NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

6711

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration For* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for 'not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instruction. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name: Weymouth Road Bridge

other names/site number: County Bridge HAML-22 Federal S.I. & A. #01HML22

2. Location

street and number: Weymouth Road N/A not for publication

city or town: Hamilton Township N/A vicinity

state: New Jersey county: Atlantic County zip code: 08330

3. State/Federal/Tribal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this [X] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. I recommend that this property be considered significant [ ] nationally [ ] statewide [X] locally. ([ ] See continuation sheet for additional comments.)

Signature of certifying official/Title — Date: 5/7/01

Assistant Commissioner, Natural & Historic Resources/DSHPO
State or Federal agency and bureau — American Indian Tribe

In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. ([ ] See continuation sheet for additional comments.)

Signature of certifying official/Title — Date

State or Federal agency and bureau — American Indian Tribe

4. National Park Service Certification

I hereby certify that the property is:

Signature of the Keeper — Date of Action

[X] entered in the National Register. — Edson H. Beall — 6.21.01
[ ] See continuation sheet.
[ ] determined eligible for the National Register.
[ ] See continuation sheet.
[ ] determined not eligible for the National Register.
[ ] removed from the National Register.
[ ] other. (explain:)

5. Classification

Ownership of Property
(Check as many boxes as apply)

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

Category of Property
(Check only one box)

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

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

Contributing	Noncontributing	
		buildings
		sites
1		structures
		objects
1	0	Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register

N/A

6. Function or Use

Historic Functions
(Enter categories from instructions)

Transportation

Historic Subfunctions
(Enter subcategories from instructions)

Road-Related

Current Functions
(Enter categories from instructions)

Transportation

Current Subfunctions
(Enter subcategories from instructions)

Road-Related

7. Description

Architectural Classification
(Enter categories from instructions)

Other

Materials
(Enter categories from instructions)

Foundation Concrete
Other Metal

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

8. Statement of Significance

Applicable National Register Criteria

(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- A Property is associated with events that have made a significant contribution to the broad patterns of our history.
- B Property is associated with the lives of persons significant in our past.
- X C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- D Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations

(Mark "x" in all the boxes that apply.)

Property is

- A owned by religious institution or used for religious purposes..
- B removed from its original location.
- C a birthplace or grave.
- D a cemetery.
- E a reconstructed building, object, or structure.
- F a commemorative property.
- G less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance

(Enter categories from instructions)

Engineering

Period of Significance

1920

Significant Dates

1920

Significant Person

(Complete if criterion B is marked above)

N/A

Cultural Affiliation

Architect/Builder

Alexander H. Nelson, engineer
Henry S. Kraus, builder

9. Major Bibliographical References

Bibliography

(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS:)

- ☐ preliminary determination of individual listing (36 CFR 67) has been requested.
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ recorded by Historic American Buildings Survey
- ☐ recorded by Historic American Engineering Record
- ☐ See continuation sheet for additional HABS/HAER documentation.

Primary location of additional data:

- ☒ State Historic Preservation Office
- ☐
- ☐
- ☒ Local Government (Repository Name:)
- ☐
- ☒ Other (Repository Name: Atlantic County Library, Mays Landing)

10. Geographical Data

Acreage of Property: 0.90

UTM References

(Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing
1	18	518980	4374140
2			
3			
4			

☐ See continuation sheet

Verbal Boundary Description

(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification

(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title: Paul Mowbray

organization:

date: 10/15/2000
revised-March, 2001

street & number: 2062 Iron Forge Road

telephone: (609) 625-0430

city or town: Mays Landing state: New Jersey zip code: 08330-

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property

Additional items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of the SHPO or FPO.)

name: Atlantic County

street & number: 201 Shore Road

telephone: (609) 645-5900

city or town: Northfield state: New Jersey zip code: 08225-

LOCATION AND SETTING

The Weymouth Road Bridge (HAML-22) is a two lane single span steel truss bridge built in 1920 that crosses the main stem of the Great Egg Harbor River about five miles upstream from the dam at Mays Landing. It is located in the southern half of the New Jersey Pinelands National Reserve on the coastal plains of Southern New Jersey in Atlantic County. The Great Egg Harbor River, which is included as a Scenic and Recreational river in the National Wild and Scenic Rivers Program, begins near Berlin in Camden County and flows through Gloucester County and Atlantic County where it is dammed at Mays Landing. Below Mays Landing it becomes a tidal river significantly widening at the confluence of the Tuckahoe River to form the Great Egg Harbor from which its name is derived. The river travels a total of 59 miles from its headwaters in Camden County to the Atlantic Ocean and drains 304 square miles of South Jersey wetlands [2].

The bridge is on the Weymouth Road (County Route 559) which runs roughly northeast from Mays Landing through Emmelville and Weymouth where it forks. At that point Route 559 continues north toward DaCosta and Hammonton while Route 623 (Elwood Road) heads northeast through Elwood and on toward Pleasant Mills and Sweetwater. The bridge itself is located in Weymouth about 750 feet south of the intersection of Routes 559 and 623 and is skewed at a slight angle to the Weymouth Road. It is about one quarter mile north of the intersection of County Route 559 and U.S. Route 322 and adjacent to the Atlantic County Park at Weymouth. The park contains the ruins of the Weymouth Iron Furnace and Forge, dating from 1801, and the Weymouth and Atlantic Paper Mills, dating from 1866. The bridge itself is within the boundaries of the Weymouth Archaeological District as delineated by archaeologist David C. Mudge in his 1983 NJDOT report on the Weymouth Road and Bridge [3]. The currently existing bridge is, however, from a later historical period than the archaeological district in which it resides.

DESCRIPTION

The Weymouth Road Bridge is a four panel Warren pony truss bridge designed by Atlantic County Engineer, Alexander H. Nelson in 1919 and built by local contractor Henry S. Kraus in 1920. It is identified at present by Atlantic County as HAML-22. This riveted steel pony truss bridge is 44 feet long

from center to center of bearings and 7 feet three inches high and clearance above high water is about 11 feet [18, 20]. The trusses are spaced 22 feet six inches from center to center with a 21 foot four inch span between trusses. The end posts and top chords are built up box beams and the diagonals, verticals and lower chords are angles with battens (photo #4). The floor beams are 20 inch "I" beams (20 I 70) attached at the lower chord panels by gusset plates and riveted connections. The stringers are 10 inch "I" beams (10 I 25) inset into the floor beams with riveted stiffeners. These stringers are spaced at 2 foot ten inches center to center and span 11 feet between panel points (photo # 10). The deck is of laminated 2 inch by 4 inch timber, four inches thick with a wearing surface of asphalt. The bridge has lower lateral tie rods and concrete abutments and wing walls. The abutments consist of a 16 foot high tapered section with a 5 foot nine inch thick base supported on a timber platform which is founded on three rows of timber piles. The wing walls consist of a 16 foot three inch high tapered section with a five foot deep base supported on a timber base which is founded on two rows of timber piles. There are no sidewalks along the bridge but there is a three element pipe rail along the inside face of each truss with a standard guard rail attached to the railing [22]. The bridge has a maker's plaque which reads: "Atlantic County, 1920, Henry S. Kraus, Contractor" [1] (photo #3).

MODIFICATIONS

The original deck as described on the 1923 County Bridge Card consisted of 3 inch creosoted planks with a 3 inch wood block floor. Also mentioned is that the "stream has plank sheeting for bottom" [18]. These features appear to be indicated on the August 13, 1919 plans as drawn up by County Engineer, A.H. Nelson.

A new deck was installed in 1946 [20] based on plans drawn up in December 1945 by the County Engineer's Office which substituted a 2 inch by 4 inch plank deck for the original 3 inch plank deck [21]. The deck was covered with black ugite beginning in November 1934 which was renewed in 1939 and 1947 [20].

The plank sheeting in the streambed is mentioned on the 1923 Bridge Card, but its existence is no longer apparent save for some remaining pilings in the river bed which may have been related to that false wooden stream bottom.

The original causeway railings leading to the bridge were part of a

supplemental contract approved by the County Freeholders before the bridge itself was completed. This contract called for "the erection of a standard wooden guard railing along the causeway at each end of the bridge when completed at a cost not in excess of $250.00 and in accordance with the County Engineer's specifications" [23]. Later historical photographs from 1973 show a causeway railing made of creosoted wooden posts with wire rope runnning between them [22]. At some point in the next ten years these were replaced with modern galvanized steel corrugated guide rail.

SIGNIFICANCE

The Weymouth Road Bridge possesses significance under National Register Criterion C in the area of engineering in that it is a well-preserved example of a once common but now increasingly rare metal truss bridge technology. According to the NJDOT's 1994 Historic Bridge Survey, compiled by A.G. Lichtenstein & Associates [1], it is one of only three surviving Warren pony truss bridges in Atlantic County and of those three it is the only one which is both in its original location and not significantly modified since its original construction.

In addition, the Weymouth Road Bridge retains significance due to the fact that it was designed by a prominent and highly accomplished county engineer, Alexander H. Nelson, and built by a local contractor of the time, Henry S. Kraus. The rarity of the Warren pony truss design in Southern New Jersey is illustrated clearly by examination of the neighboring counties of Cumberland, Salem, Gloucester, Camden and Ocean which have **no** known surviving Warren pony truss highway bridges. In Cape May County only one such truss bridge survives while in Burlington County there are three in existence [1].

While there are documents such as NJDOT archaeologist David Mudge's 1983 Cultural Resource Survey of the Weymouth Road and Bridge [3] which conclude that the Weymouth Road Bridge does not possess the significance necessary to qualify it for inclusion in the National Register of Historic Places, these documents have been superseded by the NJDOT's 1994 Historic Bridge Survey [1]. Evidence of this can be found in a series of letters from 1995 between the NJ Historic Preservation Office and NJDOT reconciling any differences of opinion between the two offices as to the eligibilty for Historic Register inclusion of various bridges throughout the state. The 1994 Historic Bridge Survey clearly states that the Weymouth Road Bridge is eligible for Historic Register inclusion because it "is one of the only extant example of its type in southern New Jersey..." [1].

EVOLUTION OF THE AREA

The Weymouth Road Bridge lies close to the center of a tract of land once known as the Great Egg Harbor Tract or the West Jersey Tract. This was one of the largest single tracts of land conveyed in New Jersey and was part of the original conveyance of Lord Berkely's rights to New Jersey to John Fenwick and Edward Byllynge.

After various off-conveyances by the West Jersey Society (which had purchased 21% of the original tract) betweeen 1692 and 1774, a group of Philadelphia investors purchased the Great Egg Harbor Tract on November 6, 1800 which included a total area of 76,860 acres.

This group of five investors soon petitioned the New Jersey Legislature for permission to dam the Great Egg Harbor River "for the accomodation of iron works and other water works" and permission was granted on February 9, 1801. By 1802, George Ashbridge, a 1/4 partner in the venture, was advertising for forgemen to operate his new forge at Weymouth [12]. The iron manufacturing venture evidently got underway and grew because, by 1811, when the Weymouth Works were briefly offered for sale, the operation included a furnace, a forge with four fires, a grist mill and a saw mill, all on one dam [4].

The iron industry and the related charcoal industry continued on the Weymouth Tract for about 60 years until the forge was destroyed by fire around 1862 and the foundry suffered a similar fate in 1865 [12]. The iron business in the area, no longer competitive with the newer anthracite coal furnaces in Pennsylvania, was finished, but the sawmill continued operation as it supplied lumber for the local shipbuilding industry [5]. At its peak, the Weymouth Furnace had made about 900 tons of casting and about 200 tons of bar iron annually and employed about 100 workmen contributing to a general population subsisting on their employment of 600 [6].

By the mid-1860's, what had been a busy rural industrial site apparently stood idle for several years until owner Stephen Colwell built a stone paper mill there in 1865. The paper mill used the water power from the dam to run the machinery of the mill which utilized old manila rope to produce brown manila paper for paper bags. A second mill was built in 1869 and in 1886 one of the mills was converted to utilize paper pulp as a raw material. The paper industry in Weymouth was struggling by this time, however, and by 1887 the mills were shut down [12]. As there was little else in the way of employment in Weymouth

at the time, most of the worker's houses were soon abandoned and apparently only the sawmill may have continued operation for a few years longer[12].

By 1915, shortly before the present Weymouth Road Bridge was constructed, the town of Weymouth which had once boasted its own post office, was described in a local newspaper article as a pretty and quaint inland village whose old-fashioned beauty makes it an ideal pilgrimage for autoists on warm days "...for a cool breeze invariably blows in beneath the magnificent old trees from the pond formed by a dam across the Great Egg Harbor River. Now little remains of the mills except vast stone walls overgrown here and there with vines...[but] there are few spots in South Jersey so picturesque or historically more interesting" [15a]. Although the mill pond was drained years ago, many of the descriptive phrases found in that article are accurate today and the areas immediately surrounding the bridge and mill ruins are rural in nature and inhabited by fewer human residents than in the prosperous 1800's.

WEYMOUTH ROAD

The forge and furnace which were built at Weymouth about 1801 were located immediately downstream of and in close proximity to the dam which supplied the waterpower used to operate the furnace bellows and the forge trip-hammer [3]. The manufacture of iron from bog ore, lime, and charcoal required that large amounts of raw material needed to be fed directly into the top of the furnace stack some 25 to 30 feet above ground level. The height and proximity of the dam provided an ideal platform from which to build a ramp to the top of the furnace stack for the transport of material [3] and in this way the top of the dam became a convenient causeway linking the roads into the forest where wood for charcoal was cut, the roads to various bog ore fields where ore was gathered, and the road to Mays Landing where limestone and oyster shells for flux were likely delivered. It should be noted that bog ore also came to the furnace on barges, either down the river and across the mill pond or down the canal that had been dredged to the major ore field. Remnants of this canal can be observed today as a ditch running alongside the Weymouth-Elwood Road on the north side of the road. As can be seen from the 1872 Beers map, the causeway along the top of the dam eventually became known as Main Street and was the major thorofare through the town of Weymouth [43].

On April 12, 1814, the Surveyors of the Highways of the County of Gloucester, meeting "at the house of Lewis N. Walker at Weymouth Works in the

Township of Hamilton", laid out a public road of two rods wide in the Townships of Hamilton and Galloway "...to begin at a stake standing in the forks of the Fork Bridge Road about fifteen rod southwest of Weymouth Furnace..." and traveling in a northeasterly direction ending at "...the Lower High Bridge or to the middle of Atsion Creek the creek being the line between the Counties of Burlington and Gloucester running generally through Weymouth and Batsto lands..." [41]. This road, crossing the Weymouth dam, is now known as the Weymouth-Elwood Road and the Elwood-Pleasant Mills Road; or County route 559 from U.S. Route 322 to the fork just northeast of Weymouth Road Bridge; and as County Route 623 from that point northeasterly all the way to its intersection with County Route 643 which runs along the south side of Atsion Creek (now more commonly known as the Mullica River).

A later Atlantic County survey of the Weymouth-DaCosta Road (the continuance of County Route 559 to Hammonton) from October 17, 1837 uses "...the bridge over Great Egg Harbor River at Weymouth Iron Works..." as a reference point for the start of the survey. This may be the earliest officially recorded mention of the bridge that became known as HAML-22, the Weymouth Road Bridge [42].

PRIOR BRIDGES AT WEYMOUTH DAM

The mills that utilized waterpower from the Weymouth Dam required several outlets controllable by flood gates and flume gates. Because the causeway for the transport of raw materials to the forge passed along the top of the dam, these outlets required bridges over them. Historic photographs show the wooden flood gates of the dam capped by wooden bridges so it is likely that both were integrally constructed of timbers [3].

Initially these bridges were probably built by the Weymouth Iron Works to accommodate their needs in providing transport across the dam. The Time Books from the Furnace which document the daily activities at the site show evidence of the company's involvement in road and bridge repair. Specific entries indicate that the causeway was repaired after a water break (5/17/1818 and 5/18/1818) and that the bridge was repaired on March 1, 1820. Entries for April 12, 13, and 14, 1820 seem to indicate that the mill pond was drained while a bridge was replaced. At the same time, the ore-raisers scoured the drained pond for bog ore. Other entries describe planks for the bridge being sawed

(8/16/1820), and more work being done on the road (11/23/1820) [13].

By comparing old County Bridge Cards, the 1872 Beers map, and newspaper accounts of bridge problems which were discussed at County Freeholders' meetings, it appears that there were four bridges along the dam causeway in the 1800's. The 44 foot span steel truss bridge (HAML-22) is probably in the same location as an earlier large wooden bridge and flood gate at the main outlet of the Weymouth dam. The three other smaller bridges were probably over flumes providing water power to various mills. At one time these were all apparently wooden bridges, subject to deterioration and necessitating frequent maintenance. It is interesting to note how responsibility for maintenance of the road and bridges over the dam gradually passed from the Weymouth Works (who had no doubt built them originally) to the County over the years.

An article in the *Mays Landing Record* of December 8, 1877 states that

"Melvin R. Morse of Weymouth reported that the Weymouth Works had raised the dam about one foot and they found it necessary to raise the bridges and in doing so found many in bad condition, therefore compelling them to build some mostly new, the lumber, carpenter work and spikes amounting to $908.88. He, therefore, asked the County to bear whatever they thought right of the burden." [14].

The *Record* of May 11, 1878 indicates that the Committee on Weymouth Bridges would recommend an award of $350.00 for repairs to the bridges [15].

By June of 1915, a few years prior to the construction of the present Weymouth Road Bridge, a controversy erupted over who exactly was responsible for the "...present dangerous condition of the bridges across the dam at Weymouth." [16] The County Freeholder Board's Solicitor felt that the county was only responsible for the superstructure, while the understructure happened to be the element in danger of imminent collapse. The Freeholder Board was also in favor of filling in one of the smaller bridges, but the owner of the property was opposed to that action. The owner, the Post Land and Mortgage Company, contended that when the road was put across the dam there was an understanding that the County should care for the bridges as a whole, but no such agreement could be found in the County Archives. Small wonder, since the road crossing the dam had been surveyed over one hundred years previously and twenty-three years before Atlantic County even came into existence. This

controversy continued for some months until the County finally admitted that since they had been assuming maintenance of the bridges for many years without objection, it would be in order for them to continue to do so [17].

TRUSS BRIDGES

In Eighteenth Century America, a growing population and centers of commerce separated by ever greater distances demanded numerous roads and the inevitable bridge wherever an intersection with a river occurred. Because of its ready availability, wood became the material of choice in bridge construction, but to advance beyond the limitations of simple wood beam structures, early bridge builders modified the well known king and queen post assembly [appendix page 1] with a diagonal brace thereby creating a triangle. The beauty of the triangular form is that it cannot be distorted by forces applied to its sides. A chain of triangles extends this property so that a truss is formed and a distance can be spanned by a fairly rigid structure. Opposing forces of tension and compression which are ultimately transmitted towards the abutments (in the case of a bridge truss) give the truss form its unique strength.

Early American carpenters and designers like Timothy Palmer, who in 1792 built a bridge of two trussed arches across the Merrimac in Massachusetts and in 1806 constructed the impressive 550 foot three arch "Permanent Bridge" over the Schuylkill River in Philadelphia, were more accurately classified as craftsmen than engineers and their designs were arrived at intuitively [7]. Contemporaries of Palmer, such as German immigrant Lewis Wernwag who built a stunning 340 foot clear span arch truss bridge over the Schuylkill River and Theodore Barr of Torrington, Connecticut who combined the king post truss and arch truss into a popular hybrid, experimented with the truss form and tested its practicality in spite of knowing little of its theory [8]. Because of the susceptibility of wood to compromised integrity due to exposure to the elements, many of these early wooden truss bridges were enclosed thus becoming covered bridges.

One of the inherent limitations of using wood as a truss construction material is its inability to accommodate tensile forces adequately in spite of its great strength in compression. This problem was overcome in 1840 by William Howe who introduced a wrought iron vertical tension member to a standard wooden truss design and took the first step toward the iron and steel truss bridges

which would appear later in the decade [9] [appendix page 2].

The understanding of the actual forces involved in truss bridges under load were analyzed for the first time in the 1847 treatise by Squire Whipple, *A Work on Bridge Building*. Using simple but accurate calculations, his readers could work out the magnitude and direction of forces which would act on each truss member in a given situation. Whipple was also an innovator in bridge building and his iron bowstring truss design of 1841 and his trapezoidal truss of 1847 [appendix page 3] ushered in the iron bridge era in America [10]. Because of their superior strength, durability and ease of maintenance, metal truss bridges eventually supplanted wooden truss design and the bridges of designers like Whipple, Pratt [appendix page 4], and Post [appendix page 5] came to dominate the field heading into the Twentieth Century [10].

THE WARREN TRUSS

In the 1890's, better understanding of material strengths and the perfecting of the pneumatic riveting process brought about a switch from pinned to field riveted connections when assembling bridge trusses. Pin connecting goes back to the 1840's and consists of the fastening of various truss components at a joint or panel point by use of what is essentially a bolt with threaded sections at both ends and two nuts used to secure the connection. Before rivets were invented, pins were the primary method of securing truss joints, and in America pin connections continued to be preferred by engineers for some time after the riveted connection had already been standard practice in Britain. There were several reasons for this initial preference for pins. First, pins were faster so not only were labor costs held in check, but because the scaffolding used to create a work platform was often risky to leave in place for long periods of time due to the potential ravages of floods and wind, the chances of death or destruction were reduced. In addition, the heated riveting technique left much to be desired in the area of quality control. It was difficult to determine if a rivet might have a crack or other flaw or if the shrinkage from cooling might leave the rivet under a fatal strain. Therefore , engineers favored the calculable strengths and predictable installation results of the well-known pin connection. By the late 1800's, however, the pin connection was reaching its practical limitations. Since it was inherently less rigid than a riveted connection, it required more web members to provide stability in high wind conditions, which complicated

assembly. The invention of the faster and more reliable portable pneumatic riveter tipped the balance in favor of the riveted connection and by 1910, most new truss bridges were of riveted construction [10] [appendix page 6].

The Warren truss design, patented in 1848 by British engineers James Warren and Willoughby Monzani, was well suited to take advantage of the ascendance of the riveted connection and by the 1910's began to overtake the previously popular Pratt design. [appendix page 4] The Warren truss was a simple sequence of triangular panels lined up in a row between parallel top and bottom chords. [appendix page 7] It generally used less material than the Pratt truss and it could easily be adapted for increased carrying capacity by adding a second set of diagonals, or stiffened by the addition of verticals [1]. The pony truss version of this design uses shallower truss depths and thus no upper bracing across the top chords. The Warren pony truss, which is suitable for shorter spans and lighter loads became very common from the end of the 19th Century through the first two decades of the 20th Century in New Jersey and is one of the best represented of metal truss bridge types in the State. The 1994 NJDOT Historic Bridge Survey identified more than 77 Warren truss bridges, 62 of which were pony truss bridges, including the Weymouth Road Bridge [1].

Most of these Warren pony truss bridges are found in the Northern part of the State for only seven remain in the Southern Counties of Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem. Three are in Atlantic County and exclusive of the Weymouth Road Bridge, they consist of a 59 foot long, single lane, 6 panel bridge at Eighth Street in Folsom over the Hospitality Branch of the Great Egg Harbor River (supplementary photo #1). It was originally built in 1915 and moved to its present location in 1937. The other is a 53 foot long, two lane, four panel bridge on County Route 559 over English Creek in Egg Harbor Township (supplementary photo #2). This bridge was built in 1914, but was significantly altered in 1972 and 1991 [1].

Burlington County has three Warren pony truss bridges. One is a 40 foot, single lane, three panel bridge over the South Branch of the Rancocas Creek on Hilliards Bridge Road in Southampton Township (supplementary photo # 3). This bridge is notable for its surviving plaques and finials. It was built in 1907 on ashlar abutments bearing an 1893 date . Another can be found by the persistent bridge seeker on Cedar Lane in Springfield Township on a portion of

that road which has been closed to traffic. The bridge crosses Assiscunk Creek and is a 76 foot long, single lane, 6 panel example which boasts unusual floor beam connections (supplementary photo # 4). The beams are suspended from large hairpin hangers that straddle oversized gusset plates. Built in 1904, during the period of transition from pinned to field riveted connections it is all riveted except for the floor beam connections at the lower panel points [1]. The third Warren pony truss bridge in Burlington County can be found in Pemberton on Hanover Street (CR 616) crossing the North Branch of Rancocas Creek (supplementary photo #5). It is a 104 foot long, two lane, six panel bridge originally built in 1932, moved and reconditioned in 1950 to accommodate a road realignment, and rehabilitated again in 1977. It carries sidewalks and a utility pipe and uses the truss design to manage secondary stresses [1].

Cape May County has one remaining Warren Pony truss bridge which is listed on the National Historic Register as contributing to the Marshallville Historic District. It is located on Marshallville Road in Upper Township and it crosses Mill Creek. The bridge is a 33 foot long, single lane, three panel example built in 1901 and slightly altered in 1990 (supplementary photo # 6) [1].

The increasing rarity of the Warren pony truss bridge in Southern New Jersey seems evident from the facts presented above. Out of eight South Jersey Counties only seven examples of this type of bridge survive.

COUNTY ENGINEER, ALEXANDER H. NELSON

In New Jersey, since 1714, each County's Board of Chosen Freeholders had been responsible for the construction and maintenance of bridges and in Atlantic County that practice continued through the early part of the Twentieth Century. However, when the State Legislature created the position of County Engineer in 1909, Atlantic County's Freeholder Board appointed their first County Engineer to oversee road and bridge projects [1]. The Weymouth Road Bridge was designed and built during the tenure of County Engineer Alexander H. Nelson, who held that position from January 1, 1913 until April 1, 1947 [24].

Born in Chambersburg , Pennsylvania in 1874, he was the son of a civil

engineer, Thomas M. Nelson, who was a pioneer in the development of steel bridge construction [11]. Alexander Nelson received a liberal education from Princeton University and went on to do post graduate work in civil engineering studies at the Massachusetts Institute of Technology. Prior to moving to Atlantic County, he specialized in bridge construction as Vice-President and Assistant Engineer for the Pittsburgh Bridge Company. After that company was absorbed by the larger American Bridge Company, he continued there as a contracting engineer through the Meredith-Nelson Company. Seeking to improve his health, he moved to Atlantic City in 1906 and in 1913 accepted the position of County Engineer for Atlantic County [11].

Because of his education in civil engineering and his considerable experience in bridge design and construction, he was perhaps one of the most highly qualified county engineers in Southern New Jersey at that time [1]. In the first ten years of his tenure, he oversaw more than 5 million dollars worth of road and bridge construction and created the modern system of county road administration [1]. Over thirty years, he either designed or approved the design of more than one hundred bridges built by the County [1]. He is also credited with the construction of the original section of the Atlantic City concrete boardwalk [11].

HENRY S. KRAUS, CONTRACTOR

Little information is readily available about the contractor for the Weymouth Road Bridge other than what can be gleaned from the Atlantic County Freeholder's Records. It appears that he tackled a fairly wide array of jobs for the County and periodically participated in the bidding process for various projects.

The earliest job which he appears to have done for the County was the reconstruction of the Gravelly Run Bridge (H-50) after a washout in 1919 [25]. Soon afterward his company won the bid to replace the Weymouth Road Bridge [26] and the next year worked on the Laundry building at the County jail and bid on the replacement of the Sugar Hill Bridge in Mays Landing [27].

His company worked on ventilating the County Courthouse in 1923 [28], built an addition to the Sheriff's Office in 1927 [29], refinished the floors in the Courthouse in 1930 [30], and made improvements to the County jail in 1931 [31]. He also made a number of unsuccessful bids on bridge reconstruction and

county building construction projects from 1925 to 1931.

From the scale of projects that he bid on and those that he completed, it can be deduced that he must have been a medium-sized contractor of somewhat varied capabilities. His bids in the 1920's and 30's ranged from a low of about $550.00 for floor refinishing to a high of $67,776.00 for construction work on the County Clerk's Office. It does not appear that his company ever bid on the very large bridge construction jobs that were offered by the County in that period, but he often bid on small to medium sized projects with occasional success. While bridge construction was certainly not his company's exclusive domain, it clearly was one of its areas of skill as bids were placed on at least six Atlantic County bridge projects from 1919 to 1929 [32].

WEYMOUTH ROAD BRIDGE

Once the County Solicitor had acknowledged responsibility for the deteriorating wooden bridges atop the Weymouth Dam in 1916, the County Freeholders took the situation in hand and replaced one of the three remaining bridges with a "...galvanized iron pipe with sand fill around it" [33]. Two years later the Freeholders' Bridge Committee requested plans and specifications for "...building the bridge over the dam at Weymouth..." and asked for advertisement for separate bids to be opened for building the bridge and building of gates for water retention [34].

It is evident from the three different sets of plans that were prepared for this bridge that several options were available to and explored by the County Engineer before he settled on the Warren pony truss design. The earliest version indicates two concrete encased "I" beam spans with a central pier and wooden flood gate extensions. A later variant of this plan eliminates the flood gate extensions, and the final plan which was eventually implemented is quite different from the first two. While the concrete encased "I" beam option would seem to have been the more modern approach at that time, the County Engineer chose to forgo a center pier in the middle of the river and instead utilize more traditional metal truss bridge technology to span the entire 44 foot dam opening [19].

Almost a year after first requesting plans for reconstruction of the bridge, the County Freeholders approved the plans for the Warren pony truss design and advertised for bids [35]. The following month six bids were received for this

project ranging from $18,372.00 to $34,000.00. Henry S. Kraus was the low bidder and was awarded the contract [26].

Although he had previously completed at least one bridge reconstruction project for Atlantic County in the Spring of 1919 [25], the Weymouth Bridge project did not seem to go smoothly for Henry Kraus. On January 16, 1920 he requested, by way of a motion of Freeholder Swoboda, an extension of time for completion of the work due to weather conditions which had necessitated a nearly complete halt to the work. As the County Engineer had vouched for Kraus' efforts, he was granted a 75 day extension [36]. However, on April 14, 1920, another Freeholder, August Filling, moved that the County Solicitor notify the contractor that unless substantial progress was made in the next month, a provision of the contract declaring abandonment of the project would be enforced [37]. Then on July 14, 1920, Freeholder Swoboda offered a resolution stating that Kraus had requested a second extension of time for completion of the work due to a freight embargo which was holding up material deliveries. Based on the belief that no good could come out of forfeiting the contract, the Freeholders approved another 75 day extension [38]. By November 10, 1920, the bridge was still not completed, but at that day's Freeholder Board meeting, Frank Swoboda proposed that a supplemental contract for wooden guard rails along the causeway at a cost of $250.00 be added to the contract and that since the second 75 day extension had expired that the Board set a completion date of December 1, 1920 "...unless some unexpected condition develops" [39].

The bridge was eventually completed, perhaps even in 1920 as the bridge plaque maintains, and on January 12, 1921, a payment to Kraus was approved for the additional work of filling in and widening the approaches to the bridge [40]. According to the County Engineers Bridge Card, the final cost tor the Weymouth Road Bridge was $19,555.21 [20].

CONCLUSION

The Weymouth Road Bridge is representative of a period of developing bridge technology in this country when wooden truss bridge construction had been long ago abandoned, but structural steel beam and reinforced concrete methods had not yet taken hold. Metal truss bridges were very common, especially in New Jersey in the 1920's, and the Warren pony truss design was

popular for short spans like the one over the outlet to the Weymouth Dam. Heavier vehicular traffic loads on local roads have led to the demise of nearly all the metal truss bridges in Atlantic County leaving the Weymouth Road Bridge as the best remaining example of a once ubiquitous design. It is one of only seven of its type remaining in the eight county South Jersey region and its relatively unadulterated condition adds to its historical value. Its significance is further enhanced by virtue of the fact that it stands as a tribute to the engineering skills of one of Atlantic County's first and possibly its foremost County Engineer and that it was built by a local contractor of the time who often performed work on County projects.

The Weymouth Road Bridge meets National Register Criterion C in the area of engineering as a typical example of a once common but now rapidly disappearing bridge type, designed and built by local professionals to address the demands that growing automobile and light truck traffic was placing upon local roads and bridges in the second decade of the Twentieth Century.

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15. Mays Landing Record, May 11, 1878

15a. Atlantic County Record, July 17, 1915

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17. Atlantic County Record, July 1, 1916 and July 15, 1916

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19. Plans for construction of Weymouth Road Bridge, dated August 13, 1919, July 1919 and February 1919

20. County Bridge Card, HAML-22, dated January 1, 1924

21. Plans indicating "Details of Roadway Repairs to Bridge H-22 over Egg Harbor River at Weymouth", December 1945

22. "In Depth Inspection and Rating Report, Bridge No. HAML-22, Weymouth Road over Great Egg Harbor River, Hamilton Township, Atlantic County, New Jersey" Prepared by A.G. Lichtenstein and Associates, Inc. April 30, 1973

Atlantic County Freeholder Clerks Office

23. Freeholders' Minutes, November 10, 1920

24. Freeholders' Minutes, 1947

25. Freeholders' Minutes, April 9, 1919

BIBLIOGRAPHY CONTINUED

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28. Freeholders' Minutes, March 14, 1923
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30. Freeholders' Minutes, May 14, 1930
31. Freeholders' Minutes, March 11, 1931
32. Freeholders' Minutes, 1919-1929
33. Freeholders' Minutes, August 12,1916
34. Freeholders' Minutes, September 11,1918
35. Freeholders' Minutes, August 13, 1919
36. Freeholders' Minutes, January 16, 1920
37. Freeholders' Minutes, April 14, 1920
38. Freeholders' Minutes, July 14, 1920
39. Freeholders' Minutes, November 20, 1920
40. Freeholders' Minutes, January 12, 1921

Gloucester County Clerk's Office

41. Gloucester County Road Book "B", Page 155, Survey of Road from Weymouth Works to Atsion Creek, 1814

Atlantic County Clerk's Office

42. Atlantic County Road Book "A", Page 1, Survey of Public Road from Weymouth to DaCosta, 1837

Maps

43. Beers 1872 Map of Atlantic County; Beers, Comstock & Cline, New York

VERBAL BOUNDARY DESCRIPTION

The nominated structure occupies the road right-of-way and extends to the back wall of the abutments.

BOUNDARY JUSTIFICATION

The boundary encompasses the site of the nominated structure.

NPS Form 10-900-a
(8-86)

OMB Approval No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

WEYMOUTH ROAD BRIDGE
BLACK AND WHITE PHOTO IDENTIFICATION KEY

The following information is the same for all photographs submitted with the nomination:

Name:	Weymouth Road Bridge
Location:	Hamilton Township, Atlantic County, N.J.
Photographer:	Paul Mowbray
Date Taken:	September 18, 2000
Negative location:	Paul Mowbray 2062 Iron Forge Road Mays Landing, N.J. 08330

1. From intersection of Bridge Rd. and Weymouth Road looking southwest. Right hand side of road.

2. From intersection of Bridge Rd. and Weymouth Road looking southwest. Left hand side of road.

3. Bridge plaque.

4. From left hand bridge abutment looking southwest.

5. From right hand side of Weymouth Rd. looking north, about 20 feet from bridge.

6. From left hand side of Weymouth Rd. looking northeast about 60 feet from bridge.

7. From right hand side of Weymouth Rd. looking north, about 60 feet from bridge.

8. From Atlantic County Park, about 150 feet downstream of bridge, looking north.

9. From Atlantic County Park about 100 feet downstream of bridge, looking north.

10. Underside of bridge.

11. From left hand side of Weymouth Rd. at Causeway Bridge looking northeast.

12. From right hand side of Weymouth Rd. at Gale Ave. intersection, looking southwest.

13. From right hand abutment looking north.

14. Typical riveted gusset detail.

Supplemental Black and White Photo Identification Key

The following information is the same for all supplemental photographs supplied with the nomination:

Photographer:	Paul Mowbray
Date Taken:	February, 2001
Negative Location:	Paul Mowbray 2062 Iron Forge Rd. Mays Landing, NJ 08330

1. #01BV007, Eighth Street Bridge, Folsom, Atlantic County, NJ

2. #01EH021, Mays Landing-Somers Point Rd. Bridge, Egg Harbor Township, Atlantic County, NJ

3. #03E4400, Hilliards Bridge, Southampton Township, Burlington County, NJ

4. #03D3760, Cedar Lane Bridge, Springfield Township, Burlington County, NJ

5. #03E4550, Hanover Street Bridge, Pemberton, Burlington County, New Jersey

6. #0500019, Marshallville Road Bridge, Upper Township, Cape May County, NJ

WEYMOUTH ROAD BRIDGE
COLOR SLIDE IDENTIFICATION KEY

The following information is the same for all slides submitted with the nomination:

Name: Weymouth Road Bridge
Location: Hamilton Township, Atlantic County, N.J.
Photographer: Paul Mowbray
Date Taken: September 18, 2000

1. From intersection of Bridge Rd. and Weymouth Rd. looking southwest. Right hand side of road.

2. From intersection of Bridge Rd. and Weymouth Rd. looking southwest. Left hand side of road.

3. From east side abutment, looking west.

4. From east side abutment, looking southwest.

5. From right hand side of Weymouth Rd., looking north.

6. From left hand side of Weymouth Rd., looking northeast.

7-10. From Atlantic County Park, downstream of bridge, looking north.

11. From left hand side of Causeway Bridge, looking NE.

12. From right hand side of Weymouth Rd., looking north, midway between Causeway Bridge and Weymouth Rd. Bridge.

13. From right hand side of Weymouth Rd. at Gale Ave., looking south.

14. From left hand side of Weymouth Rd. at Gale Ave., looking southwest.

15. From right hand side of Weymouth Rd., midway between Bridge Rd. and Weymouth Rd. Bridge.

Supplemental Color Slide Identification Key

The following information is the same for all supplemental color slides supplied with the nomination:

Photographer:	Paul Mowbray
Date Taken:	February, 2001
Negative Location:	Paul Mowbray 2062 Iron Forge Rd. Mays Landing, NJ 08330

1&2. #01BV007, Eighth Street Bridge, Folsom, Atlantic County, NJ

3-5. #01EH021, Mays Landing-Somers Point Rd. Bridge, Egg Harbor Township, Atlantic County, NJ

6-8. #03E4400, Hilliards Bridge, Southampton Township, Burlington County, NJ

9-11. #03D3760, Cedar Lane Bridge, Springfield Township, Burlington County, NJ

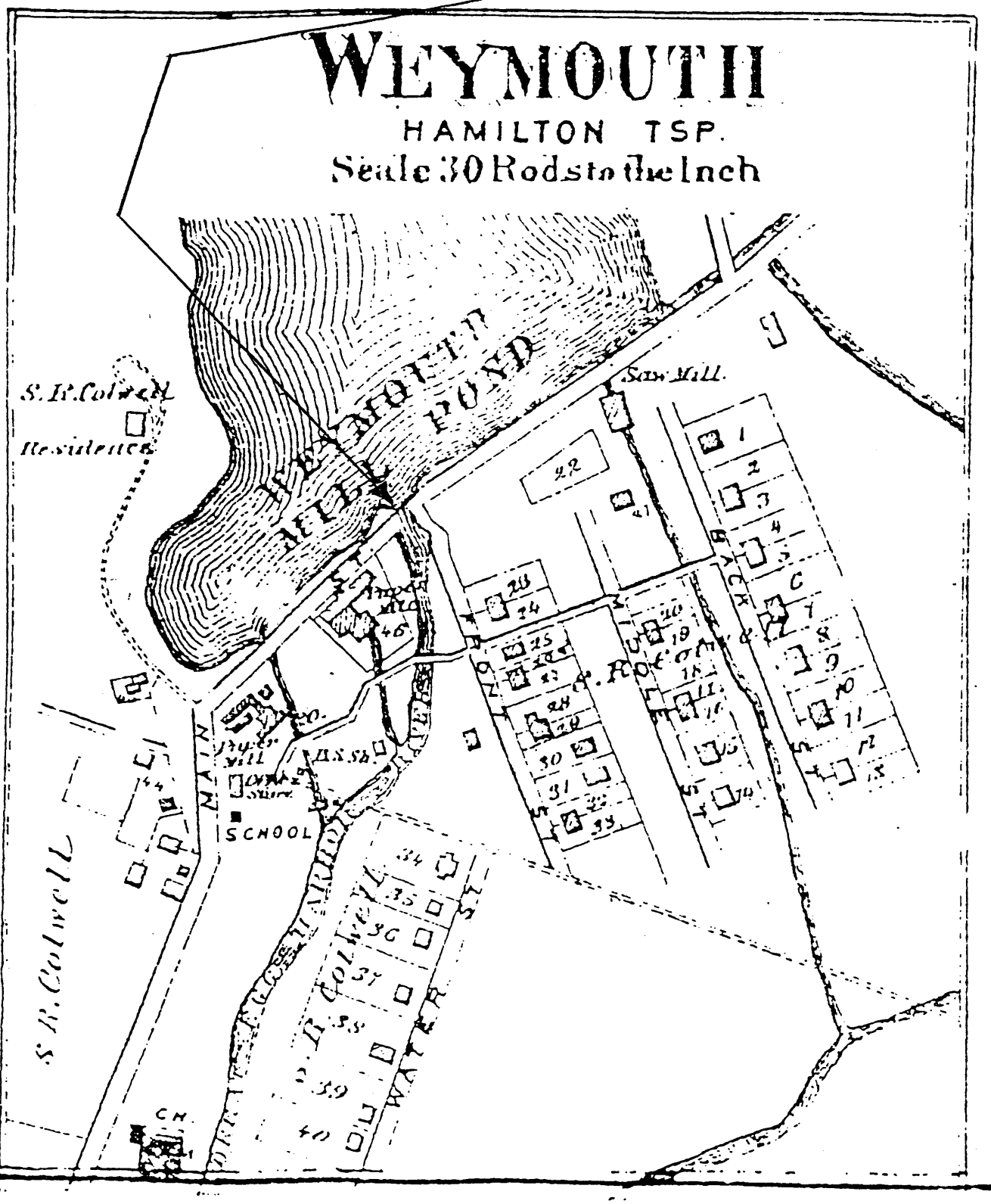
12-14.#03E4550, Hanover Street Bridge, Pemberton, Burlington New Jersey

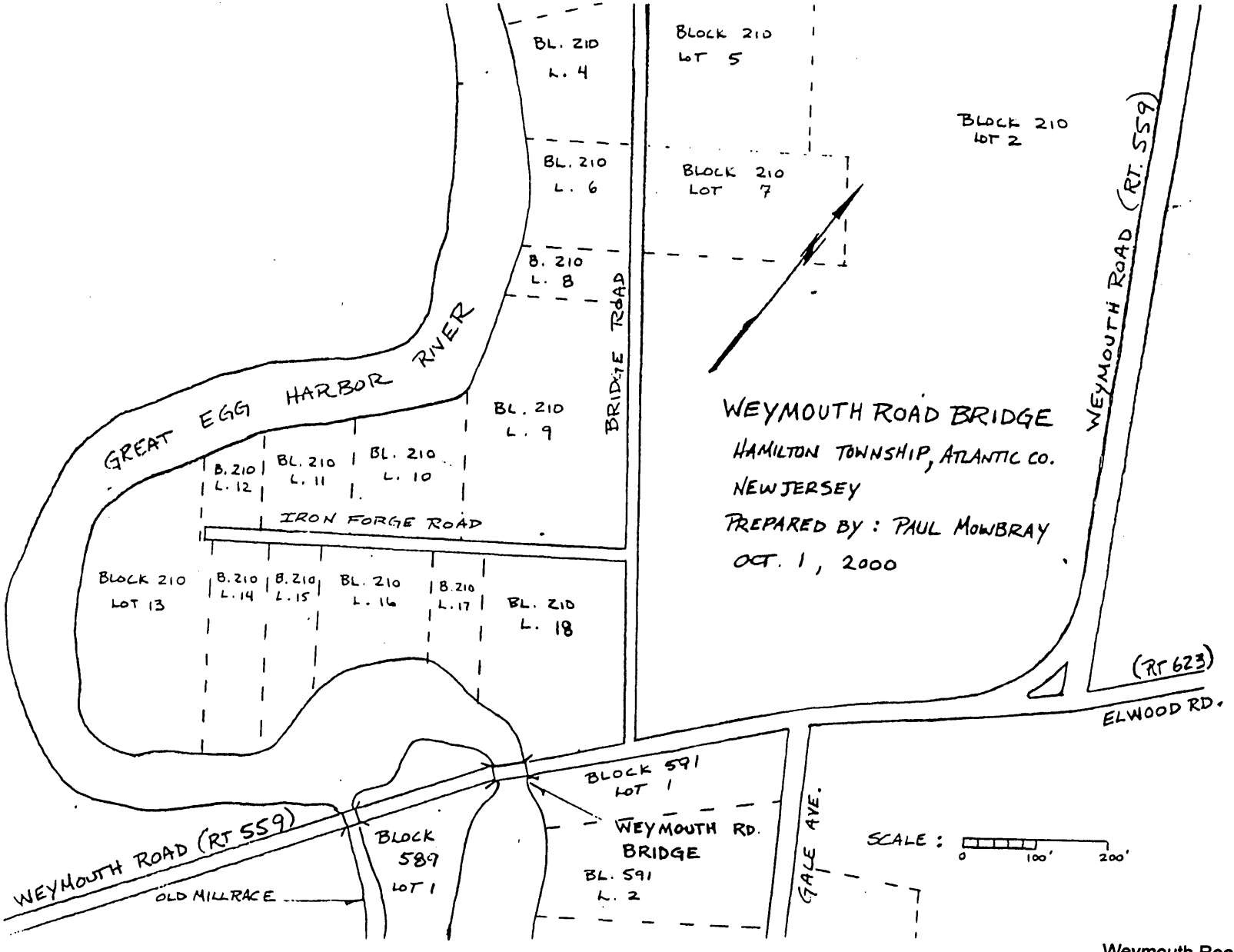
15-17.#0500019, Marshallville Road Bridge, Upper Township, Cape May County, NJ

Detail from 1872 Beers map of Atlantic County, NJ
by Beers, Comstock and Cline, New York

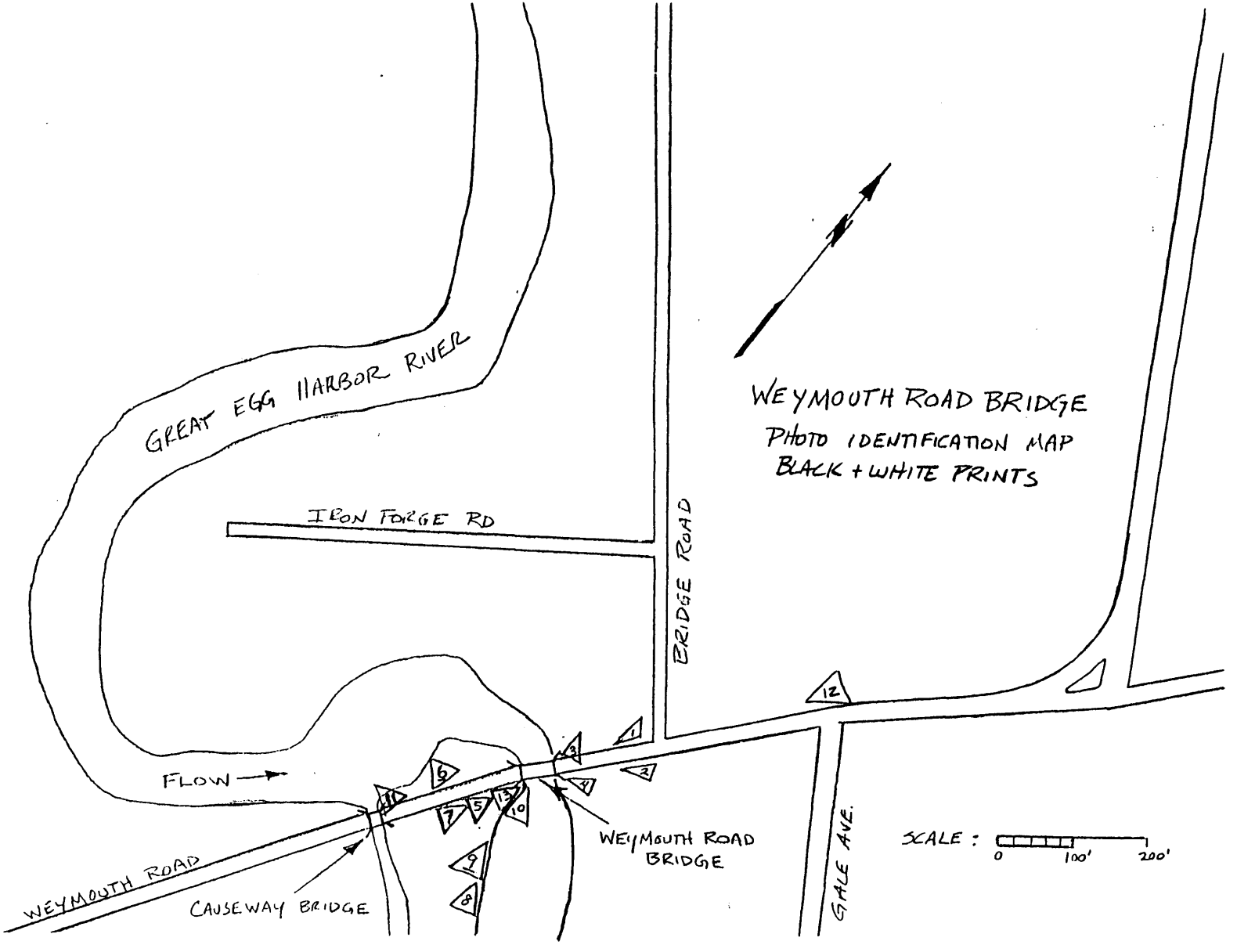
(Not to Scale. Enlarged 2:1 for greater clarity)

Probable location of Weymouth Rd. Bridge

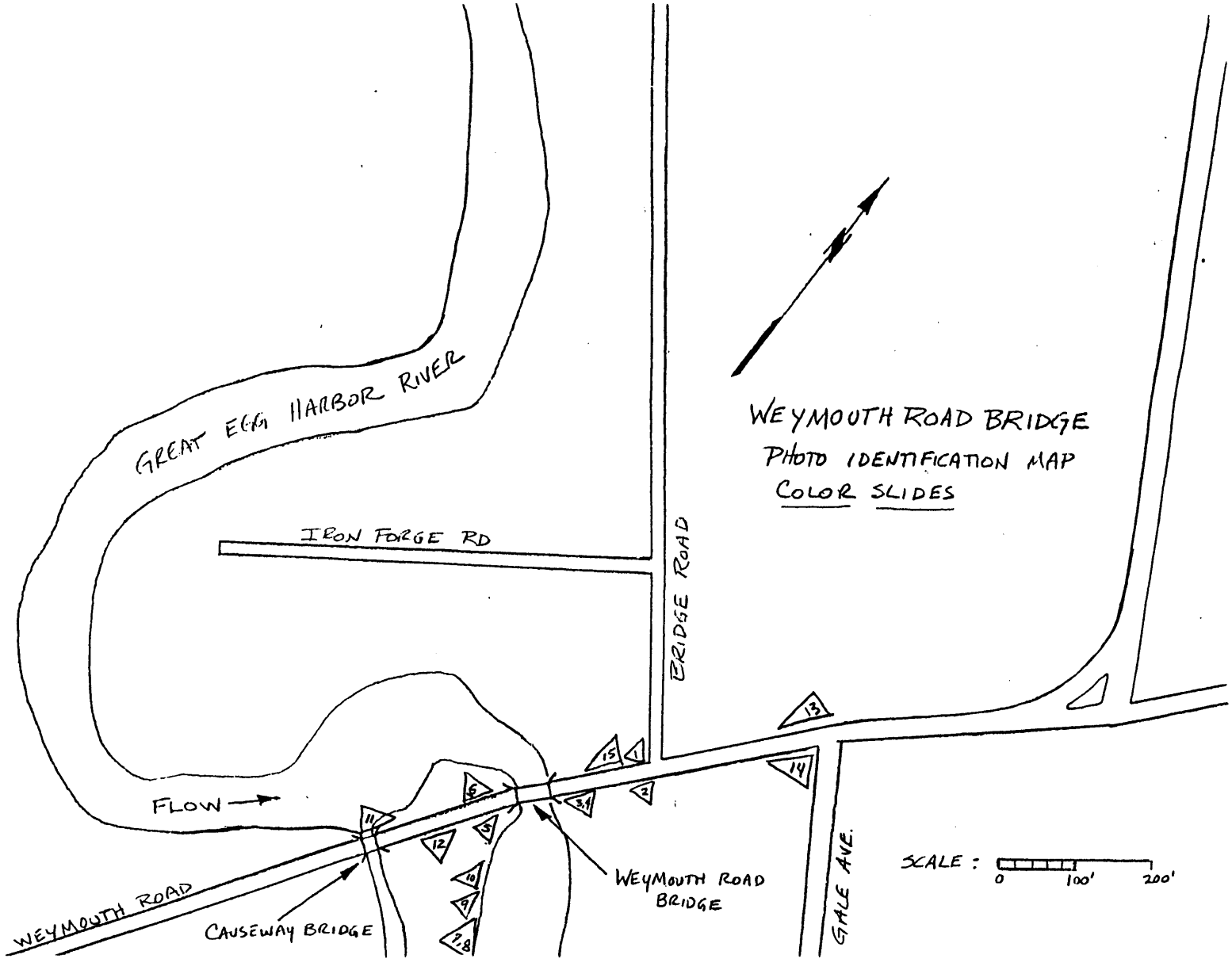




Weymouth Road Bridge
Atlantic County, New Jersey



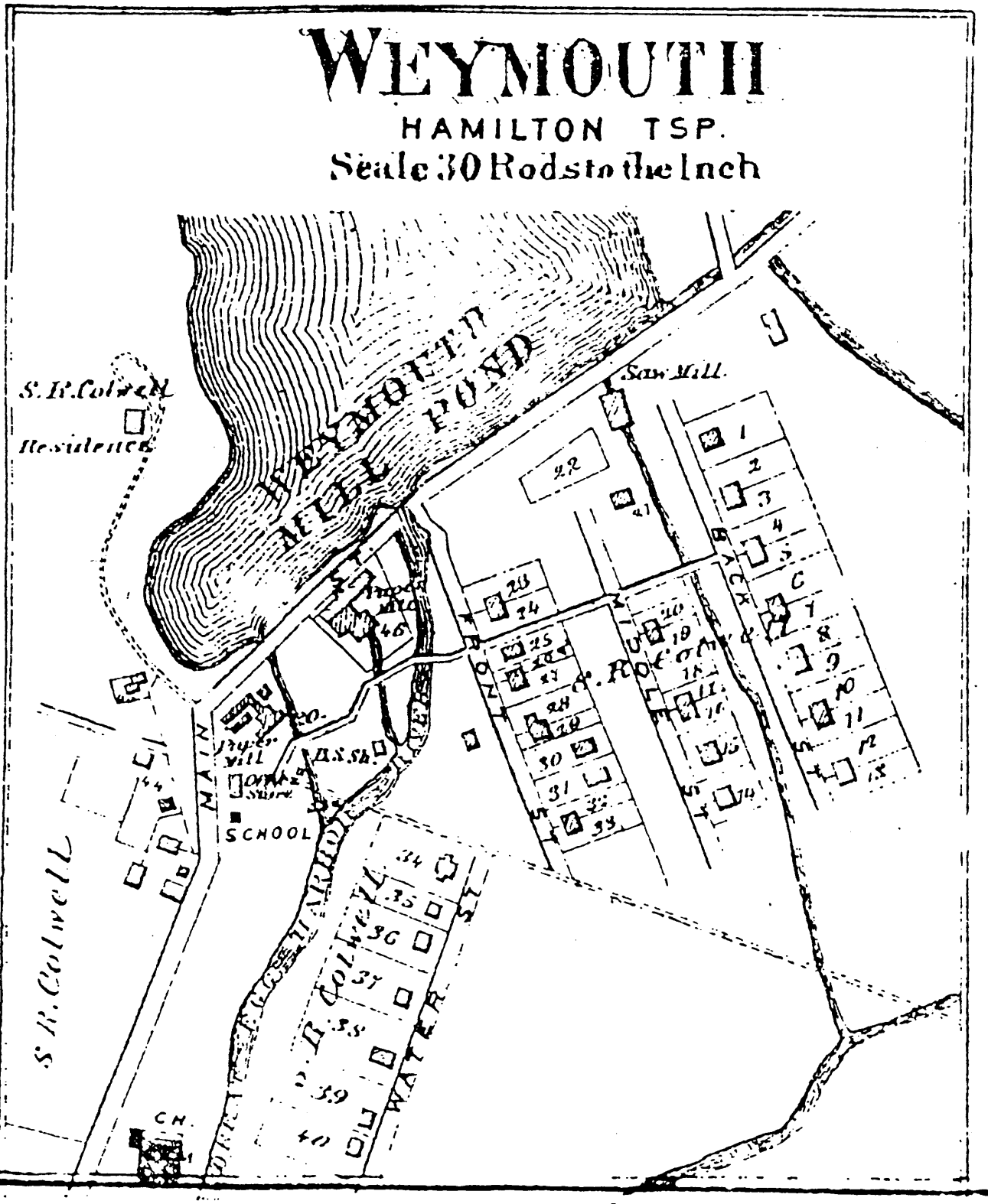
Weymouth Road Bridge
Atlantic County, New Jersey



Weymouth Road Bridge
Atlantic County, New Jersey

Detail from 1872 Beers map of Atlantic County, NJ
by Beers, Comstock and Cline, New York

(Not to Scale. Enlarged 2:1 for greater clarity)



Weymouth Road Bridge
Atlantic County, New Jersey

No. H-23

Name of Bridge:— STEEL TRUSS. Stream:— GREAT EGG HARBOR RIVER.

Location:— MAIN OUTLET OF OLD WEYMOUTH POND NOW DRAWN DOWN.

Designed by:— A.H. NELSON Contractor:— HENRY KRAUS Plans Filed:— CO. ENG. OFFICE.

Substructure:— 51-20'x12" PILES 4" PLANK PLATFORM 6'X16' FOR WING WALLS. 7'X20' FOR ABUT. OUTSIDE OF ABUT. & WING WALLS HAS DOUBLE LAYER OF 2"x14" ON ART

Superstructure:— CONC. ABUT. 16' HIGH. 5'-9" THICK AT BOTTOM 3'-8" THICK AT TOP 25' WIDE ON INNER FACE

Approaches:— GRAVEL IN CONC. WING WALLS. 16'-3" HIGH 5' THICK AT BASE 2'-6" AT TOP 16' LONG.

Total Length of Bridge (above):— 44' C-C OF BEARINGS. Clear Roadway:— 20'-0" Sidewalks:— NONE.

Capacity of Floor System:— Capacity of Trusses:—

~~Movable~~ Span:— STEEL THRU WARREN TRUSS 4 PANELS 7'-3" HIGH.

Floor Construction:— FLOOR BEAM 20" I @ 70" STRINGERS 6-10" I-25# 2-10" I 15# Guard Rail:— 3-2" GAL PIPE RAILS. BOLTS TO TRUSS. ON WING WALLS POSTS ARE 2½" GAL PIPE

Clear Head-room:— Clearance above H. W.:— 11' WITH 1' OF WATER.

Fenders:— NONE.

Operating Equipment:— "

Public Utilities Carried:— "

Date of this Record:— FEB 15 1923 General Condition of Bridge:— GOOD.

Remarks:— DECK OF BRIDGE 3" CREOSOTED PLANKS WITH 3" WOOD BLOCK FLOOR. STREAM HAS PLANK SHEETING FOR BOTTOM.

WEYMOUTH ROAD BRIDGE, COUNTY BRIDGE CARD, 1923

Weymouth Road Bridge
Atlantic County, New Jersey

No. Hamilton 22

ame of Bridge:- Stream Great Egg Harbor River

ocation:- Weymouth Road at Main outlet to Weymouth dam (now drawn off)

esigned by:- A.H. Nelson Contractor:- Henry Kraus Plans Filed:- 107-H-9 to 12

ubstructure:- 51-12"x20' piles under 4" platform, conc. abutments 5'-9" to 3'-8" thick, 16' high, 25' long - double 2" sheeting

uperstructure:- Steel, through, Warren, truss 4 panel

pproaches:- Gravel between conc. wingwalls 16'-3" high, 5' thick at base 2'-6" at top, 16' long

otal Length of Bridge Floor:- 44' c/c end bearings Clear Roadway:- 20' Sidewalks:-

~~lovable~~ Span:- 41'

eight of Truss or Trusses:- 7'-3" Clear Headroom:- Clearance above H. W.:- 11'

loor Construction:- Fl. beams 20"-20"#s - Stgs. - 6-10"-25"#s & 2-10"-15"#s - ~~Stringers~~ Guard Rail:- 3-2"G.I. pipe rails on truss - 2½" posts on walks

apacity of Trusses:- 2"x4" lom. deck on 6" spiking pieces Capacity of Floor System:- 6"x6" wheel guards on 3"x6" blocks

enders:-

perating Equipment:-

ublic Utilities Carried:-

ate of this Record:- Jan. 1, 1924, 5, 6, 7, 8, 9, 30, 1, 2, 34, 5, 6, 7, 8, 9, 42, 3, 4, 5, 6 General Condition of Bridge:- Fair Good 24 32 36 38 42

ecommendations:-

emarks:- Plank bottom - 1' water - Painted - Dec. 20, 1924 (Fair '30)

" painted Nov. '34 " 1931 (Fair '37)

" " Feb. '39 " 1940

" " Jan. 47 " Feb. 1946

WEYMOUTH ROAD BRIDGE, COUNTY BRIDGE CARD, 1924

Weymouth Road Bridge
Atlantic County, New Jersey

RECORD OF REPAIRS, ETC.

Date of Original Construction:- 1920

Date	Repaired by	Description of Work	Cost
1920	Henry Kraus	Construction of Bridge	$9555.21
Feb. 46	Bridge Maint. Dept.	New deck and nailing pieces	—

WEYMOUTH ROAD BRIDGE, COUNTY BRIDGE CARD, 1924
(REVERSE SIDE)

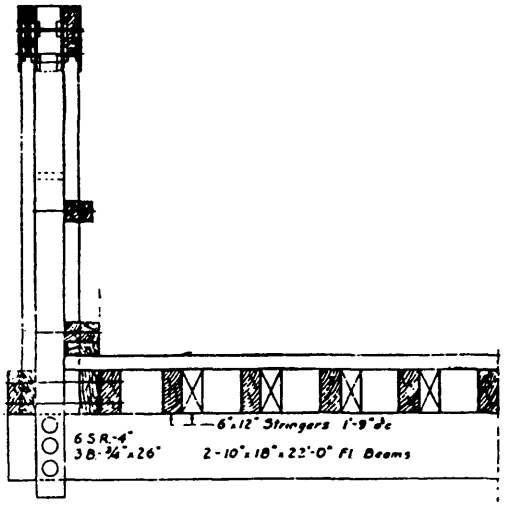
Weymouth Road Bridge
Atlantic County, New Jersey

King-Post and Queen-Post Trusses

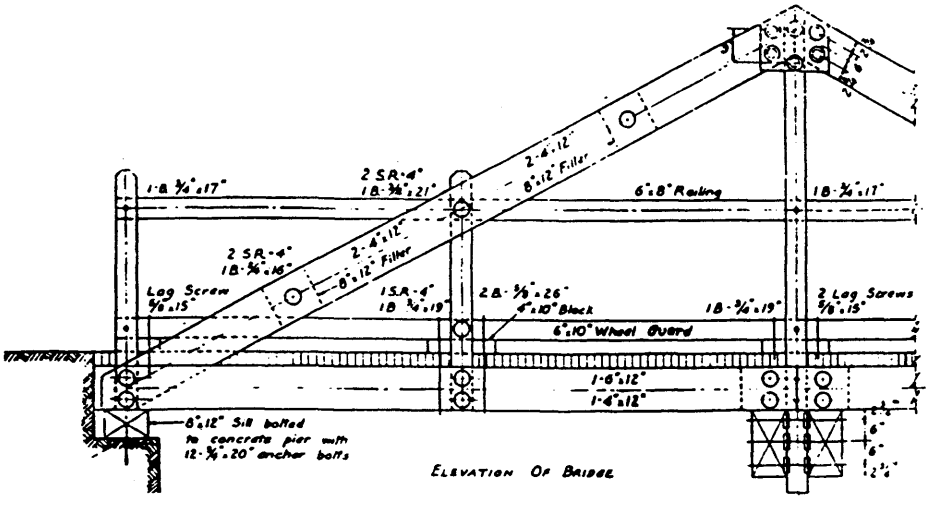
Length: 20–40 feet (king post)
20–80 feet (queen post)

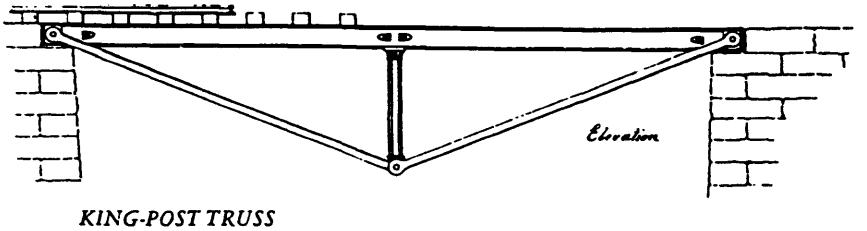
Many king- and queen-post trusses are to be found in Oregon and Washington, where timber bridges were built in recent times.

A queen-post truss is merely a king post to which one panel of top chord has been added between the end posts. This addition extends the maximum span to about 70 or 80 feet.

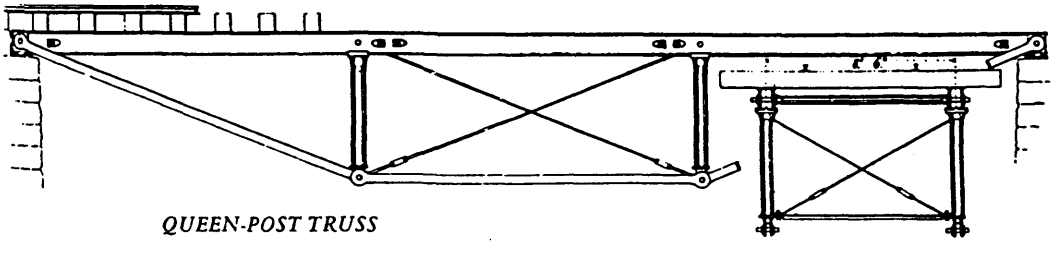


End elevation





KING-POST TRUSS



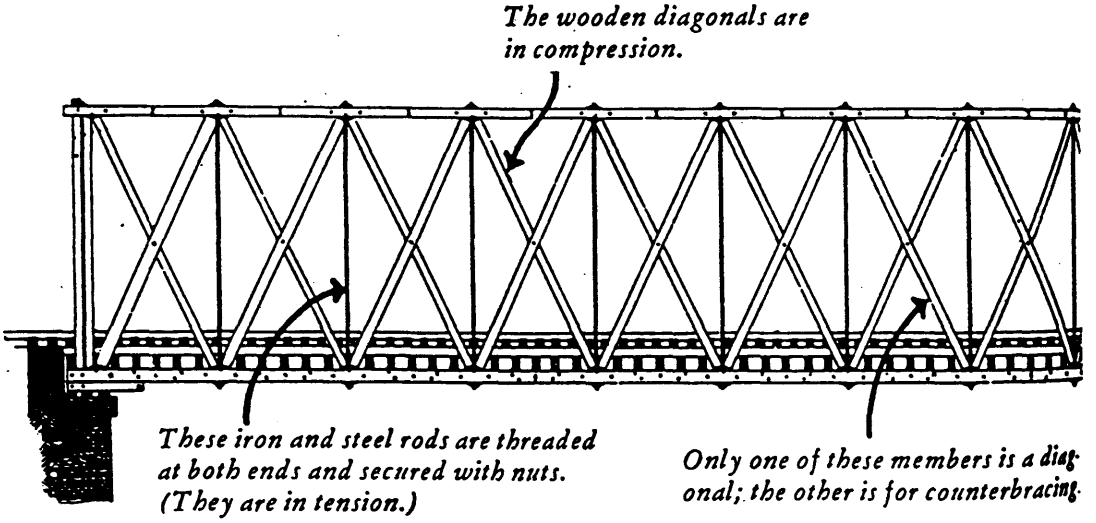
QUEEN-POST TRUSS

Excerpted from: David Weitzman, *Traces of the Past, A Field Guide to Industrial Archaeology,* New York, Charles Scribners Sons, 1980

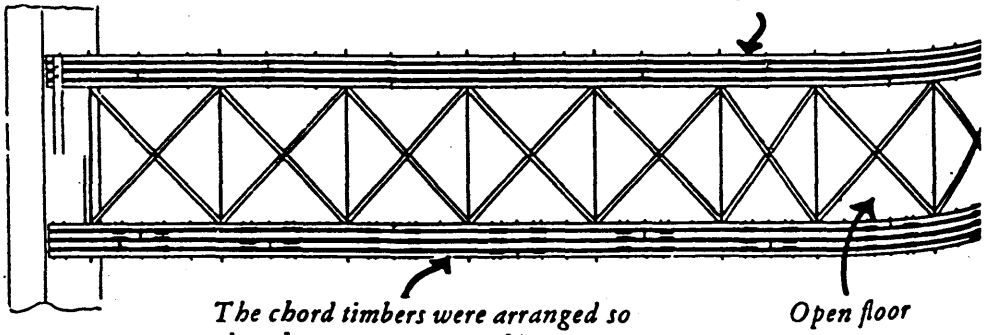
Howe Truss

Length: 30–180 feet

The Howe truss has been popular in regions where timber is plentiful, and has all but disappeared except in the Pacific Northwest. There they are still common, the covered Howe truss having served as the standard 150-foot span of the Oregon State Highway Department up through the 1920s. Extravagant timber requirements are only part of the reason for the Howe's lack of general acceptance: American engineers have always preferred trusses with *vertical* compression members, as in the more popular Pratt. The through form of the Howe truss is more common than either deck or half-through forms. For heavy railroad loadings, the panels were made very narrow so that the diagonals were almost vertical. In a properly designed truss the timber is strained longitudinally only—along the fiber.



For spans greater than 150 feet, iron trusses were more economical than ones of timber.

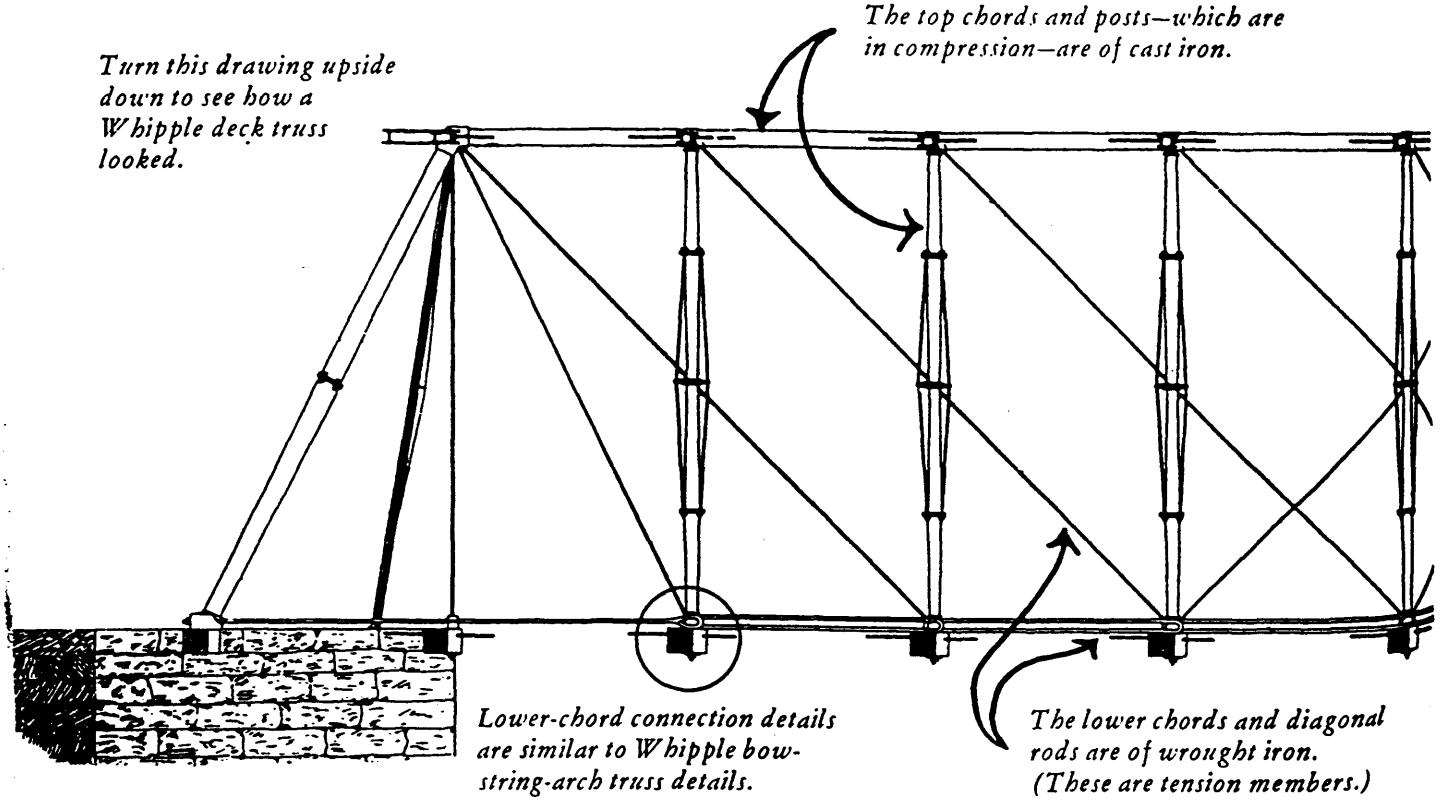


Excerpted from: David Weitzman, *Traces of the Past, A Field Guide to Industrial Archaeology,* New York, Charles Scribners Sons, 1980

Whipple Trapezoidal Truss

Length: 70–300 feet

A double-intersection truss—or double-canceled truss, as it is sometimes known—is actually two bridges in one. Faced with the need to span distances exceeding the practical limit of one system of triangles, Whipple combined two triangular systems. The trapezoidal truss is actually a double-intersection Pratt—the diagonals extending across two panels and intersecting—with inclined end posts: a form which later became known as the Whipple, Whipple-Murphy, or Linville truss. Each system works independently, carrying loads to the abutments. This particular bridge, below, built for the Rensselaer & Saratoga Railroad north of Troy, New York, was a clear span of only 146 feet, but trapezoidal trusses have been used for spans of over 400 feet. This truss was inverted, retaining the inclined end posts, and used in a deck form on the Baltimore & Ohio Railroad.

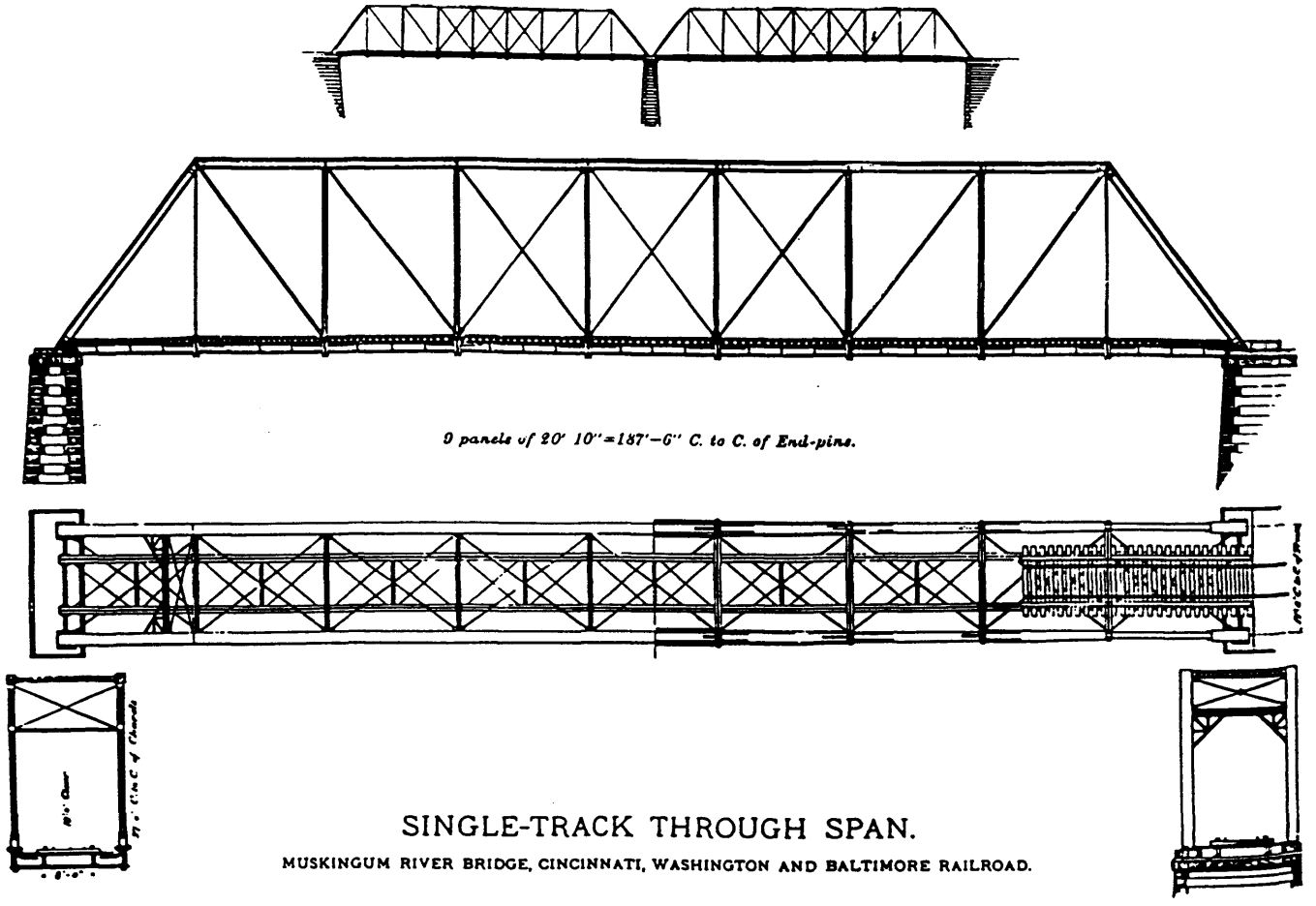


Excerpted from: David Weitzman, *Traces of the Past, A Field Guide to Industrial Archaeology,* New York, Charles Scribners Sons, 1980

Pratt Truss

Length: 30–250 feet

Thomas and Caleb Pratt's original design of 1844 called for only one tension diagonal in each panel. It was discovered, however, that under certain conditions live loads can reverse the stresses in the truss members, causing the diagonals to come under compressive forces. For this reason, a "counter" was added in the center panels. Iron Pratt trusses began to appear in large numbers in the 1850s. The Baltimore & Ohio Railroad used Pratt trusses almost exclusively from 1880 until 1905, when they began using Warrens. A very high proportion of all the road spans in use today are steel Pratts and Pratt types with riveted connections, though engineers have preferred to use pin connections on spans over 200 feet.



SINGLE-TRACK THROUGH SPAN.

MUSKINGUM RIVER BRIDGE, CINCINNATI, WASHINGTON AND BALTIMORE RAILROAD.

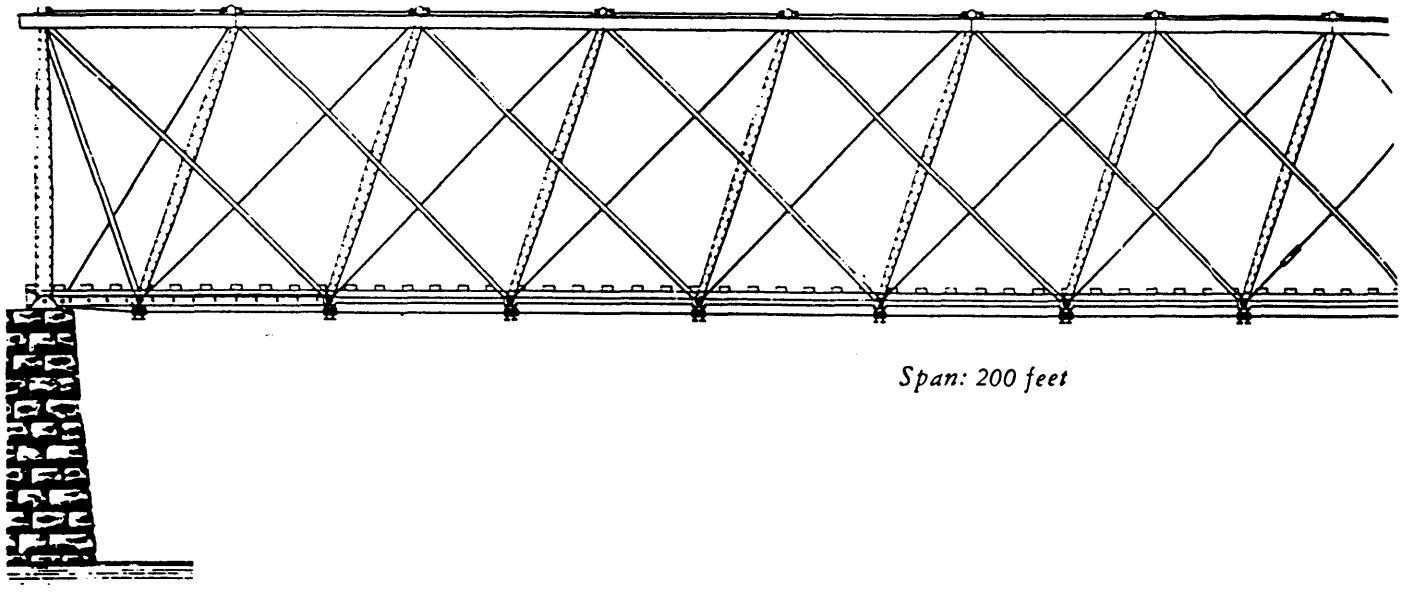
Pratts and Howes are often confused with one another. Compare this plan with that of the Howe truss (pages 92 and 93), and the difference will become obvious. In this truss the verticals are in compression and the diagonals in tension; in the Howe the arrangement is reversed.

Excerpted from: David Weitzman, *Traces of the Past, A Field Guide to Industrial Archaeology,* New York, Charles Scribners Sons, 1980

Post Diagonal Truss

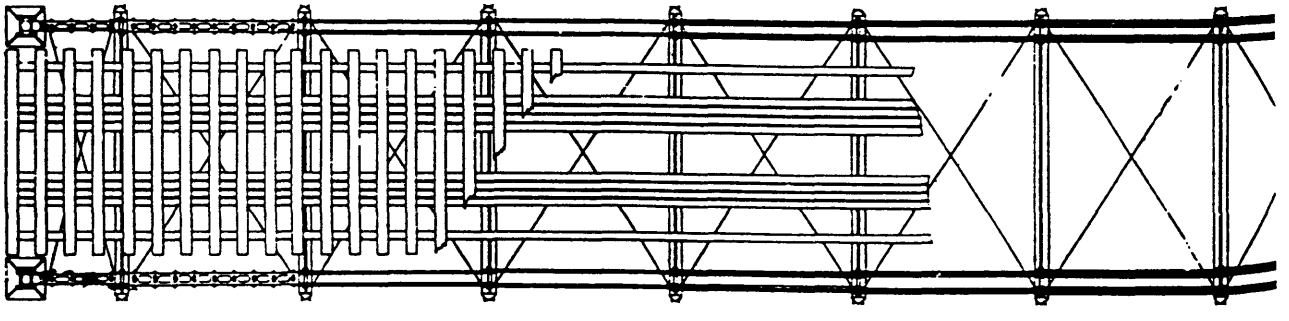
Length: 100–300 feet

S. S. Post's first patent diagonal-truss iron bridge was built on the Erie Railroad in 1865, and many others were constructed over the next fifteen years. The lower ends of the posts were inclined half a panel length toward the ends that formed the characteristic single triangle at mid-span. These inclined iron posts formed one system; diagonals of iron bars and rods with eyes at each end running counter to the posts formed two more systems. The effect was the same as combining a Warren and a double-intersection Pratt. The stresses were ambiguous, but the truss's popularity as a railroad bridge stemmed from its stiffness under heavy moving loads. It was also used as a road bridge.



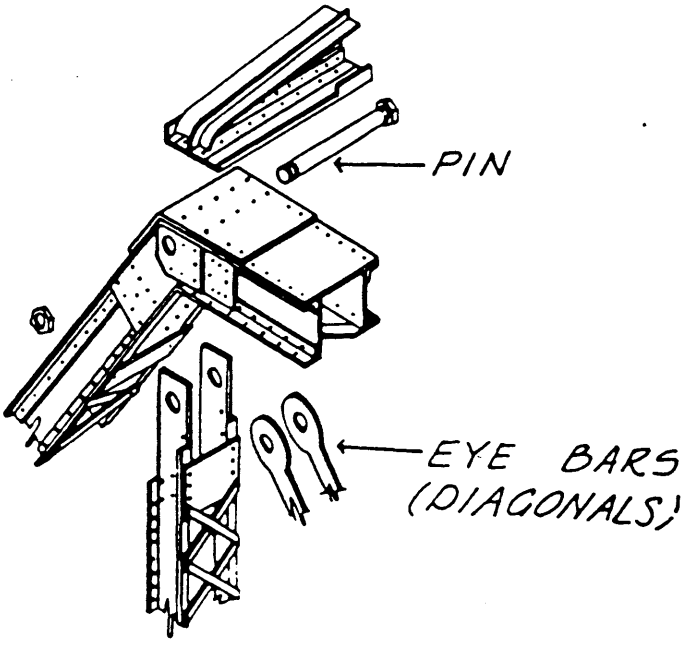
Span: 200 feet

C

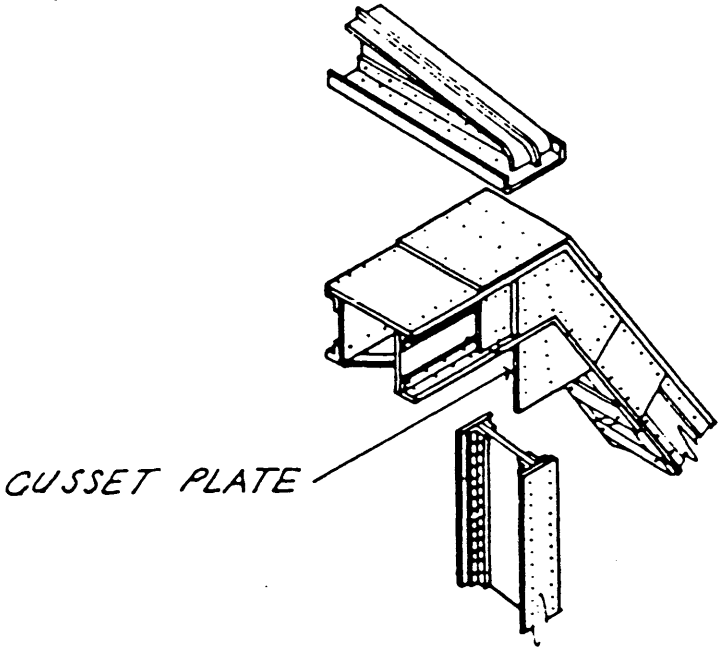


Plan of lower chords and lateral bracing

Excerpted from: David Weitzman, *Traces of the Past, A Field Guide to Industrial Archaeology,* New York, Charles Scribners Sons, 1980



PIN CONNECTION



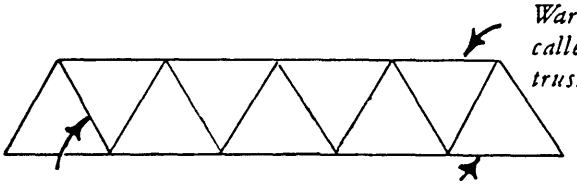
RIVETED CONNECTION

Excerpted from: David Weitzman, *Traces of the Past, A Field Guide to Industrial Archaeology,* New York, Charles Scribners Sons, 1980

Warren Truss

Length: 50–450 feet

Warren trusses of riveted construction, modified with vertical members, became the standard long-span bridge on many railroads in the early 1900s and superseded the Pratt truss for short spans as well. Deck Warrens, which had vertical end posts, were a popular truss for elevated railroads in cities, and more recently this simple triangular form is often found in continuous bridges, cantilevers, and Weichert trusses. In its original form, with inclined web members only, the Warren was elegant in its use of equilateral triangles. This simplicity was practical too—considerably less metal was needed than in vertical post designs. The Warren was never as widely used for road bridges as the Pratt and Whipple double-intersection trusses were, but it survives today in more modern forms such as bascule and Scherzer lift spans. The double-intersection Warren, composed of two separate triangular web systems superimposed on each other, reacts to forces much as does the lattice truss.



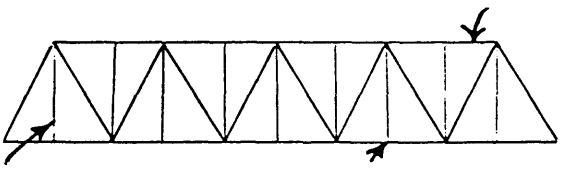
Because of its design, the Warren is sometimes called a "triangular" truss.

The diagonal web members carry both compressive and tensile forces.

In a true Warren truss, each panel is an equilateral triangle.

Most common form of the Warren truss

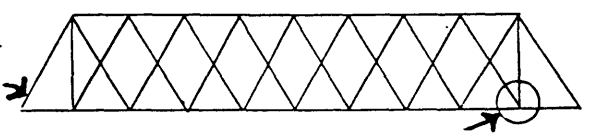
When the Warren is used as a deck truss, the tension rods become posts and are heavier.



Added vertical members are in tension.

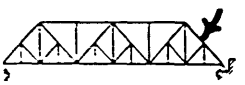
Vertical members do not transmit forces to the abutments. Their purpose is to provide intermediate support for the deck.

DOUBLE-INTERSECTION WARREN



POLYGONAL CHORD WARREN

A subdivided Warren is used in special cases where the floor must be shallower than normal.



SUBDIVIDED WARREN

As late as the 1940s, engineers recommended eye bar and pin connections for Warrens over 200 feet long. Riveting would have required very wide members as well as large joints.

Excerpted from: David Weitzman, *Traces of the Past, A Field Guide to Industrial Archaeology,* New York, Charles Scribners Sons, 1980

STRESS DIAGRAM

SECTION AT CENTER

END VIEW

DETAILS of ROLLERS

ABUTMENT

HALF ELEVATION of BRIDGE

QUARTER PLAN of BRIDGE

HALF PLAN SHOWING CONCRETE

ELEVATION of ABUTMENT and WING WALLS

PLAN of ABUTMENT and WING WALLS

HALF PLAN SHOWING PILES and PLATFORM

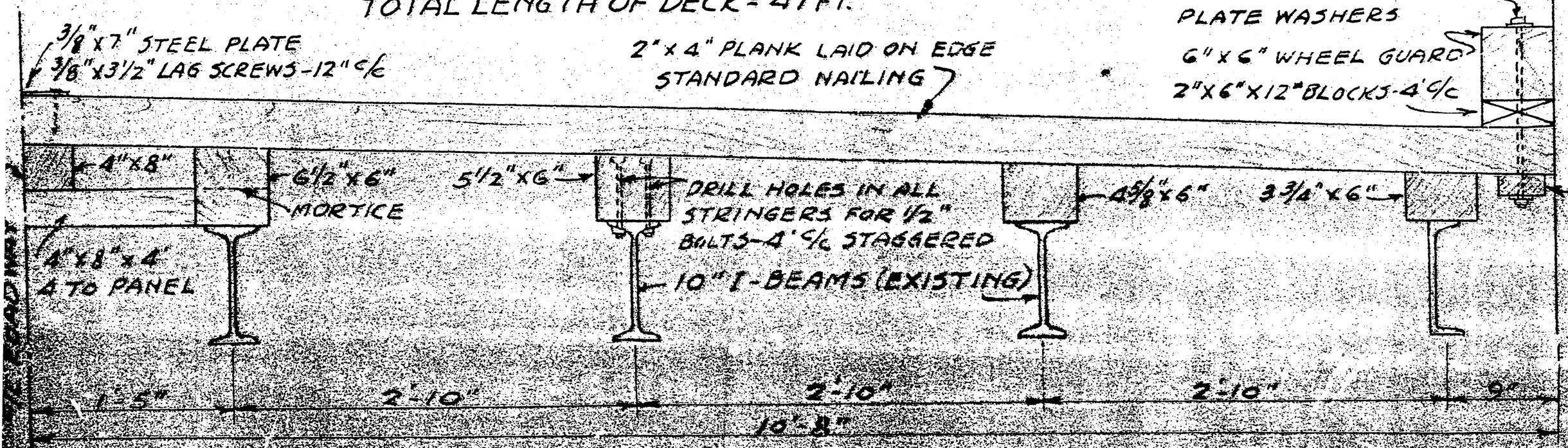
SECTION of WING WALL

PLAN
of
SUPERSTRUCTURE and SUBSTRUCTURE
for
RECONSTRUCTING BRIDGE No. H23
over
MAIN OUTLET of WEYMOUTH DAM
HAMILTON TOWNSHIP ATLANTIC CO., N. J.
Scale - 3/8 = 1'
Aug 13, 1919
County Engineer

Weymouth Road Bridge
Atlantic County, New Jersey

0" 1/2" 1" 2" 3"

TOTAL LENGTH OF DECK = 47 FT.



12" CREOSOTED PINE LUMBER

660 PCS. 2" x 4" x 12' (D.43) = 5280 F.B.M.
6 PCS. 3 3/4" x 6" x 16 (D.45) = 192 F.B.M.
6 PCS. 4 5/8" x 6" x 16' (D.45) = 240 F.B.M.
6 PCS. 5 1/2" x 6" x 16' (D.43) = 288 F.B.M.
6 PCS. 6 1/2" x 6" x 16' (D.43) = 336 F.B.M.
6 PCS. 4" x 8" x 16' ROUGH = 256 F.B.M.
6 PCS. 6" x 6" x 16' ROUGH = 288 F.B.M.
TOTAL = 6880 F.B.M.

BOLT LIST

1/2" ϕ GALV. — 30-4 1/2" / 30-5" / 30-6" / 30-7"
3/4" ϕ GALV. — 26 — 15"
3/8" LAG SCREWS — 100-3 1/2"

DETAILS of ROADWAY REPAIRS TO BRIDGE H-22 OVER EGG HARBOR RIVER AT WEYMOUTH-HAMILTON TOWNSHIP ATLANTIC COUNTY, NEW JERSEY

SCALE 1/2" = 1'-0"

DECEMBER 1945

Weymouth Road Bridge
Atlantic County, New Jersey