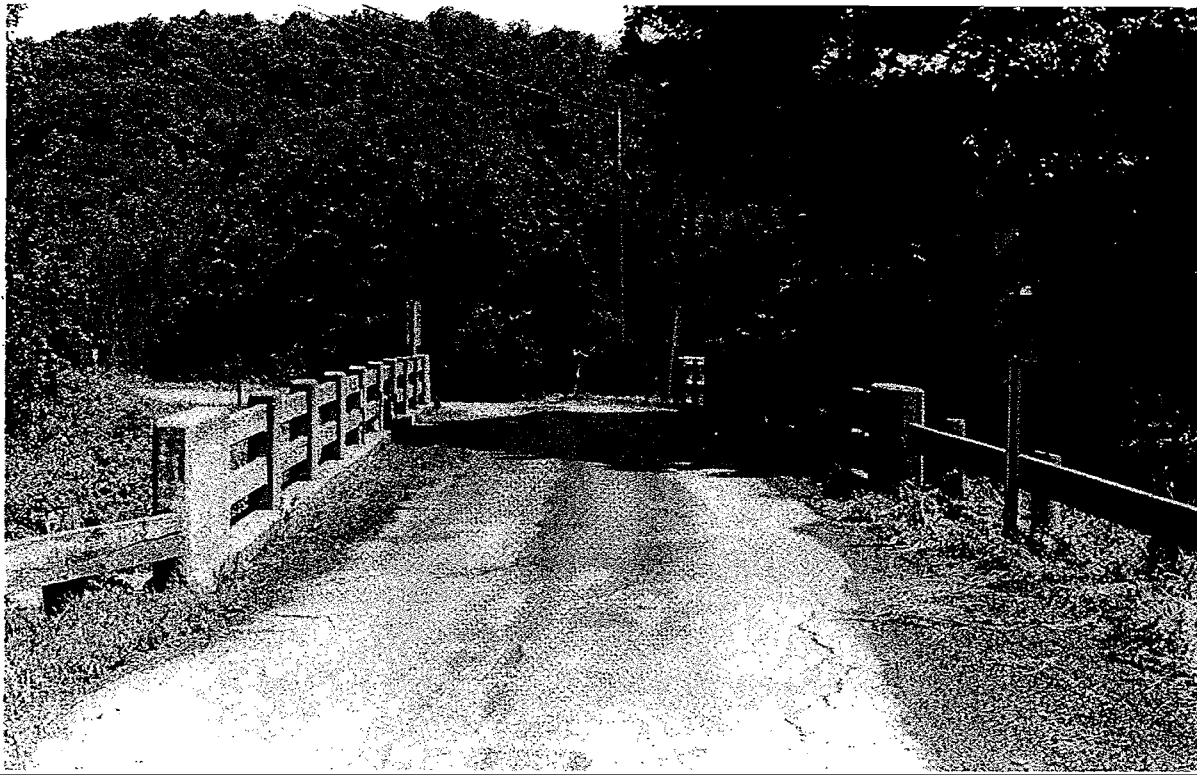
Luten was, of course, prepared to do more than just talk or write about concrete bridges. In 1902, he organized the National Bridge Co. in Indianapolis to construct these bridges.. By 1905, the firm was internally reorganized to distinguish construction work from his ongoing activities as a consulting engineer. The latter aspect was formally separated out in 1918 as the Luten Engineering Company. Not unlike a

modern consulting firm, Luten arranged for "associate engineers" in each state. In addition, arrangements were made with related companies throughout the eastern United

States, such as the Luten Bridge Company, to construct Luten designs. By the 1920s Luten himself laid claim to having designed thousands of bridges throughout North America. This distinctive ribbed 76-foot single span arch designed by Luten is representative of the many small span bridges built by the Luten Bridge Company. (Research by David A. Simmons.)

Belmont County
County Route 5
Crosses Williams Creek
UTM Coordinates-17/507680/4426140

Closed spandrel rib arch
Builder: Luten Bridge Co.
Designer: Daniel B. Luten
Constructed: 1928
Structure File No. 0730602



Playing off the early 20th century perception of the disadvantages of steel and wood, Daniel Luten noted that concrete bridges had the "permanence of stone," were "rust-proof" and "fire-proof," did not require painting, and became stronger through time, thereby anticipating increases in loading and traffic. Perhaps most important to public officials was the assertion that concrete bridges, in contrast to steel, used labor and materials, aggregate

and formwork, from the locality instead of sending taxpayers' money to a distant and powerful steel "trust." Similar claims were laid out in innumerable articles in popular and technical journals.

The single span of this characteristic Luten designed bridge measures 50 feet. The structure is 68 feet in overall length. The roadway width is 16-1/2 feet.

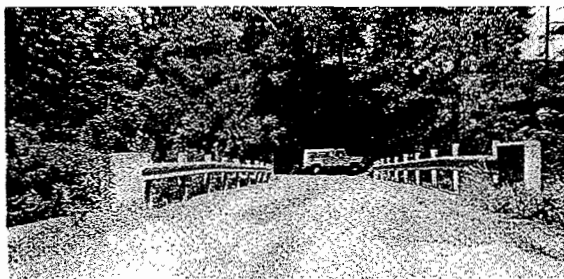
Jefferson County
County Road 53
Crosses Yellow Creek
UTM Coordinates-17/521240/4484420

Closed spandrel rib arch
Builder: Luten Bridge Co.
Designer: Daniel B. Luten
Constructed: 1928
Structure File No. 4130340



This single-span concrete deck arch over Yellow Creek in rural Jefferson County was built in 1928 by the Luten Bridge Company. A distinctive Luten type, the arch measures 101

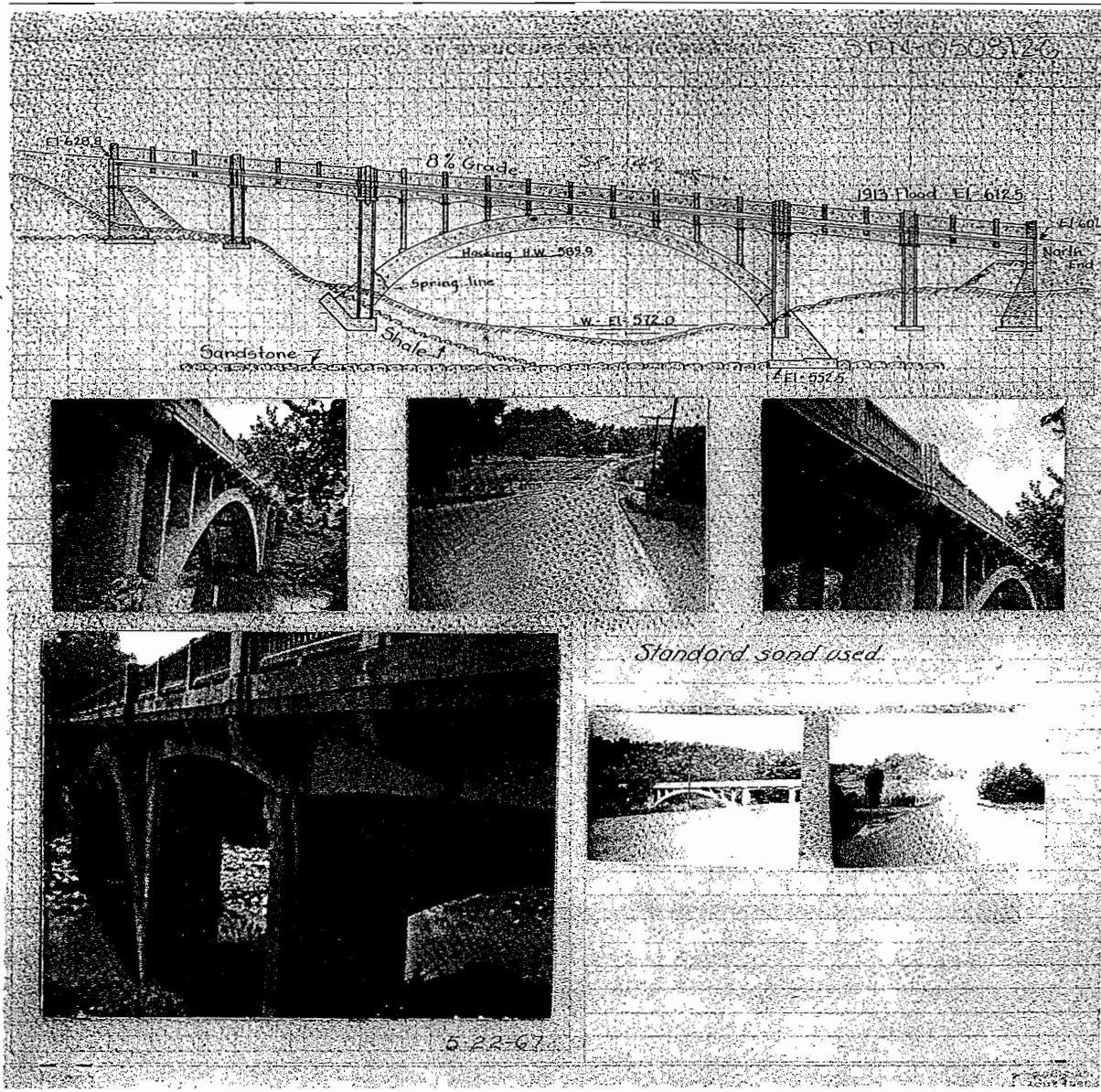
feet and the total length of the bridge is 103 feet. The original railings have been replaced with standard guardrail.



Daniel Luten, the originator of this design, intended that the solid rib arches and deck function as a unit. The two are physically tied with reinforcing steel and were fabricated simultaneously. The removal of the original railing, and addition of structural steel, while aesthetically unfortunate, has not altered the significant historic technology represented in the deck and arches.

Coolville, Athens County
 State Route 144
 Crosses Hocking River
 UTM Coordinates-17/431720/4341800

Open spandrel rib arch
 Builder: Stout & Harden
 Designers: D.H. Overman and
 C.P. Smith
 Constructed: 1930
 Structure File No. 0503126

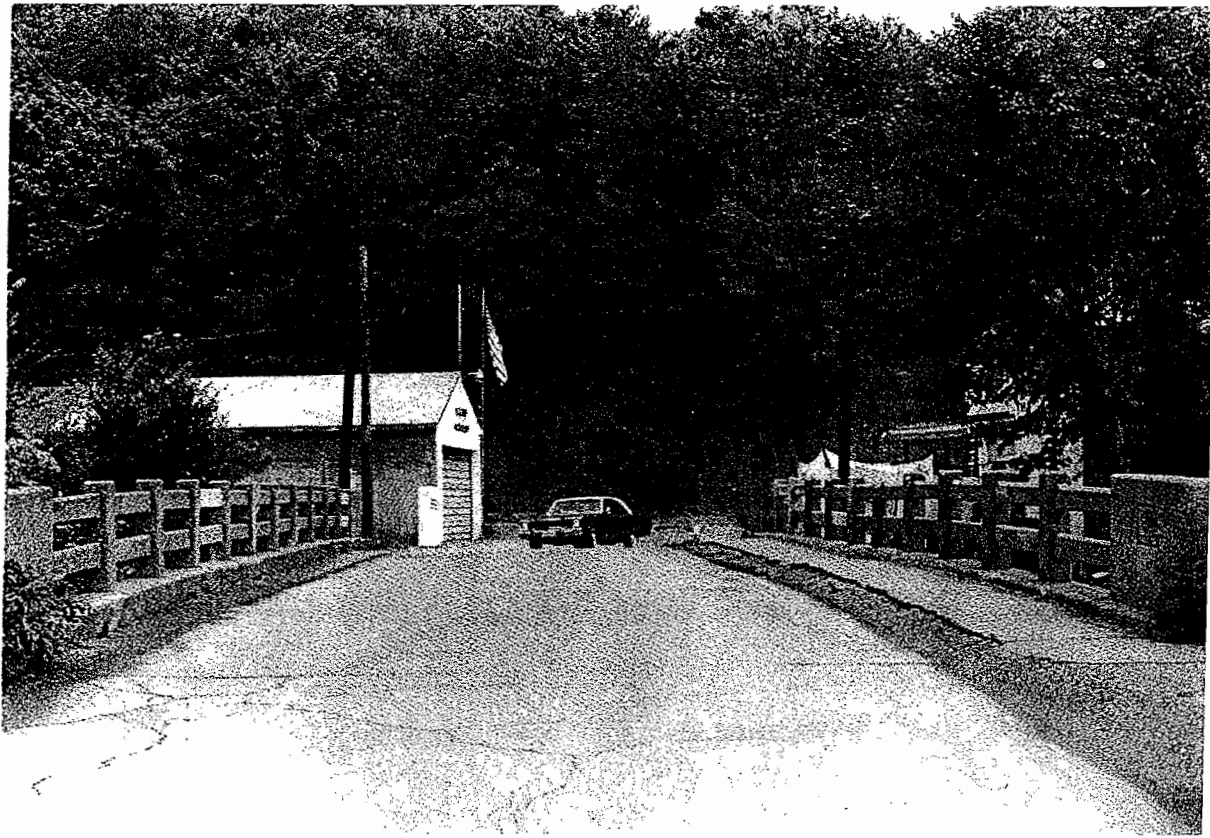


Designed by Henry Overman and C.P. Smith of the Highway Department's Bridge Bureau, this open spandrel rib arch was built in 1930. It was built at a time when bridge building in Ohio was dominated by the creation of labor-

intensive structures - filled arches, stone arches and multiple span arches. The main arch of the five-span structure measures 148 feet and 6 inches with four concrete beam approach spans each 43 feet, 6 inches.

Belmont County
County Route 4
Crosses Wheeling Creek
UTM Coordinates-17/513360/4439370

Closed spandrel rib arch
Builder: Luten Bridge Co.
Designer: Daniel B. Luten
Constructed: 1930
Structure File No. 0730475

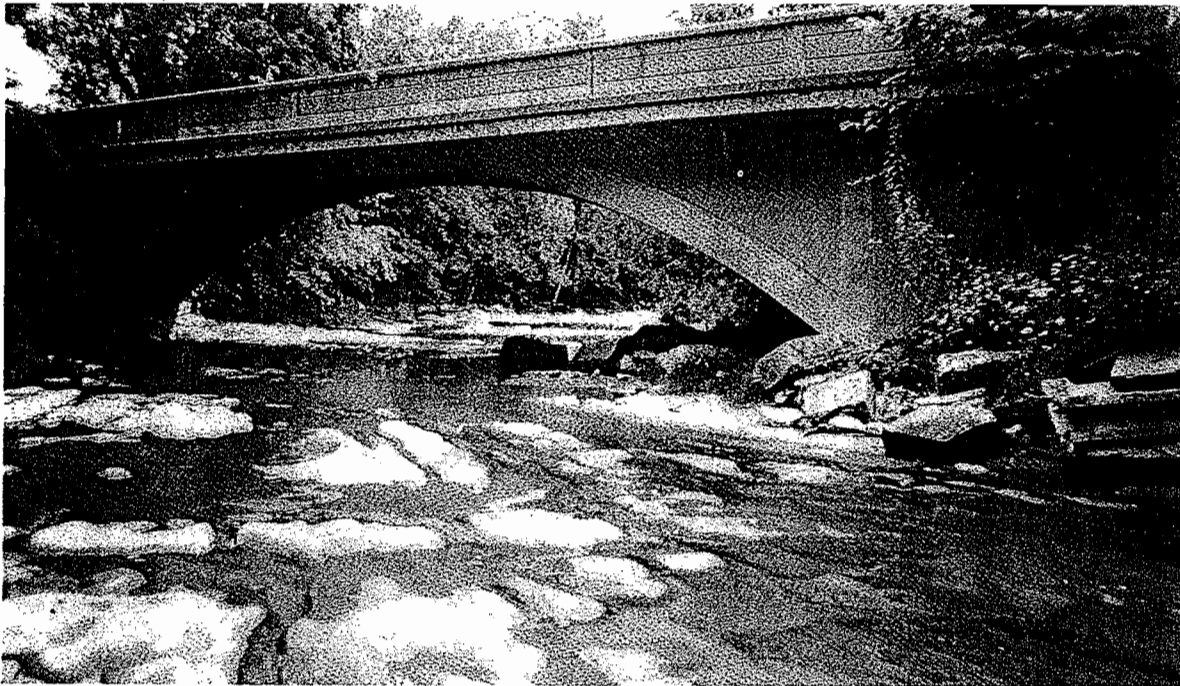


This bridge on County Route 4 in Belmont County was built in 1930, a time when the role of consulting engineers such as Daniel Luten was waning. The onset of the Great Depression in 1929 caused local funds, on which the consultants had become dependent, to be

channeled into relief for the unemployed. The plaque identifies this as a bridge built by the Luten Bridge Company. The three ribs of the 72-foot arch support a 20-foot wide roadway. The abutments are concrete with stone wingwalls.

Bundysburg, Geauga County
County Route 38 (Bundysburg Rd.)
Parkman Township
Crosses Swine Creek
UTM Coordinates-17/499520/4584320

Closed spandrel rib arch
Builder: Hereth Construction Co.
Designer: Daniel B. Luten
Constructed: 1930
Structure File No. 2831511



This skewed bridge has twin arches supporting a concrete slab deck with an overall length of 83 feet. The arch itself spans 71 feet and represents one of Daniel Luten's most popular designs.

Bids to build the bridge were opened September 30, 1930, and the estimated cost for the structure was \$6,000.00. The bid accepted was in the amount of \$5,650.00 from Hereth Construction Co., Columbus.

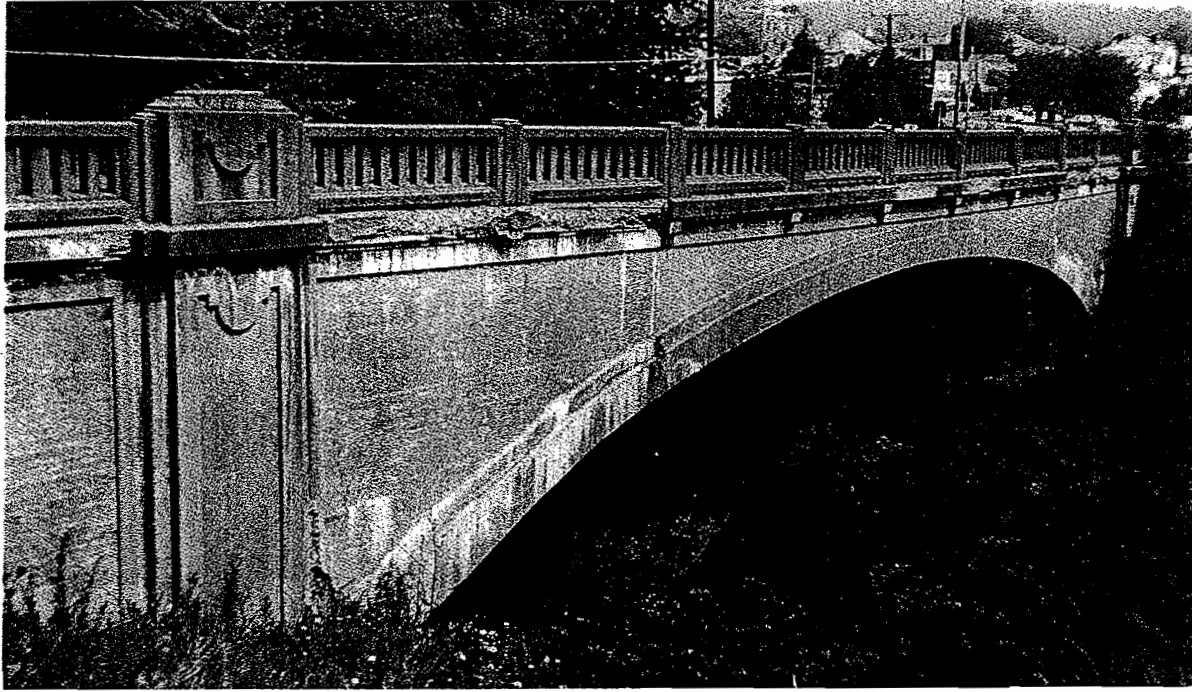
In 1983, a gabion wall approximately 60 feet

long and 12 feet high for side slope erosion protection was designed by Robert L. Phillips, who was then Geauga County Chief Deputy Engineer. Construction of the wall was completed in late summer of that year.

In 1984, Marbri Engineering and Supply repaired cracks in the arch by injecting them with epoxy resin sealer. In September of that year, BOCA Company removed the asphalt wearing surface from the bridge deck and Lago Enterprises installed a new monolithic deck at a cost of \$4,800.00.

Caldwell, Noble County
State Route 821
Crosses W. Fork of Duck Creek
UTM Coordinates-17/455640/4399210

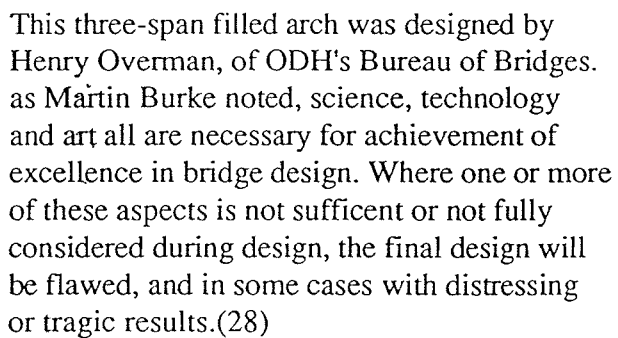
Closed spandrel filled arch
Builder: Unknown
Designers: L.W. Curl and
W.W. Flemming
Constructed: 1930
Structure File No. 6105432



This 110-foot long single span arch carries State Route 821 into Caldwell in Noble County. Decorative touches on the structure include a balustraded railing, relief work on the

abutment sides, wing walls and arches. The bridge was designed by L.W. Curl and W. W. Flemming of ODH's Bureau of Bridges.

Closed spandrel filled arch
Builder: Unknown
Designer: D.H. Overman
Constructed: 1930
Structure File No. 7500661



concrete, however, suggests that the technology was lacking, whether because of marginal constituents in the concrete or poor quality control. As a consequence, deicing salts have caused considerable deterioration of the areas of concrete exposed to them.

Brecksville Bridge
Cuyahoga and Summit Counties
State Route 82
Crosses Cuyahoga River and B&O Railroad
UTM Coordinates-17/450840/4574380

Open spandrel rib arch
Builder: Highway Construction Co.
Designer: W.S. Hindman
Constructed: 1930-31
Structure File No. 7706871



W.S. Hindman designed this elegant 1,333 foot bridge located in the scenic Cuyahoga River Valley. Mr. Hindman, one of the most prolific design engineers in the ODH's Bridge Bureau, was a colleague and possibly a mentor of Henry Overman. The structure's high parabolic arches and slender ribs are unique in the state. It is a high level structure, consisting of five arches having a span of 181.25 feet, one arch with a span of 135 feet 4.5 inches and one with a span of 90 feet 7.5 inches. Each span has two 7-foot arch ribs spaced at intervals of 19.25 feet which carry the deck and sidewalk. Graded slag was used for the coarse aggregate, the sand was Grade "A" from the Rubber City Sand Company of Akron. When the bridge was built, it had a granite chip handrail and elaborate metal lamps. The lighting system was

replaced sometime before 1976. In 1986, the bridge was determined eligible for the National Register but had deteriorated to the point that major rehabilitation was necessary. To retain the original architectural appearance, the superstructure was removed down to the top of the column caps and the existing columns and abutments were utilized. Precast arch panels were used to recreate the appearance of the original haunched fascia stringers. To retain the appearance of the cast concrete balustrade and meet current safety standards, the new parapets were solid concrete with recessed arch insets on the exterior face. McCoy Associates and the Ruhlin Construction Company shared the 1991 ODOT Historic Bridge Preservation Award in the Rehabilitation category for this project.

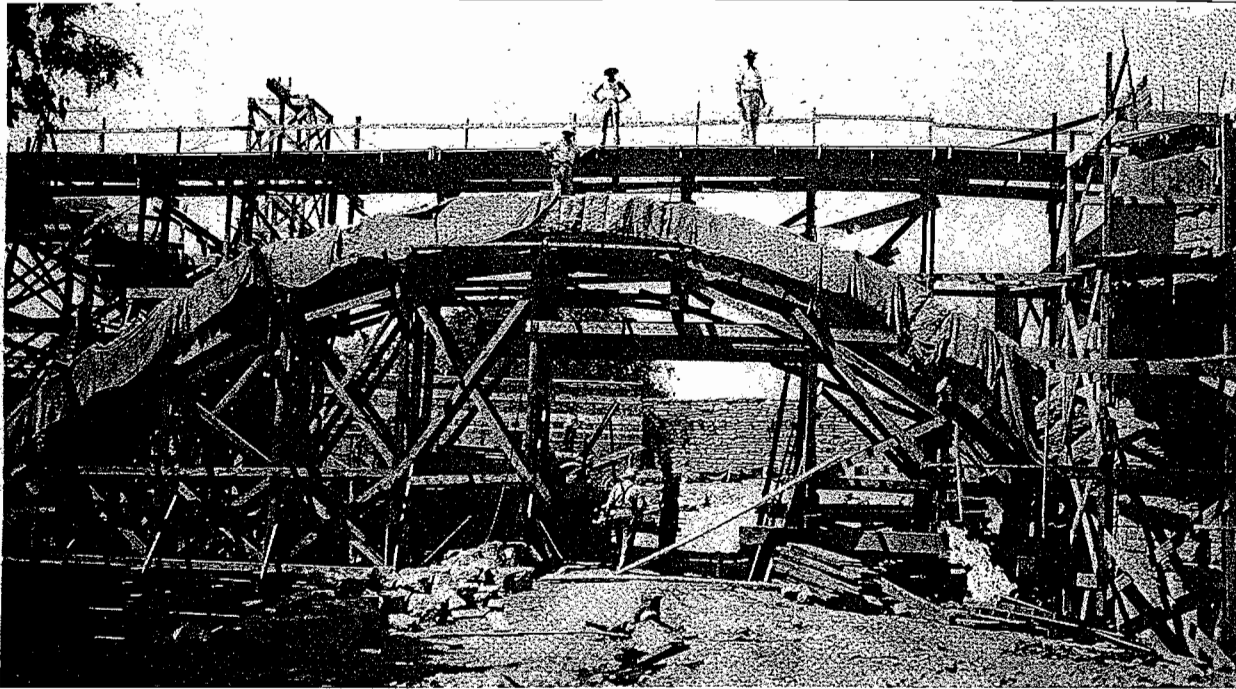
Chapter Eleven 1931-1940: Ohio's Decade Of Decorative Arches



William E. Burroughs (above) of ODH's Bureau of Bridges designed the Wakeman Bridge over the Vermilion River (pg. 108).

The circumstances that shaped bridge building in Ohio in the 1930s facilitated the construction of some outstanding examples of bridge engineering. Because of the widespread unemployment caused by the Great Depression, a large and skilled labor force desperately in need of work was available to the Bureau of Bridges. State and federal funds were channeled into building projects to provide employment at the local level. Also, during this time, demand was growing for aesthetically pleasing public buildings and structures. During this decade, the Highway Department's Bureau of Bridges was staffed by engineers with the sensitivity and talent to use these circumstances to advantage.

During the Great Depression, the Department of Highways embarked on a highway improvement and bridge replacement program aimed at increasing local employment as much as possible. Working with the WPA, over 12,300 miles of roads and streets and hundreds of bridges were built or improved. This labor-focused program had a significant effect on the design and construction of bridges as the type of structure, quality of materials and complexity and intricacy of details could be chosen with great freedom. The construction of cast-in-place concrete arch bridges, the use of stone-cut masonry, and the elaboration of structural steel, along with the adoption of intricate architectural motifs and special surface finishes, were some of the labor-intensive



During the years of the Great Depression, it was ODH practice to erect bridges that were aesthetically pleasing and labor-intensive. Structures like the Dublin bridge (above and pg. 110) provided employment for skilled workers such as carpenters who were needed to build the falsework. The skills of stonemasons were needed for application of the stone facing, visible on the arch ring.

practices used by the Department in this decade.

The role of the consulting engineer was drastically affected by the onset of the Depression. During the 1920s they had worked comfortably as consultants to city and county governments.

After 1930, the local appropriations that they had come to depend on were funneled increasingly into relief work while state-employed engineers, now assisted by federal funds, became even more influential.

Daniel Luten officially retired from bridge work in 1932 and operated a broom and mop factory in Indianapolis for the remainder of his

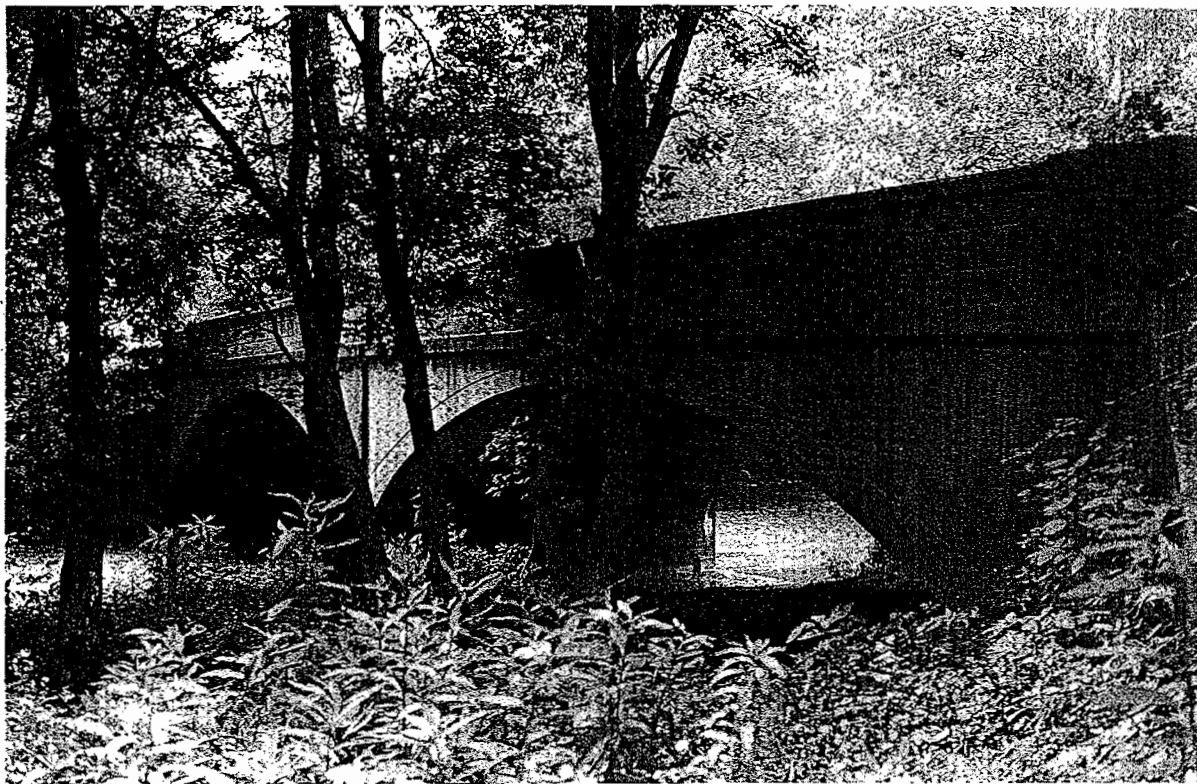
working life.

Luten had understood from the time of his earliest involvement with concrete construction that the concrete bridge business was much more open than that of steel bridges. He worked diligently to check the efforts of the "incompetent designer" during the developing years of the technology. This may be his greatest legacy.

Selected bridges from this time period include closed filled arches in Belmont and Cuyahoga counties, closed hollow rib arches in Cuyahoga County, a closed rib arch in Franklin County and open spandrel rib arches in Belmont, Trumbull, Cuyahoga, Huron, and Warren counties.

Belmont County
County Route 10
Crosses Wheeling Creek
UTM Coordinates-17/512030/4440040

Closed spandrel filled arch
Builder: Luten Bridge Co.
Designer: Daniel B. Luten
Constructed: 1931
Structure File No. 0730750



The following is adapted from an article by David Simmons that appeared in Ohio County Engineer, Winter, 1992.

The Wheeling Creek bridge in northeastern Belmont County is among Ohio's best preserved examples of the designs of Daniel Luten. It is a two-span structure, based on Luten's tied-arch design. One of the hallmarks of Luten's designs was a special type of tied concrete arch. Early in his career he experimented with timber ties that stretched between and into the abutments of a concrete arch. This feature helped sustain the horizontal thrust of the arch itself, permitting lighter, and therefore cheaper, construction while helping

protect the abutments from flood damage. Although the use of timber framing beneath the water line was a tradition of long standing in civil engineering, Luten soon recognized that reinforced concrete stream pavements, which he labeled as "flood-proofing," made a much more practical and efficient technique. His first patent for this type of structure was granted early in 1907. It was constructed by the Luten Bridge Co. of York, Pennsylvania, on a skew alignment and still maintains a forty-ton load rating. Wheeling Creek had a long history of major flooding, and the bridge's double span was likely intended to increase the waterway during times of heavy stream flow. Catalogs published by Luten emphasized the ability of

his designs to withstand virtually total submersion during high water with little or no damage.

The Luten Bridge Company of York, Pennsylvania, was founded by a group of men from Curwensville, Pennsylvania. Prominent among the founders were John, Alexander and George A. Whittaker. The Whittakers had little or no formal engineering training but learned

the contracting business and the construction of arches from their father who worked as a stone contractor, building bridges for the Pennsylvania Railroad. The company was incorporated in 1909 and specialized in Luten designs. The firm fell on hard times during the Depression Years when local governments could not afford to finance public improvements and officially closed its doors in 1940.

Blaine Hill Viaduct
Blaine, Belmont County
U.S. Route 40
Crosses Wheeling Creek and B&O RR
UTM Coordinates-17/515280/4434980

Open spandrel rib arch
Builder: Unknown
Designers: D.H. Overman,
A.J. Friemoth, K.E.
Dumbauld and C.O. Demos
Constructed: 1932
Structure File No. 0701599

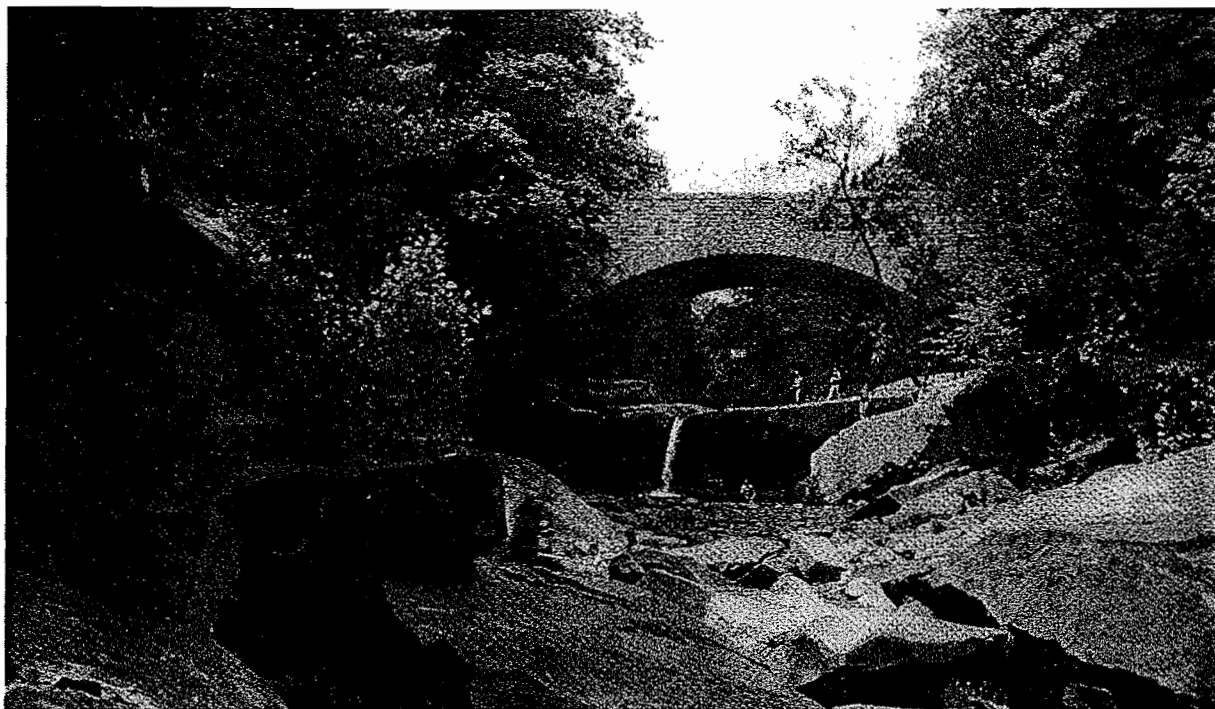


The Blaine Hill Viaduct, built in 1932, has eleven spans which vary in length from 26 to 132 feet. The bridge is 754 feet in total length. It was designed by Overman to correct a steep hillside descent into the small town of Blaine and to carry traffic over the railroad. The American Legion of Belmont County placed a plaque on the bridge designating it the "Arches

of Memory" for the World War I soldiers from the county. This designation associates the bridge with efforts to memorialize soldiers killed in the first World War. This concrete open spandrel arch bridge provides an interesting contrast to the old stone National Road bridge which is immediately beside and below it.

Chippewa Creek Bridge
Cuyahoga County
State Route 82 (Chippewa Road)
Brecksville Reservation
Crosses Chippewa Creek
UTM Coordinates-17/447950/4574280

Closed spandrel hollow arch
Builder: Highway Construction Co.
Designer: D.H. Overman
Constructed: 1932
Structure File No. 1807269



Shortly after Henry Overman's promotion to Principal Designing Engineer of Bridges, he did a design study for the SR 60 Memorial Bridge over Jamison Creek near Ashland. This is a small, 40-foot span concrete rigid-frame bridge with castle-like appearance, simulated towers, and a castellated stone facing. The characteristics of this design study were to be reflected in all his later stone faced structures. In fact, these characteristics have become a signature that clearly proclaim the influence of Henry Overman.

Today there are several surviving stone-faced concrete arch bridges that bear the castle-like configurations developed in the design study

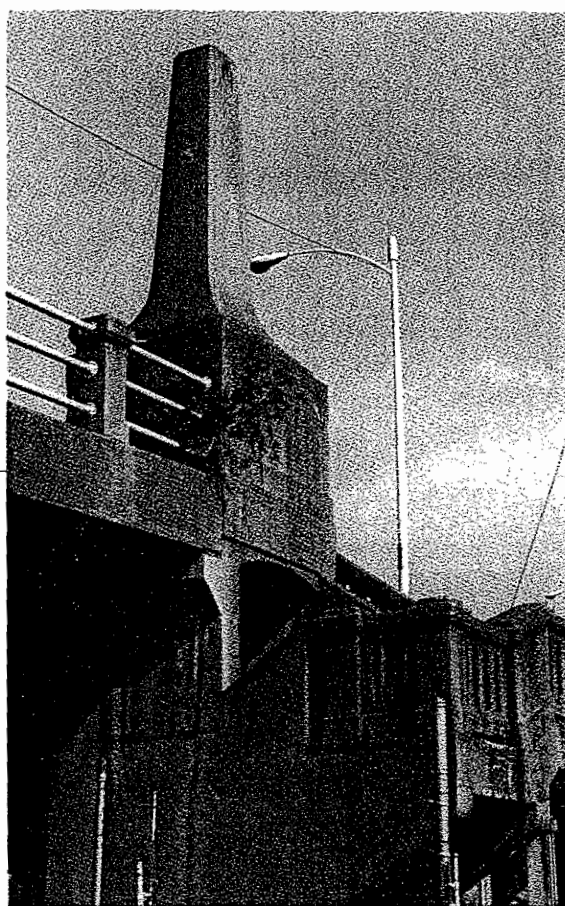
for the Jamison Creek bridge. These include: the 1934 SR 14E closed spandrel filled arch over Tinker's Creek at Bedford (pg. 109); his largest stone faced structure, the 1934 USR 33 closed spandrel rib arch over the Scioto River at Dublin (pg. 110); and the 1936 SR 6 closed spandrel hollow arch over Porter Creek at Bay Village (pg. 114). The Chippewa Creek bridge is the oldest remaining of his stone-faced bridges. This bridge and other bridges designed and constructed during the depths of the Great Depression, provided much needed employment for local labor, particularly for stone masons. They are beautiful and well-designed structures, in good condition. Construction of this bridge was a WPA project.

South Main Street Bridge
Niles, Trumbull County
State Route 46
Crosses Mahoning River, Penn RR and
Water Street
UTM Coordinates-17/519660/4558260

Open spandrel rib arch
Builder: E.H. Latham Co.
Designer: Wendell P. Brown
Constructed 1932-33
Structure File No. 7802439



The main span of this 948-foot bridge is a single open spandrel arch with a clear span of 173 feet. Built in 1932-33 to carry State Route 46 (South Main Street) over the Mahoning River in Niles, the bridge has several concrete stairways (now closed) leading to the lower level, open railings with light posts, square fluted pier columns and ornamental relief work on the arch. The remaining length of the bridge is four deck girder spans measuring 44, 54, 52, and 50 feet.



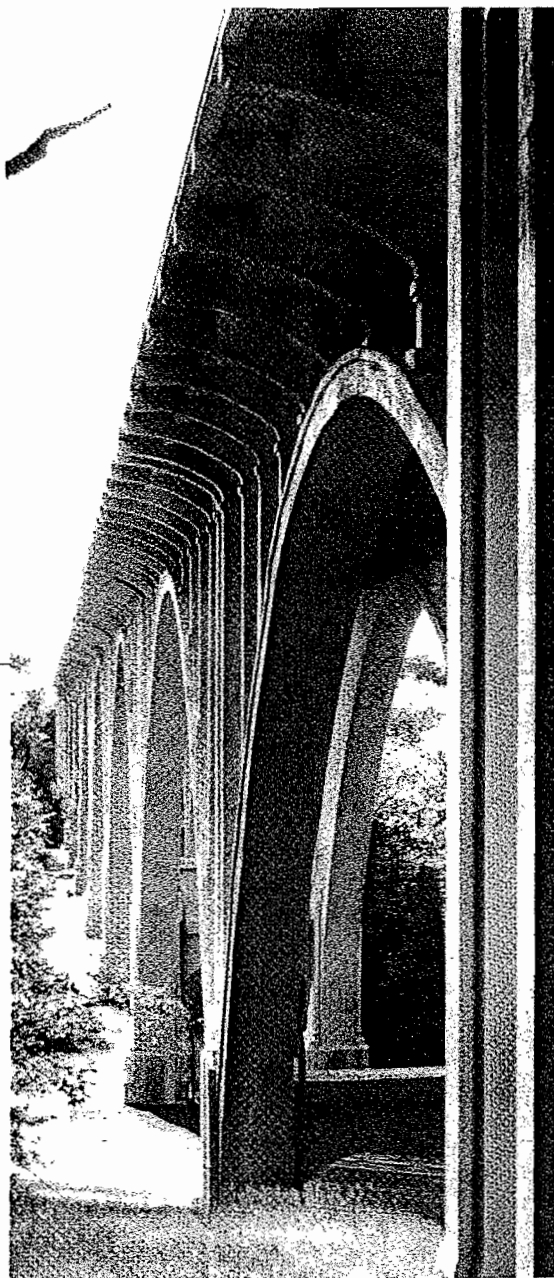
Brookpark Viaduct
Brookpark, Cuyahoga County
State Route 17
Crosses Rocky River
UTM Coordinates-17/284100/4585410

Open spandrel rib arch
Builder: Highway Construction Co.
Designers: D.H. Overman and
C.P. Smith
Constructed: 1933
Structure File No. 1802046



The following is adapted from Martin Burke's paper "Engineering Artistry in the U.S. Depression: Henry Overman's Bridges," presented at the International Bridge Conference, 1992.

One of Overman's major open spandrel bridges is the Brookpark Viaduct. Although Overman conceived the basic structure type for both this bridge and the Blaine Hill Viaduct, his attention seems to have been concentrated almost exclusively on the Brookpark Viaduct. The arch portion of this bridge consists of eight spans with the two end spans being unsymmetrical to suit the topography. This bridge is a fine example of the attention to



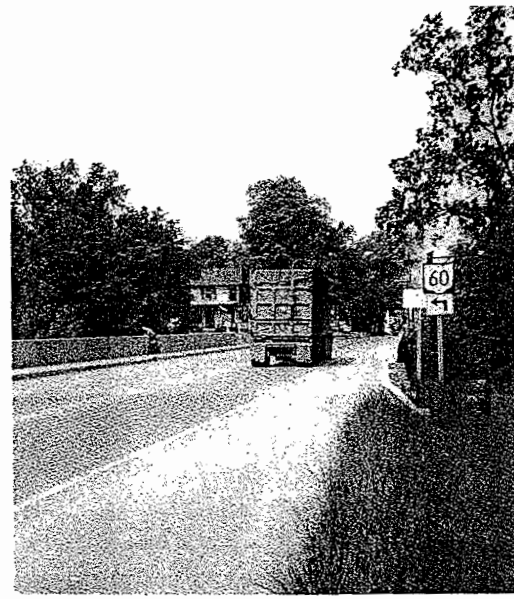
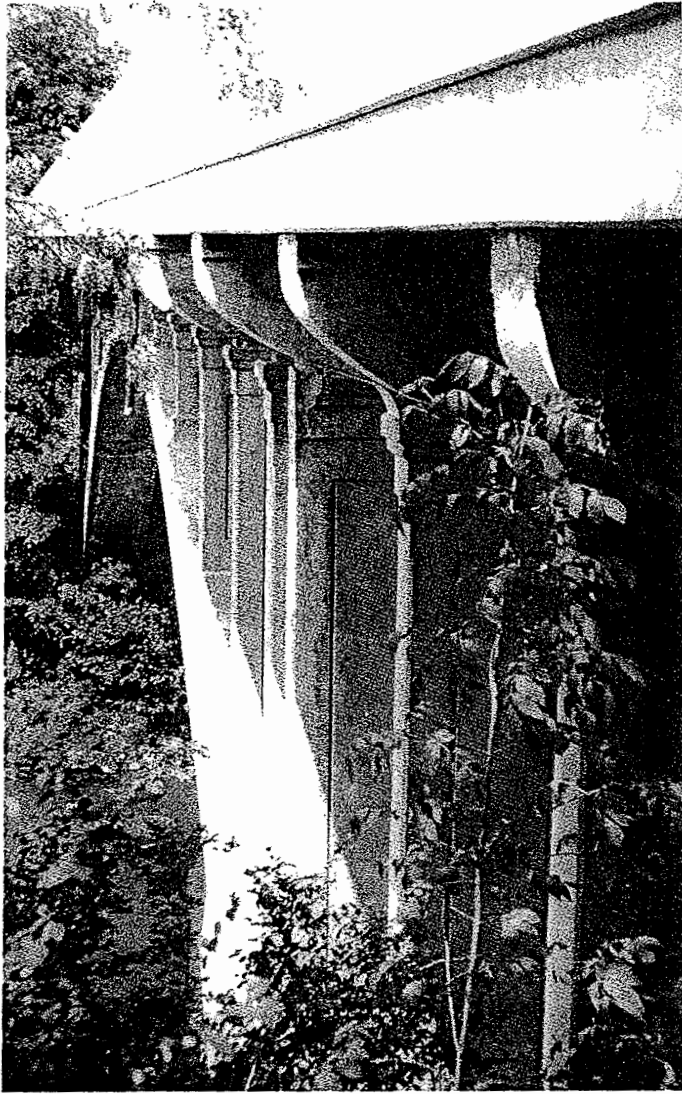
engineering and aesthetic detail that characterized Overman's designs.

The most prominent feature of this open spandrel rib-arch bridge is its sheer size. The largest bridge of this type built by the Highway Department in Cleveland, its eight major arches occupy an area more than 115 feet in height by 1,500 feet in length. The bridge springs from a shale bank on the east side of the Rocky River Valley crosses the river and park to the gentler slope on the west side. The two end spans of this eight-arch portion include six symmetrical arches of 192 feet, 3 inches center to center of piers and two unsymmetrical spans of 176 feet, 10 and one half inches center to center of piers to fit the topography. The remaining length of the 1,919 foot structure is made up of concrete T- beam spans. The bridge was designed by D.H. Overman and C.P. Smith and typical Overman touches include twin lamp standards above the twin pier columns. Structurally and aesthetically the most remarkable aspect of this bridge is the total absence of transverse lateral braces between the arch ribs above the spring lines. The avoidance of such members is one of the primary reasons why this structure has a neat, clean and uncluttered appearance. For close range views of the structure from above,

a Gothic motif was used to accentuate the railings and terminal pier pylons. Although now removed, the details of these pylons were remarkably intricate for bridge construction. This was justified at the time to achieve a public monument and also to increase employment of labor on the project. For close-range views from below, several aesthetic refinements are noticeable. As the arches bend down from the crown to the flanking piers, they gradually increase in thickness to compensate for the increasing loads. The arch ribs' rectangular shape was also slightly modified. At the top outside face of the ribs from crown to spring lines, a small 9-inch by 3-inch protrusion was provided to create a shadow line along the top edge of the ribs and give better definition to the arch during overcast days or hours of subdued daylight. At the base of each pier where the arch ribs of adjacent spans and two pier columns merge, protrusions and recesses were used in the broad pier sides to create the impression that the twin columns continued down to arch spring lines. The remarkable workmanship in the design and construction of this bridge is a result of the unique circumstances that dominated bridge building during this era.

Wakeman Bridge
Wakeman, Huron County
U.S. Route 20
Crosses Vermilion River
UTM Coordinates-17/382728/4567510

Open spandrel rib arch
Builder: Hecker-Moon Co., Cleveland
Designer: W.E. Burroughs
Constructed: 1933
Structure File No. 3901505

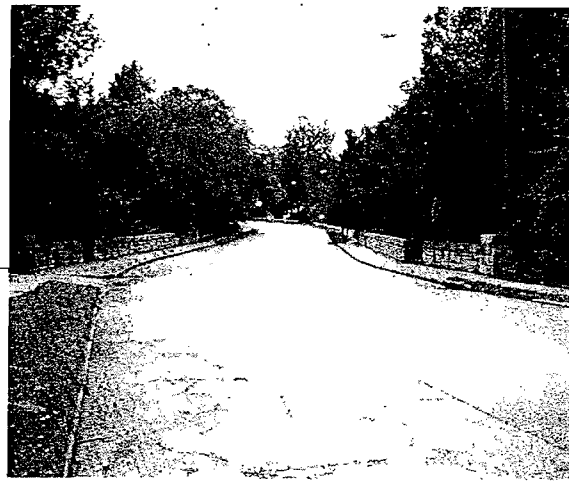
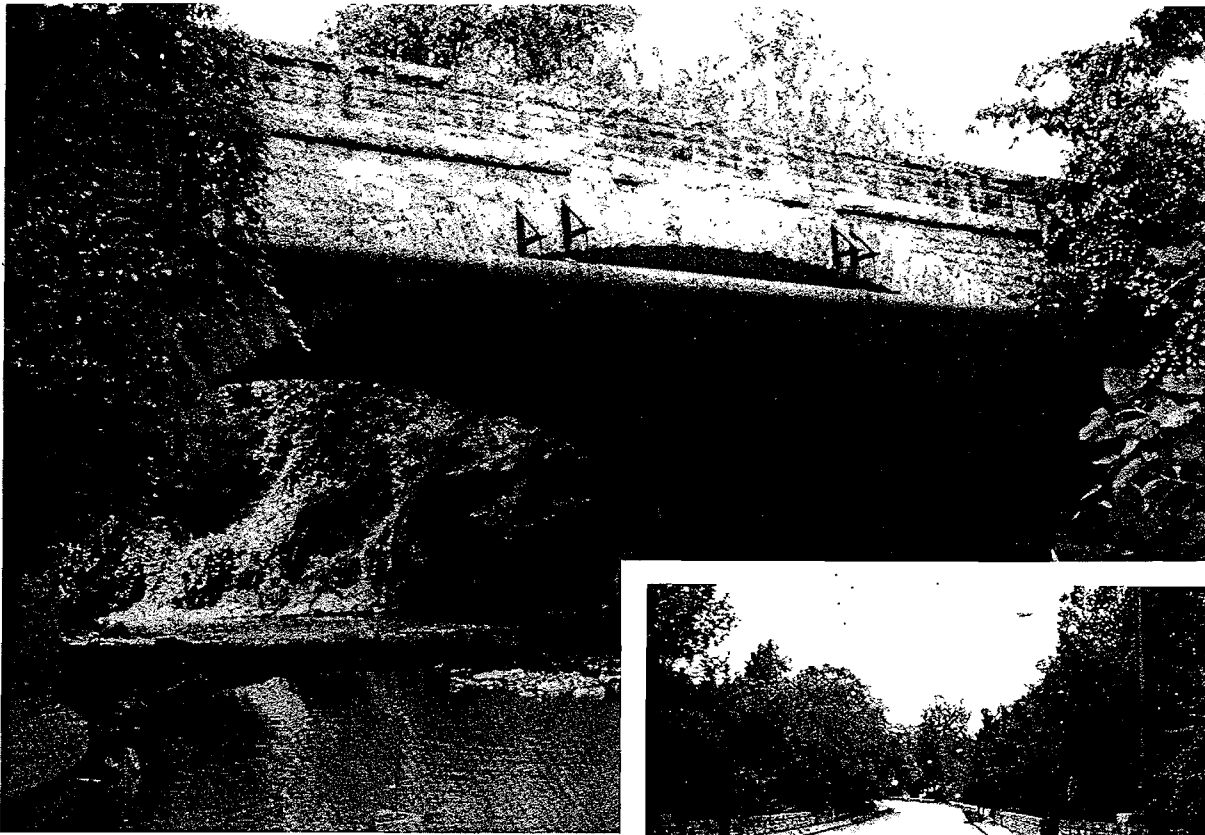


The twin ribbed arch of this open spandrel bridge measures 154 feet, one of the longer spans in the inventory of concrete structures. The 10 secondary spans are concrete T-beams of 14.5 feet each. Designed by W.E. Burroughs, Ohio Department of Highways Bureau of Bridges, it reflects the major

influence of this agency on the state's concrete bridge designs. The original decorative open railings, sidewalks and deck were replaced in the 1980s with a smooth-faced railing that features recessed exterior panels. The original decorative columns and sub-deck arcading still enhance the aesthetic rating of the bridge.

Tinkers Creek Bridge
Bedford, Cuyahoga County
State Route 14E
Crosses Tinkers Creek
UTM Coordinates-17/455590/4581560

Closed spandrel filled arch
Builder: Unknown
Designer: K.E. Dumbaugh and D.H. Overman
Constructed: 1934
Structure File No. 1801929

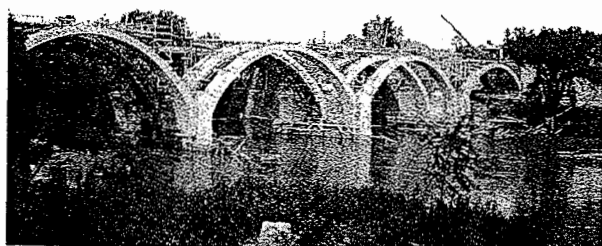
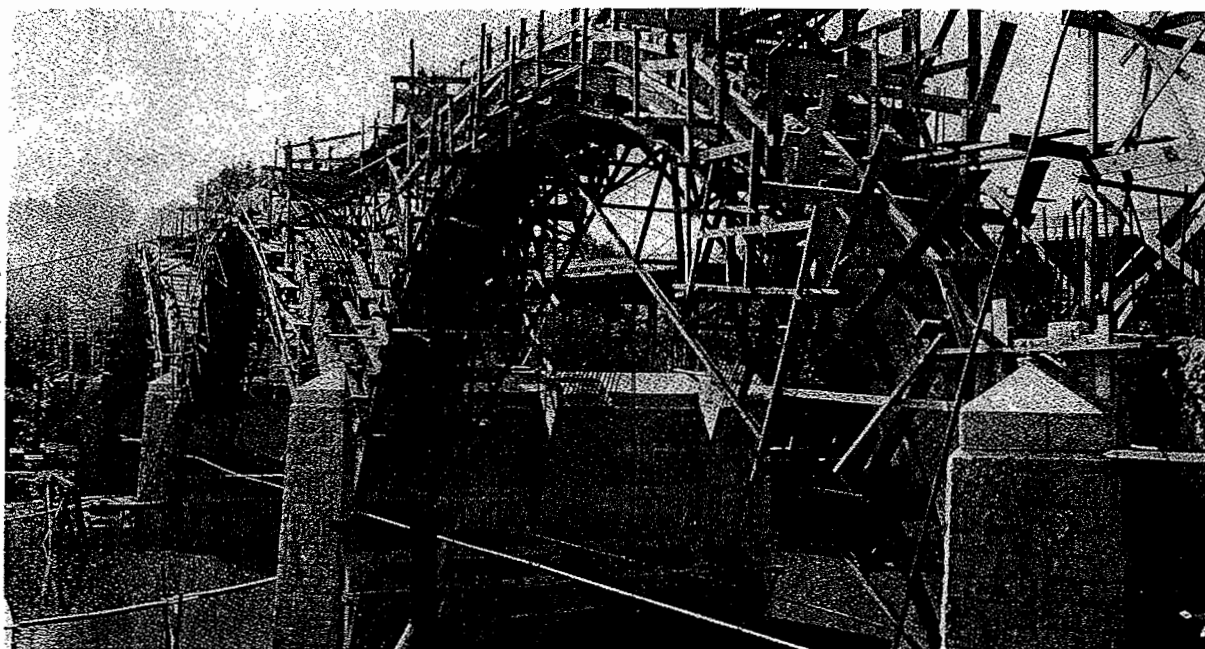


Kiser Dumbauld of the ODH Bridge Bureau designed the extensions for either side of this concrete arch bridge. The original filled span was widened by 7 feet, 9 inches on each side with cellular type stone faced arches. Castellated railings and four observation decks were added when the bridge was widened. At the time these stone faced bridges were being built, Henry Overman and the design staff of the Bridge Bureau were exceedingly busy designing approximately 150 other bridges a year in addition to a number of exceptional bridges, three of which received national attention for their great beauty. The Brookpark

Viaduct (pg. 106) was the subject of an article in Engineering News Record, Oct. 11, 1934; the Dublin Bridge (pg. 110) was the topic of an article in Civil Engineering, Aug. 1936; and the Lorain Avenue Viaduct which was chosen "Most Beautiful Steel Bridge" of its class constructed in the United States in 1935 by the American Institute of Steel Construction.

Dublin Bridge
Dublin, Franklin County
U.S. 33, State Route 161
Crosses Scioto River and
State Route 257
UTM Coordinates-17/319440/4440260

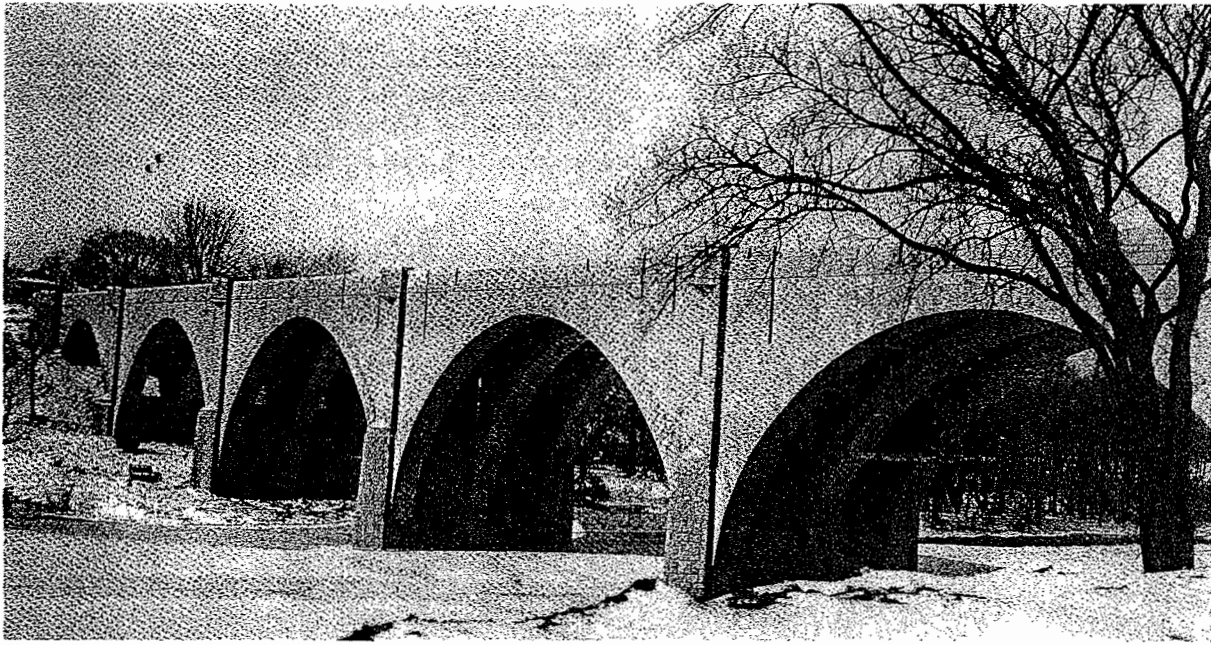
Closed spandrel rib arch
Builder: Elford Const. Co.
Designers: D.H. Overman and
A.J. Friemoth
Constructed: 1935-36
Structure File No. 2501171



The following text is adapted from Martin Burke's paper "Engineering Artistry in the U.S. Depression: Henry Overman's Bridges," presented at the International Bridge Conference, 1992, and from "Dublin Bridge and Grade Separation," by D.H. Overman, Civil Engineering, August, 1936.

The Dublin Bridge is the largest stone faced

concrete arch bridge designed by Henry Overman and an excellent example of this engineer's strong aesthetic sense. This closed spandrel concrete rib-arch carries US 33 and SR 161 across the Scioto River and over the southbound ramp of SR 257. Six spans cross the Scioto River. Of the six arch spans of three ribs each, the two central ones are 100 feet from center to center of piers, the intermediate



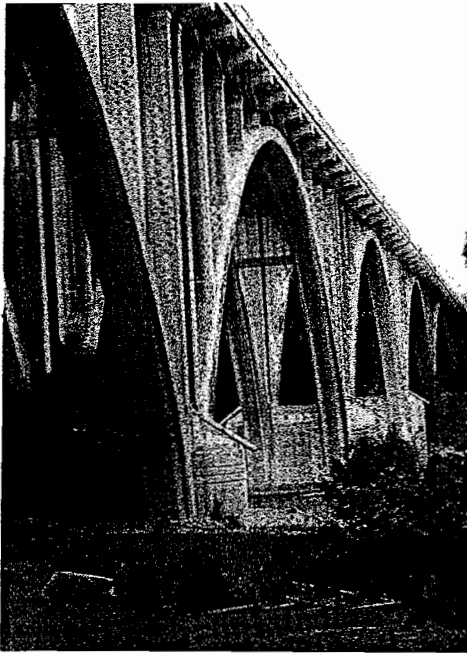
ones 95 feet, and the two ends ones which are unsymmetrical, 73 feet. The bridge has an overall length of 627 feet and carried a 32-foot roadway and two 3-1/2 foot sidewalks.

Columbus Limestone, the bedrock of the area which crops out along the banks of the river, was used for facing the bridge to produce a structure that would harmonize with its natural surroundings. Typical of Overman's stone faced bridges, the castellated limestone surface is given relief by protruding cutwaters and parapet balconies at intermediate piers, protruding, radially placed ring stones, a semicontinuous protruding belt course at the base of the parapet and variable-length vertical slits or recesses placed unsymmetrically within each span. The stone work added approximately seven percent to the cost of the structure, an increase that was justified by the

improved appearance of the bridge and by the protection from the elements offered by the facing stone. Project plans required the ring stones, belt courses and pier stones to have newly broken faces with a maximum one-inch depth variation; pier, parapet railing and curved retaining wall cap stone to have a picked finish; and the ring stones and belt courses to protrude three inches beyond the plane of the facing stones. Concrete surfaces also received considerable attention to enhance close-range views of the structure. Plywood forms or form liners were required for all exposed surfaces; form joints were to be filled to give a smooth surface; finally, the exposed concrete surfaces, except those within five feet of the bottom of the deck slab, were sand-blasted after the concrete was at least two weeks old to give a color and texture similar to that of the facing stone.

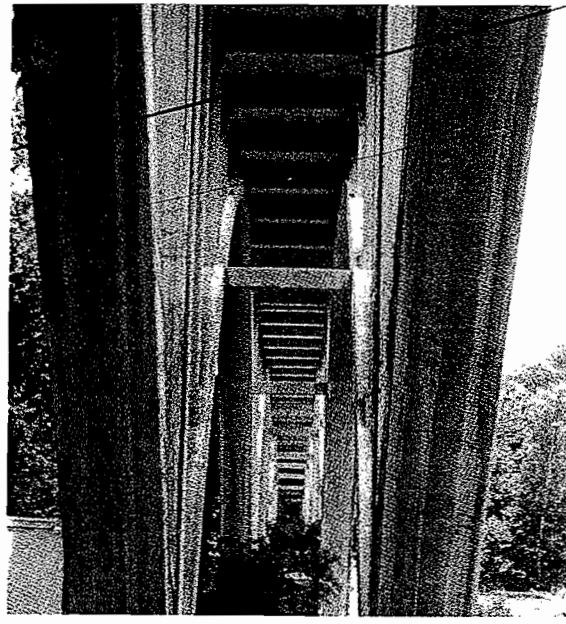
Foster Bridge
Foster, Warren County
U.S. Route 22, State Route 3
Crosses Little Miami River
UTM Coordinates-16/736880/4355700

Open spandrel rib arch
Builder: Unknown
Designers: D.H. Overman,
A.J. Friemoth and C.P. Smith
Constructed: 1936-38
Structure File No. 8300038



The following is an excerpt of Martin Burke's paper "Engineering Artistry in the U.S. Depression: Henry Overman's Bridges," presented at the International Bridge Conference, 1992.

This 1,404-foot concrete rib arch is located about 20 miles northeast of Cincinnati. The basic characteristics of this bridge are the same as previously used for the Ashtabula, Brecksville, Blaine, and Brookpark structures. These include haunched fascia beams, flexible spandrel columns, and movable deck joints at piers. Also, the deck and piers of approach spans are shaped to reflect the deck and spandrel columns of the arch spans. The length



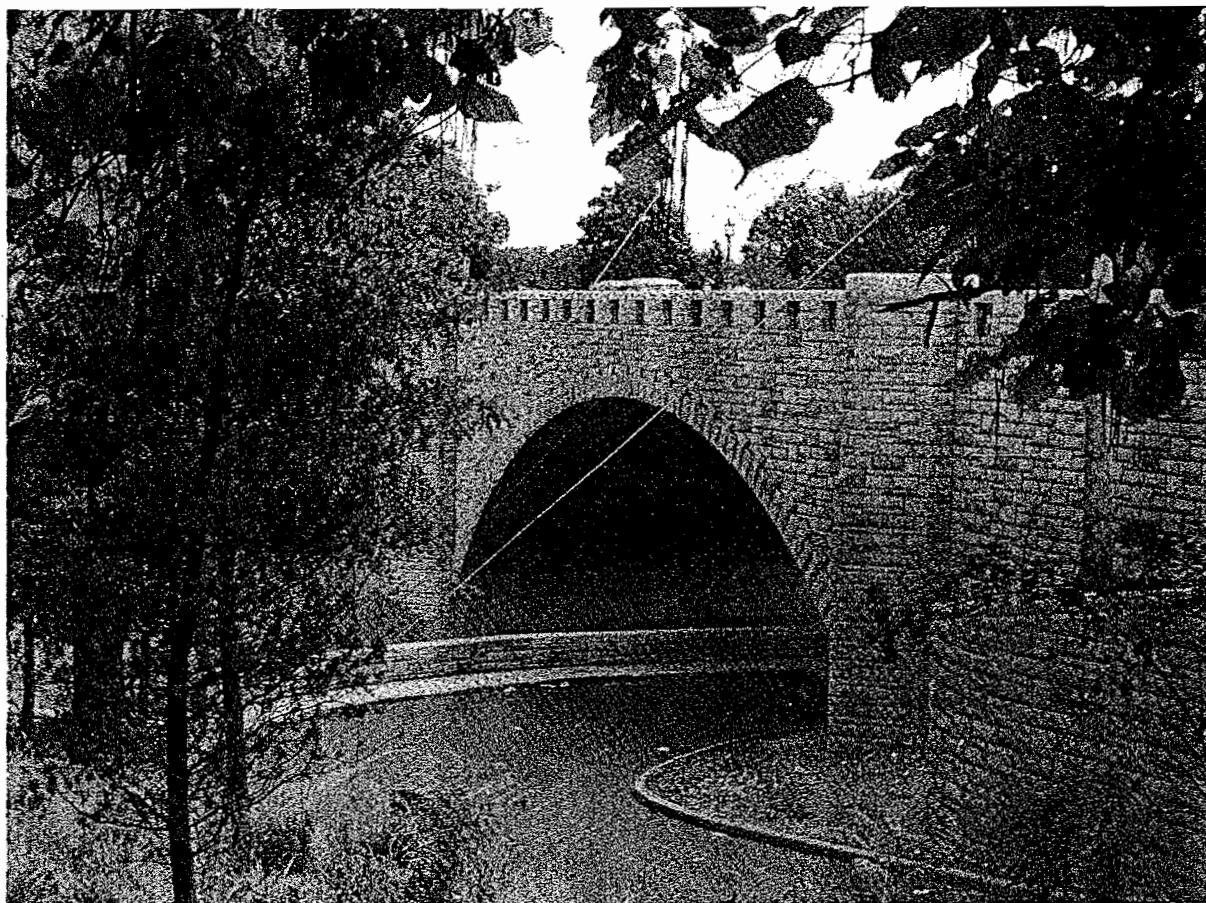
of the bridge and the grade of the roadway were the determinates that influenced the primary characteristics of this structure. Since the spring line elevation of the arches at interior piers, the deck depth throughout the length of the structure, and the height of the spandrel columns at the arch crown were made the same, the span, rise and rib thickness of the arches are each progressively greater as the deck of the structure ascends the grade. Not only were these arches labor intensive to build, this bridge with its six major spans, each with a different length, rise, and rib thickness (spans vary in increments of five feet, rib thicknesses vary in increments of one inch), it was also labor intensive to design in an era before computers. To simplify the design, it would have been possible to design one or two arches by increasing the spandrel column lengths as the bridge ascends the grade. This would have spoiled the appearance of the structure as seen in elevation since the juxtaposition of the arch

crown and the underside of the deck would be noticeably different, span after span, and there would be no regularity in these differences. By gradually changing the rise and length of each arch span at a rate determined by the change in grade, the junction of the arch crown and the deck of each span is the same, the spandrel columns of each span are essentially the same, and the arches appear to be the same, or at least so similar the differences are difficult to distinguish. The largest arch has a span of 175 feet center to center of piers, a rise of 72 feet, 4 inches, and ribs measuring 2 feet, three inches by 6 feet at the crown. Construction of this bridge required 220,295.5 man-hours of work, 9,000 cubic yards of concrete, 1,100,000 tons of steel and \$500,000 in cost.

The bridge was extensively rehabilitated in 1991. All superstructure above the pier caps was removed and reconstructed and the curbs and railings were replaced.

Bay Village, Cuyahoga County
U.S. Route 6
Crosses Porter Creek
and Park Drive
UTM Coordinates-17/422200/4593280

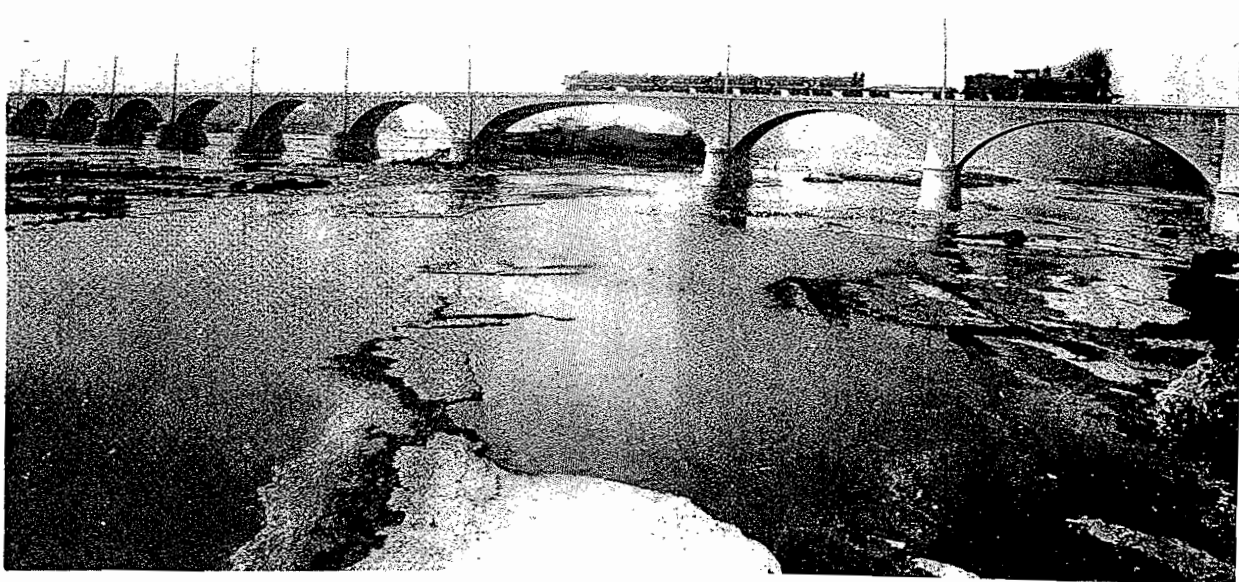
Closed spandrel hollow arch
Builder: Unknown
Designers: D.H. Overman and
C.P. Smith
Constructed: 1937
Structure File No. 1800426



The stone facing of this concrete arch and its castellated appearance are typical of Henry Overman's stone-faced structures designed in the 1930s. While the bridge appears to be a filled spandrel, it is in reality a hollow arch, without fill material between the floor slab and the arch proper. The floor slab is 10-1/2 inches thick, supported by seven arch cross walls 1 foot, 1 inch thick spaced 10 feet, 2 inches and two arch cross walls one foot, 6 inches thick spaced 10 feet, 4-1/2 inches at each abutment.

The 80 foot arch carries U.S. 6 over Porters Creek and Park Drive in Bay Village. Medusa supplied the cement for the constructions, Schmidt Brothers Sand and Supply of Cleveland supplied the fine aggregate and National Tube Co., Lorain, supplied the coarse aggregate. The sandstone railings have decorative square openings with steel grill work and there are four observation balconies with benches.

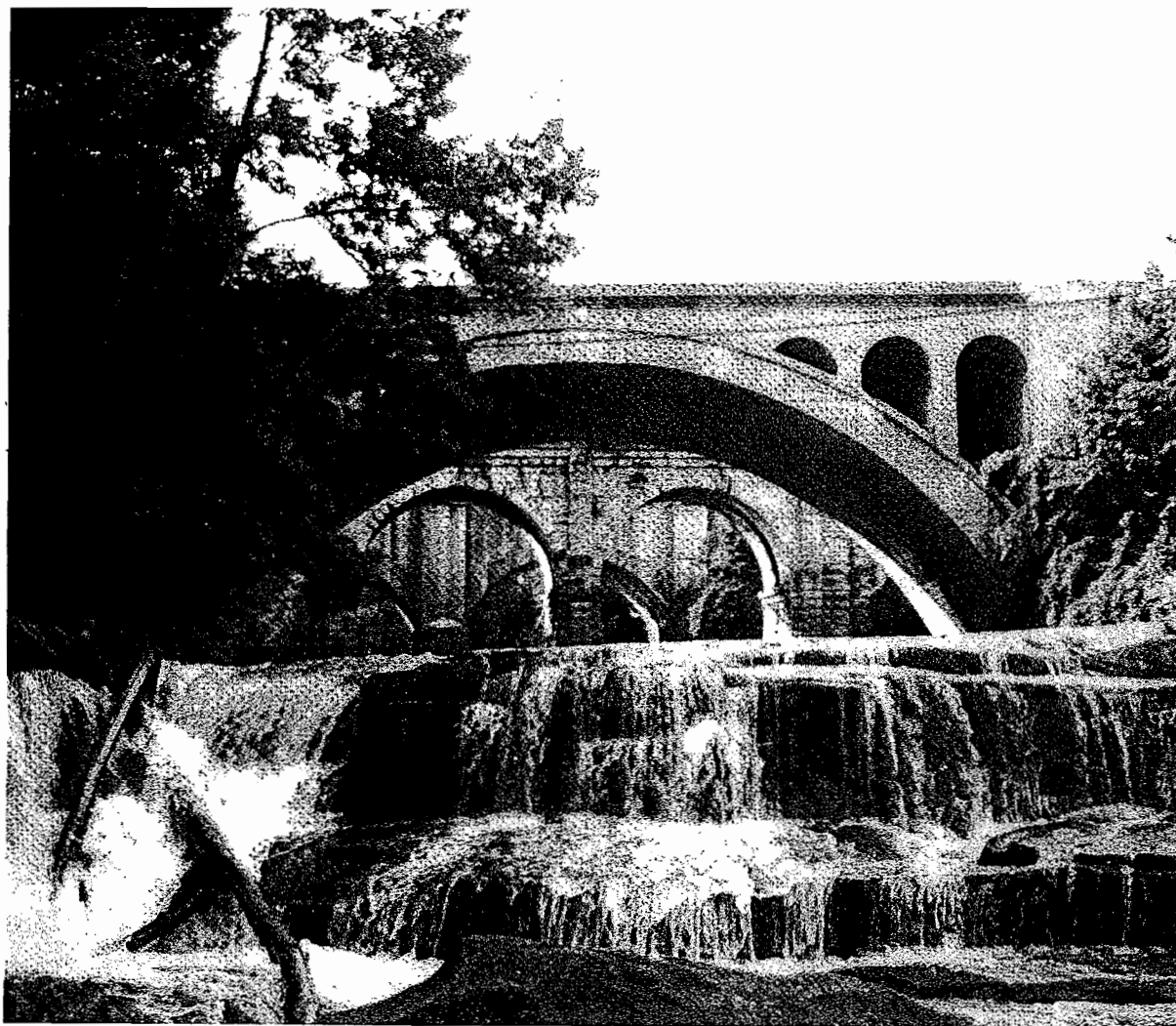
Part Four: Preservation Plan



The Maumee River bridge on the Lima and Toledo Traction Railway at Waterville was, at the time of its construction in 1907, the longest concrete bridge ever built. Constructed by Daniel Luten's National Bridge Company, the structure consisted of twelve spans of 75 to 90 feet with a total length of 1,200 feet.

Photograph from James Cooper collection

Chapter Twelve: Programmatic Agreement



Beyond the concrete slab arch bridge (pg. 51) that carries Conrail over Barrett Rd. in Berea, Cuyahoga County, a stone viaduct known as the Lincoln Bridge is visible with a 1918 railroad bridge beyond.

PROGRAMMATIC AGREEMENT
AMONG
THE FEDERAL HIGHWAY ADMINISTRATION, OHIO DIVISION
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
OHIO DEPARTMENT OF TRANSPORTATION
OHIO STATE HISTORIC PRESERVATION OFFICER

REGARDING

FEDERALLY FUNDED OR APPROVED HIGHWAY BRIDGE PROJECTS

WHEREAS, the Federal Highway Administration (FHWA) has determined that assisting the Ohio Department of Transportation (ODOT) with replacement or rehabilitation of bridges (the Projects) may have an adverse effect on bridges listed or determined eligible for listing in the National Register of Historic Places, and has therefore consulted with the Advisory Council on Historic Preservation (the Council) and the Ohio State Historic Preservation Officer (OSHPO), pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. 470f), and implementing regulations (36 CFR Part 800), and

WHEREAS, FHWA, the Council, OSHPO and ODOT agree that as used in this Programmatic Agreement the term "first historic bridge inventory" refers to the bridge inventory completed by ODOT in 1982 and published in 1983 as The Ohio Historic Bridge Inventory, Evaluation and Preservation Plan, and

WHEREAS, FHWA, ODOT, and OSHPO agree to accept the results of the "first historic bridge inventory" regarding Baltimore through trusses; bascules; bowstring arch pony and through trusses; camelback pony and through trusses; cantilevered deck and through trusses; double intersection Pratt through trusses; double intersection Warren pony, deck and through trusses; Fink through truss; king post; lattice trusses; lenticular pony and through trusses; Parker pony, deck and through trusses; Pegram through truss; Pennsylvania through trusses; Pratt double deck truss; Pratt pony, deck and through trusses; steel arches; suspension bridges; swing bridges; truss leg bedsteads; vertical lifts; Warren pony and through trusses; Warren polygonal chord pony and through trusses; and stone arch bridges, and

WHEREAS, FHWA, ODOT and OSHPO agree that metal and stone bridges identified as "Selected" in the first historic bridge inventory, are eligible for the National Register of Historic Places. Undertakings, as defined in Stipulation I, involving Selected bridges, are subject to the 106 Consultation Process, and

WHEREAS, FHWA, the Council, OSHPO and ODOT agree that as used in this Programmatic Agreement, the term "second historic bridge inventory" refers to the inventory completed and published as the Second Ohio Historic Bridge Inventory, Evaluation and Preservation Plan in 1990, and

WHEREAS, FHWA, ODOT and OSHPO agree to accept the results of the second historic bridge inventory, concerning metal truss bridges, continuous steel deck girders and beams, concrete arches, cantilevered deck and steel arches, and

WHEREAS, FHWA, ODOT and OSHPO agree that bridges identified as "Selected" in the "second historic bridge inventory", are eligible for the National Register of Historic Places. "Undertakings", as defined in Stipulation A-I, involving these bridges are subject to the 106 Consultation Process, and

WHEREAS, FHWA, the Council, OSHPO and ODOT agree that as used in this Programmatic Agreement, the term "Concrete Arch Inventory" refers to the survey completed and accepted by the Advisory Committee in February 12, 1993, and

WHEREAS, FHWA, ODOT and OSHPO agree to accept the February 1993 results of the concrete arch inventory for closed concrete filled, hollow and ribbed arches, and open concrete ribbed and slab arches. FHWA, ODOT, and OSHPO agree that these results supersede any previous designations of Selected or Reserve Pool in the concrete arch categories built prior to 1941.

WHEREAS, FHWA, ODOT and OSHPO agree that concrete arch bridges identified as "Selected" in the concrete arch inventory are eligible for the National Register of Historic Places. "Undertakings", as defined in Stipulation I, involving these bridges, are subject to the 106 Consultation Process, and

WHEREAS, FHWA, the Council, OSHPO and ODOT agree that the goal of these inventories is to identify and preserve bridges on or eligible for listing on the National Register, and

WHEREAS, FHWA, the Council, OSHPO and ODOT agree that as used in this Programmatic Agreement, the term "historic bridge" refers to bridges included in or eligible for inclusion on the National Register of Historic Places; considered a contributing element within a listed or eligible historic district; or identified as Selected bridges in Ohio's historic bridge inventories. Historic bridges are subject to the 106 Consultation Process, and

WHEREAS, FHWA, the Council, OSHPO, and ODOT agree that as used in this Programmatic Agreement, the term "Reserve Pool" bridge refers to bridges included in the historic bridge inventories that will be assessed for National Register

eligibility when they are programed for rehabilitation or replacement. If the "Reserve Pool" bridge is identified as eligible for the National Register of Historic Places it will be subject to the 106 Consultation Process. If the Reserve Pool bridge is identified as not eligible for the National Register of Historic Places the 106 Consultation Process has been completed for that bridge, and

WHEREAS, FHWA, the Council, OSHPO, and ODOT agree that all bridges included in the historic bridge inventories and not identified as Selected or Reserve Pool structures, or located within a historic district are determined to be not eligible for the National Register of Historic Places, and

WHEREAS, FHWA, the Council, OSHPO and ODOT agree that all slab, beam, box beam, girder and frame bridges, or culverts made of concrete, steel or aluminum are determined to be not eligible for the National Register of Historic Places, and

WHEREAS, FHWA, the Council, OSHPO and ODOT agree this Programmatic Agreement shall remain in effect until the completion and acceptance by all parties of the historic bridge inventory update scheduled for the year 2000 or January 1, 2001. Renewal of this Programmatic Agreement will be by mutual consent of all parties.

NOW, THEREFORE, FHWA, the Council, OSHPO, and ODOT (the parties to this agreement) agree that Highway Bridge Projects shall be administered in accordance with the above provisions and the following stipulations to satisfy FHWA's Section 106 responsibility for all individual undertakings of the highway bridge projects.

STIPULATIONS

Section A - Definitions

- A-I. As used in this Programmatic Agreement, the term "undertaking" refers to federal actions potentially affecting bridges. "Undertakings" include replacement, rehabilitation, restoration or repair of bridges; removal and replacement of structural parapets on historic bridges; and attachment of guardrails across historic bridges.
- A-II. "Undertakings" involving historic bridges will be subject to the 106 Consultation Process.
- A-III. "Undertakings" affecting bridges not eligible for the National Register of Historic Places will not be subject to the 106 Consultation Process, if the undertaking, in compliance with 36 CFR Part 800, will have no effect upon other known cultural resources.

- A-IV. Routine maintenance, road repair, deck replacement, resurfacing and attachment of approach guardrails to an existing historic structure are not considered "undertakings" as defined in Stipulation A-I. and are not subject to the 106 Consultation Process.

Section B -General

- B-I. The next update is scheduled for the year 2000, when, at such time FHWA, ODOT and the OSHPO agree to update the historic bridge inventory every ten years. During the evaluation scheduled for the year 2000, bridges built between the years of 1951 and 1960 will be added to the evaluation; and the bridge styles previously identified as not eligible for the National Register will be re-evaluated.
- B-II. In the event of an emergency involving a historic bridge, ODOT and (where it involves a federal approval) FHWA will undertake only those repairs or other immediate actions necessary to maintain public safety and remedy the emergency situation; once the immediate emergency is remedied, ODOT will consult with the OSHPO in accordance with Stipulation A-I. regarding any further necessary, permanent repair work.
- B-III. When an owner of a historic bridge notifies ODOT of its intent to replace the bridge using local funds and no federal approvals are required ODOT will immediately notify the OSHPO and will encourage the owner to consider one or all of the following: rehabilitation, reuse, or relocation. If the bridge is removed ODOT will notify the OSHPO and will encourage documentation.
- B-IV. When an owner of a historic bridge notifies ODOT of its intent to rehabilitate the bridge using local funds, ODOT and the OSHPO will, upon the owner's request, meet with the owner and provide expert advice on a rehabilitation which would retain the historic integrity of the structure.
- B-V. ODOT will encourage county engineers to salvage usable elements of non-historic structures for use on historic structures.
- B-VI. ODOT will notify the OSHPO when a National Register, Selected, or Reserve Pool bridge is lost through a natural disaster, an accident, or through demolition by a local government. When a Selected bridge is

lost, ODOT will recommend a Reserve Pool structure, in the same category, as a replacement.

- B-VII. The OSHPO will utilize the results of the historic bridge inventories in making recommendations to The Ohio Historic Site Preservation Advisory Board, county engineers, and interested individuals who may be considering National Register nominations for bridges not identified as Selected or Reserve Pool.
- B-VIII. The OSHPO will notify ODOT of nominations (historic district, thematic, individual) that include bridges.
- B-IX. ODOT and the OSHPO will present up to three annual awards to city, town, village and county engineers who have initiated and completed the most outstanding projects involving the preservation, rehabilitation and reuse of historic bridges. The recipients of the awards will be selected jointly by representatives of ODOT and the OSHPO.
- B-X. The OSHPO and ODOT will maintain an updated file of parks, political subdivisions, agencies, museums, and individuals interested in obtaining a historic bridge for non-vehicular or limited use. If economically and structurally feasible to move the bridge to a new location, the Ohio SHPO and ODOT will assist by identifying potential funding sources to aid in the relocation.
- B-XI. When significant new information is found for a bridge not listed on the National Register or identified as Selected, it will be re-evaluated for National Register eligibility by ODOT and the SHPO.

Section C - Monitoring, Amendments and Termination

- C-I. FHWA, ODOT, and the OSHPO will meet on an annual basis for a process review which will include an assessment of this Programmatic Agreement.
- C-II. ODOT will provide annually to the OSHPO a listing of bridge project undertakings which, in accordance with Stipulation A-III., are not subject to the 106 Consultation Process.
- C-III. ODOT and the OSHPO will meet on an annual basis to review the status of the National Register, Selected, and Reserve Pool structures. To assist in this review ODOT will provide the OSHPO, annually, a status report of the National Register, Selected, and Reserve Pool structures. During the annual review when the numbers of any Reserve Pool category reaches

50% of the original total of Reserve Pool structures in that category, the remaining bridges in that category will be re-evaluated. Based upon the re-evaluation, ODOT will recommend to the SHPO those bridges to be re-classified as Reserve Pool structures. A sufficient number of structures will be elevated to the Reserve Pool category to compensate for losses and to re-establish the original number of Reserve Pool structures in individual categories.

- C-IV. Any party to this agreement may institute a 60 day negotiation period to resolve any mutually identified problems with any particular stipulation. In the event that all parties are unable to develop a mutually agreeable resolution, the Stipulation in question will be nullified, and FHWA and ODOT will comply with the applicable procedures of 36 CFR Part 800.4 through 800.6 regarding undertakings.

Section D - Rainbow Arch Bridges

- D-I. As used in this Programmatic Agreement, the term "rainbow arch" refers to reinforced concrete structures that essentially duplicate 19th century bowstring metal trusses with main arches, diagonal braces, and verticals, comprising the "bow" and the horizontal lower chord in tension comprising the "string". These bridges are subject to the 106 Consultation Process.
- D-II. FHWA, ODOT and OSHPO agree that when any of the existing rainbow arch bridges is programed for replacement, ODOT will encourage rehabilitation. If rehabilitation is not feasible and prudent, ODOT will recommend bypassing the bridge and reusing it for pedestrian and/or bicycle traffic.
- D-III. FHWA, ODOT and OSHPO agree that if it is deemed not prudent and feasible to rehabilitate or bypass a rainbow arch, ODOT will recommend a new rainbow arch. The new rainbow arch will not necessarily constitute a replica, but will be built using the plan developed by ODOT for rainbow arches. This plan utilizes original highway department standard plans, to meet current design standards. This standard shall be considered only if there are no other available alternatives. FHWA, ODOT and OSHPO agree that no more than three rainbow arches will be replaced in such a manner, with one in northern Ohio, one in central Ohio and one in southern Ohio.

Section E - Determinations of Effect

- E-I. For all proposed "undertakings" involving historic bridges, ODOT, in consultation with the OSHPO, will use the Criteria of Effect in 36 CFR Part 800.9(a)-(c) to determine the effect of the undertaking on the historic bridge. FHWA or ODOT will seek the concurrence of the OSHPO with the finding and transmitting of sufficient descriptive information (such as maps, photographs, preliminary engineering studies) to enable the OSHPO to evaluate the effect of the undertaking. Within 30 days of receipt of notice of the undertaking, the OSHPO will notify ODOT of their concurrence or disagreement with ODOT's assessment of the effect of the undertaking.
- E-II. When FHWA, ODOT, and the OSHPO agree to a finding of "No Effect" or "No Adverse Effect", the project may proceed. The summary documentation for the Council provided for in 36 CFR Part 800.5(d)(1)(i) will not be required.
- E-III. ODOT and the OSHPO will mutually determine the level of documentation necessary for proposed rehabilitation or replacement projects for Reserve Pool bridges that are identified as eligible for the National Register.
- E-IV. When FHWA, ODOT and the OSHPO agree to a finding of an "Adverse Effect" for a historic bridge, FHWA and ODOT will attempt to minimize, and mitigate the adverse effect. FHWA and ODOT will evaluate as appropriate, alternatives such as one-way traffic, minor rehabilitation, and major structural upgrade of the existing bridge as mitigation measures. If these alternatives are found to be not feasible and prudent, then relocation and marketing of the historic bridge will be considered prior to demolition, with recordation of the bridge.
- E-V. In the case of an "Adverse Effect", for a historic bridge, FHWA and ODOT will comply with all sections of 36 CFR Part 800.6(a). FHWA and ODOT agree to provide a Memorandum of Agreement accompanied by the documentation specified in Section 800.8(b) and (c) and afford the Council an opportunity to comment as provided in 36 CFR Part 800.6(a).

- E-VI. When FHWA, ODOT, and the OSHPD cannot agree on the potential effects of an "undertaking" or mitigation measures, FHWA will request the comments of the Council in the ordinary process, pursuant to 36 CFR Part 800.
- E-VII. When required FHWA or ODOT will contact the HABS/HAER Coordinator, Preservation Planning Branch, Cultural Resource Management, Mid-Atlantic Region, National Park Service, U.S. Custom House, Room 251, Second & Chestnut Streets, Philadelphia, Pennsylvania 19106 to determine what level and kind of recordation is required for the bridge. Prior to the demolition, unless otherwise agreed to by the National Park Service, FHWA and ODOT will ensure that all documentation is complete and accepted by the National Park Service and made available to the OSHPD.

Execution and implementation of the terms of this Programmatic Agreement evidences that FHWA has satisfied its Section 106 responsibilities for individual undertakings affecting historic bridges under the federally approved or funded Highway Bridge Projects.

ADVISORY COUNCIL ON HISTORIC PRESERVATION

BY: Robert D. Bush 7/28/93
Executive Director DATE

FEDERAL HIGHWAY ADMINISTRATION

BY: Jeff Hengel 5/5/93
Division Administrator DATE

OHIO HISTORIC PRESERVATION OFFICE

BY: W. Ray Luce 4/30/93
State Historic Preservation Officer DATE

OHIO DEPARTMENT OF TRANSPORTATION

BY: Jeremy Wany 4-30-93
Director DATE

Appendix A

Ohio Bridges by County

ADAMS

National Register

Harshaville Covered Bridge,

Multiple kingpost truss, CR 1, crosses Cherry Fork, unknown builder, 1855, Structure File No. 0130192

Kirker Covered Bridge,

Multiple kingpost truss, SW of West Union off SR 136, crosses East Fork of Eagle Creek (closed), unknown builder, unknown date, abandoned to county

Selected Bridges

Parker Through,

SR 348, crosses Ohio Brush Creek, Champion Bridge Co., 1924, may be by-passed, Structure File No. 0104140

Pennsylvania Through,

CR 1, crosses Ohio Brush Creek, unknown builder, 1888, Structure File No. 0132012

Continuous Steel Deck Girder,

US 52, crosses Isaacs Creek, Brewer, Brewer and Sons, Inc., 1931, programmed for replacement, Structure File No. 0101834

Continuous Steel Deck Girder,

SR 125, crosses Ohio Brush Creek, George W. Timmons Co., 1932-33, Structure File No. 0103098

ALLEN

Selected Bridges

Baltimore Through,

Lima, Metcalf Street, crosses railroads, American Bridge Co., 1923, rehabbed 1989, Structure File No. 0260487

Closed Spandrel Filled Arch,

7.5 miles E of Delphos, Lincoln Highway, crosses Ottawa River, Charles Ash of ODH Bridge Bureau, designer, 1926, Structure File No. 0254096 p.83

Reserve Pool Bridges

Stone,

Delphos, Second St., Crosses Flat Fork, unknown builder, unknown date, Structure File No. 0260703

Closed Spandrel Filled Arch,

Bluffton, CR 270 (Main St.), crosses unnamed stream, Pandora Cement Block, 1926, railing repaired 1988-

89, Structure File No. 0247596

Closed Spandrel Filled Arch,

Lima, CR 270 (Metcalf St.), crosses Ottawa River, Zopher Blodgett, 1920, programmed for replacement, Structure File No. 0260290

Closed Spandrel Filled Arch,

Lima, High Street, crosses Ottawa River, Roberts Supply Co., builder, 1923-24, Structure File No. 0260304

Closed Spandrel Filled Arch,

Lima, Pierce St., crosses Ottawa River, Zopher Blodgett, builder, 1919, Structure File No. 0260118

Closed Spandrel Filled Arch,

SR 88, Lincoln Highway, crosses Auglaize River, 1926, Structure File No. 0241636

ASHTABULA

National Register Bridges

Harpersfield Covered Bridge

Howe truss, CR 154, crosses Grand River, unknown builder, 1868, rehabbed 1989-91, Structure File No. 0432482

Wiswell Road (Warner Hollow) Covered Bridge

Town truss, CR 537, crosses Phelps Creek (closed), unknown builder, 1867

Selected Bridges

Bascule,

Ashtabula, SR 531 (W 5th St.), crosses Ashtabula River, Kell-Atkinson Construction Co., 1925, major reconstruction, 1986, Structure File No. 0406635

Open Spandrel Rib Arch,

US 20 (Prospect Rd.), crosses Ashtabula River, J.R. Burkey, designer, Standish Engineering, builder, 1926, rehabbed, 1984, Structure File No. 0402192 p. 84

Rainbow Arch,

Old SR 7, crosses Conneaut Creek, ODH design, 1926, Structure File No. 0432156 p. 82

Closed Spandrel Filled Arch,

1.9 miles NW of Orwell, CR 6 (New Hudson Rd.), crosses Grand River, Burnett Construction, builder, 1906, Structure File No. 0430056 p. 43

Open Spandrel Rib Arch,

Conneaut, SR 20, crosses Conneaut Creek, Wendell Brown Co., designer, Pitt Construction Co., builder, 1922, Structure File No. 0402281 p. 78

Reserve Pool Bridges

Closed Spandrel Filled Arch,
SR 193, crosses Ashtabula River, C.P. Smith, D.H. Overman, designers, 1931, Structure File No. 0405760
Pratt Through
TR 197, crosses Mill Creek, King Bridge Co., builder, 1897, Structure File No. 0431737

ATHENS

National Register Bridges

Palos Covered Bridge
Multiple kingpost truss, 1 mile N of Glouster off SR 13, unknown builder, 1875, Structure File No. 0541044

Kidwell Covered Bridge
Howe truss, just off SR 13 on TR 583, 1 mile N of Truetown, crosses Sunday Creek (closed), August Borneman, Hocking Valley Bridge Works, 1881

Blackwood Covered Bridge,
Multiple kingpost truss, S of Athens on CR 46, crosses Pratt Fork, unknown builder, 1881, Structure File No. 0549568

Selected Bridges

Warren Polygonal Chord Pony Truss,
CR 28C, crosses Monday Creek, unknown builder, 1950, Structure File No. 0544272

Continuous Steel Beam,
SR 78, crosses Sunday Creek, Simon Straley, 1933, Structure File No. 0502944

Open Spandrel Rib Arch,
Coolville, SR 144, crosses Hocking River, D.H. Overman, C.P. Smith, designers, Stout & Harden, builders, 1930, Structure File No. 0503126 p. 93

AUGLAIZE

Selected Bridges

Closed Spandrel Filled Arch,
St. Mary's, SR 29 (Spring Street), crosses Miami and Erie Canal, Roberts Supply Co., builder, 1921, Structure File No. 0600067 p. 74

Truss Leg Bedstead,
TR 215, crosses Wrestle Creek, Lanfersieck and Grothaus, 1904, pedestrians only, Structure File No. 0637572

Bowstring Arch Pony,
Moved to Lions Club Park in New Bremen in 1985, crosses Miami & Erie Canal, pedestrians only, D.H. Morrison, 1864

BELMONT

National Register Bridges

B & O Railroad Viaduct,
Bellaire, 31st St., Structure File No. 0700428

Selected Bridges

Closed Spandrel Filled Arch,
CR 10, crosses Wheeling Creek, Colerain Township, Daniel Luten, designer, Luten Bridge Co., builder, 1931, Structure File No. 0730750 p. 101

Open Spandrel Rib Arch, US 40, crosses Wheeling Creek and B & O Railroad, D.H. Overman, A.J. Freimoth, K.E. Dumbauld, C.O. Demos, designers, 1932, Structure File No. 0701599 p. 103

Stone,
Blaine, TR 649 (Old National Road), crosses Wheeling Creek, unknown builder, 1828, Structure File No. 0732141

Stone,
SR 40B, crosses tributary of Wheeling Creek, unknown builder, 1828, Structure File No. 0733504

Stone,
TR 814, Union Township, crosses Barkcamp Creek, unknown builder, 1828, Structure File No. 0733806

Closed Spandrel Rib Arch,
CR 5, 9.6 miles W of Bellaire, crosses Williams Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1927, Structure File No. 0730610 p. 88

Closed Spandrel Rib Arch,
CR 5, 10.5 miles SW of Bellaire, crosses Williams Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1928, Structure File No. 0730602 p. 91

Closed Spandrel Rib Arch,
CR 4, 3.5 miles NW of St. Clairsville, crosses Wheeling Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1930, Structure File No. 0730475 p. 94

Reserve Pool Bridges

Closed Spandrel Filled Arch,
CR 10, 4.3 miles N of St. Clairsville, crosses Wheeling Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1927, Structure File No. 0730793

Closed Spandrel Filled Arch,
CR 4, 6.4 miles NW of Bellaire, crosses Little McMahon Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1930, Structure File No. 0730491

Closed Spandrel Filled Arch,
CR 48, 1.8 miles W of Shadyside, crosses Wegee Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1930, Structure File No. 0730998

CLINTON

National Register Bridges

Martinsville Road Covered Bridge,
Multiple kingpost truss, W. of Martinsville, CR 80,
crosses Todd Fork, Zimri Wall, Champion Bridge Co.,
1871, Structure File No. 1432001

Selected Bridges

Bowstring Arch Pony Truss,
Moved to city park in Wilmington, 1992, Massillon
Bridge Co., unknown date
Warren Polygonal Chord Pony,
CR 58, crosses Anderson Fork, Champion Bridge Co.,
builder, 1947, Structure File No. 1435191

Reserve Pool Bridges

Warren Polygonal Chord Pony,
CR5, crosses Anderson Fork, Champion Bridge Co.,
builder, 1947, painted 1988, Structure File No.
1430602

COLUMBIANA

National Register Bridges

Church Hill Road Covered Bridge,
Single kingpost truss, moved by Elkton Historical So-
ciety to Elkton and erected near the Sandy and Beaver
Canal Lock 24 Restaurant, unknown builder, c. 1870

Selected Bridges

Stone,
TR 842, crosses Cold Run Creek, Center Township,
Ross Rue, builder, 1877, Structure File No. 1537202
Warren Polygonal Chord Pony,
Camp Road, TR 914, crosses W Fork of Little Beaver,
unknown builder, 1950, Structure File No. 1537644
Double Intersection Pratt Through,
TR 1042, crosses Little Beaver Creek, Wrought Iron
Bridge Co., builder, 1884, Structure File No. 1538241

Reserve Pool Bridges

Double Intersection Pratt Through,
TR 1026, crosses Little Beaver Creek, Columbia
Bridge Works, builder, 1882, Structure File No.
1530291
Pratt Deck,
TR 843, crosses railroad, unknown builder, unknown
date, Structure File No. 1536915

Stone,
TR 1030, crosses unnamed stream, unknown builder,
1912, Structure File No. 1539248
Stone,
TR 929, crosses unnamed stream, unknown builder,
1921, Structure File No. 1537733
Warren Polygonal Chord Pony,
CR 428, crosses Little Beaver Creek, unknown
builder, 1950, Structure File No. 1533266
Closed Spandrel Filled Arch,
Old SR 7, crosses Little Yellow Creek, 1940, Structure
File No. 1560018

COSHOCTON

National Register Bridges

Helmick Covered Bridge,
Multiple kingpost truss, E. of Blissfield on TR 25
(closed), crosses Killbuck Creek, John Shrake, 1860,
Structure File No. 1631322
Roderick Bridge,
Metal bowstring, 9 miles SE of Coshocton on aban-
doned TR 144, crosses Wills Creek (closed), Coshoc-
ton Iron Works, builder, 1872

Selected Bridges

Pennsylvania Through,
SR 715, crosses Walhonding River, Newcastle Town-
ship, Central Concrete & Construction Co., builder,
1914, by-passed, scheduled for replacement, Structure
File No. 1602888

CRAWFORD

Selected Bridges

Lattice,
Moved to private property, Canton Bridge Co.,
builder, 1890
Warren Polygonal Chord Pony,
TR 104, crosses Sycamore Creek, Brookville Bridge
Co., builder, 1925, Structure File No. 1743961

CUYAHOGA

National Register Bridges

Cleveland and Pittsburgh Railroad Bridge,
Bedford vicinity, crosses Tinkers Creek
Detroit-Superior High Level Bridge,
Concrete and metal arches, cantilevered truss, Cleve-
land, crosses Cuyahoga River, Structure File No.
1800930

CLINTON

National Register Bridges

Martinsville Road Covered Bridge,
Multiple kingpost truss, W. of Martinsville, CR 80,
crosses Todd Fork, Zimri Wall, Champion Bridge Co.,
1871, Structure File No. 1432001

Selected Bridges

Bowstring Arch Pony Truss,
Moved to city park in Wilmington, 1992, Massillon
Bridge Co., unknown date
Warren Polygonal Chord Pony,
CR 58, crosses Anderson Fork, Champion Bridge Co.,
builder, 1947, Structure File No. 1435191

Reserve Pool Bridges

Warren Polygonal Chord Pony,
CR5, crosses Anderson Fork, Champion Bridge Co.,
builder, 1947, painted 1988, Structure File No.
1430602

COLUMBIANA

National Register Bridges

Church Hill Road Covered Bridge,
Single kingpost truss, moved by Elkton Historical So-
ciety to Elkton and erected near the Sandy and Beaver
Canal Lock 24 Restaurant, unknown builder, c. 1870

Selected Bridges

Stone,
TR 842, crosses Cold Run Creek, Center Township,
Ross Rue, builder, 1877, Structure File No. 1537202
Warren Polygonal Chord Pony,
Camp Road, TR 914, crosses W Fork of Little Beaver,
unknown builder, 1950, Structure File No. 1537644
Double Intersection Pratt Through,
TR 1042, crosses Little Beaver Creek, Wrought Iron
Bridge Co., builder, 1884, Structure File No. 1538241

Reserve Pool Bridges

Double Intersection Pratt Through,
TR 1026, crosses Little Beaver Creek, Columbia
Bridge Works, builder, 1882, Structure File No.
1530291
Pratt Deck,
TR 843, crosses railroad, unknown builder, unknown
date, Structure File No. 1536915

Stone,
TR 1030, crosses unnamed stream, unknown builder,
1912, Structure File No. 1539248

Stone,
TR 929, crosses unnamed stream, unknown builder,
1921, Structure File No. 1537733
Warren Polygonal Chord Pony,
CR 428, crosses Little Beaver Creek, unknown
builder, 1950, Structure File No. 1533266
Closed Spandrel Filled Arch,
Old SR 7, crosses Little Yellow Creek, 1940, Structure
File No. 1560018

COSHOCTON

National Register Bridges

Helmick Covered Bridge,
Multiple kingpost truss, E. of Blissfield on TR 25
(closed), crosses Killbuck Creek, John Shrake, 1860,
Structure File No. 1631322
Roderick Bridge,
Metal bowstring, 9 miles SE of Coshocton on aban-
doned TR 144, crosses Wills Creek (closed), Coshoc-
ton Iron Works, builder, 1872

Selected Bridges

Pennsylvania Through,
SR 715, crosses Walhonding River, Newcastle Town-
ship, Central Concrete & Construction Co., builder,
1914, by-passed, scheduled for replacement, Structure
File No. 1602888

CRAWFORD

Selected Bridges

Lattice,
Moved to private property, Canton Bridge Co.,
builder, 1890
Warren Polygonal Chord Pony,
TR 104, crosses Sycamore Creek, Brookville Bridge
Co., builder, 1925, Structure File No. 1743961

CUYAHOGA

National Register Bridges

Cleveland and Pittsburgh Railroad Bridge,
Bedford vicinity, crosses Tinkers Creek
Detroit-Superior High Level Bridge,
Concrete and metal arches, cantilevered truss, Cleve-
land, crosses Cuyahoga River, Structure File No.
1800930

Lorain-Carnegie (Hope Memorial) Bridge,
Cleveland, crosses Cuyahoga River Valley, Mt. Vernon Bridge Co., builder, 1932, rehabbed 1983, Structure File No. 1801503

Detroit Avenue Bridge, (Rocky River Bridge),
Lakewood, crosses Rocky River (partially removed)

Rockefeller Park Bridges:

Superior Avenue,
rehab planned, Structure File No. 1801023

Penn Central Railroad Bridge,
Structure File No. 1869531

St. Clair Avenue,
Crosses Martin Luther King Dr., Structure File No. 1831445

Wade Park,
rehab planned, Crosses Martin Luther King Dr., Structure File No. 1869485

Station Road Bridge,

Whipple Truss,
E. of Brecksville on CR 257, crosses Cuyahoga River (closed) Structure File No. 1831674

Superior Avenue Viaduct,
Cleveland, (abandoned) stone

Pratt Through, Gates Mills Historic District Bridge,
crosses Chagrin River, old interurban, now pedestrian
Main Street Bridge,
Chagrin Falls, Triangle Park District, crosses Chagrin River, Structure File No. 1812483

Selected Bridges

Open Spandrel Rib Arch,
Cleveland, SR 17 (Brookpark Rd.), crosses Rocky River, D.H. Overman, C.P. Smith, designers, Highway Construction Co., builder, 1933, rehabbed, 1989, Structure File No. 1802046 p. 106

Steel Arch,
Cleveland, Lorain Rd., crosses Rocky River, unknown builder, 1935, rehabbed 1988, Structure File No. 1801325

Stone,
Cleveland, Detroit Ave., crosses Erie-Lackawana Railroad, Cleveland & Mahoning Valley Railway Co., builder, 1853, Structure File No. 1867644

Closed Spandrel Filled Arch,
Cleveland Brookside Park Drive (Cleveland Zoo), crosses Big Creek, A.W. Zesiger and W.A. Stinchcomb, designers, unknown builder, 1909, Structure File No. 1867318 p. 53

Closed Spandrel Hollow Arch,
Bay Village, US 6 (Lake Rd.), crosses Porter Creek and Park Dr., D.H. Overman and C.P. Smith, design-

ers; unknown builders, 1937, Structure File No. 1800426 p. 114

Swing,
Cleveland, Center Street, crosses Cuyahoga River, King Bridge Co., builder, 1901, rehabbed 1989, Structure File No. 1869345

Vertical Lift,
Cleveland, Eagle Ave., crosses Cuyahoga River, unknown builder, 1931, rehabbed 1993, Structure File No. 1869604

Vertical Lift,
Cleveland, W. Third St., crosses Cuyahoga River, R.C. Mahon, builder, 1940, Structure File No. 1869728

Vertical Lift,
Cleveland, Columbus Rd., crosses Cuyahoga River, Wisconsin Bridge Co., builder, 1940, rehab plans in process, Structure File No. 1833758

Vertical Lift,
Cleveland, Carter Road, crosses Cuyahoga River, Mt. Vernon Bridge Co., builder, 1940, Structure File No. 1869264

Baltimore Through,
Cleveland, Stone's Levee, crosses B & O Railroad, Interstate Engineering, builder, 1908, Structure File No. 1866389

Continuous Steel Deck Girder,
SR 8, crosses Pennsylvania Railroad, William E. McHugh Co., builder, 1936, Structure File No. 1801201

Closed Spandrel Hollow Arch,
Brecksville, SR 82 (Chippewa Rd.), crosses Chippewa Creek, D.H. Overman, designer, Highway Construction Co., builder, 1932, Structure File No. 1807269 p. 104

Open Spandrel Rib Arch,
SR 69 (Hilliard Rd.), crosses Rocky River, A.M. Felgate, designer, Walsh Construction Co., builder, 1925, Structure File No. 1830147 p. 79

Open Spandrel Slab Arch,
CR 178, crosses Barrett Rd., unknown builder, 1909, Structure File No. 1840053 p. 51

Closed Spandrel Filled Arch,
Bedford, SR 14E, crosses Tinkers Creek, K.E. Dumbauld, designer of extensions, 1934, programmed for rehab, Structure File No. 1801929 p. 109

Reserve Pool Bridges

Cantilevered Deck,
Cleveland, SR 2 (Main Ave.), crosses Cuyahoga River, R.C. Mahon, builder, 1939, rehabbed 1992, Structure File No. 1800035

Pratt Deck,
US 42, crosses railroads, unknown builder, 1917, Structure File No. 1803301

Stone,
Cleveland, East Blvd., crosses Doan Brook, unknown
builder, 1897, Structure File No. 1869418

Stone,
Cleveland, Martin Luther King Blvd., crosses Doan
Brook, unknown builder, 1897, Structure File No.
1869515

Stone,
Cleveland, Martin Luther King Blvd., crosses Doan
Brook, unknown builder, 1899, Structure File No.
1869469

Closed Spandrel Filled Arch,
Cleveland, CR 329 (Clark Ave.), under Conrail, 1906,
unknown builder, Structure File No. 1840118

Closed Spandrel Filled Arch,
Euclid, US 6 & 20 (Euclid Ave.), crosses Euclid
Creek, 1932, Structure File No. 1801082

DARKE

Selected Bridges

Warren Polygonal Chord Pony,
TR 294, crosses Stillwater River, Massillon Bridge
Co., builder, 1930, Structure File No. 1946838

Open Spandrel Slab Arch,
Greenville, SR 49, crosses Greenville Creek, Walter P.
Rice, designer, A.W. Yawger, builder, 1907, rehabbed
1990-91, Structure File No. 1901176 p. 46

Reserve Pool Bridges.

Open Spandrel Rib Arch,
CR 35, crosses Stillwater River, unknown builder,
1930, Structure File No. 1946226

Double Intersection Pratt Through,
TR 385, crosses Greenville Creek, Massillon Bridge
Co., builder, 1881, programmed for replacement,
Structure File No. 1945696

DEFIANCE

Selected Bridges

Pratt Through,
crosses Tiffin River, Toledo Massillon Bridge Co.,
builder, 1906, by-pass approved, Structure File No.
2033739

Warren pony,
CR 140, crosses Prairie Creek, unknown builder,
1903, Structure File No. 2041227

DELAWARE

National Register Bridges

Chambers Road Covered Bridge,
Childs Truss, 2 miles NE of Olive Green, TR 63,
crosses Big Walnut Creek, E.S. Sherman, builder,
1883, Structure File No. 2143268

Selected Bridges

Parker Through,
Rathbone, TR 124, crosses Scioto River, S.C. Kissner
& Sons, builder, 1938, Structure File No. 2130998

Warren Pony,
CR 183, crosses Scioto River, Radnor Township,
Bellefontaine Bridge & Steel Co., builder, 1915, Struc-
ture File No. 2132788

Parker Through,
CR 213, crosses Olentangy River, Bellefontaine
Bridge Co., builder, 1915, programmed for replace-
ment, Structure File No. 2132850

Reserve Pool Bridges

Pratt Through,
TR 114, crosses Olentangy River, Toledo Bridge Co.,
builder, 1898, Structure File No. 2132184

ERIE

Selected Bridges

Stone,
Sandusky, SR 6, crosses Mill Creek, G.W. Doerzbach,
builder, 1894, Structure File No. 2201569

Baltimore Through,
Originally on SR 269, over Penn Central Railroad,
moved to private property for reuse, 1993

Reserve Pool Bridges

Pennsylvania Through,
Vermilion US 6, crosses Vermilion River, Fort Pitt
Bridge Works, builder, 1928, rehabbed 1991, Structure
File No. 2202344

FAIRFIELD

National Register Bridges

John Bright #2 Covered Bridge
Suspension truss, originally 2.5 miles SW of Balti-
more, crossed Poplar Creek, (HAER 1986 - moved to
OU campus Lancaster Branch, 1988), August

Borneman, 1881

Hizey Covered Bridge,

originally E. of Pickerington on TR 235, crossed Poplar Creek, (moved to private property)

Rock Mill Covered Bridge

Queenpost truss, Rock Mill on CR 39, crosses Hocking River, Jacob Brandt, 1901, Structure File No. 2332191

R.F. Baker Covered Bridge,

Multiple kingpost truss, moved to Fairfield Union School Grounds, James Arnold, 1871

John Bright #1 Iron Bridge,

Originally 2 miles NE of Carroll on Havenport Rd., TR 263, crossed Poplar Creek (HAER 1986 - moved to OU campus Lancaster Branch 1989), Hocking Valley Bridge Works, 1884

Selected Bridges

Pratt Deck,

CR 77, crosses Rush Creek, unknown builder, 1928, rehabbed 1990, Structure File No. 2340208

Reserve Pool Bridges

Warren Polygonal Chord Pony,

TR 263, 2 miles NE of Carroll, crosses Poplar Creek, moved in 1989 to replace John Bright # 1, Structure File No. 2337290

FAYETTE

Selected Bridges

Pratt Through,

TR 54, crosses Sugar Creek, Union Township, Wrought Iron Bridge Co., builder, 1883, to be rehabbed, Structure File No. 2430959

FRANKLIN

National Register Bridges

Bergstresser Covered Bridge

Partridge truss, Ashbrook Rd., crosses Little Walnut Creek, Columbus Bridge Co., builder, 1887, rehabbed 1991, Structure File No. 2532212

Closed Spandrel Filled Arch,

Columbus, Town St., crosses Scioto River, part of Civic Center Historic District, Structure File No. 2503697

Open Spandrel Slab Arch,

Columbus, US 62 (Main St.), crosses Scioto River, Part of Civic Center Historic District, Structure File

No. 2503212

Smith Road Bridge,

moved from Crawford County to Ohio Historical Society, Columbus, King Iron Bridge Co., builder, c. 1870

Closed Spandrel Filled Arch,

Columbus, Indianola Ave., part of Iuka Ravine District, unknown builder, 1912, rehab planned, Structure File No. 2561433

Stone,

Columbus, US 23, crosses Iuka Ave., part of Iuka Ravine Historic District, rehab planned, Structure File No. 2500930

Selected Bridges

Double Intersection Pratt Through,

TR 150, crosses Big Darby Creek, Columbus Bridge Co., builder, 1888, Structure File No. 2530139

Closed Spandrel Filled Arch,

Columbus, King Ave., crosses Olentangy River, Wilbur Watson and Walter Braun, designers, unknown builder, 1912, Structure File No. 2531658 p. 59

Closed Spandrel Filled Arch,

Columbus, W. Third Ave., crosses Olentangy River, Wilbur Watson & Co., designer, Robert H. Evans & Co., builder, 1919, Structure File No. 2531844 p. 68

Closed Spandrel Rib Arch

Dublin, SR 33 & 161, crosses Scioto River, SR 257, D.H. Overman, A.J. Friemoth, designers, Elford Construction Co., builder, 1935, Structure File No. 2501171 p. 110

Reserve Pool Bridges

Stone,

CR 11 (Alkire Rd.), crosses Chessie System Railroad, unknown builder, 1902, Structure File No. 2530252

Stone,

Columbus, Eureka Ave., crosses Dry Run, unknown builder, 1930, Structure File No. 2562979

Closed Spandrel Filled Arch,

Columbus, Lane Ave., crosses Olentangy River, Elford Construction Co., builder, 1919, Structure File No. 2531402

Closed Spandrel Filled Arch,

Columbus, SR 23, crosses Glen Echo Ravine, 1921, unknown builder, Structure File No. 2500698

Open spandrel concrete arch,

Columbus, US 33, crosses Olentangy River, unknown builder, 1932, cleared for rehab, Structure File No. 2501449

FULTON

Selected Bridges

Warren Through,
TR 21, crosses Bean Creek, Toledo Bridge Co.,
builder, 1913, Structure File No. 2634538

GALLIA

Selected Bridges

Continuous Steel Deck Girder,
SR 160, crosses Raccoon Creek, W.C. Moore and E.
Elford and Son, builder, rehab planned, 1934,
Structure File No. 2702371

GEAUGA

Selected Bridges

Closed Spandrel Rib Arch,
Bundysburg, CR 38, crosses Swine Creek, Hereth
Construction Co., builder, 1930, Structure File No.
2831511 p. 95

GREENE

National Register Bridges

Ballard Road Covered Bridge,
Howe truss, TR 6, NW of Jamestown on Ballard Rd.,
crosses N. Fork of Caesar's Creek, J.C. Brown, 1883,
Structure File No. 2934744

Selected Bridges

Stone,
CR 81, crosses Massies Creek, Cedarville Township,
unknown builder, unknown date, Structure File No.
2931354

Reserve Pool Bridges

Stone,
Xenia, US 42, crosses Shawnee Creek, unknown
builder, 1928, rehab planned, Structure File No.
2900939

GUERNSEY

National Register Bridges

"S" Bridge, Stone Arch,
National Road, 4 miles E of Old Washington on US

40, unknown builder, Structure File No. 3030970

Selected Bridges

Pratt Through,
TR 186, crosses Wills Creek, Wheeling Township,
Wrought Iron Bridge Co., builder, 1894, Structure
File No. 3031705
Stone,
US 40, crosses tributary of Salt Fork, Wills Township,
Structure File No. 3032868
Stone,
Cambridge, CR 430 (National Road), crosses Crooked
Creek, Structure File No. 3031691
Stone,
Roadside Park, Adams Township
(abandoned section of National Road)

HAMILTON

National Register Bridges

Covington and Cincinnati Suspension Bridge,
Cincinnati, crosses Ohio River, John Roebling, de-
signer, 1846-47
Ida Street Bridge,
Cincinnati, Mt. Adams and Eden Park, Structure File
No. 3160076
Jediah Hill Covered Bridge,
Queenpost truss (supported by steel beams since 1981),
7 miles N of Cincinnati off US 127 on Covered Bridge
Road, Jediah Hill, builder, 1850, Structure File No.
3139778

Selected Bridges

Closed Spandrel Filled Arch,
Cincinnati, Eden Park, crosses Eden Park Dr., Melan
Arch Construction Co., 1895, Structure File No.
3160726 p. 34

Open Spandrel Rib Arch,
Cincinnati, Victory Parkway, crosses Kemper Ln., J.
Robert Biedinger, designer, D.P. Foley, builder, 1917,
repaired, 1990, Structure File No. 3160777 p. 66

Parker Through,
New Baltimore, CR 71, crosses Great Miami River,
Brackett Bridge Co., builder, 1914, Structure File No.
3130762

Rainbow Arch,
Lockland, Benson St., crosses W Fork of Mill Creek,
G.A. Gast and H. Eichler, designers; 1909, rehabbed,
1992, Structure File No. 3137600 p. 54

Pennsylvania Through,
CR 307, crosses Miami River, unknown builder, 1922,
Structure File No. 3132463

Reserve Pool

Open Spandrel Rib Arch

Cincinnati, crosses Mill Creek Valley, Cincinnati Union Terminal and Cincinnati Department of Public Works, designers, unknown builder, 1931, Structure File No. 3105458

Baltimore Through,

Cincinnati, City St. 1608, crosses Chessie System, McClintic-Marshall, builder, 1931, Structure File No. 3161153

Rainbow Arch,

CR 63, crosses Paddy's Run Creek, unknown builder, 1931, rehab planned, Structure File No. 3130622

HANCOCK

Selected Bridges

Double Intersection Pratt Through,

Mt. Blanchard, CR 24, crosses Blanchard River, Columbia Bridge Works, builder, 1884, Structure File No. 3261212

Warren Polygonal Chord Pony Truss,

CR 204, crosses Eagle Creek, unknown builder, 1945, Structure File No. 3233863

Pratt Through,

Mt. Blanchard, TR 22, crosses Blanchard River, Canton Bridge Co., builder, 1896, Structure File No. 3261107

Pratt Through,

CR 205, crosses Blanchard River, Wrought Iron Bridge Co., builder, 1876, scheduled for replacement, Structure File No. 3230325

Reserve Pool Bridges

Rainbow Arch,

CR 26, crosses Eagle Creek, unknown builder, 1930, Structure File No. 3231135

Stone, CR 203, crosses Stephen Otto Ditch, unknown builder, 1940, Structure File No. 3233820

HARDIN

Reserve Pool Bridges

Warren Pony,

CR 64, crosses Blanchard River, Edwards Sheet Metal, builder, 1922, Structure File No. 3344487

HENRY

Selected Bridges

Stone, US 24, crosses Bad Creek, Washington Township, unknown builder, 1842, Structure File No. 3501620

Stone,

SR 424, crosses Benier Creek, Napoleon Township, unknown builder, 1850, rehab scheduled, Structure File No. 3503631

Reserve Pool

Stone,

SR 424, crosses Oberhaus Creek, unknown builder, 1850, rehab scheduled, Structure File No. 3503720

Stone,

SR 24, crosses Dry Creek, unknown builder, unknown date, rehab scheduled, Structure File No. 3501590

HIGHLAND

National Register Bridges

Lynchburg Covered Bridge,

Long truss, E. Fork of Little Miami River on Clinton-Highland County line (bypassed), John C. Gregg, 1870

Selected Bridges

Bowstring Arch Through,

TR 42, crosses E. Fork of Little Miami River, Dodson Township, (closed), Wrought Iron Bridge Co., builder, 1874

Reserve Pool Bridges

Warren Polygonal Chord Pony,

TR 240, crosses Middle Fork, unknown builder, 1945, Structure File No. 3632652

HOCKING

Reserve Pool Bridges

Pennsylvania Through,

SR 644, crosses Hocking River, unknown builder, 1914, Structure File No. 3704629

HOLMES

Selected Bridges

Lattice,

TR 655, crosses Middle Fork of Sugar Creek, unknown builder, 1900, Structure File No. 3841278

HURON

Selected Bridges

Lattice,

Greenwich, Tilton St., crosses County Ditch No. 1851, Huron County, builder, unknown date, rehabbed 1942, Structure File No. 3978028

Pratt Pony,

TR 109, crosses W. Branch of Huron River, New Haven Township, Mt. Vernon Bridge Co., builder, 1881, rehabbed 1971, Structure File No. 3946304

Open Spandrel Rib Arch,

US 20, Wakeman, crosses the Vermilion River, W.E. Burroughs, designer, Hecker-Moon Co., builder, 1933, Structure File No. 3901505 p. 108

Reserve Pool Bridges

Stone,

Norwalk, US 250, crosses Norwalk Creek, unknown builder, 1865, Structure File No. 3903540

Open Spandrel Rib Arch,

Fitchville, US 250, crosses Vermilion River, D.H. Overman, M.X. Wisda, designers; unknown builder, 1928, Structure File No. 3903842

JACKSON

National Register Bridges

Byer Covered Bridge,

Smith truss, crosses Pigeon Creek, Smith Bridge Co., builder, 1872, Structure File No. 4031113

Buckeye Furnace Covered Bridge,

Smith truss, 3 miles SE of Wellston on TR 165, crosses Little Raccoon Creek, Smith Bridge Co., builder, 1872, Structure File No. 4032292

Johnson Road Covered Bridge,

Smith truss, Smith Bridge Co., builder, 1869, Structure File No. 4032977

Selected Bridges

Double Intersection Warren Through,

CR 40, crosses Little Raccoon Creek, unknown builder, 1909, (closed), Structure File No. 4031245

JEFFERSON

Selected Bridges

Baltimore Through,

Steubenville, crosses Ohio River and SR 7, unknown builder, 1927, Structure File No. 4100999

Closed Spandrel Rib Arch,

CR 53, 9.7 miles W of Empire, crosses Yellow Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1928, Structure File No. 4130340 p. 92

Reserve Pool Bridges

Stone,

TR 304, crosses Conrail Railroad, unknown builder, unknown date, Structure File No. 4133730

Bowstring,

TR 125, crosses Piney Fork, unknown builder, 1900, Structure File No. 4133773

Warren Deck,

CR 74, crosses N & W Railroad, unknown builder, 1903, Structure File No. 4133633

Closed Spandrel Filled Arch,

CR 23, crosses McIntyre Creek, Daniel Luten, designer, Luten Bridge Co., builder, 1929, Structure File No. 4130596

Closed Spandrel Filled Arch,

CR 75A, crosses Wolf Run, Daniel Luten, designer, Luten Bridge Co., builder, 1927, Structure File No. 4133064

Closed Spandrel Filled Arch,

TR 167, crosses Georges Run, Daniel Luten, designer, Luten Bridge Co., builder, 1927, Structure File No. 4133560

Bowstring,

TR 67, near Bergholz, crosses Yellow Creek, (closed), pre-1900, unknown builder, Structure File No. 4133013

KNOX

National Register Bridges

Mill Road Bowstring Bridge,

TR 184 (Mill Road), near Bladensburg, crosses Wakatomika Creek, (closed), unknown builder, Structure File No. 4236157

Pratt Through,

TR 259 (Lehmon Rd.), crosses Kokosing River, Mt. Vernon Bridge Co., builder, 1883, (closed)

Selected Bridges

Double Intersection Pratt Through,
CR 35, crosses Kokosing River, Howard Township,
Columbia Bridge Co., builder, 1872, (closed and by-
passed), Structure File No. 4231341

Double Intersection Warren Pony,
TR 384, crosses Granny Creek, Wayne Township
(closed), unknown builder, 1900, Structure File No.
4237609

Stone, Mt. Vernon, SR 13, crosses Kokosing River,
T.B. Townsend & Co., builder, 1892, Structure File
No. 4200632

Warren Polygonal Chord Through,
CR 54, crosses Kokosing River, College Township,
Mt. Vernon Bridge Co., builder, 1915, by-pass
approved, 1994, Structure File No. 4232828

Closed Spandrel Filled Arch,
TR 369, Tributary of North Branch Kokosing River,
Buckeye Portland Cement Co., builder, 1896, Struc-
ture File No. 4236580 p. 37

Pratt Pony,
TR 171, crosses Wakatomika Creek, Mt. Vernon
Bridge Co., builder, 1900, Structure File No. 4236203

Reserve Pool Bridges

Pratt Through,
TR 218, crosses Mohican River, Mt. Vernon Bridge
Co., builder, 1915, Structure File No. 4237374

Stone,
CR 46, crosses Coleman Branch, unknown builder,
1900, Structure File No. 4234073

LAKE

Selected Bridges

Double Intersection Pratt Through,
Willoughby Hills, Pleasant Valley Dr., crosses Cha-
grin River, Wrought Iron Bridge Co., builder, 1881,
Structure File No. 4352165

LAWRENCE

National Register Bridges

Scottown Covered Bridge,
Multiple kingpost truss variant, CR 67, E of Scottown,
crosses Indian Guyan Creek, W. Thompson, builder,
1877, rehabbed 1991, Structure File No. 4441923

Selected Bridges

Cantilevered Through,
Ironton, SR 93, crosses Ohio River, unknown builder,
1922, Structure File No. 4401255

Stone,
CR 29, crosses Storms Creek, Elizabeth Township,
WPA, builder, 1940, rehabbed, 1990, Structure File
No. 4436628

Reserve Pool

Warren Deck,
Ironton, Second St., crosses N & W Railroad, un-
known builder, 1936, Structure File No. 4460014

LICKING

National Register Bridges

Belle Center Covered Bridge.
Dutch Cross Rd., TR 56, crosses Otter Fork, Structure
File No. 4534840

Selected Bridges

King Post,
TR 332, originally crossed Valley Run, Bowling Green
Township, moved to Blackhand Gorge Nature Pre-
serve in 1983, now crosses Claylick Creek, unknown
builder, unknown date

Warren Pony,
Huston-Cleveland Bridge Co., builder, 1905, moved
from Lawrence County, rebuilt on golf course, 1990,
previously Structure File No 4439481

Reserve Pool Bridges

Warren Polygonal Chord Pony,
CR 210, crosses Rocky Fork, Pittsburgh, Des Moines
Steel Co., builder, 1928, Structure File No. 4531221

LOGAN

National Register Bridges

McColly Covered Bridge,
Howe truss, 2 miles SE of Bloom Center on CR 13,
crosses Miami River, Anderson Green Co., 1876,
county plans to move and repair in 1994, Structure
File No. 4631137

Selected Bridges

Lattice,

TR 201, crosses McKees Creek, Bellefontaine Bridge & Iron Co., builder, 1896, scheduled for replacement, Structure File No. 4648943

Pratt Pony,

Formerly on TR 79, crossed Brandywine Creek, moved to private land, 1991, crosses Brandywine Creek, Bellefontaine Bridge & Iron Co., builder, 1896

Truss Leg Bedstead,

TR 157, crosses Little Darby Creek, Bellefontaine Bridge & Iron Co., builder, 1896, scheduled for replacement, Structure File No. 4644832

Reserve Pool Bridges

Double Intersection Pratt Through,

CR 21, crosses Miami River, Massillon Bridge Co., builder, unknown date, Structure File No. 4631838

LORAIN

National Register Bridges

Dean Road Bridge,

Double Intersection Pratt Through, W of South Amherst at Dean Road, crosses Vermilion River, Massillon Bridge Co., builder, 1898

Selected Bridges

Bascule,

Lorain, US 6, crosses Black River, Mt. Vernon Bridge Co., builder, 1939, rehabbed late 1980s, Structure File No. 4700813

Cantilevered Through,

Lorain, SR 611, crosses Black River, unknown builder, 1939, rehabbed 1989, Structure File No. 4707443

Stone,

Amherst, TR M-32, crosses Beaver Creek, unknown builder, 1885, Structure File No. 4737393

Stone,

Elyria, CR 3, crosses E branch of Black River, unknown builder, 1907, rehab approved, Structure File No. 4770579

Warren Polygonal Chord Pony,

TR 64, crosses W branch of Black River, Wellington Township, Bellefontaine Bridge & Steel Co., builder, 1915, Structure File No. 4738845

Warren Polygonal Chord Pony,

TR 71, crosses Wellington Creek, Wellington Township, Massillon Bridge & Structural Co., builder,

1916, Structure File No. 4740823

Reserve Pool Bridges

Rainbow Arch,

Elyria, bypassed SR 20, crosses W branch of Black River, unknown builder, 1923, Structure File No. 4702042

Stone,

Oberlin, US 58, crosses Plum Creek, V.C. Berg Stone Co., 1883, Structure File No. 4703278

Stone,

Elyria, Lake Ave., crosses W Branch of Black River, J. Berg Contractor, 1894, Structure File No. 4770455

Stone,

Amherst, W. Martin Ave., crosses Beaver Creek, unknown builder, 1930, Structure File No. 4760271

Stone,

CR 30, crosses Haul Rd. and Stone Rd., unknown builder, 1902, Structure File No. 4739469

Stone,

Elyria, Mussey Rd., crosses W Branch of Black River, unknown builder, 1904, Structure File No. 4770242

Stone,

M 158, crosses Wellington Creek, unknown builder, unknown date, Structure File No. 4734173

Stone,

TR 18, crosses Beaver Creek, unknown builder, 1883, Structure File No. 4735323

Warren Pony,

Amherst, Jackson St., crosses Beaver Creek, Toledo Bridge Co., 1911, Structure File No. 4760220

LUCAS

National Register Bridges

Interurban Bridge,

Closed Spandrel Filled Arch, 1 mile S of Waterville, crosses Maumee River (abandoned), National Bridge Co., 1907

Selected Bridges

Bascule,

Toledo, Monroe St., crosses Swan Creek, King Bridge Co., 1907, Structure File No. 4861132

Bascule,

Toledo, Washington St., crosses Swan Creek, unknown builder, 1920, Structure File No. 4860926

Closed Spandrel Filled Arch with Movable Span,

Toledo, Cherry St., crosses Maumee River, W. Watson, designer; 1910- 1914, Structure File No. 4860004 p. 56

Double Intersection Warren Pony,

Toledo, carries N & W Railroad, crosses Collingwood Rd., Detroit Bridge & Iron Works, 1888, Structure File No. 4860624

Steel Arch,

Toledo, Marengo Street, crosses ravine to Delaware Creek, unknown builder, 1915, Structure File No. 4861035

Stone,

CR 47, crosses Langenderfer Ditch, Spencer Township, unknown builder, 1938, Structure File No. 4831284

Suspension Bridge,

Toledo, SR 2, crosses Maumee River, McClintic-Marshall Co., 1929, rehabbed, Structure File No. 4800303

Closed Spandrel Rib Arch,

Toledo, South Avenue, crosses Swan Creek, Newton-Baxter Co., 1927, Structure File No. 4860349 p. 89

MAHONING**National Register Bridges****Mill Creek Park Suspension Bridge,**

Youngstown, Structure File No. 5059941

Bowstring Arch Pony,

Poland, Cemetery Drive, crosses Yellow Creek, unknown builder, unknown date, (closed), Structure File No. 5052289

Selected Bridges**Parker Pony,**

Poland SR 170, crosses Yellow Creek, Huston-Cleveland Bridge Co., 1904, programmed for replacement, Structure File No. 5004144

Pratt Double Deck,

Youngstown, Mahoning Ave., crosses Mill Creek, unknown builder, 1903, (closed), Structure File No. 5058449

Stone,

Youngstown, CR 110, crosses E tributary of Mill Creek, unknown builder, 1895, Structure File No. 5059992

Steel Arch,

CR 18, crosses Mahoning River, Mt. Vernon Bridge Co., 1949, Structure File No. 5058082

Open Spandrel Rib Arch,

US 62, Youngstown, crosses Mill Creek, N.R. Porterfield, 1920, Structure File No. 5001951 p. 69

Warren Polygonal Chord Through,

Youngstown, Marshall St., crosses Mahoning River, Bethlehem Steel Co., 1940, scheduled for rehab, Structure File No. 5060230

Reserve Pool Bridges**Baltimore Through,**

Struthers, Bridge St., crosses Mahoning River, unknown builder, 1935, scheduled for replacement, Structure File No. 5005949

Baltimore Through,

Youngstown, West Ave., crosses Mahoning River, unknown builder, 1929, Structure File No. 5060524

Open Spandrel Rib Arch,

Youngstown, Ohio Ave., crosses Crandall Run, unknown builder, 1920, (closed), scheduled for replacement, Structure File No. 5060850

Double Intersection Pratt Through,

Campbell, SR 289, pedestrian, unknown builder, 1927, Structure File No. 5005019

Double Intersection Warren Pony,

TR 15, Fish Creek Rd., crosses Fish Creek, unknown builder, unknown date, (closed), Structure File No. 5054079

Pennsylvania Through,

Youngstown, Division St., crosses Mahoning River, Atlas Engineering, 1939, Structure File No. 5058325

Stone,

Youngstown, McCollum Rd., crosses Bears Den Creek, unknown builder, unknown date, Structure File No. 5058376

Stone,

Youngstown, S. Schenley Ave., crosses Axe Factory Run, unknown builder, 1937, Structure File No. 5060451

Warren Through,

Youngstown, CR 313 crosses Mahoning River, American Bridge Co., 1911, rehab planned, Structure File No. 5058368

Stone,

Youngstown, CR 190 (Gladstone St.), crosses Dry Run Creek, Structure File No. 5058287

Open Spandrel Concrete Arch,

Youngstown, Fifth Ave., crosses Crandall Run, unknown builder, 1920, rehab planned, Structure File No. 5060540

MARION**National Register Bridges****Caledonia Bowstring Bridge,**

In park N of Caledonia, crosses Olentangy River

Selected Bridges**Lattice,**

TR 68J, crosses Linn Ditch, Grand Prairie Township,

unknown builder, unknown date, Structure File No. 5131480

Parker Through,

Prospect, SR 47, crosses Scioto River, Standard Engineering Co., 1913, rehabbed 1985, Structure File No. 5102251

Pratt Pony,

TR 24B, crosses Tymochtee Creek, Grand Township, Wrought Iron Bridge Co., 1874, Structure File No. 5130298

Pratt Pony,

TR 154A, crosses Olentangy River, Richland Township, New Columbus Bridge Co., 1897, Structure File No. 5132592

Pratt Through,

CR 67R, crosses Olentangy River, Tully Township, Wrought Iron Bridge Co., 1876, Structure File No. 5131464

Reserve Pool

Pratt Pony,

TR 164B, crosses Riffle Creek, unknown builder, 1948, Structure File No. 5132797

MEDINA

National Register Bridges

Stone,

B & O Railroad Viaduct, off SR 421, Structure File No. 5208017

MEIGS

Selected Bridges

Rainbow Arch,

Chester, SR 248, crosses Shade River, W.M. Rabe and V.E. Schuler, designers; 1926, Structure File No. 5302587 p. 87

MERCER

Selected Bridges

Double Intersection Pratt Through,

CR 223, crosses St. Mary's River, Union Township, Columbia Bridge Works, 1887, Structure File No. 5457467

Warren Polygonal Chord Pony Truss,

Celina-Mendon Rd., crosses Twelve Mile Creek, unknown builder, 1950, Structure File No. 5457173

MIAMI

National Register Bridges

Eldean Covered Bridge,

Long truss, N of Troy, old section of CR 33 over Great Miami River, Jas. & Wm. Hamilton, 1860

Selected Bridges

Pennsylvania Through,

Tipp City, CR 166, crosses Great Miami River, Central States Bridge Co., 1926, Structure File No. 5535301

Closed Spandrel Filled Arch,

Troy, CR 14 (Adams St.), crosses Great Miami River, Miami Conservancy District, 1922, Structure File No. 5537126 p. 76

Closed Spandrel Filled Arch,

Piqua, S. Main St., crosses Great Miami River, Daniel B. Luten, Hackedorn Contracting Co., 1914, Structure File No. 5535972 p. 64

Reserve Pool Bridges

Closed Spandrel Filled Arch,

Piqua, US 36, under Penn Central RR, 1910, Structure File No. 5500060

MONROE

National Register Bridges

Foreaker Covered Bridge,

Multiple kingpost truss, 3 miles E of Graysville, CR 40, crosses Little Muskingum River, unknown builder, 1886, Structure File No. 5633354

Knowlton Covered Bridge,

Multiple kingpost truss, N of Rinards Mill on TR 88, crosses Little Muskingum River, unknown builder, 1887 (closed), Structure File No. 5634652

Selected Bridges

Closed Spandrel Rib Arch,

TR 313, .6 mile E of Marr, crosses Little Muskingum River, Luten Bridge Co., 1927, Structure File No. 5634555 p. 90

Reserve Pool Bridges

Open Spandrel Rib Arch,

CR 12, crosses Little Muskingum River, WPA, 1936, Structure File No. 5630452

Double Intersection Pratt Through,
CR 15, crosses Clear Fork, King Iron Bridge Co.,
1883, Structure File No. 5632854

Stone,

TR 691, crosses Jims Run, unknown builder, unknown
date, Structure File No. 5635357

Closed Spandrel Filled Arch,

CR 2, crosses Branch of Wills Creek, Luten Bridge
Co., 1927, Structure File No. 5630703

MONTGOMERY

National Register Bridges

Germantown Covered Bridge,

Suspension truss, Germantown, Center Street, crosses
Little Twin Creek, D.H. Morrison, 1865, (closed)
Structure File No. 5767172

Double Intersection Pratt Through,

Originally on Lower Gratis Road, crossed Tom Run,
moved to Carillon Park, Dayton, Columbia Bridge
Works, 1881

Selected Bridges

Closed Spandrel Filled Arch,

Dayton, Monument Ave., crosses Great Miami River,
E.M. Gephart & R.E. Kline, 1908-09, Structure File
No. 5704030 p. 49

Closed Spandrel Filled Arch,

Dayton, Helena St., crosses Great Miami River, Smith
& Chamberlain - Architects & Engineers/The Wiley
Construction Co., 1925, Structure File No. 5760437 p.
80

Closed Spandrel Filled Arch,

Dayton, Stewart Street, crosses Great Miami River,
E.M. Gephart & R.E. Kline, builders; Concrete-Steel
Engineering Co., designers; 1911, Structure File No.
5760003 p. 58

Closed Spandrel Filled Arch,

Dayton, Washington St., crosses Great Miami River,
William Mueser, Concrete-Steel Engineering Co., de-
signer, 1906, Structure File No. 5760062 p. 44

Reserve Pool Bridges

Closed Spandrel Filled Arch,

Dayton, Moses Dr., crosses Wolf Creek, unknown
builder, 1926, Structure File No. 5760607

Camelback Through,

Dayton, Bridge St., crosses Wolf Creek, Central States
Bridge Co., 1926, Structure File No. 5760887

Pennsylvania Through,

Hemple Rd., unknown builder, 1927, by-passed,
Structure File No. 5740509

Pennsylvania Through,

Wagoner Ford Rd., crosses E Branch Great Miami
River, unknown builder, 1924, scheduled for removal,
Structure File No. 5760526

Pennsylvania Through,

Dayton, Rip Rap Rd., crosses Miami River, unknown
builder, 1923, to be rehabbed, Structure File No.
5760577

Pennsylvania Through,

Dayton, Siebenthaler Rd., crosses Stillwater River, un-
known builder, 1928, Structure File No. 5761549

Stone,

Dayton, Gettysburg Ave., crosses VA Lake, unknown
builder, unknown date, removal planned, Structure
File No. 5761980

Closed Spandrel Filled Arch,

Dayton, Keowee St., crosses Great Miami River,
Maxon Construction Co., 1931, Structure File No.
5760550

MORGAN

National Register Bridges

Old Iron Bridge,

connects Malta and McConnelsville, crosses Muskin-
gum River, Oregonia Bridge Co., Structure File No.
5835712

Selected Bridges

Warren Polygonal Chord Pony Truss,

CR 79, crosses W Branch of Wolf Creek, unknown
builder, 1950, Structure File No. 5834686

MORROW

Selected Bridges

Pratt Pony,

TR 25, crosses Shaw Creek, Westfield Township, -
Massillon Bridge Co., 1880, Structure File No.
5930251

Pratt Pony,

TR 136, crosses Whetstone Creek, Gilead Township,
Wrought Iron Bridge Co., 1874, Structure File No.
5930146

Warren Polygonal Chord Pony,

TR 221, crosses Alum Creek, Peru Township, Capitol
Construction Co., 1906, Structure File No. 5932602

Bowstring Arch Truss,

TR 127, crosses Whetstone Creek, Wrought Iron
Bridge Co., 1879, Structure File No. 5930197

Pratt Pony,
TR 138, crosses Shaw Creek, Massillon Bridge Co.,
1887, Structure File No. 5931339

Reserve Pool Bridges

Pratt Pony,
TR 126, crosses Whetstone Creek, Wrought Iron
Bridge Co., 1874, Structure File No. 5930073

MUSKINGUM

National Register Bridges

Dresden Suspension Bridge,
SR 208 and SR 666, crosses Muskingum River,
(closed) rehab planned, Structure File No. 6005284

Stone "S" Bridge,
US 40 W of New Concord, crosses Fox Creek
Salt Creek Covered Bridge,
Warren truss, 3 miles NW of Norwich off CR 82,
crosses Salt Creek, Thos. Fisher, 1876, owned by the
Ohio Historic Bridge Association

Selected Bridges

Camelback Pony,
TR 209, crosses Buffalo Fork, Salt Creek Township,
unknown builder, unknown date, Structure File No.
6032613

Stone,
TR 420 (National Road), crosses tributary of Timber
Run, Falls Township, John Carnahan, 1830, Structure
File No. 6040349

Stone,
Abandoned section of National Road just north of US
40 edge of Mt. Sterling, Hopewell Township, un-
known builder, 1828

Stone,
TR 26 (National Road), crosses Valley Run, Hopewell
Township, unknown builder, 1830, Structure File No.
6039154

Warren Through,
Zanesville, US 22 (6th St.), crosses Muskingum River,
J.A. Swingle, 1914, Structure File No. 6000487

Warren Pony,
TR 442, crosses Salt Creek, Mt. Vernon Bridge Co.,
1909, Structure File No. 6048412

NOBLE

National Register Bridges

Huffman Covered Bridge,
Multiple kingpost truss, 1.5 miles S of Middleburg off

SR 564, crosses Middle Fork of Duck Creek on private
property (closed), unknown builder, c. 1914

Selected Bridges

Closed Spandrel Filled Arch,
Caldwell, SR 821, crosses West Fork of Duck Creek,
L.W. Curl, W. W. Flemming, 1930, Structure File No.
6105432 p. 96

OTTAWA

National Register

Closed Spandrel Filled Arch,
N side of Elmore, SR 51, crosses Portage River, D.H.
Overman, 1926, Structure File No. 6201202

Selected Bridges

Bascule,
Port Clinton, SR 163, crosses Portage River, A.
Bentley & Sons, 1933, Structure File No. 6201628

Reserve Pool Bridges

Warren Polygonal Chord Pony,
CR 19, crosses Toussaint Creek, Ohio Bridge Co.,
1950, Structure File No. 6231985

PAULDING

Selected Bridges

Pratt Through,
Intersection CR 73 and 192, crosses Maumee River,
Crane Township, Milwaukee Bridge & Iron Works,
unknown date, scheduled for replacement, Structure
File No. 6331041

Reserve Pool Bridges

Camelback Through,
TR 25, crosses Auglaize River, Oregonia Bridge Co.,
1912, Structure File No. 6335896

PERRY

National Register Bridges

Parks Covered Bridge,
Multiple kingpost, N of Somerset on CR 33, crosses
Painter's Fork, Wm. Dean, 1883, Structure File No.
6431232

Bowman Mill Covered Bridge,
Multiple kingpost, originally S of New Reading on SR 86, crossed Little Rush Creek (moved to Fairgrounds), Gottlieb Bunz, 1859

Reserve Pool Bridges

Warren Polygonal Chord Pony,
Glenford, Main St., crosses Jonathan Creek, Capitol Construction Co., 1915, (closed), Structure File No. 6434053

PICKAWAY

Selected Bridges

Bowstring Arch Pony,
New Holland, CR 25 (Egypt Pike), crosses Mud Run, pedestrian bridge, Champion Bridge Co., 1877

Camelback Through,
CR 4, crosses Scioto River, Jackson Township, Oregonia Bridge Co., 1914, rehabbed 1989, Structure File No. 6533159

Double Intersection Pratt Through,
SR 762, crosses Big Darby Creek, Darby Township, Cleveland Bridge & Iron Co, 1885, (bypassed), Structure File No. 6503756

Warren Through,
TR 127, crosses Big Darby Creek, Jackson Township, Oregonia Bridge Co., 1912, Structure File No. 6533167

Reserve Pool Bridges

Parker Pony,
SR 56, crosses Salt Creek, unknown builder, 1935, rehabbed 1985, Structure File No. 6501567

PIKE

Selected Bridges

Warren Polygonal Chord Pony Truss,
TR 338, crosses Sunfish Creek, unknown builder, 1945, Structure File No. 6633242

PORTAGE

National Register Bridges

Stone,
Main Street Bridge,
Kent, (closed), Structure File No. 6737080

PREBLE

National Register Bridges

Christman Covered Bridge,
Childs truss, TR 142, 1.5 miles NW of Eaton, crosses Seven Mile Creek, E.S. Sherman, 1895, Structure File No. 6839258

Double Intersection Pratt Through, Eaton, crosses Seven Mile Creek, Columbia Bridge Works, 1887, deck rehabbed, 1993, Structure File No. 6842364

Harshman Covered Bridge,
Childs truss, 4 miles N of Fairhaven on TR 218 (Concord-Fairhaven Rd.), crosses Four Mile Creek, E.S. Sherman, 1894, Structure File No. 6836399

Brubaker Covered Bridge,
Childs truss, W of Gratis on TR 328 (Aukerman Creek Rd.), crosses Sams Creek, E.S. Sherman, 1887, Structure File No. 6832377

Geeting Covered Bridge,
Childs truss, 2 miles W of Lewisburg on TR 436 (Price Rd.), crosses Price Creek, E.S. Sherman, 1894, Structure File No. 6830072

Warnke Covered Bridge,
Childs truss, NE of Lewisburg on TR 403 (Swamp Creek Rd.), crosses Swamp Creek, E.S. Sherman, 1895, Structure File No. 6837344

Roberts Covered Bridge,
Burr truss, Eaton, crosses Seven Mile Creek, 1829, (partially destroyed by fire 1986, moved to Eaton, restored 1991), Structure File No. 6831710

Selected Bridges

Pratt Pony,
TR 347, crosses Aukerman Creek, Central States Bridge Co., 1913, Structure File No. 6838235

Bowstring Arch Through,
TR 235, crosses Four Mile Creek, Israel Township, unknown builder, unknown date, deck replaced 1992, Structure File No. 6841295

Closed Spandrel Filled Arch,
CR 30, crosses Big Cave Run, unknown builder, 1942, Structure File No. 6835678

Pegram Through,
TR 331, crosses Seven Mile Creek, Gasper Township, Indiana Bridge Co., 1906, deck replaced 1985, Structure File No. 6831826

Warren Polygonal Chord Pony,
US 40, crosses Twin Creek, Harrison Township, Brookville Bridge Co., 1925, Structure File No. 6800602

Camelback Through,
TR 453, crosses Twin Creek, Indiana Bridge Co.,

1904, scheduled for replacement, Structure File No. 6833861

Warren Through,
CR 15, crosses Twin Creek, Brookville Bridge Co.,
1915, to be by-passed, Structure File No. 6837166

Reserve Pool Bridges

Warren Polygonal Chord Pony,
CR 15, scheduled for replacement, Structure File No. 6834116

PUTNAM

National Register Bridges

Gilboa Bridge,
Gilboa, crosses Blanchard River, Structure File No. 6930077

Selected Bridges

Bowstring Arch Pony,
CR M-6, crosses Riley Creek, D.H. Morrison, 1876,
deck replaced, Structure File No. 6932509

Lattice,
CR 18, crosses South Powell Creek, Monroe Town-
ship, Canton Bridge Co., 1897, Structure File No. 6931871

Reserve Pool Bridges

Pratt Pony,
TR 25, crosses Little Auglaize River, Canton Bridge
Co., unknown date, Structure File No. 6931472

Closed Spandrel Filled Arch,
Old SR 12, crosses Ottawa River, State of Ohio, 1932,
Structure File No. 6933416

RICHLAND

Selected Bridges

Pratt Pony,
TR 230, crosses Brubaker Creek, Weller Township,
Massillon Bridge Co., 1883, Structure File No. 7032730

Reserve Pool Bridge

Stone,
Mansfield, W. Fourth St., crosses Maple Run, un-
known builder, 1897, Structure File No. 7060319
Stone,
Ontario, Rock Rd., crosses Conrail, unknown builder,

1868, Structure File No. 7064799

ROSS

National Register Bridges

South Salem Covered Bridge,
Smith truss, W of South Salem on CR 54 (Lower Twin
Road), crosses Buckskin Creek, Smith Bridge Co.,
1873, Structure File No. 7132603

Selected Bridges

Continuous Steel Deck Girder,
US 35, crosses N Fork of Paint Creek, C.A. Baker and
Midland Construction Co., 1935, Structure File No. 7101503

Continuous Steel Beam,
US 35, crosses Walnut Creek, Midland Construction
Co., 1935-36, Structure File No. 7102496

Reserve Pool Bridges

Pratt Through,
CR 278, crosses Scioto River, Smith Bridge Co., 1887,
approved for replacement, Structure File No. 7150547

SANDUSKY

National Register Bridges

Mull Covered Bridge,
Town truss, E of Burgoon between SR 12 and 53 off
TR 9, over E Branch of Wolf Creek, unknown builder,
1842, (closed)

Selected Bridges

Closed Spandrel Filled Arch,
Fremont, 20th St., crosses Sandusky River, J.H. Jones,
builder; W. Braun, designer; 1926, rehabbed, 1981,
Structure File No. 7242298 p. 86

SCIOTO

National Register Bridges

Otway Covered Bridge,
Smith truss, Otway, off SR 348, crosses Scioto Brush
Creek, Smith Bridge Co., 1874

Bennett Schoolhouse Road Covered Bridge,
Originally SE of Minford on TR 12, crossed Little
Scioto River, (dismantled and in storage in South
Webster Area)

Selected Bridges

Bowstring Arch Through,

TR 238, crosses Little Scioto River, Harrison Township, Brackett Bridge Co., 1900, Structure File No. 7334303

Pennsylvania Through,

Portsmouth, SR 73, crosses Scioto River, Mt. Vernon Bridge Co., 1915, scheduled for replacement, Structure File No. 7303009

Pratt Through Truss,

CR 48, crosses Scioto Brush Creek, unknown builder, 1944, Structure File No. 7332521

Pratt Pony,

TR 277, crosses Ginat Creek, Champion Bridge Co., 1950, Structure File No. 7332270

Reserve Pool Bridges

Suspension,

crosses Ohio River, railroad & First St., unknown builder, 1927, Structure File No. 7300018

Warren Polygonal Chord Through,

CR 15, crosses Little Scioto River, unknown builder, 1940, Structure File No. 7330464

SENECA

Selected Bridges

Closed Spandrel Filled Arch,

TR 75, crosses Indian Creek, unknown builder, 1950, Structure File No. 7443943

Parker Through,

CR 33, crosses Sandusky River, Pleasant Township, Massillon Bridge Co., 1897, rehab planned, Structure File No. 7443889

Reserve Pool Bridges

Pennsylvania Through,

CR 51, crosses Sandusky River, American Bridge Co., 1924, Structure File No. 7443781

Stone,

SR 19, crosses B & O Railroad, unknown builder, 1900, scheduled for replacement, Structure File No. 7401086

SHELBY

Selected Bridges

Pratt Pony,

CR 132, originally crossed Great Miami River, Washington Township, Brackett Bridge Co., 1895,

moved for re-use at new location

Closed Spandrel Filled Arch,

Sidney, SR 47, crosses Great Miami River, D.H. Overman, 1930, Structure File No. 7500661 p. 97

Reserve Pool Bridges

Pratt Through,

CR 141, crosses Great Miami River, Champion Bridge Co., 1906, Structure File No. 7540183

STARK

National Register Bridges

Stone Arch,

Market Street Bridge, Canal Fulton Historic District, crosses Tuscarawas River, Structure File No. 7633041

Pratt Pony,

Cherry Street Bridge, crosses Tuscarawas River, Canal Fulton Historic District, scheduled for replacement, Structure File No. 7605137

Selected Bridges

Pratt Pony,

CR 3, crosses Deer Creek, WPA, 1941, Structure File No. 7632053

Pratt Through Truss,

CR 13, crosses Mahoning River, Wrought Iron Bridge Co., 1948, Structure File No. 7632681

Closed Spandrel Filled Arch,

Cherry Ave., crosses E Branch of Nimishillin Creek, Geraux Brothers Co., 1949, Structure File No. 7631375

Parker Pony,

SR 44, Louisville, crosses Branch of Nimishillin Creek, WPA, 1938, approved for replacement, Structure File No. 7601778

Reserve Pool Bridges

Parker Pony,

Alliance, Walnut Ave., E.O. Vogt, 1938, (closed) Structure File No. 7663099

Stone,

Canton, 7th St., NW, crosses W Branch Nimishillin Creek, unknown builder, 1903, Structure File No. 7661274

Pratt Through Truss,

TR 356, crosses Tuscarawas River, Massillon Bridge Co., 1948, Structure File No. 7630190

Closed Spandrel Filled Arch,

Canton, 12th St., crosses Nimishillin Creek, unknown builder, 1929, Structure File No. 7631324

Closed Spandrel Filled Arch,
Canton, 12th St. NW, crosses Water Works Race,
1928, Structure File No. 7661215

SUMMIT

National Register Bridges

Everett Road Covered Bridge,
Smith truss, SW of Peninsula on TR 47 (Everett
Road), crosses Furnace Run, rebuilt by National Park
Service

Double Intersection Pratt Through,
Sagamore Hills, TH 36, crosses Cuyahoga River,
(closed)

Selected Bridges

Open Spandrel Rib Arch,
SR 82, crosses Cuyahoga River and B & O Railroad,
W.S. Hindman, designer, Highway Construction Co.,
1930, reconstruction, 1981, Structure File No.
7706871 p. 98

Cantilevered Deck,
Old State Route 8, crosses Cuyahoga River, Mt. Ver-
non Bridge Co., 1947- 48, scheduled for rehab, Struc-
ture File No. 7730306

TRUMBULL

National Register Bridges

Newton Falls Covered Bridge,
Town truss, Arlington Ave., crosses E Branch of Ma-
honing River, unknown builder, 1831, Structure File
No. 7830165

Selected Bridges

Warren Pony Truss,
CR 68C, crosses Mahoning River, unknown builder,
1948, Structure File No. 7837283

Open Spandrel Rib Arch,
Niles, Main St., crosses railroad, Water St., Mahoning
River, E.H. Latham Co., builder, Wendell P. Brown,
Cleveland, designer, 1932, major reconstruction 1980,
Structure File No. 7802439 p. 105

Reserve Pool Bridges

Warren Polygonal Chord Pony,
CR 114F, crosses Eagle Creek, unknown builder,
1950, Structure File No. 7841779

TUSCARAWAS

Selected Bridges

Fink Through,
Abandoned section of TR 212, crosses Conotton
Creek, vicinity of Zoarville, Smith, Latrobe & Co.,
1868

Pratt Through,
Abandoned section of CR 82, crosses Tuscarawas
River, Lawrence Township, Wrought Iron Bridge Co.,
1883

Camelback Through Truss,
US 36, crosses Tuscarawas River, American Bridge
Co., 1949, Structure File No. 7900333

Closed Spandrel Filled Arch,
Uhrichsville, East 4th St., crosses Little Stillwater
Creek, W.M. Brode & Co., 1908, Structure File No.
7960298 p. 48

Reserve Pool

Pratt Pony,
formerly on TR 52, crossed Indian Trail Creek, un-
known builder, 1920, moved to private property, for-
merly Structure File No. 7935641

Warren Deck,
Mineral City, Huff Rd., crosses B & O Railroad, un-
known builder, 1899, Structure File No. 7930801

Closed Spandrel Filled Arch,
Dover, Tuscarawas Ave., crosses Tuscarawas River,
Concrete-Steel Engineering Co., 1907, Structure File
No. 7960018

UNION

National Register Bridges

Reed Covered Bridge,
Partridge truss, 3.5 miles S of Marysville off SR 38,
crosses Big Darby Creek, R.L. Partridge, 1884,
collapsed in August, 1993

Selected Bridges

Pratt Through,
TR 67, crosses Big Darby Creek, Union Township,
Central Concrete Construction Co., 1914, rehabbed,
1992, Structure File No. 8031401

Warren Pony,
CR 113 (White Stone Road), crosses Blue Creek,
Dover Township, Capitol Construction Co., 1923, re-
hab planned, Structure File No. 8051100

VAN WERT

Selected Bridges

Truss Leg Bedstead,
CR 208, crosses North Creek, Scott Township,
Wrought Iron Bridge Co., 1893, Structure File No.
8131538

Truss Leg Bedstead,
CR 82, crosses Town Creek, Liberty Township, Brack-
ett Bridge Co., 1894, Structure File No. 8135150

VINTON

National Register Bridges

Mt. Olive Road Covered Bridge,
Queenpost truss, 1 mile NE of Allensville on Mt. Ol-
ive Road, crosses Middle Fork of Salt Creek, G.W.
Pilcher, 1875, Structure File No. 8234922

Eakin Mill Covered Bridge,
Double multiple kingpost truss w/arches, CR 38
(Mound Hill Road) near Arbaugh, crosses Big Rac-
coon Creek (closed), Gilman and Ward, 1870-71

Humpback/Ponn Covered Bridge, Multiple kingpost
truss w/arches, 3- span, 4 miles SW of Wilkesville on
TR 4, crosses Big Raccoon Creek, McGrath and Wells,
1874, Structure File No. 8235988

Selected Bridges

Pratt Pony,
TR 5, crosses Middle Fork of Salt Creek, Harrison
Township, Smith Bridge Co., 1910, Structure File No.
8233209

Warren Pony,
TR 4, crosses Big Raccoon Creek, Knox Township,
Champion Bridge Co., 1906, Structure File No.
8234000

WARREN

Selected Bridges

Bowstring Arch Pony,
CR 200, crossed Todds Fork, Harlan and Salem
Townships, King Bridge Co., 1871, dismantled,
awaiting re- use, Structure File No. 8333580

Closed Spandrel Filled Arch,
Lebanon, South Broadway, crosses Turtle Creek, Em-
erson & Jones, 1897, Structure File No. 8360081 p. 39

Lenticular Pony,
TR 82, crosses Dry Run Creek, Union township, Ber-
lin Iron Bridge Co., unknown date, Structure File No.

8332517

Lenticular Through,
Oregonia, CR 12, crosses Little Miami River, Berlin
Iron Bridge Works, 1883, county plans to by-pass,
Structure File No. 8330085

Pratt Through,
adjacent to SR 123, crosses Penn Central Railroad bed,
Salem Township, Kellogg and Maurice Bridge Works,
1880

Open Spandrel Rib Arch,
SR 22, crosses Little Miami River, D.H. Overman,
A.J. Friemoth, C.P. Smith, designers; 1936-8, re-
habbed 1991, Structure File No. 8300038 p. 112

Reserve Pool Bridges

Stone,
SR 132, crosses tributary of Todd Fork, unknown
builder, unknown date, Structure File No. 8305048

WASHINGTON

National Register Bridges

Shinn Covered Bridge,
Multiple kingpost truss w/arches, NE of Bartlett off SR
555 on TR 447, crosses W Branch of Wolf Creek, E.B.
Henderson, 1886, closed, Structure File No. 8437017

Hune Covered Bridge,
Long truss, 2.5 miles N of Dart on TR 34, crosses
Little Muskingum River, Rolla Merydith, 1879, Struc-
ture File No. 8433720

Root Covered Bridge,
Long truss, 1 mile N of Decaturville on CR 6, crosses
W Branch of Little Hocking River (bypassed), Rolla
Merydith, 1878

Rinard Covered Bridge,
Smith truss NE of Marietta on CR 406, crosses Little
Muskingum River (bypassed), Smith Bridge Co.,
1876, repaired and painted, 1991

Harra Covered Bridge,
Long truss, 2 miles NW of Watertown on abandoned
section of TR 172, crosses S Branch of Wolf Creek
(bypassed), Rolla Merydith, 1878, Structure File No.
8436215

Hills Covered Bridge,
Howe truss, 5 miles E of Marietta off CR 333, crosses
Little Muskingum River (bypassed), Hocking Valley
Bridge Works, 1878, Structure File No. 8430799

Swing,
Marietta, Putnam and Front Streets, crosses Muskin-
gum River, Nelson- Merydith Co., 1914, Structure File
No. 8438536

Selected Bridges

Cantilevered Deck,

SR 124, crosses Little Hocking River, Belpre Township, Massillon Bridge & Structural Co., 1930, cleared for rehab, Structure File No. 8403783

Parker Pony,

TR 189, crosses W Branch of Little Hocking River, Decatur Township, Massillon Bridge Co., 1910, (rehabbed 1989), Structure File No. 8438153

Reserve Pool Bridges

Closed Spandrel Filled Arch,

SR 124, crosses Sawyers Run, D.H. Overman, designer, 1926, Structure File No. 8403724

Parker Pony,

TR 7, crosses Sawyer Run, Nelson-Merydith Co., 1914, Structure File No. 8437378

Pennsylvania Through,

Belpre, crosses B & O Railroad, unknown builder, 1930, Structure File No. 8404801

Pratt Through,

CR 102, crosses Wolf Creek, unknown builder, 1947, Structure File No. 8430691

WAYNE

Selected Bridges

Truss Leg Bedstead

formerly on TR 261, crossed E Branch of Red Run, Canton Bridge Co., 1890, moved to Marshallville for re-use by local historical society, previously Structure File No. 8535922

WOOD

Selected Bridges

Concrete Rainbow Arch,

CR 25, crosses N Branch of Portage River, ODH design, 1925, scheduled for replacement, Structure File No. 8701830 p. 81

Reserve Pool Bridges

Concrete Rainbow Arch,

SR 25, crosses Middle Branch of Portage River, ODH design, 1925, scheduled for replacement, Structure File No. 8701741

Concrete Rainbow Arch,

Insley Rd., crosses Rocky Ford Creek, unknown builder, 1930, Structure File No. 8759162

Parker Through,

CR 112B, crosses Portage River, unknown builder, 1914, Structure File No. 8750513

WYANDOT

National Register Bridges

Parker Covered Bridge,

Howe truss, 5 miles NE of Upper Sandusky on CR 40A, J.C. Davis, 1873, crosses Sandusky River, burned, partially collapsed, May 1991; rehabbed 1991-2, Structure File No. 8834350

Swartz Covered Bridge,

Howe truss, NW of Wyandot on CR 130A, unknown builder, 1878, crosses Sandusky River, Structure File No. 8847134

Appendix B

Identified Builders/Designers

Extant Concrete Arches 1993 Update

Designers/Builders

Akins Bridge
Z. Blodgett and Pollick
W. M. Brode and Company
Buckeye Portland Cement Co.
Burnett Construction
Butler County
F.J. Cullen
G.W. Doerzbach
E.D. Drumm
E. Elford Construction Co.
Emerson and Jones
Fritz von Emperger
Robert Evans & Co.
Fath & Son Construction
D.P. Foley
E.M. Gephart and R.E. Kline
Hackedorn Contracting Co.
Hanneman Brothers
Hecker-Moon Co., Cleveland
P.M. Henry
Frank Herge Inc.
Hereth Construction
Highway Construction Co.
W.S. Hostler
J.H. Jones
E.H. Latham Co.
Luten Bridge Co.
Maxon Construction Company
Melan Arch Construction Co., N.Y.
R. Merydith Construction Company
Miami Conservancy District
Miller-Taylor Construction Co.
National Foundation & Engineering Co.
Newton-Baxter Company
Noble Construction Company
Pandora Cement Block Co.
Penn Railroad
Pitt Construction Co.
N.R. Porterfield

Roberts Supply Co.
C.F. Schwab
Standish Engineering Corp.
G.R. Stoller
Stout & Harden
F.K. Vaughn Building Company
Walsh Construction Company
W.P.A.
C.A. Warner (Contractor)
Wilbur Watson, Watson Engineering Co.
Wiley Construction Co., Dayton
Wynkoop McGormley Co.
A.W. Yawger & Co.

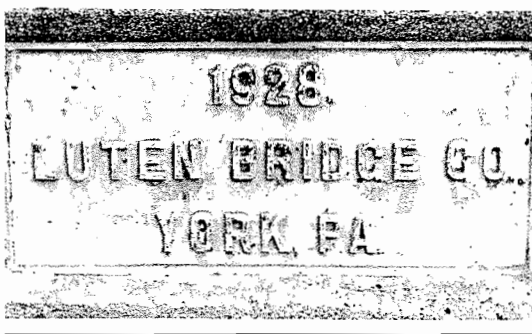
Designers

Charles Ash
J.R. Biedinger
A. G. Bixler
Walter Braun
Wendell P. Brown Co.
J. R. Burkey
W. E. Burroughs
Concrete Steel Engineering Co.
L. W. Curl
C. O. Demos
K. E. Dumbauld
V. A. Eberly
Hugo Eichler
A.M. Felgate
W.W. Flemming
W. Freeman
A. J. Friemoth
E. A. Gast
H.H. Hawley
W.S. Hindman
J.H. Jones
William Lucas
Daniel B. Luten
William Mueser
P.O. Monfort

C.E. Nofer
Ohio Department of Highways
Osborn Engineering Co.
C.E. Osborn
D.H. Overman
N.R. Porterfield
W.H. Pratt
W.H. Rabe
Walter Rice

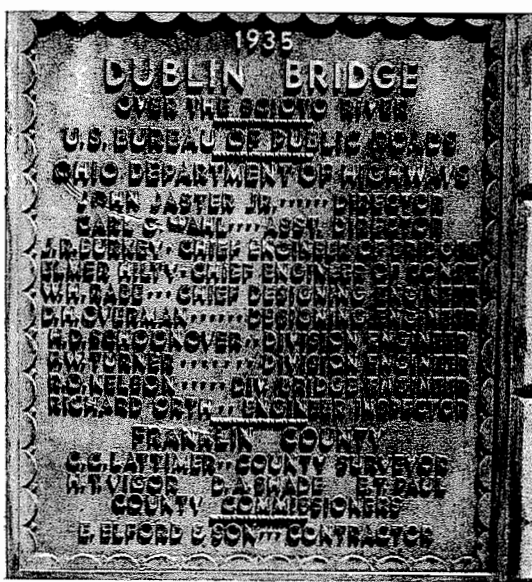
V.E. Schuler
C.P. Smith
Smith & Chamberlain, Architects & Engineers
W.A. Stinchcomb
Martin Ward
Wilbur Watson
M.X. Wisda
A.W. Zesiger

Luten Bridge Company



The Luten Bridge Company of York, Pa., was incorporated in 1909 as a contracting concern specializing in the designs of Daniel Luten. It grew to be the largest of Luten's loosely affiliated corporations and operated offices in Clarksburg, West Virginia; Concord, New Hampshire; Columbus, Ohio; Chatsworth Georgia; and Syracuse, New York.

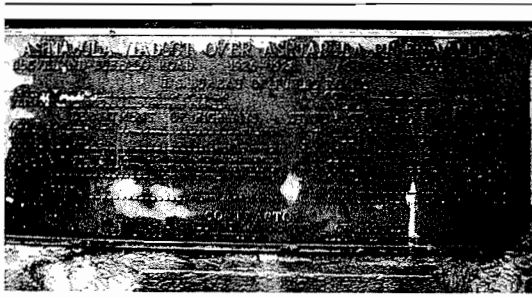
D.H. Overman, J. R. Burkey



D.H. (Henry) Overman (1898-1972) was a 1925 graduate of the Ohio State University. He was employed by ODOT for more than forty years. At the time of his retirement in 1964 he was Chief Engineer of Bridges. Overman and his colleagues in the Bridge Bureau designed bridges, particularly during the Depression Era, that drew national attention.

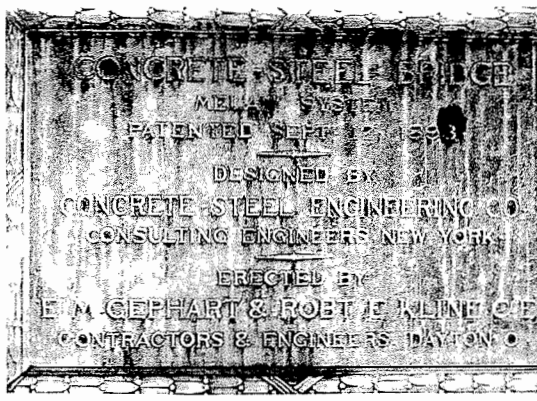
J.R. Burkey (born 1882) was Chief Engineer of Bridges and Railroad Crossings for the State Highway Department from 1925 to 1939. During his administration, which spanned the Depression Years, the department embarked on a program of highway improvement and bridge replacement designed to increase local employment of workers in the project locales.

William H. Rabe



William H. (Bill) Rabe (born 1891) became Chief Designing Engineer of Bridges in 1923 and was Henry Overman's immediate supervisor during the period in which Overman did his early design work.

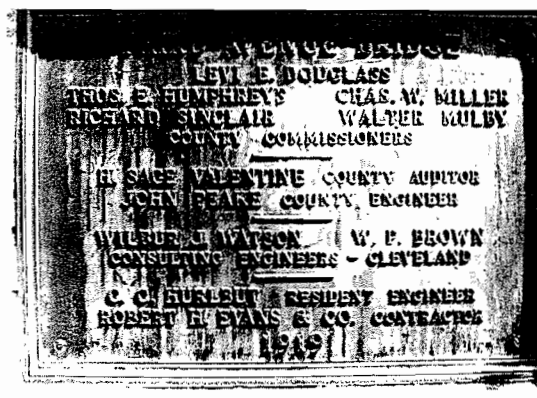
**Melan Arch Construction Co.,
Concrete Steel Engineering Co.**



Austrian engineer Joseph Melan was originator of the Melan system of reinforced concrete. His design was modified and patented by Austrian engineer Fritz von Emperger. This system essentially used large rolled steel structural steel encased in concrete. Under the direction of von Emperger, this company built the first reinforced concrete arch in Ohio, the Melan Arch in Cincinnati.

A consulting firm established in 1900 by Edwin Thacher and William Mueser. Based in New York, the company was responsible for the design of several concrete bridges constructed over the Great Miami River in Dayton during the first decade of this century. Thacher dropped out of the company in 1911. Mueser continued until 1933 when he joined federal civil works as an engineer. Responsible for first reinforced concrete bridges in New York and Pennsylvania. The company used the Melan system of reinforcing. At least five of these bridges survived the 1913 flood intact, a tribute to the company's skill with concrete.

Watson Engineering Company



Watson Engineering Company was the engineering firm of Wilbur J. Watson, an engineer with a special interest in bridge aesthetics. He founded the company in 1907, beginning a private practice that lasted until his death in 1939. Watson authored several books on bridge aesthetics and on outstanding bridges.

Appendix C

National Register Criteria

The National Register criteria define, for the Nation as a whole, the scope and nature of historic and archaeological properties that are to be considered eligible for listing in the National Register of Historic Places.

Criteria for Evaluation

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association:

- a. That are associated with events that have made a significant contribution to the broad patterns of our history; or
- b. That are associated with the lives of persons significant in our past; or
- c. That embody the distinctive characteristics of a type, period, or method of construction, or that 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; or
- d. That have yielded, or may be likely to yield, information important in prehistory or history.

Criteria Considerations

Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved

significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories:

- a. A religious property deriving primary significance from architectural or artistic distinction or historical importance; or
- b. A building or structure removed from its original location but significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
- c. A birthplace or grave of a historical figure of outstanding importance if there is no other appropriate site or building directly associated with his productive life; or
- d. A cemetery that derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
- e. A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
- f. A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own historical significance; or
- g. A property achieving significance within the past 50 years if it is of exceptional importance

Appendix D

Criteria for Assessing Integrity

Location

Location is the place where the historic property was constructed or the place where the historic event occurred.

particular period of time and in a particular pattern or configuration to form a historic property.

Workmanship

Design

Design is the combination of elements that create the form, plan, space structure, and style of a property.

Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.

Feeling

Setting

Setting is the physical environment of a historic property.

Feeling is a property's expression of the aesthetic or historic sense of a particular period of time.

Association

Materials

Materials are the physical elements that were combined or deposited during a

Association is the direct link between an important historic event or person and a historic property.

Glossary

AASHTO	American Association of State Highway Transportation Officials;		support, especially one in which the projection is great with relation to the depth, so that the upper part is in tension and the lower part in compression;
abutment	a substructure supporting the end of a single span or the extreme end of a multispan structure and, in general, supporting the approach embankment;	cartouche	a tablet for ornament, usually for receiving an inscription;
attenuate	to make slender or thin tapering gradually to a point - weaken;	chord	the upper and lower longitudinal members which extend the full length of the truss;
balustrade	a railing or parapet consisting of a handrail on balusters, sometimes on a base member;	coping	the capping or top course of a wall, usually adapted to the protection of the wall from the weather;
bridge	any structure spanning and providing passage over a river, chasm, road or the like;	crenelated	describing a parapet in which the top is notched as in a battlement;
buttress	an abutting pier which strengthens a wall, sometimes taking the thrust of an inner pier;	cutwater	the sharpened end of a pier, built with an angle or edge to better resist the action of water and ice;
cantilever	any rigid structural member projecting from a vertical		

deck	that portion of a bridge which provides direct support for vehicular and pedestrian traffic;	NHPA	stone or concrete in or for a structure; National Historic Preservation Act passed in 1966;
dentile	one of a series of block-like projections forming a molding, as in an Ionic entablature;	ODH	Ohio Department of Highways;
		ODOT	Ohio Department of Transportation, formerly Ohio Department of Highways, name changed by Act of Legislature, 1973;
FHWA	Federal Highway Administration;		
HAER	Historic American Engineering Record, a part of the National Park Service within the Department of the Interior;	OHPO	Ohio Historic Preservation Office; also called State Historic Preservation Office (SHPO);
hydroscopic	absorbing moisture from the air - changed or altered by the absorption of moisture;	parapet	a low retaining wall;
		pier	a substructure unit which supports the spans of a multi-span superstructure at an intermediate location between its abutments;
keystone	the wedge-shaped top of an arch;		
masonry	general term applying to abutments, piers, retaining walls, arches and allied structures built of stone, brick, or concrete and known as stone, brick or concrete masonry;	portal	clear unobstructed space of a through bridge forming the entrance to the structure;
monolith	a single block of		

quoins	the selected pieces of material by which the corner is marked; in stone the quoins consist of blocks larger than those used in the rest of the buildings and cut to dimension;	spandrel	of a beam, arch, or the like; an area between the exterior of two adjoining curves;
rainbow arch	a concrete arch configuration typical in the 1920s and 1930s;	spring line	the line within the face of a surface of an abutment or pier at which the soffit of an arch takes its beginning or origin;
rustication	masonry in which the principal face of each stone is rough, reticulated or vermiculated, with a margin tooled smooth along rectangular edges; or the principal face may be smooth and surrounded by a bevel margin returning to the plane of the wall;	substructure	abutments, piers or other construction built to support the span or spans of a superstructure;
		superstructure	entire portion of a bridge structure which primarily receives and supports highway traffic and transfers such loads to the substructure;
skewed	having the center line of its opening forming an oblique angle in the direction in which its spanning structure is built;	through bridge	form of bridge in which traffic actually moves through the supporting parts;
soffit	the curve defining the interior surface of an arch; also known as intrados;	viaduct	series of spans carried on piers at short intervals;
span	the distance between the supports	voussoir	one of the stones of an arch lying between impost and keystone;

WPA

Works Projects
Administration, a
federal agency
(1935-1943)
charged with insti-
tuting and adminis-
tering public works
(its original title
was Works Progress
Administration).

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Filled Arch				
	34	Hamilton	1895	Melan Arch Construction
	37	Knox	1896	W.H.Pratt, Buckeye Portland Cement
	39	Warren	1897	Emerson & Jones, P.O. Monfort
	43	Ashtabula	1906	Burnett Construction
	49	Montgomery	1906	William Menser, Concrete Steel Engineering Co. & F.J. Cullen
	48	Tuscarawas	1908	W.M. Brode & Co.
	49	Montgomery	1908	Concrete Steel Engineering, E.M. Gephart & R.E. Kline
	53	Cuyahoga	1909	Zesiger & Stinchcomb
	56	Lucas	1910	Wilbur Watson, C.H. Fath & Son Construction and National Foundation and Engineering Co.
	58	Montgomery	1911	Concrete Steel Engineering, E.M. Gephart & R.E. Kline
	59	Franklin	1912-13	Wilbur Watson & Walter Braun
	63	Butler	1914	A.W. Yawger
	64	Miami	1914	Daniel Luten
	68	Franklin	1919	Wilbur Watson, Robert H. Evans & Co.
	74	Auglaize	1921	Roberts Supply Co.
	75	Butler	1921	Miami Conservancy District
	76	Miami	1922	Miami Conservancy District
	80	Montgomery	1925	E.R. Smith & J.J. Chamberlain, Wiley Construction Co.
	83	Allen	1926	Charles Ash
	86	Sandusky	1926	J.H. Jones & Walter Braun
	96	Noble	1930	L.W. Curl, W.W. Flemming
	97	Shelby	1930	D.H. Overman
	101	Belmont	1931	Luten Bridge Co.
	109	Cuyahoga	1934	K.E. Dumbaugh, D.H. Overman

	Page	County	Date	Designer/Builder
Closed Spandrel Hollow Arch				
	104	Cuyahoga	1932	D.H. Overman, The Highway Construction Co.
	114	Cuyahoga	1937	D.H. Overman, C.P. Smith
Closed Spandrel Rib Arch				
	88	Belmont	1927	Luten Bridge Co.
	89	Lucas	1927	Newton-Baxter Co.
	90	Monroe	1927	Luten Bridge Co.
	91	Belmont	1928	Luten Bridge Co.
	92	Jefferson	1928	Luten Bridge Co.
	94	Belmont	1930	Luten Bridge Co.
	95	Geauga	1930	Hereth Construction
	110	Franklin	1935	Elford Construction, D.H. Overman, A.J. Freimoth
Open Spandrel Rib Arch				
	66	Hamilton	1917	D.P. Foley
	69	Mahoning	1920	N.R. Porterfield
	78	Ashtabula	1922	Pitt Construction Co., Wendell Brown Co.
	79	Cuyahoga	1925	A.M. Felgate, The Walsh Construction Co.
	84	Ashtabula	1926	J.R. Burkey, Standish Eng. Corp.
	93	Athens	1930	D.H. Overman, C.P. Smith, Stout & Harden
	98	Summit & Cuyahoga	1930-31	W.S. Hindman, Highway Construction
	103	Belmont	1932	D.H. Overman, A.J. Freimoth, K.E. Dumbauld, C.O. Demos
	105	Trumbull	1932-33	E.H. Latham Co., Wendell P. Brown
	106	Cuyahoga	1933	D.H. Overman, C.P. Smith Highway Construction
	108	Huron	1933	W.E. Burroughs, Hecker-Moon Co.
	112	Warren	1936-38	D.H. Overman

	Page	County	Date	Designer/Builder
Open Spandrel Slab Arch				
	46	Darke	1907	Walter P. Rice, A.W. Yawger
	51	Cuyahoga	1909	Unknown

Through Open Spandrel Rib Arch (Rainbow Arch)

54	Hamilton	1909	E.A. Gast, Hugo Eichler
81	Wood	1925	ODH standard design
82	Ashtabula	1926	ODH
87	Meigs	1926	W.H. Rabe, V.E. Schuler