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National Register of Historic Places Multiple Property Documentation Form

This form is for use in documenting multiple property groups relating to one or several historic contexts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. For additional space use continuation sheets (Form 10-900-a). Type all entries.

A. Name of Multiple Property Listing

Metal Truss Bridges of Somerset County, New Jersey 1885-1927

B. Associated Historic Contexts

Application of Metal Truss Bridge Technology to Highways Within Somerset Co.
Development of Railroad Lines Within Somerset Co.

C. Geographical Data

Boundaries of Somerset County, New Jersey

☐ See continuation sheet

D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR Part 60 and the Secretary of the Interior's Standards for Planning and Evaluation.

[signature]
Signature of certifying official

9/11/92
Date

Assistant Commissioner for Natural & Historic Resources/DSHPO
State or Federal agency and bureau

I, hereby, certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

for Patrick Andrus
Signature of the Keeper of the National Register

11/12/92
Date

E. Statement of Historic Contexts

Discuss each historic context listed in Section B.

This multiple property documentation form is organized to address one property type that contrIbuted to the development of transportation networks and the related historic development of Somerset County, a diversified county ranging from highly industrialized corridors to sparsely developed, decidedly rural areas. The property type is the metal truss bridge.

The property type falls into two historic contexts; the application of metal truss bridge technology to internal improvements within Somerset County and the development of railroad lines within Somerset County. Each context is divided into themes which develop the context.

E. STATEMENT OF HISTORIC CONTEXTS

I. <u>Application of Metal Truss Bridge Technology to Highways Within Somerset County</u>

A. The Evolution of the Metal Truss Bridge in America

American metal truss bridge development and construction flourished in the period from approximately 1840 until 1930. In that time railroads grew rapidly, highway systems expanded, and engineers/designers developed bridge truss types that could accommodate the new weight, length, and use demands. Just as railroads made the 19th century the age of iron, they also made metal truss bridge technology a necessity (Condit, p. 103). Timber building technology of the past was combined with new materials and systematic engineering principles and calculations to produce a structure type to meet the needs of the rapidly expanding transportation networks across the country. By the 1880s, metal truss bridges, introduced less than 50 years before, had become an integral part of America's technological landscape.

Prior to this country's Industrial Revolution during the first quarter of the nineteenth century, most bridges were either simply supported timber beams and or, less frequently, masonry arches. During the early years of the 19th century the need increased for longer, more permanent spans in response to the development of urban centers and regional transportation networks. The most successful solution to sturdy long spans was the introduction of the truss which functions on the principle of diagonal members to transfer vertical forces in a horizontal direction. The first truss bridges were built

[X] See continuation sheet

entirely of wood, and the form came into its own in the first two decades of the 19th century. What was innovative about the early 19th-century wooden truss bridges is that they multiplied the basic truss pattern many times over in order to span greater lengths than the 18th-century timber beam or single King-post trusses (Clouette, p. 18). The most famous of the wood truss types are the Town lattice truss patented in 1820, and the Burr arch patented by Theodore Burr in 1817. His truss combined a plain truss, with parallel top and bottom chords, with arched ribs located on either side of the roadway (condit, p. 82). A 5-span bridge designed by Burr was built across the Delaware River at Trenton in 1804-1806.

The most dramatic and far reaching advance in bridge design occurred during the middle third of the 19th century when metal was incorporated into truss bridges. In the 1830s and 1840s American bridge builders began to experiment with substituting wrought and cast iron for wood. Wrought iron possesses good tensile qualities, and William Howe, Thomas Pratt, and Squire Whipple all patented historically and technologically important combination wood and wrought iron trusses that were frequently used by a number of early railroads and on highways. The designs of these men ushered in an era of unprecedented advancement of metal bridge technology that was both a product of and a response to industrial advancement in this country.

It was the growth of railroads in the 1840s and 1850s that more than any other factor prompted advances in metal bridge development. As the size and weight of locomotives and rolling stock increased, bridge designers/builders passed into a pioneering age of technological development; they tested a variety of new metal truss bridge designs in wrought and cast iron, and they eagerly sought out rapid, economic, and efficient means of bridge manufacture and construction. Unfortunately, knowledge of the strength and properties of the new building materials was limited, and there followed a number of deadly and highly publicized bridge failures. As a result of both trial-and-error and better understanding of engineering principles, technology and design had advanced sufficiently so that bridge failures became less commonplace after the 1870s, and metal bridge technology became generally accepted (Condit, 1960:103-162; Kemp 1989: 6-14).

The last quarter of the 19th century was the halcyon era of the metal truss bridge in America. The proliferation of metal truss bridges was driven by both technological advances in design and material as well as by demand to produce longer and stronger spans for the railroads. Introduction in this country of the Bessemer process for making steel in 1868 made the highly desirable material, which works well in both tension (an axial force or stress caused by equal and opposite forces pulling at the ends of the members) and compression (an axial force or stress caused by equal and opposite forces pushing on the ends of members), an increasingly reasonably priced option for bridge elements. Steel replaced cast and wrought iron in the majority of truss bridges built after 1895, although much of the early steel is not markedly different in composition from wrought iron.

Metal truss bridge designs tended toward greater uniformity and standardization in the last two decades of the 19th century. While the live load requirements of the railroad promoted their continued use of a variety of truss designs, the Pratt and Warren trusses dominated highway use from about 1885 on. The Pratt and Warren truss types were well-regarded for their simplicity of design (composed of rolled plate, angle, and or channel shapes) and easily determined structural action as well as economy of fabrication. Ironically, both types had been invented in the 1840s, but did not become popular until after their respective creators had died. "The Pratt truss is the type most commonly used in America for spans under two hundred and fifty (250) feet' (Waddell, p. 468). The Pratt and Warren truss design was applied to both "high" (through) and "low" (pony) truss bridges.

Most 19th-century bridges, from light Pratt pony trusses to heavy Parker railroad spans were assembled in the field (at the site) with pinned connections rather than the riveted connections. The reasons for the use of the pins (circular bars with threaded ends which were passed through the individual components) were several including the ease of erection, lack of sophisticated analysis of stresses at a rigid joint, and the relatively primitive state of shop preparation of members to be joined in the field. Another reason pinned connections continued in use until almost the end of the 19th century was that the forged wrought-iron or later steel eyebar, more trustworthy than the early rolled sections, suited the pinned connection. Understanding of the distribution of secondary moments (the bending in a member at at given point) caused by rigid-end connections in a truss as well as better metallurgy, and better understanding of the strength of materials combined with advances in shop preparation for assembly led to the transition from pinned to riveted gusset plate (a large connecting plate used at panel points to join the chord and web members) connected spans in the 1890s.

Coupled with technological and metallurgical advances was the fact that both railroads and highways were expanding and improving at an unprecedented rate which stimulated keen competition between manufacturers and designers of prefabricated metal trusses. Well over 500 different American bridge building companies have been identified in operation from 1840 to 1900 (Darnell 1984). Some owned foundries and fabricating shops to form, drill, and shop rivet the truss pieces for shipment to the construction site, while others simply subcontracted much of the work. Some, like the King Bridge Company of Cleveland, Ohio, or the New Jersey Steel and Iron Company of Trenton, New Jersey, were large and stable with well-established regional and/or national markets while others existed for only a short time, perhaps constructing only a few bridges in a limited area before going out of business. Many of the bridge fabricating companies were owned (wholly or partially) and operated by a patentee to promote and build spans of his proprietary design.

In 1900 J. P. Morgan and Company incorporated the American Bridge Company, an amalgamation of over 20 previously independent bridge manufacturers. The new company comprised fifty percent of the nation's metal bridge fabricating capacity. The formation of the American Bridge Company effectively brought to an end the era of the small manufacturers and the diversity of metal truss design that characterized 19th century marketing and manufacturing (Darnell 1984:85-86).

The construction of metal truss bridges peaked during the first decade of the 20th century. Other bridge types, like steel stringers and reinforced concrete spans, were developed, and they proved to be more economical and required less maintenance than metal truss spans. The new technologies, which could be inexpensively built in large numbers based upon uniform and standardized specifications, quickly gained favor during the first two decades of the 20th century when the nation was developing both its farm-to-market and rural delivery road systems as well as early state highways systems. Dramatic increases in the weight of rolling stock in the period between

1890 and 1910 mandated that railroad companies replace existing bridges on their established rights-of-way with spans capable of handling the significantly greater loads. Consequently, most early or first-generation railroad bridges were replaced in the upgrading campaigns of the 1890s and the 1900s. The greatest innovations in truss design in the 20th century occurred in the development of large continuous or cantilevered spans. After the 1930s, state highway departments continued to build metal trusses but in increasingly modest numbers, usually for spans of over 300'. (Condit 1961:88-94, 207-212).

Many of the metal trusses crucial to the early development of America's railroad and highway transportation systems were not built to accommodate modern traffic conditions and requirements. Consequently metal truss bridges have been considered obsolete and systematically have been demolished or replaced. Only within the last twenty-five years did there grow a greater appreciation of their design, development, and historic importance. Nationwide, only a small number of pre-1885 wrought and cast iron bridges still exist, and post-1885 steel trusses are becoming increasingly rare (Comp and Jackson 1977:1; Kemp 1989:189-19; DeLony 1989:57-71; Pennsylvania Historical and Museum Commission 1986: 1, 109-152).

B. Metal Truss Bridge Technology Within New Jersey

Due to its established population centers, abundance of water power and subsequent industrial development, proximity to the destination markets of New York and Philadelphia, and situation next to the anthracite coal fields in eastern Pennsylvania, New Jersey was a microcosm of the national development and application of metal truss bridge technology. Governmental bodies, like the Hunterdon County Board of Chosen Freeholders which had three of Francis Lowthorp's innovative cast and wrought iron pony truss spans built between 1867 and 1869, and many railroads that crossed the state were in the forefront of using the burgeoning metal truss bridge technology. Data from the partially completed Department of Transportation statewide survey of pre-1945 bridges indicates that metal truss highway bridges were in common use replacing timber spans as the bridge type of choice by 1880. In some counties it was as early as 1873 (Somerset County Freeholder Minutes Book 4, p. 180 9/17/1873). Other early truss types that are known to have been constructed on roadways in the state include Fink and Moseley bowstring arches. And, like the national trend, the most common 19th-century metal truss bridge type in the state was the single and double intersection Pratt. Pinned connections were commonly, although not universally, used until after the turn of the century. While some early bolted field connections have been identified, post-1905 spans are predominantly riveted. The most frequent 20th-century truss type is the rivet-connected Warren, which was built through the 1920s.

Like most other industrialized states, New Jersey had some noted and successful bridge fabricating companies that marketed their products regionally as well as nationally. Among the largest were the Passaic Rolling Mill Company of Paterson, one of the largest capacity operations in the country in 1884 (Darnell 1984, p. 33) and the Trenton Iron Works, later the New Jersey Steel and Iron Company of Trenton, manufacturer of the first steel railroad rails. Most companies, which may or may not have employed professional civil engineers, designed the bridges they marketed through agents. In addition to the large companies, a host of smaller firms like the Dover Boiler Works in Morris County (1901 through at least 1903) and the New Jersey Bridge Company of Manasquan (1880-1907) existed in the state. While the New Jersey Bridge Company is known to have built bridges outside New Jersey, no examples of the Dover Boiler Works have been identified outside the state.

C. Historical Development of Somerset County

1. Geography

Somerset County is located in the northern portion of central New Jersey and is entirely within the state's Piedmont region, except for the extreme northwestern area which lies within the Highlands. The topography is for the most part one of gently rolling hills which flatten on the south side of the county. The county's primary river system is the Raritan River and its principal tributaries; the Millstone, North Branch of the Raritan, South Branch of the Raritan, and Lamington Rivers. The Raritan, the largest river wholly within the state drains an area of over 1100 square miles, rises in Morris County, and runs eastward through Somerset and Middlesex Counties before emptying into Raritan Bay. Given the county's many streams and its soils and topography well-suited to an agricultural economy, it is not surprising that a need for numerous bridges developed early in the county's history of European settlement.

2. Historical Background 1688-1940.

The area of Somerset County was settled by European immigrants primarily of English, Dutch, Scotch-Irish, and German origin in the early 1680s. The colony's proprietors first set out the boundaries of the county in 1688, although the borders were frequently disputed and changed until 1876. It was not divided into townships until the last half of the 18th century (Woodruff 1930:22). The earliest settlements, which include Bound Brook and Somerville, were located on the north side of the Raritan River. The economy of the county was primarily agriculturally based from the late-17th through the early 20th century.

Transportation networks have had as significant an influence on the development and thus the physical composition of the county as any other factor. Each transportation network reflects a discreet aspect of the county's development, and each has left a lasting imprint. The earliest transportation networks were the natural waterways, like the Raritan River, and a series of roads that incorporated existing Indian trails, historic highways like the Old York Road created by decree of the Colonial governor in the late-17th century, and byways connecting settlements. One of the earliest records of a bridge in the county is a 1728 legislative enactment authorizing construction of a bridge at Bound Brook on or very near the Old York Road (Doughty pp. 99-101). At least part of that stone arch bridge survives. Stone bridges, however, were not common in the pre-revolution era, and they were constructed only at the most permanent and prominent locations.

Somerset County benefitted from the two transportation systems that would dominate the first half of the 19th century. The completion of the Delaware and Raritan Canal in the mid-1830s introduced a network for moving agricultural goods to market and a means for moving raw materials (like coal from the eastern Pennsylvania anthracite coal fields) into the county and processed goods out. The access to materials and markets was further enhanced by the coming of the Elizabethtown and

Somerville Railroad (part of the Central Railroad of New Jersey after 1849) in 1840-41. The railroad proved to be much more successful and influential to the future growth of the county than the canal. Somerset County was so significant in the geographic link between New York and Philadelphia and the coal fields in Pennsylvania that between 1870 and 1875, when the Camden & Amboy Railroad's monopoly on cross-state rail lines expired, four new railroads were chartered or actually built in the county. Because of their location, the four small local lines were immediately attractive to the larger, ever-expanding companies. After a series of mergers and acquisitions in the 1870s and 1880s, Somerset County was included in the systems of the Lehigh Valley Railroad, the Reading Railroad, the Pennsylvania Railroad, and the Delaware, Lackawanna, and Western Railroad in addition to the pioneering Central Railroad of New Jersey.

The railroads, even more than the canal had done, stimulated development, especially in the early, small-scale industrial sections along the Raritan river in the eastern portion of the county. By the 1880s, manufacturers in the Somerville-Bound Brook area produced and/or processed a wide variety of products from clothing and paint to foundries. In the early 1910s, two large industrial concerns moved to the eastern portion of the county because of its proximity to major rail lines. The Johns-Manville Corporation and the Calco Chemical Company, one of the forerunners of American Cyanamid, began operations respectively in Manville, a totally new community that developed around the plant, and Bound Brook. By 1930 the two companies employed over 2700 workers and were the largest employers in the county. While the western and northern portions of the county remained agricultural well into the 20th century, the eastern side developed, largely in response to the rail-and highway transportation networks into an industrial and suburban area.

Metal truss bridge technology played a significant role in the development of the influential rail and road transportation networks within the county with its major rivers and streams that had to be safely crossed in order to stimulate commerce and therefore growth and improvement. Without the technological advances to meet the need of carrying heavy loads across long sparis, Somerset County's historical development would have been decidedly less prosperous. Even agriculture benefitted from the industrialization of the county as the numerous rail lines provided opportunities for access to urban markets stimulating the farm to market economy which was so important to the county.

D. Political Structure of Bridge Building in Somerset County

The recorded political history of Somerset County begins in 1681, with four land purchases from the resident native Americans by the widow of proprietor Sir George Carteret. These lands were in turn acquired by the East Jersey Proprietors. In 1688, Somerset was delineated as a separate county. Courts and a courthouse at Franklin Park were established by 1714. This early structure was destroyed by fire in 1737, with all records lost. The earliest records available begin in 1772.

The governing body of each county in New Jersey is the Board of Chosen Freeholders, as provided for by an act of the legislature in 1714. These representatives are responsible for the building and maintenance of roads and bridges, and the management of county institutions. A 1774 "Act for Regulating Roads and Bridges," empowered the freeholders to hire two surveyors who in turn had the power after advertising their intention, to create public roads, "with as little damage as may be to the owners of the lands..." (Doughty 1912:102).

The responsibility of maintaining bridges over the Raritan, Millstone, and Passaic River systems was the major preoccupation of the Board of Freeholders. Virtually each page of the Freeholders Minutes refers to the repair or construction of bridges over the numerous waterways. The process, as illustrated in a typical entry in the minutes, delegated board powers to one or more "managers" responsible for completing the project:

> May 26, 1774, It is agreed by this board that there shall be a bridge built below the Mills over the River at a certain place by a parcell of Allum trees known by the Board provided that the road is laid out to that place. It is agreed by this Board that Rowland Chamber and John Gaston be appointed a committee to agree with proper persons to build the bridge and that there Shall be Raised the Sum of 5150 proc for the carry on or build said Bridge. (Kudless and

Kudless 1977:6).

Occasionally the board would state specific materials to be used in the construction:

> May 31, 1774, It is agreed by this board that there Shall be Stone Pillars built and Finished with new Timber over the River... (Kudless and Kudless 1977:6).

This early pattern continued in later years. In examining the minutes beginning in 1869, the process of building a bridge entailed meeting at the proposed site as requested by members, discussing the possibility of repair or replacement, appointing a bridge committee with the power to act for the board, and again meeting at the bridge to accept or reject the completed structure. The board frequently made specific direction to the committee, as in the following motion regarding the iron bridge at Bound Brook on May 31, 1884:

> Moved that the top plank be taken off and that the Bridge be planked with two and one-half inch spruce plank twenty feet long spiked down and that the columns be topped so as to let the water out. (Freeholders Minutes Book 5 1884:93).

At other times the details of construction were entrusted to the committee.

Each year, freeholders were individually authorized to "build or repair bridges in his own Township not to exceed $15.00 each, two freeholders not to exceed $50.00, and three not to exceed $500.00." (Freeholders Minutes Book 5 1884:92). This amount remained constant over time. Occasionally, the board received petitions from "citizens and taxpayers" requesting that the board construct a bridge for their convenience. In some instances, such as the following concerning the Raritan Bridge, the citizens felt it necessary to revise board specifications:

> June 8, 1886, The board received a petition from 90 citizens and taxpayers of the county asking the board to reconsider and make the roadbed of the Raritan Bridge 18' rather than 16'. The board agreed with the petitioners. (Freeholders Minutes Book 5 1886:237).

As new methods of construction became common, bids were solicited for alternative plans, and it was proposed that the committee be given the authority to decide "which in their judgement it will be expedient to build, the difference in cost not to exceed $200.00." (Freeholders Minutes Book 5 1885:173). The board may have been uncomfortable with this loss of control however. This proposal lost. An examination of Freeholders Minutes beginning in the year 1868 reveals the first incident in which the board sought alternative technologies to have occurred on June 12, 1869. The board members were impressed by "parties appearing before the Board with proposals to Build iron bridges over the Millstone River and also over the South Branch at such prices as met with favor of the Board," but before committing themselves to a contract, they asked that a committee "proceed to examine different Iron Bridges in the State and neighboring states if necessary." Freeholders Minutes Book 4 1869:44). This infers that iron bridges had not yet been built in Somerset County at this date.

As projects became more complex, freeholders sought professional advice. Of the records examined, the first mention of hiring an outside consultant occured on May 8, 1872, when a bridge committee is authorized to "employ a practical Enginier to give the Best plan for the Construction of a good and Substantial Bridge." (Freeholders Minutes Book 4 1872:134). The engineer's responsibilities also included securing the best price on materials. Engineers were often employed when a decision between bridge types was required. On May 15, 1886, in a discussion regarding a bridge crossing the Raritan River, the board decided to accept bids for both a wooden A-truss iron stringer bridge and a high truss iron structure, and the committee was authorized to "employ a civil engineer." (Freeholders Minutes Book 5 1886:230). Thereafter in Book 5, the decision to use outside experts was common on larger or complex bridges. In April of 1897, an engineer named Joshua Doughty, Jr., was hired to survey roads proposed for the county. (Freeholders Minutes Book 6, 1897:311). In May of 1897, Doughty was elected the first County Engineer. (Freeholders Minutes Book 6 1897:323). Doughty remained County Engineer through 1920, overseeing a period of tremendous expansion of the county and state road system.

The political process underwent significant change as the 20th century wore on resulting in a distancing from local authority.

The creation of the position of County Engineer and the introduction of state and then federally sponsored road programs removed the freeholders from the intimate position of control which they had enjoyed earlier in their history. After 1900 stone and macadam roads replaced bridges as the dominant concern of the freeholders. The state made funds available for-road improvement through its local aid program starting in 1881, and in 1915 it created the first state highway system so that by 1920, both the state and the freeholders were actively improving roadways in the county. In 1900 the county had just hired its first permanent professional county engineer, but by 1930 it permanently employed a county engineer, a bridge supervisor, a roads supervisor, 5 foremen, and 35 laborers.

By 1930, many of the metal trusses erected in the period before the advent of the automobile had become antiquated and unsafe. The county had adopted a policy of systematically replacing older structures with "new bridges of a permanent type - structural steel encased in concrete and re-enforced concrete," even though an occasional short-span riveted truss continued to be built. Noting that the county had about 2,000 bridges and culverts, the Freeholders (1930:28) rhetorically asked, "Bearing in mind that it is the bridge which spans the stream, river and lake, and overcomes those natural barriers to land travel ... that Somerset County, surrounded by busy metropolitan centres, lies in the path of exceedingly heavy traffic ... and that each year the traffic becomes heavier and heavier ... is it a wonder that the County's bridge problem each year becomes greater and more complicated?" They took pride in the replacement of the county's last covered bridge in 1929 and claimed that the new bridge types did not sacrifice strength, increase costs, or lack beauty and artistry.

E. Metal Truss Bridges in Somerset County

It is possible to trace the evolution of bridge technology through the minutes of the freeholders of Somerset County. In the early pages of the record, bridges were constructed of stone and timber by local "hands." (Kudless and Kudless 1977). It appears that the Freeholders initially considered metal truss bridges in 1869. In May, 1869, a committee appointed to rebuild two bridges over the Millstone River was to determine the difference in cost between iron and wood spans (Freeholders Minute Book 4:40). The committee found the price for an iron bridge "acceptable," but it decided to send a committee "to examine different iron Bridges in the state and neighboring states if necessary" (Freeholders Minutes 4:44). The outcome of their investigation at that time was to build a wooden bridge. A few years later, however, the first iron bridge built by the Freeholders was the 1872 span at Weston (Freeholders Minutes 4:136). In 1873 another was constructed over Peters Brook at the east end of Somerville (Freeholders Minutes 4:185). While the truss type and fabricator were not specified in the minutes, what is significant is that by the early 1870s, metal truss spans were replacing wooden bridges in the county. In 1875 the Freeholders specified iron for the 3-span, approximately 200'-long bridge over the Raritan at Bound Brook. Known as Queen's Bridge, the double-intersection Pratt span with Phoenix columns survived until 1984. In addition to that bridge, the county was also constructing iron bridges at Washington Street in North Plainfield (non-extant) and over the North Branch of the Raritan River at North Branch.

The switch from wood to iron bridges was gradual. A period of experimentation seems to have been underway after 1875, as there are examples, which occur with greater frequency over time, of board members requesting that bids for alternative wooden and iron structures be solicited. These proposals for bids for both types of bridges generally lost in 1884 and 1885, but gradually gained currency. Cost was an important consideration as illustrated by this example:

> June 9, 1885 the joint committee upon the line bridge between Morris and Somerset Counties at Osbourne Mill after advertising for proposals and receiving bids for the bridge ascertained that an iron structure would exceed a wooden structure in cost only about $100.00 and that the joint committee have taken the responsibility to contract for an iron structure. (Freeholders Minutes Book 5 1885:164).

By 1887, agents for both regional and national bridge building companies were making deeper inroads on the wooden truss iron stringer local bridge. The freeholders minutes reveal an eclectic assortment of bridges being constructed in 1887; wooden A truss iron stringers are still being built, but so are high and low truss iron bridges, as well as stone and brick arch bridges. (Freeholders Minutes Book 5 1887:312-330). No style has clear preference in the 1880s. The 1890s, however, brought the ascendancy of the iron structure, but both wooden and stone bridges continue to be built.

Changes in technology, including the adoption of the use of new materials, are reflected in the pages of the minutes. In 1889, it is specified that stone work is to be "laid with imported Portland cement," the first mention of that material. (Freeholders Minutes Book 5: 1889:458). An 1899 entry regarding advertisements for a low truss span states that it may be "wrought iron or steel," the first use of that term (Freeholders Minutes Book 6 1899:480). An entry on August 11, 1898, requests bids for both iron and wooden replacement structures. An entry one week later requests bids for both iron and concrete alternatives showing that iron or steels reign as the material of choice was being challenged. (Freeholders Minutes Book 6 1898:430).

The minutes from the 1880s and 1890s reveal the tendency of contracts for shorter spans being awarded to local or smaller regional builders, like W.T. Kirk of Plainfield while longer multi-span bridge brought proposals from a host of larger, national fabricators. Bids submitted for spans of all lengths often included plans and prices for several different designs from the same builder, leaving the final decision as to both price and design to the freeholders. The process for selection of a replacement span for the bridge over the North Branch of the Raritan River at Neshanic Station lost in the early February freshet in 1896 is indicative of how larger bridges were built. The freeholders voted to build a new iron bridge with an 18' roadway on February 11, 1896 (Freeholders Minutes 1896 6:209). Just two weeks later, the contract for the new bridge was awarded to the Berlin Iron Bridge Company for a "parabolic Suspension Bridge" described in the specifications as plan "A 2" (Freeholders Minutes 1896 6:215). Berlin Iron Bridge Company, which submitted six design alternatives, was one of 15 bidders submitting 39 proposals, and those attempting to secure the commission represent most of the largest fabricators in the country including the Wrought Iron Bridge Company, Dean & Westbrook of New York, Canton Bridge Company, Toledo Bridge Company, Havana Bridge Company, Youngstown Bridge Company, Boston Bridge Company, and Horseheads Bridge Company of Horseheads, New York (Freeholders Minutes 1896 6:214).

In summary, Somerset County was building metal truss highway bridges from 1872 until 1927 which places it within the national mainstream of the application of metal truss bridge technology. Its first uses were tentative selections, but by 1875 it had become the technology of choice for all long spans. The surviving metal truss highway bridges chronicle as well as any county in the state the evolution of the technology from the earliest days when the Phoenix column was an innovative alternative to wood and wrought iron to the standardization of designs and construction in the late-1920s.

II. Development of Rail Lines Within Somerset County

A. Historical Background

Unlike the road system in the county whose development was controlled locally by the Board of Chosen Freeholders, railroad development was almost totally controlled by outside interests. While the initial rush to develop lines in the 1840s-1860s was promoted locally, during the heyday of actual railroad right-of-way development in Somerset County during the 1870s-1910s, the decisions were controlled by private corporate interests-outside the county, and often times outside even the state. The Freeholders Minutes from 1869 through 1903 reveal very few entries concerning erection of railroad bridges which illustrates that the railroads and the Public Utilities Commission, the state regulating body, were making the decisions concerning railroad crossings.

Due to its situation between New York City and Philadelphia as well as its proximity to the anthracite coal fields of eastern Pennsylvania, Somerset County was important in the development of interstate rail lines. Although the earliest railroad in the state, the Camden & Amboy Railroad chartered in 1831, did not cross the county, it did have a direct influence on railroad development in Somerset County. The Camden & Amboy was granted a 40-year monopoly on cross-state rail traffic which served to retard development of competing lines. Short lines, however, did spring up, and the first rail service to Somerset County was provided by the Elizabethtown and Somerville Railroad short line. Its development and growth were slow, with only 45 miles of track built between 1841 and 1849 when the previously bankrupt line was reorganized as part of the Central Railroad of New Jersey (CNJ). The CNJ put together a series of short lines and went on to become the major carrier between the Pennsylvania coal fields and New York. The line was extended west from Somerville in the early 1850s.

The period of greatest rail development in the county occurred from 1860 through 1875 when no less than four different lines were chartered or built. The end of the Camden & Amboy's monopoly on cross-state lines in 1871 stimulated a rush to charter lines. Promoted locally and undercapitalized, the new lines were often not actually built by the charters, but their rights-of-way proved attractive to those developing longer trunk lines or companies wanting much coveted access to the greater New York area. The Philadelphia & Reading (Reading), which completed its double-track through the county in 1875, and the Lehigh Valley Railroad, a major coal hauler that completed its right-of-way through the county in 1875, gained access to the local "paper" lines and made them an integral part of the network, and they joined the CNJ, which added the South Branch line from Somerville to Flemington in 1864, as major regional lines. In the early 1890s the Reading Railroad developed its own coal terminal on the Arthur Kill near Carteret. It built a single-track spur from its line near Manville to Port Reading in 1890-1892. It is on that line that some of the oldest railroad bridges in the county were built. The Delaware Lackawanna & Western Railroad, primarily a coal-hauling freight line established in the Scranton area in 1853, extended the former New Jersey West Line (chartered in 1865) from Bernardsville to Peapack in 1890. The line carried both freight and passengers, and the double-intersection Warren truss bridge it erected over the North Branch Raritan River in Far Hills is the oldest metal truss railroad bridge in the county. It was built in conjunction with the initial development of that section of the line.

The proliferation of rail lines in Somerset County had a profound effect on its development. While the rail lines were conceived to be part of larger regional networks, their passing through the county encouraged everything from industrial development in the Somerville-Bound Brook corridor to seasonal estates in the picturesque rolling hills in the northwest part of the county. Eighteenth- and early-19th century towns and villages lived or died based on their proximity to the new rail lines. Places like Neshanic, an established crossroad village in western Hillsborough Township, was eclipsed by Neshanic Station, the settlement and mill that grew up after 1865 along the right-of-way of the CNJ's South Branch. Twentieth-century boroughs like Manville owe their existence to the railroad for if the rail connection had not existed, Johns-Manville Corporation would not have located its new factory there in 1913.

Thus, while controlled by interests outside the county, the railroads had a profound effect on the development of Somerset County. They provided a means to bring raw materials into the county and to take finished products and agricultural commodities to market. It is unlikely that Somerset County would appear as it does today, with its handsome estates and large industrial complexes, if it were not for the large railroads that crisscrossed the county on their way to and from New York.

B. Railroad Bridges Within Somerset County

The railroads designed and built their own bridges. The companies maintained in-house engineering departments that developed the plans and contracted with various fabricators, such as the Pencoyd Iron Works of Philadelphia or The Phoenix Bridge Company of Phoenixville, Pennsylvania, for their construction. Because of the ever-increasing weight of the locomotives and rolling stock, railroads were, throughout the 19th and into the 20th century, in the lead of truss and material development. It was the railroads that pioneered and promoted use of metal truss bridges and later refinements in both truss design and material. The period of greatest railroad bridge construction occurred between 1890 and 1910 when dramatic increases in the weight and capacity of rolling stock made upgrading of bridges mandatory. Consequently, few early (pre-1890) railroad bridges survived. All ten of the rail-carrying metal truss bridges in Somerset County were erected during this two-decade period of upgrading and expansion.

F. Associated Property Types

I. Name of Property Type Metal Truss Bridges

II. Description

See Continuation Sheet

III. Significance

See Continuation Sheet

IV. Registration Requirements

See Continuation Sheet

[X] See continuation sheet

[ ] See continuation sheet for additional property types

N/A

G. Summary of Identification and Evaluation Methods

Discuss the methods used in developing the multiple property listing.

The multiple property documentation was compiled from data generated from field inspections and evaluations of all metal truss bridges (highway and railroad) in the Somerset County by A.G. Lichtenstein & Associates, Inc. personnel during September-December 1991. The field data, which emphasized identification of truss types, originality of fabric, and construction details, was augmented by primary and secondary source research in repositories in Somerset County as well as railroad records and the state archives. Of particular value was the page-by-page examination of the free-holder minutes from 1875 through 1902. The information from all sources was then compiled into narratives about each bridge and this multiple property documentation form.

☐ See continuation sheet

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☒ See continuation sheet

Primary location of additional documentation:

☐ State historic preservation office
☐ Other State agency
☐ Federal agency
☒ Local government
☐ University
☐ Other

Specify repository:

I. Form Prepared By

name/title Mary McCahon, Architectural Historian
organization A.G. Lichtenstein & Assoc., Inc. date 6/92
street & number 17-10 Fair Lawn Ave. telephone (201) 796-6550
city or town Fair Lawn state NJ zip code 07410

F. ASSOCIATED PROPERTY TYPES

1. Name of Property Type: Metal Truss Bridge

II. Description:

All metal truss bridges, regardless of their size and design, are made up of common elements, with each having a top chord, bottom chord, verticals and/or diagonals, and floor beams of cast or rolled ferrous material (iron or steel). Whether a through, pony, or deck (trusses located below the road surface) truss, they all incorporate the same engineering principles. A truss works by transmitting dead (weight of the structure itself and the stresses placed on it by the elements) and live load (weight of objects moving over the bridge) to the abutments by transferring vertical forces in a horizontal direction. The differences in metal truss bridges is not in their function (to span a feature) or their composition; it is how their members (top chord, bottom chord, verticals, etc.) are arranged and the dimensioned. While live load capacity calculations of highway and railroad bridges differ, the principles of the truss itself do not.

The individual components of all metal truss bridges are joined by either or a combination of rivet, pinned, or bolted connections. The earliest metal truss bridges were composed of wrought iron diagonals or tension members and complicated but uniform cast compression members like the fittings for the technologically important Phoenix column. By about 1885, however, most metal truss bridges were built with four standard shapes: rolled plate, angles (a 2-sided L-shaped section), channels (C-shaped sections), and I-sections. Eye bars, a round or rectangular section with either cast of forged loops on either end, were used for the diagonals, hangers, and/or bottom chords in 19th-century pin-connected metal trusses. With these basic components, increasingly made of steel after the late 1890s, any number of truss patterns were created, each with a unique arrangement of members designed to transfer the load to the abutments.

The main differences between 19th and 20th century truss bridges are the use of steel instead of iron, riveted rather than pinned connections, and diagonals composed of rolled sections rather than rods. Replacement of the field pin connection with members joined by riveting to a gusset plate at the panel points eliminated the need for loop-ended pieces. Angles or channels joined by lacing, lattice or battens became the standard vertical and/or diagonal. This change is best reflected in the well-preserved Warren pony truss spans that survive in the county as represented by the 1919 Opie Road bridge in Branchburg Township.

Of the extant 29 road-carrying or highway metal truss bridges in Somerset County (see appendix A for name and location), nine were built in the 19th century, and 20 date from the 20th century (those whose date of construction has not been documented have been dated stylistically).

The earliest documented date of construction is 1886 (Raritan Bridge) and the latest is 1927. Interestingly, seven of the nine 19th century bridges are through truss spans, and five of them are still in use as vehicular bridges. Five are Pratt trusses or a variation of the Pratt. Of the 20 20th-century metal truss bridges in the county, only three are through trusses. The other 17 are pony trusses. The reasons for the infrequency of 20th century through trusses is not that the technology was waning, but rather that those crossings needing long, multi-span bridges had been improved in the late-I9th century.

Metal truss highway bridges are scattered throughout the county, and while metal truss railroad bridges survive in congested highly developed 20th-century areas, their highway counterpart is more frequently found in a rural or reasonably uncongested setting. Metal truss highway bridges in congested areas have usually been replaced over the last 60 years by wider, stronger spans.

The ten surviving metal truss railroad bridges built in the county between 1890 and 1902 are all thru trusses (see appendix A for name and location), and they illustrate the variety of truss types used by the railroads during its heyday of metal truss bridge fabrication. In contrast to the predominance of two truss types in highway construction, four different truss types (Parker, double-intersection Warren, Pratt, Baltimore) were employed for railroad use within the county. All are through or high truss bridges, and the larger size of the members distinguish the railroad spans from their lighter highway counterparts. While visually different, the railroad spans fabricated of the same members in the same manner and according to the same engineering principles as highway bridges.

Metal truss bridges are associated with larger transportation networks that played an important role in the development of the county. All are located on a right-of-way, both vehicular and rail, that link places and are significant in the movement of goods and people. The bridges were constructed in the county between 1885 and 1927, the era of greatest expansion of roads and railroads the county has ever known.

III. Significance

The metal truss bridge, almost more than any other second-half-of-the-nineteenth-century technological advance, stimulated the development of vehicular and rail transportation networks that had a far-reaching effect on the economic and physical development of Somerset County. Because metal truss bridges are often technologically distinguished in their own right and are also historically important to subsequent development patterns, they are significant for the association with events that have made a significant contribution to the broad patterns of our history (criterion A) and the distinctive characteristics of a type, period, and/or method of construction they possess (criterion C).

The earliest documented metal truss bridge in Somerset County is the well-preserved pin-connected double-intersection Pratt 2-span bridge that carries Nevius Street in Raritan over the Raritan River. It was built in 1886 by the Wrought Iron Bridge Company of Canton, Ohio, one of the more successful late-19th century bridge fabricators. Still in use today, the Nevius Street Bridge stands as one of the most important examples in the county of the transition to the industrialized era of bridge construction. It is composed of standardized rolled section members with both stamped and forged loop eyebars for the diagonals and bottom chords. The double-intersection Pratt is characterized by the diagonals spanning two panels. Examples of the more common single intersection pin-connected through Pratt truss, with the diagonal crossing just one panel, are located on Higginsville Road and Woodfern Road in Hillsborough Township.

The basic Pratt truss, with its verticals in compression and its diagonals and counters in tension, lent itself to several important variations which provided maximum strength at the center of the truss, where it is most needed. The 1896 lenticular truss at Neshanic station has the distinctive polygonal top and bottom chord, but the truss pattern is that of a Pratt. Another variation, the Parker truss, is discussed as a railroad bridge.

Also representative of the earliest metal truss bridges in the county is the Mill Road Pratt through truss over the right-of-way of the former South Branch of the Central New Jersey Railroad in Hillsborough Township. It dates stylistically to ca. 1885 and was built for the railroad prior to 1894. The bridge survives, albeit in deteriorating condition, as the only county example of a Phoenix column span. The Phoenix column, composed of at least four flanged rolled segmental sections riveted together and then joined by complicated cast-iron bearing blocks, was developed in 1864 by.the Phoenix Bridge Company (Phoeni ville, PA), and it is reported that "the column was a great factor in causing the substitution of wrought-iron for cast iron in the compression members of pin-connected bridges" (Waddell p. 24). The columns are used for the top chord, inclined end posts, verticals, and struts on the Mill Road bridge.

Unlike the previously cited pin-connected spans, which are representative of the genre of their era, the 1888 Province Line Road bridge over Bedens Brook is innovative in that it is a totally rivet-connected span. Built as a joint-county project on the Somerset-Mercer County line, the bridge ranks as not only the earliest documented county example of a Warren truss, but it is also the oldest all-riveted span. Generally, rigid (riveted) field connections were not common until the mid-1890s. Instead of the top chord and verticals being composed of built-up members, the bridge is built entirely of angles. Another rivet-connected Warren truss bridge is Bound Brook Road over Green Brook span that is out of service. It dates stylistically to the 1890s.

The Bridge Street (Manville) rivet-connected Warren through truss erected as a grade crossing elimination by the Reading Railroad in 1918 is a good example of the stiff through trusses that dominated the middle decades of this century. It is also the only 20th-century rivet-connected through highway truss bridge in the county. Composed of deep-section built-up members, its dimensioning reflects the scale of bridges designed to carry the heavier live loads over longer, wider spans.

Only one pin-connected Pratt pony (low) truss from the 19th century was identified, yet, from the freeholders minutes, it is known that many were built. The four-panel Canal Road bridge over Ten Mile Run, dated 1886, is the most complete example of the once-common bridge type. It was fabricated by the Penn Bridge Company, established in Philadelphia in 1868.

The best represented metal truss bridge type in the county is the early-20th century rivet-connected pony or low truss constructed totally of steel. They were built with frequency as late as 1927 (Jackson Road over North Branch of Raritan River), which is again reflective of the national trend. Five of the 20th-century low trusses are Pratts and eight are Warrens. Built of standardized members, the riveted Warren and Pratt bridges in the county illustrate the uniformity of bridge design and construction achieved in the early 20th century. The 1909 Parker pony truss bridge on Burnt Hill Road (Montgomery Township) is the most significant of the 20th-century low trusses due to its early use of bolts for field connections and its truss type, which affords strength at the center of the truss, where it is most needed, and economy of material. The Parker is an uncommon highway truss bridge type in New Jersey.

Most bridges were constructed for the county by regionally or nationally active bridge fabricating companies that were represented in Somerset County by an agent. Several local contractors, like J.W. Scott and W.T. Kirk were strictly local contractors who purchased the rolled section members from manufacturers like the Phoenix works in Phoenixville, Pennsylvania, and merely assembled the spans. Both approaches are well represented in the county in the era before 1905.

The oldest railroad metal truss bridge in the county is the rivet-connected double-intersection Warren span erected in 1890 by the Delaware, Lackawanna & Western Railroad as part of its completion of the line from Bernardsville to Peapack. It is composed of wrought iron members, and the truss type, also known as a lattice truss, is a survivor from the era of wood truss bridges.

Nearly as early as the Gladstone Branch Warren truss span are the three pin-connected Pratt through truss bridges built in 1891 by the Reading Railroad over the Raritan River, Middle Brook, and an unnamed brook in Bound Brook. Varying only in length, the bridges differ from their highway counterparts in the size of the members. The built-up (composed of plates and angles joined by rivets) floor beams are located above the bottom chord which results in a distinctive built-up section of the verticals in order to frame in the floor beams. A fourth pin-connected Pratt railroad bridge was built in 1896 at Neshanic Station. It also has built-up floor beams, but they are located in the more common position below the bottom chord. The 1896 Parker truss bridge over the Raritan River at Manville differs from the other single-intersection Pratt trusses in that it has a polygonal top chord to accommodate greater strength at the center of the span where it is most needed. The design provided strength and economy of material.

It is not known for certain if the 19th-century railroad truss bridges were fabricated of iron or steel members. Soft steel and wrought iron have the same physical properties, but are processed in a different manner as iron

is worked to temper it and steel is quenched. The two materials rust in a similar manner. From what documentation was obtained, it appears that wrought iron survived as material of choice well into the 1890s.
The heaviest metal truss type represented in the county is the Baltimore or Petit truss. The Lehigh Valley Railroad constructed four of them in the Bound Brook area between 1899 and 1902. Basically a Pratt truss with sub ties (tension members) and sub struts (compression members), the Baltimore truss has subdivided panels which permit a lighter floor system. The truss type was developed by Pennsylvania Railroad bridge engineers in the early 1870s as an effective long span capable of carrying great load (Condit, p. 148). The rivet-connected bridges are composed of deep built-up members connected to large gusset plates. Such oversizing of members was predicated on the critical moments or stress under load. The four spans differ only in length.

Railroads were also responsible for separating grade crossings. Most of the grade crossing elimination bridges in the county that carry a vehicular road over the railroad right-of-way are built-up through girder spans. The bridges were paid for by the railroad, and were built at the direction of the Public Utilities Commission, the state regulatory agency. The oldest and most significant of the two truss grade crossing elimination bridges In Somerset County is the 1889 3-span Howe pony truss bridge at Skillman. This truss type, which works on the opposite arrangement of the Pratt truss and has the diagonals in compression and the verticals in tension, is not a common late-19th century truss type. The heavily skewed bridge has replacement floor beams and stringers, but the trusses themselves are well preserved, and the bridge is a historically and technologically significant example of an early grade crossing elimination span built by a regional railroad company (Reading Railroad). The fabricator is not known.

Each railroad company maintained its own office of the chief engineer that, among other responsibilities, designed the bridges used on the lines which accounts, in part, for the repetition of bridge design. The railroad bridges in Somerset County were erected as part of major line development that extended beyond the county. The 1890-1892 Port Reading Branch of the Reading Railroad was developed as an entirely new line, and the 1899-1902 bridges on the Lehigh Valley line were part of a larger campaign to accommodate heavier rolling stock. The bridges of similar design, like the Lehigh Valley's Baltimore trusses built by the A. & P. Roberts Company that operated the Pencoyd Iron Works in Philadelphia, were usually all fabricated by one company. This was not the case with highway bridges which were bid individually.

As a body, the metal truss bridges within Somerset County embody the variety of design and construction techniques that characterized the period of experimentation and development of the property type in the last two decades of the 19th century. They also reflect the standardization of design and construction that came to dominate the 20th century. Metal truss bridge technology made possible the rapid and affordable development of the influential transportation systems within Somerset County. Thus, the property type is historically associated with not only road and rail history, but also the industrial, commercial, agricultural, and residential development of the county as well as the historical functioning of governmental bodies, like the Somerset County Board of Chosen Freeholders, that applied the technology to practical use.

IV. Registration Requirements

For inclusion in the nomination metal truss bridges must meet one of the following registration requirements.

1. The bridge must have been erected within the period of significance; 1885-1927.

2. The bridge must function in the manner consistent with its original design and workmanship. The bridge should not be so altered or strengthened that it no longer relies on its original connection technique to function. Some pin-connected pony truss bridges have been reinforced with so many welded members, including gusset plates, verticals, and diagonals, that the bridge no longer performs like a pin-connected truss.

3. The bridge must be a reasonably complete example of its type. Alterations, which are different from expected maintenance which includes such items are replaced wearing surfaces and stringers and inkind replacement of deteriorated members, should not compromise the integrity of original design.

Allowances for upgrading to meet modern traffic and load requirements are permitted when the upgrading is done in a manner that is sensitive to the original design and workmanship.

The requirement is applied differently to highway and railroad bridges.

Most of the metal truss highway bridges in the county are still in active service, and they are thus subject to modern traffic safety and load requirements. They also are subject to greater wear and damage from impact. As a result certain alterations of original design are common and their presence should not be evaluated as disqualifying a bridge. These changes include replacement of the original floor beams with modern rolled section, installation of modern beam guide rails on the inner face of the trusses, removal of the original railing, some welded repairs to deteriorated portions of members, installation of turnbuckles and/or sleeve nuts on counters, limited strengthening of the truss by the addition of members, strengthening of the abutments and/or bearing, and the addition of knee braces.

The load and traffic demands on railroad spans, for the most part, have not changed over time, and consequently the need to upgrade or alter railroad bridges has not been a significant factor in their history. Therefore, the degree of integrity of original design is greater in a railroad bridge than in a highway bridge.

4. Bridges that are sole survivors of a type that falls within the historic contexts or exhibits patented or unusual construction details are eligible. A greater degree of alteration will be accepted in this category as it is the type and detail that is of significance.

5. Bridges that are sole or rare examples of a significant fabricator or designer are eligible.

6. Bridges are eligible if they contribute to the themes of historic districts or historic contexts.

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