DOTY ROAD BRIDGE
(Doty Bridge)
Doty Road, spanning the Ramapo River
Oakland
Bergen County
New Jersey

HAER No. NJ-93

HAER
N.J.
2-OAKL,
2-

PHOTOGRAPHS

WRITTEN AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Customs House
200 Chestnut Street
Philadelphia, PA 19016

HISTORIC AMERICAN ENGINEERING RECORD

HAER NJ 2-OAKL, 2-

DOTY ROAD BRIDGE
(Doty Bridge)

HAER No. NJ-93

Location: Doty Road, spanning the Ramapo River,
Oakland, Bergen County, New Jersey

UTM: 18.562090.4540640
Quad: Wanaque, New Jersey 7.5 minute series

Date of Construction: 1891

Engineer/Architect: Phoenix Bridge Company, Phoenixville, Pennsylvania
Fabricator: Phoenix Bridge Company, Phoenixville, Pennsylvania

Contractor: Dean and Westbrook, New York

Present Owner: Bergen County, New Jersey

Present Use: Neighborhood vehicular bridge

Significance: On February 16, 1990, the Doty Road Bridge was determined to be eligible for listing on the National Register of Historic Places by the New Jersey Historic Preservation Officer (HPO) due to its association with the Phoenix Bridge Company. The bridge is one of fewer than six Phoenix Column trusses in New Jersey built by Dean and Westbrook, highway agents for the Phoenix Bridge Company (A.G. Lichtenstein & Associates, Inc. 1994).

Project Information: The New York District, U.S. Army Corps of Engineers (USACE) is scheduled to replace Doty Road Bridge as part of the Ramapo River Flood Control Project. The historic bridge will be removed from the present site and relocated to a Bergen County Park by USACE, New York District. The New Jersey Department of Transportation will build a new bridge at Doty Road. The programmatic agreement among USACE, New Jersey HPO, and the Advisory Council on Historic Places confirms that the project will have an adverse effect on the bridge. To mitigate this effect USACE is required to record the bridge according to HABS/HAER Standards. This documentation was undertaken to fulfill this requirement.

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## INTRODUCTION

Doty Road Bridge (New Jersey Department of Transportation [NJDOT] Structure Inventory and Appraisal number [SI&A] 020042A) is located on Doty Road, Oakland, Bergen County, New Jersey. It spans the Ramapo River in an area traditionally called "The Ponds" at UTM coordinates 18.562090.4540640. Doty Road Bridge, also known as the Doty Bridge, is a five-panel, wrought-iron, Pratt pony truss bridge that has Phoenix column upper chord sections supported on stone abutments that have been refaced with concrete. In 1984 a Bailey bridge was inserted through the middle of original bridge relieving the original bridge from carrying any actual traffic. The Bailey bridge is not an irreversible alteration. The original bridge was erected in 1891 by Dean and Westbrook, highway bridge agents for the Phoenix Bridge Company, under contract to Bergen County to replace an earlier bridge that had been swept away by winter floods in 1890 (Bergen County Board of Chosen Freeholders 1890).

Doty Road Bridge was first noted in 1982 by Pat Garbe and T. Robins Brown in *Bergen County Historic Sites Survey, Borough of Oakland* (Brown and Garbe 1983), which was an attempt to identify buildings, streetscapes, districts, and sites of historical and architectural significance in the county. Identified by the historic sites inventory number of 0242-14, the bridge was described as a "metal truss single lane bridge with a 72[-foot] span. ... It [was] one of two roadway bridges in Oakland included in the survey site report [the other being the Glen Gray Road Bridge (198317-25)] and was among several bridges along the Ramapo from Suffern to Pompton Lakes to have survived the great floods in March 1902 and 1903" (Brown and Garbe 1983:L1). Between 1983 and 1991, three cultural resources studies were completed within the Oakland, Pompton Lakes, and Wayne, New Jersey area (Marshall 1983; Pickman and Boesch 1990, 1991). However, none of these surveys included any information on the Doty Road Bridge.

The bridge was recommended as eligible for the National Register of Historic Places (NRHP) as cited in a New Jersey Historic Preservation Office (HPO) finding of December 7, 1989, although the actual date of the eligibility determination in official HPO letters is February 16, 1990 (Guzzo 1997). Further, Doty Road Bridge was included in the recent survey of New Jersey's historic bridges (A.G. Lichtenstein & Associates, Inc. 1994), which found the bridge to be "a technologically significant example of late-[nineteen]th century construction" (A.G. Lichtenstein & Associates, Inc. 1994:Bergen County Vol., np.).

Only 80 feet long, the single-span, single-lane bridge was condemned in 1983 and is in very poor condition. As noted, a Bailey bridge was inserted through the middle of Doty Bridge the following year (1984) and actually carries the current traffic.

## PART 1. HISTORICAL INFORMATION

### A. Physical History

1. **Date of Erection:** 1891. A photograph of the builders plaque on file at the New Jersey HPO in Trenton established this date. (The builders plaque is no longer extant.) In 1890 the Bergen County Board of Chosen Freeholders decided to construct a bridge at the site of the former Doty Bridge that had been swept away by flooding in 1890. Although the minutes of the Board of Freeholders do not record the construction process and completion of the bridge, they do record the decision to build it (Bergen County Board of Chosen Freeholders 1890:439). The time between their decision in February 1890 and the bridge's completion agrees with the date on the bridge's builders plaque. In addition, the county Board of Freeholders fastened a plaque to the bridge which listed the members who served on the bridge committee. (This plaque is also missing.) Despite the theft of these plaques sometime after 1994, good photographs of them exist in the New Jersey HPO files. Although these photographs do not show the precise locations of the plaques, holes found in the upper chords of both sides of the bridge suggest that the plaques were located in the middle of the bridge facing each other across the road bed. The side locations of each plaque (east or west) is not known, however, a curved concrete wall appears in the lower left corner of one photograph. A wall of this type can be found on the southwest bank of the river behind the former Pleasureland snack bar (later, Angie's Pub). If the wall depicted in the photograph is indeed the curved wall behind the snack bar, then the builders plaque would have been located on the west side of the bridge. The builders plaque read:

1891
BUILT BY
DEAN AND WESTBROOK
BRIDGE ENGINEERS
NEW YORK.

The Bergen County plaque read:

COMMITTEE:
D. H. SPEAR
J. F. CRUSE
A. BOGERT

2. **Engineer/Architect and Fabricator:** Phoenix Bridge Company, Phoenixville, Pennsylvania, in 1890-1891. A detailed history of the Phoenix Bridge Company has been written by Thomas R. Winpenny in *Without Fitting, Filing, or Chipping; An Illustrated History of the Phoenix Bridge Company* (1996). The following context paraphrases information derived from Winpenny's monograph.

Located in Phoenixville, Pennsylvania, 28 miles northwest of Philadelphia, the Phoenix Bridge Company (1884-1962), was a wholly-owned subsidiary of the Phoenix Iron and Steel Company, also of Phoenixville, Pennsylvania. The bridge company was originally known as Kellogg, Clarke and Company (1868-1870), and later as Clarke, Reeves and Company (1871-1884). Every year Phoenix Bridge purchased between 20 percent and 40 percent of Phoenix Iron and Steel's output. While many competitors grumbled about this relationship, it was essentially no different from that of Carnegie Steel and Keystone Bridge Company (Winpenny 1996:xvi).

The Phoenix Iron Company started business as the French Creek Nail Works in 1790. Founded by Benjamin Longstreth, the nail works was the first nail factory in the United States and was augmented by a rolling and slitting mill. The company was renamed the Phoenix Iron Company in 1813 by Lewis Wernwag, a noted engineer and then-new investor in the firm. Shortly thereafter the village in which factory was located became known as Phoenixville. As the company grew during the first decades of the nineteenth century, the iron works expanded and utilized the puddling process, a technique by which pig iron is made into wrought iron, by 1827. A decade later, the company added a blast furnace to smelt iron through the then-innovative use of anthracite coal. The company took advantage of a number of fortuitous opportunities and by 1840 was in position to begin making iron rails for America's ever proliferating railroad network. With the business increasingly expanding based on its rail production, Phoenix Iron Company (called Reeves, Buck and Company from 1846 through 1855) soon began to develop new railroad-related technologies, such as a rail straightening machine known as the "gag press" (Winpenny 1996:1-3).

By the start of the Civil War, Phoenix Iron was a prominent and respected firm, widely known for its innovative technologies. During the war years the company was best known for its development and production of the Griffen Gun, but its real success during these years was "the invention, fabrication, sale, and utilization of the famous Phoenix Column" (Winpenny 1996:6). The Phoenix Column, invented and patented in 1862 by Samuel Reeves, is "hollow and circular and made up of four, six, or eight wrought-iron segments that are flanged and riveted together," thus forming a column (Winpenny 1996:6). Not in wide utilization until the 1880s, the column

greatly facilitated the erection of tall structures because it obviated requirements for exceptionally heavy and thick load-bearing walls. Moreover, it also had important applications to the construction of bridges, viaducts, and elevated rail lines (Winpenny 1996:6-8).

One of the real advantages of a wrought-iron column over a cast-iron column was that wrought iron could be riveted, a feature that was desirable since it addressed windbracing in taller buildings. Through riveting, the connections between columns and beams were sufficiently rigid so that windbracing became a relatively simple task. Another great advantage of the Phoenix Column was "that its wrought-iron composition rendered it a ductile compression element"; it was not as brittle as the cast-iron column had been (Winpenny 1996:8).

As the company developed and marketed the Phoenix Column, it expanded into actual bridge construction. The exact origins of the company's interest in building bridges are not clear but they seem to be related to its pre-war railroading activities. Whatever the reasons, by the end of the Civil War, the Phoenix Iron Company was in the bridge-building business. Not only did the new bridge-building company use its patented Phoenix Column, but it also utilized a patented "I" bar that was "'forged by hydraulic pressure [for] use as a connecting link in its bridges'" (Clegg [1987:3], quoted in Winpenny 1996:10).

The formation of a bridge company by Phoenix Iron in 1868 was actually to its advantage. A bridge company would guarantee that a certain percentage of iron stock was always purchased from the parent company. The bridge company also helped to advertise the parent company, and finally the bridge business might compensate for any down turns in the iron business. By November 1898, Phoenix Bridge Works was operating night and day to meet the demands for its bridges, announcing that year that they had "not been so busy and so pressed for orders for ten years" (Winpenny 1996:14). The parent company was pleased.

By the 1890s the Phoenix Column as well as other circular iron columns were being replaced by the Zee-bar and rolled H-columns. Further, Bessemer steel was finally exerting an influence on building materials. Even as the Phoenix Column was fading in importance, the Phoenix Bridge Company's fortunes were rising (Winpenny 1996:9). In the twentieth century, the company went on to erect spectacular bridges and often to create equally spectacular disasters (e.g., the 1907 Québec Bridge collapse). By the 1940s Phoenix Bridge was for sale, but since no buyers appeared the company limped along until 1962 when it was finally closed.

In the overcrowded bridge construction industry of the late-nineteenth century, the Phoenix Bridge Company was a glittering success. They created hundreds of railway bridges, viaducts, and highway spans in the United States and Canada. Many of the bridges, like the Doty Road Bridge, are modest in length, used Phoenix Columns and truss designs, appeared in the firm's trade catalog, and were reproduced time and again. "Phoenix Bridge had a very comfortable market niche fabricating unspectacular but readily available and reliable products" (Winpenny 1996:xvi).

3. **Contractor:** Dean and Westbrook, Bridge Engineers, New York. Dean and Westbrook (1870-1901), also known as Dean-Westbrook Bridge Company (1899-1901), was a bridge engineering and contracting firm comprising partners C.W. Dean and John A. Westbrook. The firm was organized in 1870 in Cleveland, Ohio, and remained until at least 1883. Sometime between 1883 and 1886, Dean and Westbrook apparently relocated to New York City, where they appear in city directories from 1886 through 1901 (Darnell 1984). It is not clear where the firm was located or what it was doing between 1883 and 1886. However, by 1885 they were actively marketing and erecting Phoenix Bridge Company bridges out of New York City, although they did not appear in city directories until the following year. The company specialized in the design and general contracting of short- and medium-span railway and highway bridges (Louis Berger & Associates 1996).

When Clark, Reeves and Company, an ancillary to Phoenix Iron Company, was reorganized in 1884 as the Phoenix Bridge Company, it began to enter into brokerage agreements with unaffiliated bridge contracting firm to sell its bridges. In 1885 Phoenix Bridge entered into such an agreement with Dean and Westbrook for the marketing and erection of its highway bridges that featured Phoenix-section compression members. As agents for Phoenix Bridge from 1885 to 1895, Dean and Westbrook handled the bidding process for bridges, made arrangements and contracts with local officials, and erected highway bridges on site from their office at 32 Liberty Street in New York City (A.G. Lichtenstein & Associates, Inc. 1994; Louis Berger & Associates 1996).

Dean and Westbrook ordered 279 of the Phoenix Bridge Company's bridges between 1885 and 1893 (Louis Berger & Associates 1996). They built at least 70 bridges with Phoenix sections in New Jersey, with approximately six of those bridges still standing as of 1994. These bridges included the Doty Road Bridge, Bergen County; Hamden Road Bridge (10XXF65), Hunterdon County; and two bridges on Walnford Mill Road (1300U47 and 1300U48), Monmouth County (A.G. Lichtenstein & Associates, Inc. 1994). Dean and Westbrook worked throughout the northeastern United States, and were the general contractors for the Walnut Street Bridge,

Harrisburg, Pennsylvania, and the Arkwright Bridge, West Warwick, Rhode Island. The Walnut Street Bridge (HAER No. PA-412), erected 1889-1890, has been recorded to HAER specifications and the Arkwright Bridge (RI 1978121278000061) is listed on the NRHP.

Although Dean and Westbrook were agents for the Phoenix Bridge Company, they were still bridge engineers in their own right. Since Phoenix bridges were "catalog" bridges, constructed from designs and parts ordered through the company with local engineers customizing the designs for a particular location, engineers were faced on many occasions with problems not addressed by the "pre-fabricated" bridge parts which called for creative solutions. In 1891 Dean and Westbrook confronted such a problem in English Center, Pennsylvania. Here the partners erected a pair of bridges that required greater stiffening. They accomplished this task by using I-bar suspension chains stiffened by diagonally crossing each panel between chain and deck (Spivey 1999). Although the bridge looks like a suspension structure, the bridge load is actually carried by the stout vertical compression elements, thereby making its load-carrying capacity closer to a truss action than a suspension effort. The stiffening system used for these two bridges holds an important place in Pennsylvania's suspension bridge heritage (Spivey 1999). Dean and Westbrook's creative solution for stiffening helped to make short spans more efficient (Spivey 1999).

4. **Original and Subsequent Owners:** Bergen County, New Jersey. Doty Road Bridge was originally financed by the Bergen County Board of Chosen Freeholders in 1890. The bridge is still owned and maintained by Bergen County through its County Engineer's Office on Main Street in Hackensack, New Jersey.

5. **Original Plans and Construction:** The original plans for Doty Road Bridge do not exist. On February 11, 1890, the Bergen County Board of Chosen Freeholders met at the old Doty Bridge site to decide if a new bridge was needed. The minutes record,

> After inspecting the site of the Bridge [Doty Bridge], across the Ramapo River, on the road recenlly carried away by the flood, it was on motion ordered that said Bridge be replace by an Iron Bridge [sic] with suitable stone abutments. The new Bridge to have a span of 75 ft. and to be 16 ft. wide with whole to cost not more than $2,500. The whole to be charged to the Fallen Bridge Account [Bergen County Board of Chosen Freeholders 1890:439].

The description of a proposed new bridge by the Freeholders provides a glimpse of the type of bridge they envisioned.

Phoenix Bridge Company records, which are stored at the Hagley Museum and Library in Greenville, Delaware, do not contain individual drawings of bridges until the 1920s (Christopher Baer, personal communication 1999). Dean and Westbrook would have drawn and prepared the specifications and requested the required parts from Phoenix Bridge. The whole bridge was "constructed" in an almost "kit-like" fashion with the agents picking and choosing what they needed and what the purchaser could afford (Christopher Baer, personal communication 1999).

Three dated plans for Doty Road Bridge were located in the Bergen County Engineer's Office. The oldest of these plans is dated January 19, 1937, and is actually a plan for repairs to the wings and abutments (Bergen County Engineer's Office 1937: Plan 42-B-8-1). The plan indicates that the "walls and truss be shored up" and that the "S.E. seat [be] replaced by concrete 2' x 2' x 1'. Abuts [sic] and wings to be painted." The next oldest plan is dated August 1940 for the proposed strengthening of the bridge (Bergen County Engineer's Office 1940: Plan 42-B-2-1). This plan actually calls for the replacement of the existing wooden deck with a laminated fir deck to be raised over the existing old deck. Timber hand and guard rails were replaced and the macadam road was to be regraded to meet the new deck. Finally, in May 1980, an inspection and rating drawing of Doty Road Bridge was created (Bergen County Engineer's Office 1980). This drawing clearly indicates the Phoenix Columns used in the upper chord.

Two undated blueprints for Doty Road Bridge also exist (Bergen County Engineer's Office n.d.a: Plan 42-B-1-1, n.d.b: Plan 42-B-20-1. Plan 42-B-1-1 was prepared sometime after ca. 1930. The area around the bridge is clearly shown with buildings associated with Pleasureland, a recreational facility that eventually included two swimming pools, a pub (refreshments/restaurant), and a beach bathing area. Plan 42-B-20-1 was prepared sometime after 1940 since it involves replacing the laminated fir deck with a steel deck.

During the latter part of the nineteenth century, Bergen County, like other New Jersey counties, began to assume responsibility for all bridges within its borders. This new responsibility kept the Freeholders in a constant state of road and bridge review, which in turn required significant outlays of money to meet the needs of the county. A Summary of the County Collectors Report for the year 1889 to 1890 showed that the largest expenditure of the county was for "Bridges and culverts," totaling $35,221.94. This amount did not cover all bridge expenditures since the county also had a line for "Fallen Bridges," which was listed as $5,057.49. The total outlay for bridges far exceeded the county's next highest expenditure—"Temporary loans and interest," listed as $25,325.84 (Bergen County Board of Chosen Freeholders

1890:388). At every Freeholders' meeting, the Board had to deal with at least one, and on many occasions several, bridge issue; all of which required the expenditure of money. In general, the Board which met once a month in Hackensack would schedule a bridge inspection meeting one-to-two weeks after the usually monthly meeting. The purpose of the inspection meeting was to examine the bridge and site in question and decide what they were going to do about the problem. Usually while on the site at the time of the inspection meeting, the Board would vote to fund or not fund a project.

Seemingly a quick and easy approach to bridge funding, the Board actually had a series of bridge committees which did the research and apparently presented their findings to the larger Board when it came time to vote on funding. Bergen County's bridge committees were organized in a roughly geographical fashion with certain committees handling bridges only within a defined area. Some committees seemed to focus solely on larger municipalities within the county (Bergen County Board of Chosen Freeholders 1882-1892). The Oakland Committee handled the Doty Road Bridge issue. Its members were David H. Spear, John F. Cruse and Albert Bogert, all of whom were listed on the county bridge plaque, formerly located on the Doty Road Bridge (Bergen County Board of Chosen Freeholders 1882-1892).

When the Board of Chosen Freeholders met for their regular monthly meeting on February 2, 1890, it resolved to meet on February 11 at 2 p.m. at the former site of the flood-razed Doty Bridge. During this meeting the Freeholders also discussed another bridge, the Yates Mill Bridge which is no longer extant. The Board resolved to pay Dean and Westbrook $900.00 for the erection of the Yates Mill Bridge when the iron was delivered, in accordance with the contract (Bergen County Board of Chosen Freeholders 1890:437).

Bergen County obviously had done business with Dean and Westbrook before they contracted with them for the new Doty Road Bridge. Their previous experiences with the company apparently led them to believe that Dean and Westbrook could do the job required. The minutes unfortunately do not explain the process by which Dean and Westbrook were selected for the Doty Road Bridge construction project. In the spring of 1892 a Freeholder moved that all bridge construction contracts be more widely circulated throughout the bridge building industry (Bergen County Board of Chosen Freeholders 1892). His motion was accepted and passed; presumably bridge proposals were more widely circulated. It is not clear up until this time how the Freeholders decided upon a contractor.

During the year 1890-1891, the Board of Chosen Freeholders surprisingly spent only $29,959.14 for bridges and culverts and $2,360.78 for fallen bridges, one of which was Doty Road. During that same fiscal year the Freeholders spent $30,468.06 on temporary loans and interest, just a few dollars more than bridge expenditures (Bergen County Board of Chosen Freeholders 1891:448). It is surprising that less was spent on bridges during that year because a rainy winter had led to heavy flooding which had in turn washed away the road and the original Doty Bridge. Since Doty Bridge had washed away one assumes that other bridges would have been damaged or destroyed as well. While this may have been true, it certainly did not impact the budget the way bridge building had in the previous year.

Doty Road Bridge is named for the Doty family who were early settlers in the area. An Oakland area map of 1861 shows a bridge across the Ramapo River at the present site of Doty Road Bridge (Walker 1876:121). The property immediately to the right of the bridge is owned by Aaron Doty. George Doty also appears on the map as a land owner. A post-Civil War historic house is also located in Oakland at 342 West Oakland Avenue (Brown and Garbe 1983).

With the advent of active English development of colonial New Jersey in the late seventeenth century, European settlers with a variety of backgrounds cleared the land and erected farmsteads in the colony in increasing numbers. Settlers from New England via Long Island began filtering into eastern part of what was then known as East Jersey; and since the earliest English immigrants came from the Piscataqua River valley in New Hampshire and Newbury, Massachusetts, the area along the Raritan River, south of the project area, acquired the name Piscataway when townships were being created (Wacker 1982:199).

Although the Dotys were early settlers in the area, little seems to be known about the actual family. The Dotys appear to have immigrated to New Jersey from the Plymouth, Massachusetts, area and began to settle in the Piscataway area just south of Bergen County (igateway 1999). The Piscataway region is located in what is now Middlesex County, one of the four original counties in East Jersey (the others being Bergen, Essex, and Monmouth). As early as 1696 Piscataawaytown had a graveyard, a common, town meeting house and small house lots. While the area tended to be agricultural in nature it also supported a significant early milling industry situated on the banks of the Green Brook and its tributaries (Nolte et al. 1999). Perhaps members of the Doty family moved north into the Bergen County area since it also supported an agricultural base and small-scale industries related to water power.

6. **Alterations and additions:** Doty Road Bridge has undergone a number of major changes during its more than 100-year history. One of the first recorded alterations to the bridge was the replacement of the bridge seat in 1937. This iron truss bridge had a number of wooden components, which could include the decking, hand rails, guide rails, and possibly the bridge seat. The 1937 blueprint does not indicate the material of the original bridge seat, although the new bridge seat was to be concrete, measuring 2 ft x 2 ft x 1 ft. Some truss and wall work were completed about this time as well, since the blueprint called for them to be "shored up" with any damage done to the bridge repaired free of charge by the contractor. An interesting note added to the blueprint calls for the abutments and wings to be painted. The color, however, was not specified.

This note regarding the painting of the abutments and wing walls is interesting because the original abutments and wings were made of stone. The Freeholders who approved the bridge's construction specified that it have "suitable stone abutments" (Bergen County Board of Chosen Freeholders 1890:439). These stone abutments and wings could still be seen at the time of this investigation under a coating of concrete. By 1937 the abutments and wings evidently had received at least one coat of concrete since it makes little sense to paint stone wings and abutments.

By 1940 Doty Bridge was undergoing some major changes. A strengthening plan for the bridge called for the replacement of all wooden hand rails, posts, and timber guards, as well as the 3-inch plank floor and the steel stringers. These original components were to be replaced with larger steel I-beams that made the deck higher, a laminated fir deck, and new, heavier timber guard and hand rails. Because the deck would be higher, the road had to be regraded and raised at both approaches to the bridge. Since parts were being removed from the bridge, the plan specified that anything taken off should be carefully removed so that no other parts of the bridge would be damaged. Further, if removed trusses revealed rust on other portions of the bridge, the spots were to be cleaned and/or painted to the County Engineer's satisfaction. The new steel stringers were to be painted with one shop coat and two field coats of paint, no specified color, according to the Bergen County Engineering Department paint specifications (Bergen County Engineer's Office 1940).

The existing 3-inch wood deck was to be replaced with a 4-inch laminated fir deck. In fact, all the replacement timber was to be fir and had to planed on all four sides and coated with hot creosote before installation. All hardware used , including bolts and washers, had to be galvanized. The blueprint also specified that bridge warnings be posted at either end in the form of large in-ground signage.

By 1957 the county decided to replace the laminated fir deck with a 5-inch steel deck and new guard and hand rails. Although the date is illegible on the blueprint, a report for NJDOT dates the installation of the steel deck at 1957 under the supervision of County Bridge Engineer Frank Tamborelle (Borough of Oakland 1990). The weldlock, open-type deck was to be welded to the stringers. New metal hand and guard rails were to be spot welded to the trusses. All new steel was to have one shop coat of red lead, which could still be seen in some places at the time of the present investigation, and one field coat of Bergen County Engineer-approved paint, no color specified. The whole bridge was to receive a new coat of approved paint.

Although they do not appear on any extant blueprint or plan, a gas pipeline and a water pipeline were added to sides of the bridge. The large pipes are carried on either side of the bridge in out-rigger fashion. Support arms for both of these pipes were spot welded onto the truss.

During the 1970s and early-1980s Doty Road Bridge came under scrutiny as federal, state, and local officials began to consider flood control measures on the Ramapo River, especially in the Borough of Oakland. In order to effectively implement flood control measures, the bridge would have to be replaced due to its location and the proximity of its deck to the water. Negotiations were initiated among the parties and seemed to be proceeding well (Borough of Oakland 1980-1999).

Doty Road Bridge appears to have undergone no other large-scale work after the steel deck replacement, except for routine maintenance and inspection. Suddenly, as a result of taking bridge measurements, the bridge was closed on December 29, 1983 because it was unsafe. While Mahwah Engineering Company was completing an as-built drawing of the bridge for use by the county in attempts to obtain federal and state funds, an engineer noticed extreme, advanced corrosion in the beams near the center of the bridge. "The corrosion was so bad that there were holes in the beams..." (Ibert 1983:A15). The damage was reported to the county at 10:30 a.m. and by noon the bridge was closed to all traffic. A county bridge engineer reported, "if the beams were to break you could have a massive collapse" (Ibert 1983:A15). The county closed the bridge and Oakland's mayor voiced both the county's and the municipality's sentiments in the local paper, "It's better to be cautious than brave" (Ibert 1983:A15). The closing of the bridge was expected to have a severe impact on the neighborhood of Pleasureland, the industrial parks in Oakland, and traffic in Ringwood, Pompton Lakes, and Oakland.

To mitigate the impacts to the area's traffic, the county and borough decided on a temporary measure to solve the problem. The county would place a Bailey bridge

though the center of the existing bridge. The Bailey bridge would not rely on the old bridge for any form of support. The Bailey bridge was inserted in 1984 and, at the time of the present investigation, actually carries the Doty Bridge traffic. The New Jersey HPO decided that the insertion of the Bailey bridge does not detract from the NRHP eligibility of Doty Road Bridge (Borough of Oakland 1990).

## B. Historical Context:

1. **State:** Building on the Office of New Jersey Heritage's Metropolitan New Jersey historic context (Karschner 1991), a detailed transportation context for the state of New Jersey was prepared as part of the 1994 survey of New Jersey's historic bridges (A.G. Lichtenstein & Associates, Inc. 1994). The survey further divided this broad context into five sections: (1) New Jersey's transportation network prior to 1801; (2) turnpikes; (3) canals; (4) railroads; and (5) highways and byways. New Jersey's transportation networks have been strongly influenced by the state's position between two major cities: New York and Philadelphia. In order to facilitate the movement of goods and people and accommodate the increasing volume of traffic between these cities as well as locally-oriented traffic many transportation developments would occur here. This context paraphrases information derived from the 1994 historic bridge survey.

   From the colonial period to the closing decades of the nineteenth century, turnpike, bridge and road construction was within the jurisdiction of locally-elected officials, largely untrained in the specifics of bridge and road building. By 1880 a division of responsibility was loosely maintained where town or municipal officials handled road construction and maintenance and county Boards of Chosen Freeholders erected and maintained bridges. Despite the involvement of local officials, road conditions were generally poor and road maintenance, in some areas, was performed in lieu of tax payments. The railroads handled the heavy freight as well as long distance shipping. Educational efforts by the League of American Wheelmen, an organization of bicycling enthusiasts, under the rubric of the Good Roads Movement generated support for improving the nation's roads during the last quarter of the nineteenth century. Their efforts led to the creation on the federal level of the Office of Road Inquiry, later the Office of Public Roads, within the Department of Agriculture during the early twentieth century (A.G. Lichtenstein & Associates, Inc. 1994:29-30).

   With the advent of new methods of bridge construction during the late-nineteenth century and early-twentieth century, complex bridge projects required the input of professional civil engineers. A bridge committee in Somerset County in 1872 was

authorized to hire a civil engineer to provide technical assistance in the design and erection of major bridge projects. "Civil engineers were retained on a project by project basis to assist freeholders and bridge committees with bridge type selection and designs for bridges, but final authority for acceptance of both design and fabricator remained with the lay freeholders" (A.G. Lichtenstein & Associates, Inc. 1994:33-34).

In addition to the use of professional engineers in bridge planning and construction, New Jersey was also a pioneer in providing state money for a road building program. In 1891 New Jersey devised a state aid program which divided the costs of road construction among the state (1/3 of the cost), property owners (1/10 of the cost), and the county (the remainder), with the county determining upon state approval which roads would be improved. This act established the earliest precedent where both state and local authorities shared the responsibility for road improvements. Despite this consensus regarding shared responsibility, state monies were reserved for construction and local governments—town and county—retained responsibility for road maintenance (A.G. Lichtenstein & Associates, Inc. 1994:30).

Excluded from receiving state aid as well, bridge improvements remained a county issue. Both highway and bridge construction and maintenance also occurred without uniform statewide standards until the twentieth century. In an attempt to regularize highway construction, New Jersey established a state highway organization in 1891—the Commission of Public Roads, the predecessor of the NJDOT—with materials testing and publicity responsibilities. Ominously, the increasing popularity of the motor car undermined the success of these early initiatives. As early as 1905 existing bridges and newly improved roads were not sufficient to handle the increased speed and weight of the automobile and the truck. As new roads were built, bridges became a hindrance to traffic flow. "Old bridges that were narrower than the improved roads were often bottlenecks as was their alignment. Bridges were primarily set at a right angle, or as close to it as possible, regardless of the actual alignment of the road. The result was sharp curves and abrupt grades that became a greater hazard as motor vehicles increased in currency" (A.G. Lichtenstein & Associates, Inc. 1994:31). The revision of state policies and increased roads funding would occur under the governorship of progressive Woodrow Wilson in 1910.

Embodying the Progressive philosophy of relying on apolitical experts, the Wilson administration initiated an era of reform that utilized a scientific approach to social problem-solving and policy. Wilson's Commissioner of Public Roads was Edwin A. Stevens who would serve in that position from 1911 to 1916. "Under Stevens' leadership, the staff of the department increased dramatically, as did its funding.

Bridge construction was included under state aid, uniform standards for construction and maintenance were implemented, and state highways were established, surveyed, and improved" (A.G. Lichtenstein & Associates, Inc. 1994:32).

The State Highway Commission replaced the Public Road Commission in 1917. Part of the commission's new mandates was the requirement that it "prepare all plans and specifications and control all construction and maintenance on state highway routes" (A.G. Lichtenstein & Associates. Inc. 1994:33). Directed by George W. Goethals, the commission's first tasks were to inventory state routes, assess their condition, and determine their improvement costs. This assignment included a survey of the state's bridges. With control of bridge and road building on through routes now placed with the state rather than the township or county, the department became more intimately responsible for building and maintaining a statewide highway system. Now, road and bridge work was placed in the hands of professionals who studied road work as a business to be handled in a fair and efficient manner to best serve the needs of the state (A.G. Lichtenstein & Associates, Inc. 1994:33).

Around the turn of the century, counties, facing new demands in road maintenance and construction, began to hire professional civil engineers for both road and bridge projects. Somerset County was a pioneer in this regard, hiring its first county engineer in 1897. Other counties waited until the state legislature created the position of County Engineer in 1909. "[T]he introduction of state and then federally sponsored road and bridge programs removed the freeholders from the intimate position of control which they had enjoyed earlier in their history. In addition to the design and construction of bridges and roads, the county was responsible for maintenance and repairs as well" (A.G. Lichtenstein & Associates, Inc. 1994:34).

The State Road Department first funded bridge building in 1912 through its local aid program. As a result, the number of bridges constructed with this local aid increased by about 25 every year. By 1915 civil service bridge inspectors were hired by the department. With the establishment of the State Highway Department in 1916, construction and maintenance of bridges became part of the activities of the Public Utilities Commission Division of Bridges, which was responsible for railroad-related bridges. However, after the State Highway Department was reorganized (1920), the bridge division was consolidated into the Highway Department's Trenton offices in December 1923 (A.G. Lichtenstein & Associates, Inc. 1994:38)

As noted, in 1913, bridge standards were non-existent regarding width and type. In addition, new improved roads were not compatible with the old narrow and substandard bridges, as bottlenecks at bridge crossing clogged roadways. As a result,

the bridge division promoted a standard 30-foot width for bridges with a capacity of no less than I5 tons (A.G. Lichtenstein & Associates, Inc. I994:38).

The New Jersey State Highway Department under the guidance of William G. Sloan (1876-1960), who served as State Engineer from 1923-1929 and 1933-1937, developed innovative solutions to New Jersey's complex traffic problems. Funded through a combination of state, federal and local funds, these solutions included viaduct construction, railroad grade separations, wider and straighter roadways, highway grade separations, by-passing centers of populations, and improved directionary and cautionary signage (A.G. Lichtenstein & Associates, Inc. 1994:35-36). Responsibility for all bridge design and building on state routes remained in the hands of the state's bridge division. In addition, the division was responsible for approving the designs and specifications for local bridge projects receiving state aid.

Since the 1920s the automobile in combination with an improved highway system have revolutionized the lifestyle of the average American, freeing families from the confines of a single locality. Encouraging suburbanization of areas once deemed inaccessible, the automobile has improved the average American's ability to choose where to live, work, recreate, and shop. As population boomed after World War II, people and businesses that served them relocated away from crowded urban areas. "Throughout all of these transformations in American Culture, New Jersey because of its quickly developing suburban character and its excellent system of state highways was among the first states in the nation to feel the impacts of the car culture" (A.G. Lichtenstein & Associates, Inc. 1994:40).

2. **Local:** A transportation context was prepared for each of New Jersey's 2I counties as part of the 1994 New Jersey historic bridge survey (A.G. Lichtenstein & Associates, Inc. 1994). This context in part paraphrases information derived from that report.

The history of transportation within Bergen County is dominated by the county's proximity to New York City and efforts to improve the movement of people and goods to and from the city. While this may be a primary driving force an equally important factor was the need to improve internal access to nearby towns, farms, and homes (A.G. Lichtenstein & Associates, Inc. 1994). In Bergen County, 156 bridges were evaluated for New Jersey Historic Bridge Survey (A.G. Lichtenstein & Associates, Inc. 1994), including the Doty Road Bridge. The variety of bridges in Bergen County reflects the area's transformation from a "rural colonial settlement to a major metropolitan suburb" (A.G. Lichtenstein & Associates, Inc. I994:BER-1).

Situated in the northeast corner of New Jersey, Bergen County is bordered by the Hudson River to the east, New York State to the north, the Passaic River to the west, and Hudson County, New Jersey, to the south. Originally, the county was larger encompassing portions of what are now Essex and Hudson counties. The county was settled by the Dutch in the early seventeenth century (1610s) with Dutch land grants lying along the Hackensack, Passaic, and Saddle rivers, the natural transportation networks within the area. Hostilities between the native Lenni Lenape (or Minisink Delaware) Indians and the Dutch precluded the establishment of permanent communities until after 1664. The English seized New Netherland from the Dutch that year and in 1666 signed a peace treaty with the Indians that in turn opened Bergen County to settlement (Goddard 1978; Pomfret 1964:8).

In 1695, Major Anthony Brockholst and Captain Arent Schuyler purchased approximately 5,500 acres of land in the Pompton valley area of Bergen County from the Indians. Although the exact boundaries are unknown it is believed that this land included parts of what is now the Borough of Oakland (Kraft 1976). In addition, parts of the Borough of Oakland were included in the Ryerson and Westervelt purchases of 1709 and the Willocks and Johnson Patent in the early-1700s (Kraft 1976). By the early eighteenth century permanent settlers had moved into the valley that was known as "The Ponds." The term "ponds" is derived from the Dutch word *de panne* or *panne*, which means small bodies of water, and refers to the numerous bodies of water found in the area. By 1790 there were ten families living in "the Ponds" area (Kraft 1976). Like many other settlements in Bergen County, "the Ponds" relied on water, in this case the Ramapo River, for its major transportation network.

During the colonial period Bergen County's transportation needs were generally satisfied by its many navigable rivers, although roads were required to move goods from the water inland. The earliest and most significant roads connected interior Bergen County to ferries that crossed the Hudson River to New York City. By the eighteenth century numerous ferries connecting Manhattan with Bergen County had been built with private financing from New York City merchants. In the eastern part of the county, roads tended to run north-south converging at ferries at the Hackensack and Hudson rivers. In the western part of the county, where the Borough of Oakland is located, important roads paralleled the Saddle and Ramapo rivers, thereby opening the area to increased settlement during the eighteenth century (A.G. Lichtenstein & Associates, Inc. 1994).

The Ramapo River valley is the dominate feature of the Oakland landscape. Heavily-traveled Ramapo Valley Road (Route 202), built prior the American Revolution,

remains the only north-south thoroughfare through the borough. Doty Road, in switch-back fashion, feeds off the Valley Road crossing the Ramapo River.

The construction, management, and repair of the county's roads and bridges were handled by local officials. In 1761 the minutes of the Bergen County Board of Justices and Freeholders mentions raising funds exclusively for bridge support. From 1761 to 1795 over 20 different bridges are mention by name in the minutes. Most of the county's early bridges were timber stringers on braced beam timber bents with hand rails, but there were also as many as six drawbridges in the county. The drawbridges were operated by rope or chain raising mechanisms and sometimes had fixed end weights to facilitate raising. The preferred materials for drawbridges were white oak or pitched pine (A.G. Lichtenstein & Associates, Inc. 1994).

Despite the rudimentary network of roads crossing Bergen County by the end of the Colonial period, it was not until the advent of New Jersey's "Turnpike Era" (1801-1820) that road improvements began to expand Bergen's system. Hackensack, already the commercial center of Bergen County, became its transportation center in the nineteenth century with three of the county's five major turnpikes terminating in that city. However, turnpikes required large capitalization and upkeep, and quickly began to face competition from canals and railroads. Interest in turnpikes declined in the mid-nineteenth century in part due to the huge success of the railroads.

Between 1830 and 1880 seven different railroad companies established lines in Bergen County, making it one of the most densely developed counties in the state (A.G. Lichtenstein & Associates, Inc. 1994). By 1847 the Ramapo River region was connected to New York City by the Paterson-Ramapo Railroad with connections to the New York & Erie Railroad at Piermont, New York. When the New Jersey Midland Railroad was built in 1869 it had a depot in Brushville, later called Oakland. The importance of Bergen County's many railroads was verified as a result of the New York & Erie's decision to lease the Patterson-Ramapo line to complete its connection to Buffalo, New York (A.G. Lichtenstein & Associates, Inc. 1994).

The development of the railroads was a major factor in the expansion of truck farming in northeast New Jersey (A.G. Lichtenstein & Associates, Inc. 1994). Until well into the twentieth century much of Oakland remained a collection of farmsteads (Brown and Garbe 1983). Families of primarily Dutch ancestry had established and maintained farms and related industries such as grist mills, saw mills, and wool carding mills. These sleepy little farms became thriving enterprises as the demand for fresh fruits and vegetables from New Jersey's industrial cities and New York City escalated. More important, the railroads were responsible for establishing numerous residential

communities and resorts that grew up in the vicinity of the tracks. By 1890 Bergen County railroads were carrying well over 7 million passengers a year, mostly male commuters to jobs in New York City (A.G. Lichtenstein & Associates, Inc. 1994). These same railroads carried weary urbanites into the vacation pleasures of the green New Jersey countryside or the sandy boardwalks of New Jersey's Atlantic seaboard.

Even as the transportation network expanded, sectional disagreements over financing, maintaining, and repairing the roads and bridges became a central feature of northeastern New Jersey politics. In 1889 Bergen County Freeholders assumed full responsibility for all county roads and bridges from the townships in order to gain greater control over county funds for highway and bridge improvements within their own communities. Bitter political warfare erupted between the eastern suburbs and the rural western areas, but by the mid-1890s this warfare cooled and a sense of cooperation emerged. Although this period was heralded as "Bergen's new era of good roads," the county only had 40 miles of macadam road in 1907 (A.G. Lichtenstein & Associates, Inc. 1994:BER-4).

Western Bergen County had supported small water-driven industries such as grist and wool carding mills almost from the outset. At the turn of the nineteenth century, these small water-powered industries boomed. In 1890 the Anglo-American Gunpowder Company opened in Oakland, and was joined shortly thereafter by the Wilkens Brush Factory in 1894. The Kanouse bottling plant opened in 1904 (Brown and Garbe 1983). By the late-1920s water power had been supplanted by electricity, and "the Ponds'" water-powered manufacturing companies closed.

As the factories closed, a new "industry" began to flourish along the banks of the crystal clear Ramapo River—tourism. Oakland took on the character of a summer resort as numerous swimming and recreational areas developed along the Ramapo. These summer communities, with such names as Sandy Beach and Pleasureland, drew throngs of New Jersey and New York vacationers, who could catch a train in their grimy industrial cities and, in just a few hours, be enjoying the delights of rural New Jersey. Even the literati of New York City were attracted to the pristine river and beautiful vistas. During the 1930s a group of New York writers and actors regularly retreated to the Oakland area (Brown and Garbe 1983). As the rural character of the area slowly changed, so to did its appeal as a vacation spot.

Like other New Jersey counties, Bergen's Freeholders supervised all bridge and road projects through standing committees until 1907 (A.G. Lichtenstein & Associates, Inc. 1994). When professional advice was needed they hired a consulting engineer, but by 1907 work had expanded to the point where the Freeholders hired a full-time

county engineer. The county engineer was responsible for the design of roads, bridges, storm sewers and drains; the preparation of specifications, bids, and plans for county projects; and the submission of detailed and itemized completion reports at the conclusion of each project. By 1911, state law required all counties to have a county engineer (A.G. Lichtenstein & Associates, Inc. 1994).

After the creation of the county engineer's office, efforts to improve and upgrade Bergen County's roads and bridges intensified. By the late 1930s Bergen County was taking advantage of Depression-era state and federal government funding for work projects, which increased the number of transportation projects undertaken. The county also benefitted from the larger bi-state construction projects, including the building of the Holland Tunnel (1920-1927), the George Washington Bridge (1927-1931), and the Lincoln Tunnel (1934-1945). These major river-crossing projects provided unparalleled access into Bergen County. From 1927 to 1933, the New Jersey State Highway Department spent over $40 million within a ten-mile radius of the George Washington Bridge, making intricate highway connections to all New Jersey and New York points (A.G. Lichtenstein & Associates, Inc. 1994). Bergen County's transportation network was greatly impacted by the construction of the George Washington Bridge.

By the end of World War II, Bergen County had an integrated system of state highways in place. This system not only promoted the post-war suburban boom but also put tremendous stresses on pre-war highways. During the 1950s, this system was once again expanded and now followed by the development of shopping malls, corporate office parks, and high-rise office buildings. The expansion of suburbia radically changed to county's landscape. Remnants of the county's agricultural past still can be glimpsed in the former dairy barn converted into a furniture store or the occasional ground nursery, a small piece of solitude in the rush of buildings and traffic.

3. **Architectural/Engineering:** Part of the history of bridge building is the chronicle of technological construction advances and achievements. This section discusses the evolution of the truss bridge, particularly the Pratt pony truss, and its role in New Jersey's transportation history.

The application of the truss to the construction of long-span bridges ca. 1800 ushered in the modern era of bridge technology in the United States. The use of the truss in building construction has a long history, but until that time bridge construction was limited to stone arches or wood beams (A.G. Lichtenstein & Associates, Inc. 1994). Wood truss bridges were the predominant type of construction until the frenetic growth in railroad building in the 1840s and 1850s. To accommodate the increased

size and weight of locomotives and rolling stock, engineers introduced metal into truss bridges, particularly wrought and cast iron for compression and tension members. By the third quarter of the nineteenth century, metal truss bridges had moved from the rails to the highway (A.G. Lichtenstein & Associates, Inc. 1994).

The principal feature of the truss is its dependency upon the triangle as its basic structural shape. The triangle is exceptionally stable and requires no external backing to hold its shape. Further, it could be used in various combinations to produce many types and sizes of trusses. The truss resisted loads by acting like a hollow beam. The top chord was in compression and the bottom in tension with diagonal and vertical members joined at the top and bottom chords acting as either tension or compression (University of Alabama 1998).

Initially, trusses were very simple, such as the Kingpost, which was common in roofing systems. From 1810 to 1840—the Golden Age of Trusses—a significant number of new trusses with varying complexities were introduced (University of Alabama 1998). Moreover, the mid-nineteenth century was a period of great experimentation in truss design and included the creation of the Howe truss (1840), the Bowstring Arch (1840), the Bollman (1852) and the Fink (1851). The most common type of truss configuration by this time was the Howe, which was invented by William Howe. However, it was soon surpassed in popularity by the Pratt truss, patented in 1844 by William and Caleb Pratt.

The Pratt truss was originally used for wood compression members and iron tension members. It was extremely easy and practical to build, which meant its construction costs were sufficiently small to make it attractive to bridge builders. The Pratt truss used I-bars to facilitate field connections and provided a stiff truss, an important factor in load-bearing capacities. The famous bridge designer and writer J.A.L. Waddell estimated in 1916 that the Pratt was the most commonly used truss for spans of less than 250 feet (University of Alabama 1998). One of the reasons for its common usage was that it was routinely recommended as the most economical truss type for spans up to 150 to 200 feet (Merriman 1948:1233). Despite its widespread use and economy, the Pratt was soon eclipsed by another truss type, the Warren truss, in the twentieth century.

The Warren truss was patented in 1848 by British engineers James Warren and Willoughby Monzani. This truss is famous for its simplicity, ease of construction (due to its equal-sized members), and the ability of some of the diagonals to reverse stresses. Its capacity could be increased easily with the addition of a second set of diagonals (known as a double intersection Warren truss), and it could be stiffened

with the addition of verticals (A.G. Lichtenstein & Associates, Inc. 1994). During the mid-nineteenth century, improvements in the fields of metallurgy and pneumatic riveting led to a transition from pinned to riveted connections. The adoption of riveted connections resulted in a rapid shift from the Pratt to the Warren truss by the early-twentieth century. As a result, construction of Warren truss bridges became extremely widespread throughout the United States and bridges of this type can be found in almost every state (A.G. Lichtenstein & Associates, Inc. 1994).

Pony truss bridges have shallow truss depths for shorter spans and, therefore, have no upper bracing between the chords. This type of bridge was also quite common by the end of the nineteenth century. The standardization of truss members in addition to the proliferation of bridge fabricating companies throughout the United States made these bridges readily available. These trends combined with the bridge literature of the time helped to make the Pony truss a prevalent bridge type. The survey of New Jersey's historic bridges inventoried 142 Pony truss bridges during its preparation (A.G. Lichtenstein & Associates, Inc. 1994).

During the mid-to-late nineteenth century, bridge safety became a paramount issue in the minds of bridge designers as well as the owners and stockholders of railroad lines. For years, railroad magnates and their allies in the bridge-building business had wanted the least expensive bridges possible; sacrificing bridge safety at the altar of profit. The fruition of this policy was the collapse of 40 bridges per year between 1870 and 1880 (Jacobs and Neville 1968). The spectacular collapse of the Ashtabula Bridge in 1876, one of the worst railroad disasters of the nineteenth century, which resulted in 80 fatalities shook the general public's confidence in the ability of the railroads to move patrons safely. In spite of instituted reforms, more than 200 bridges collapsed in the decade following Ashtabula (Jacobs and Neville 1968).

As expected, iron bridges began to replace wooden ones, but iron had a number of inherent problems that were not well understood at the time—iron rusts and decays. Further, the pin-connected joints traditionally used on iron bridges could be dangerously weakened when they rusted in their sockets (Jacobs and Neville 1968). Thus, even well designed and constructed bridges could weaken and fail because of faulty pin connections. A new material was required to transform bridge building; and that new material was steel. By the end of the nineteenth century, steel could be made cheaply in the United States using the Bessemer process, which was easily adapted to the type of iron ore most common in this country.

Steel also rusted, but builders discovered that riveted joints were more rigid and resistant than the tradition pin connections. Like the iron trusses of earlier bridges,

steel trusses could be prefabricated and shipped all over the country. Steel was cheap, flexible, moldable and readily available, especially in Pennsylvania where companies like Phoenix Bridge were actually part of large iron-making organizations.

Construction of steel truss bridges peaked during the first two decades of the twentieth century. Their decline in popularity was precipitated by the rise of newer technological advances, particularly steel stringers, steel girders, and reinforced concrete spans. These new technologies proved more cost-efficient since they required less maintenance (A.G. Lichtenstein & Associates, Inc. 1994).

New Jersey possesses "an exceptionally rich and well preserved assemblage of nineteenth century metal truss bridges. Over 50 thru, or high, truss bridges and 142 pony, or low, truss spans were identified. ... Of that total 100 or about 50% are Pratt designs, or a variation of the Pratt truss" (A.G. Lichtenstein & Associates, Inc. 1994:47).

## PART II. ARCHITECTURAL/ENGINEERING INFORMATION

### A. General Statement:

Doty Road Bridge (NJDOT SI&A 020042A) is located in Oakland Borough, Bergen County, New Jersey, and spans the Ramapo River in an area known as "the Ponds." Erected in 1891, it is a single-span Pratt pony truss bridge. Only 80 feet long, the bridge comprises five panels with the upper chord consisting of Phoenix Columns that are clearly marked as such. Doty Road Bridge is a single lane bridge in very poor condition. It was condemned in 1983, and a Bailey bridge, inserted through the middle of it in 1984, actually carries the current traffic.

### B. Description:

#### 1. Overall Doty Road Bridge Dimensions:

| | |
|---|---|
| Total length of span: | 80 ft |
| Length of span over Ramapo River: | 74.6 ft |
| Width (center to center truss): | 16.2 ft |
| Height of truss (between upper & lower chords): | 6.5 ft |
| Phoenix Column size: | B2 (5-15/16 in) |
| Number of spans: | 1 |
| Number of spans over flood plain: | 1 |

2. **Architectural/Engineering Description:** As noted, Doty Road Bridge is a single-span, single lane Pratt pony truss bridge consisting of five panels with the upper chord incorporating Phoenix Columns. The Phoenix Columns themselves are made of four sections that are flanged and riveted in typical fashion. They appear to be B2 size columns (5-15/16 inches) as illustrated in a company advertisement. The various faces of the columns are stamped with the inscription: "Phoenix Iron Co./Phila PA."

Thomas Winpenny noted in his monograph on the Phoenix Bridge Company that almost every Phoenix bridge could be found in its various illustrated catalogs (Winpenny 1996). Although his text is illustrated with a number of bridges from the company's publications, a depiction of a five panel, low (Pony) Pratt truss was not among them. One illustration of a four panel truss shows a railroad bridge, but this type of bridge was readily adaptable to highway traffic. The primary difference between Doty Road Bridge and the illustrated four-panel truss bridge is that the Doty Road Bridge has crossed diagonal 1-inch tie rods only within the center panel and one 1-inch diagonal tie rod within the panels to the left and right of center and the illustrated bridge has two panels with crossed diagonal tie rods and no panels with only one diagonal tie rods.

These panel sections were sent to the job site with all the riveting work completed. All the field crew had to do was pin the bridge together. Riveting in the field was slow, exacting, and costly; not appealing to money-conscious purchasers. The Phoenix Bridge Company guaranteed assembly without "fitting, chipping or filing," so that all that was needed in the field were pins (Winpenny 1996:22). Doty Road Bridge is pinned (with 2-inch pins) in typical Phoenix fashion.

The original bridge deck rested on I-beam stringers that were replaced in 1940 in an attempt to increase the load capacity of the bridge (Bergen County Engineer's Office 1940). At about the same time, the wooden deck (possibly original) and the hand and guard rails were replaced as well. Because of the height of the new stringers, the road bed had to elevated and resurfaced. The stringers which were put in place in 1940 have now deteriorated in an alarming fashion. This deterioration led to the bridge's closing in 1983 and the insertion of the Bailey bridge in 1984. The floor beams, which appear to be original, are not as badly deteriorated. At some point outriggers carrying 20-inch water and gas lines were welded to either side of the bridge.

The entire bridge rests on stone abutments. The stone abutments and wingwalls are laid in rubble courses and appear to be original, but have been reface with concrete. Despite the absence of prototype blueprints and the vagueness of the Bergen County Freeholder's minutes, it does not seem unreasonable to assume that the stone was

locally gathered or quarried. Since the area has an abundance of sandstone it would be economically feasible and desirable to do so.

Like the many of the Phoenix bridges, Doty Road Bridge has no decorative components. The pin connections are plain and appear to have never had finials. The only real "decorations" on the bridge were the plaques that have now disappeared.

## PART III. SOURCES OF INFORMATION

### A. Architectural Drawings:

No original extant drawings exist for Doty Road Bridge and it is unlikely that any drawings of it exist in the Phoenix Bridge Company files, located at the Hagley Museum and Library, Greenville, Delaware, since individual bridge drawings were not prepared for Phoenix bridges until the 1920s (Christopher Baer, personal communication 1999). However, five historic drawings are on file at the Bergen County Engineer's Office, Hackensack, New Jersey, and have been submitted with this report. The drawings are: *Doty Bridge over Ramapo River in Oakland Repairs to Abutments & Wings*, Plan 42-B-8-1, dated January 19, 1937; *Doty Bridge over Ramapo River Proposed Strengthening for H-10 Loading*, Plan 42-B-2-1, dated August 1940; *Inspection and Rating of Existing Bridge Structure No. 42-A Doty Road over Ramapo River*, dated May 1980; *Location Plan of Doty Bridge, Oakland, N.J.*, Plan 42-B-1, no date; *Proposed 5' Steel Deck on Doty Road Bridge over Ramapo River*, Plan 42-B-20-1, no date.

### B. Early Views:

No early, pre-1980 views of the bridge have been located. The earliest view of the bridge dates to the early-1980s prior to the insertion of the Bailey bridge. A black-and-white reproduction of this color photograph has been submitted as part of the bridge documentation. The original photograph is on file at the New Jersey HPO, Trenton.

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## D. Likely Sources Not Yet Investigated:

The traditional sources of historical information (local libraries, local informants, local newspapers, local governmental agencies) have been investigated with the exception of the Oakland Historical Society, which meets irregularity and is difficult to contact. In addition, Hagley Museum and Library Archivist Christopher Baer stated that original drawings for the bridge were not likely to exist in the Phoenix Bridge Company files, located at the facility (personal communication 1999). Perhaps state college and university libraries, such as Rutgers University, the Oakland Historical Society, or the State Library at Trenton would have early photographs of Doty Road Bridge.

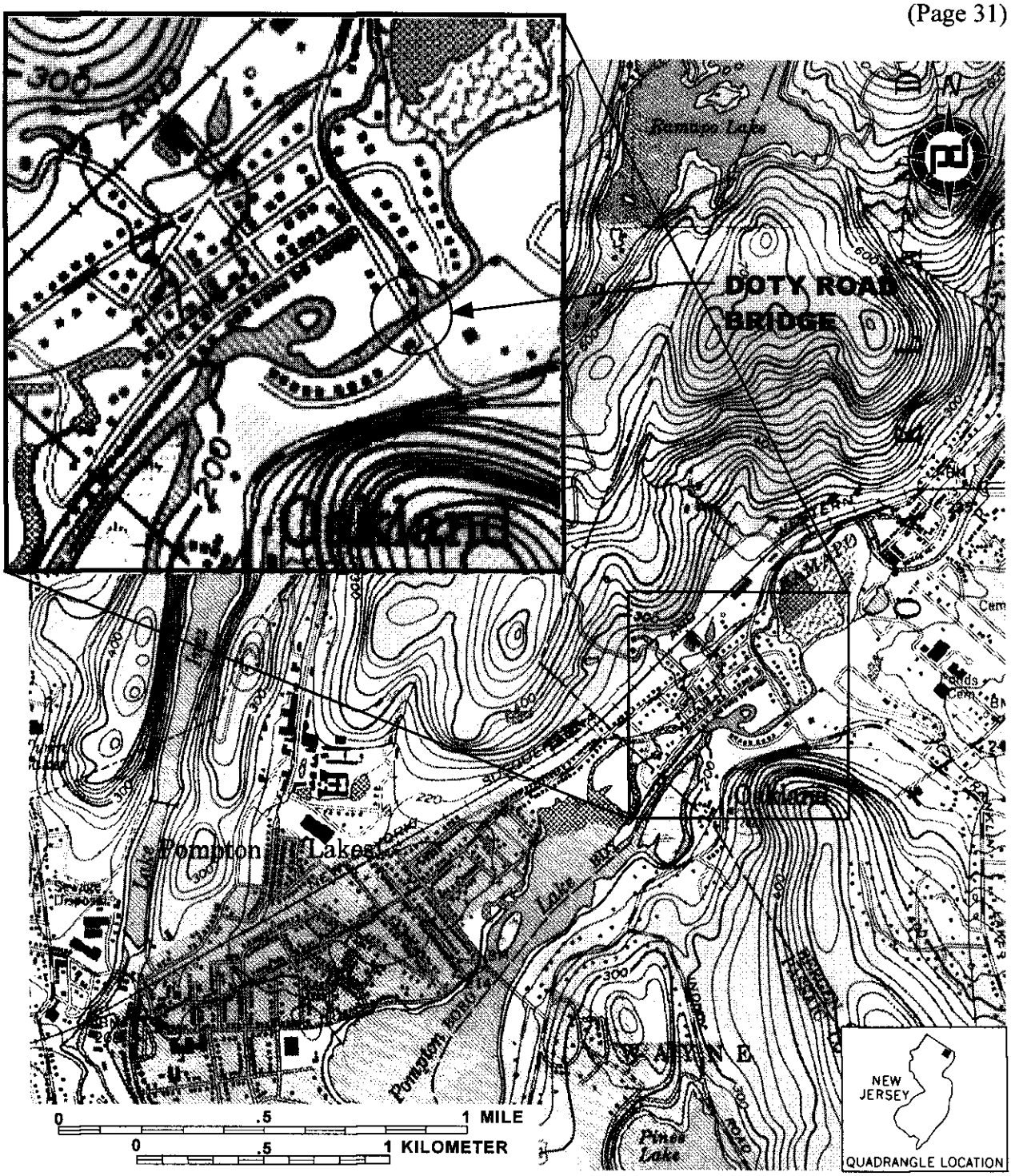
## E. Project Credits:

This project was completed for USACE, New York District by PCI under contract to Northern Ecological Associates, Inc. The cultural resources mitigation of Doty Road Bridge (SI&A 020042A), Oakland, Bergen County, New Jersey, was conducted as part of activities

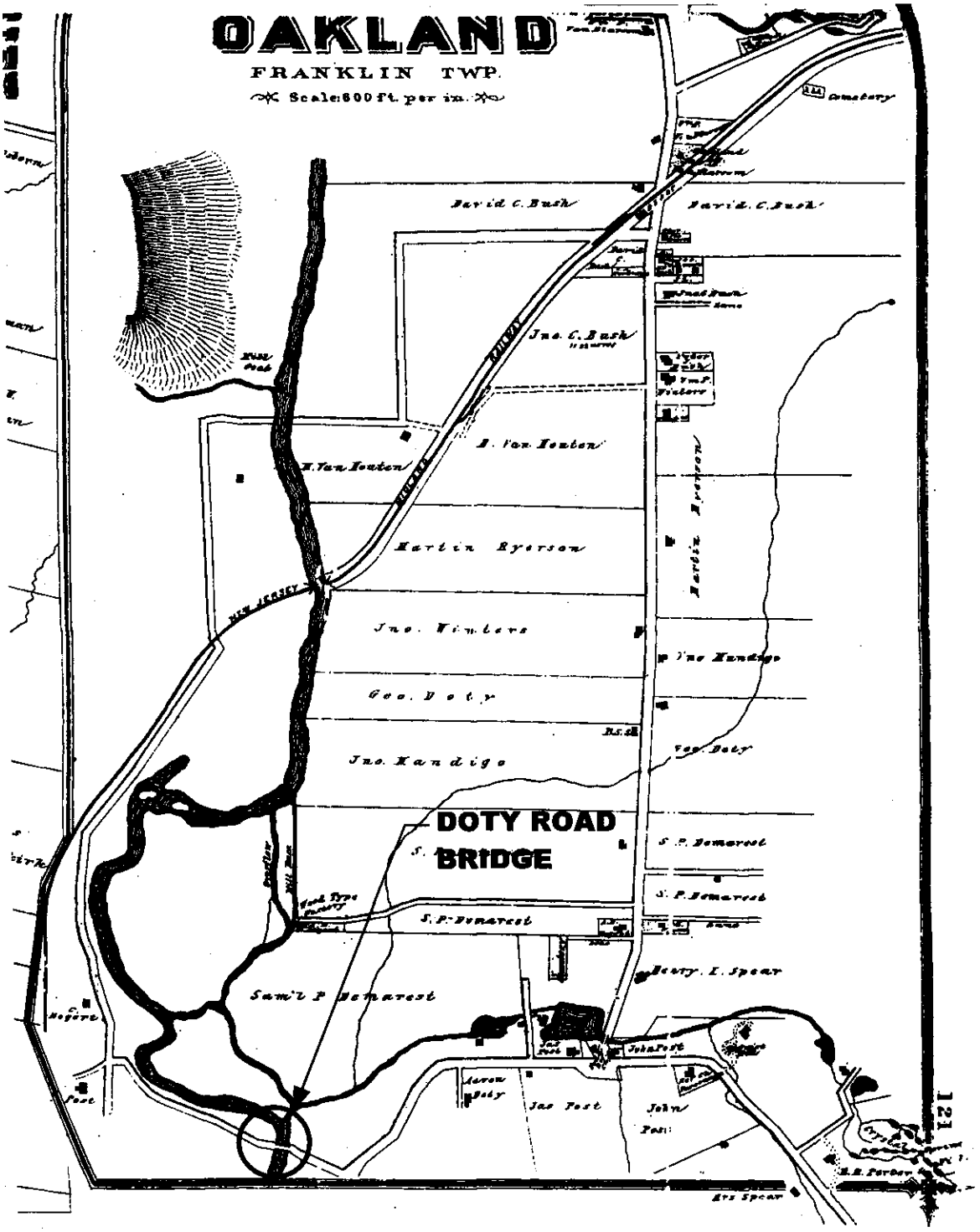
associated with USACE's flood control project on the Ramapo River. The bridge was recorded and documented by Ms. Kelly Nolte, Architectural Historian, and Mr. Mark Drumlevitch, Photographer, between May 10 and May 15, 1999. Ms. Nolte directed the field investigation and wrote the majority of this report. Mr. Drumlevitch was responsible for the large format photography. Mr. Mark A. Steinback prepared the historical section, edited the document, and supervised its preparation. Dr. Michael A. Cinquino, Director of PCI's Buffalo Office, served as Project Director.

Research on the bridge's history was conducted at the following locations: New Jersey HPO, Trenton; Oakland Borough Hall, Oakland, NJ; Cultural Resources Division, Bergen County, Hackensack, NJ; Bergen County Engineer's Office, Hackensack, NJ; Hackensack Free Library, Hackensack, NJ; and the Oakland Public Library, Oakland, NJ. In addition, the Hagley Museum and Library, Greenville, DE, the depository for the Phoenix Bridge Company's archives, was consulted.

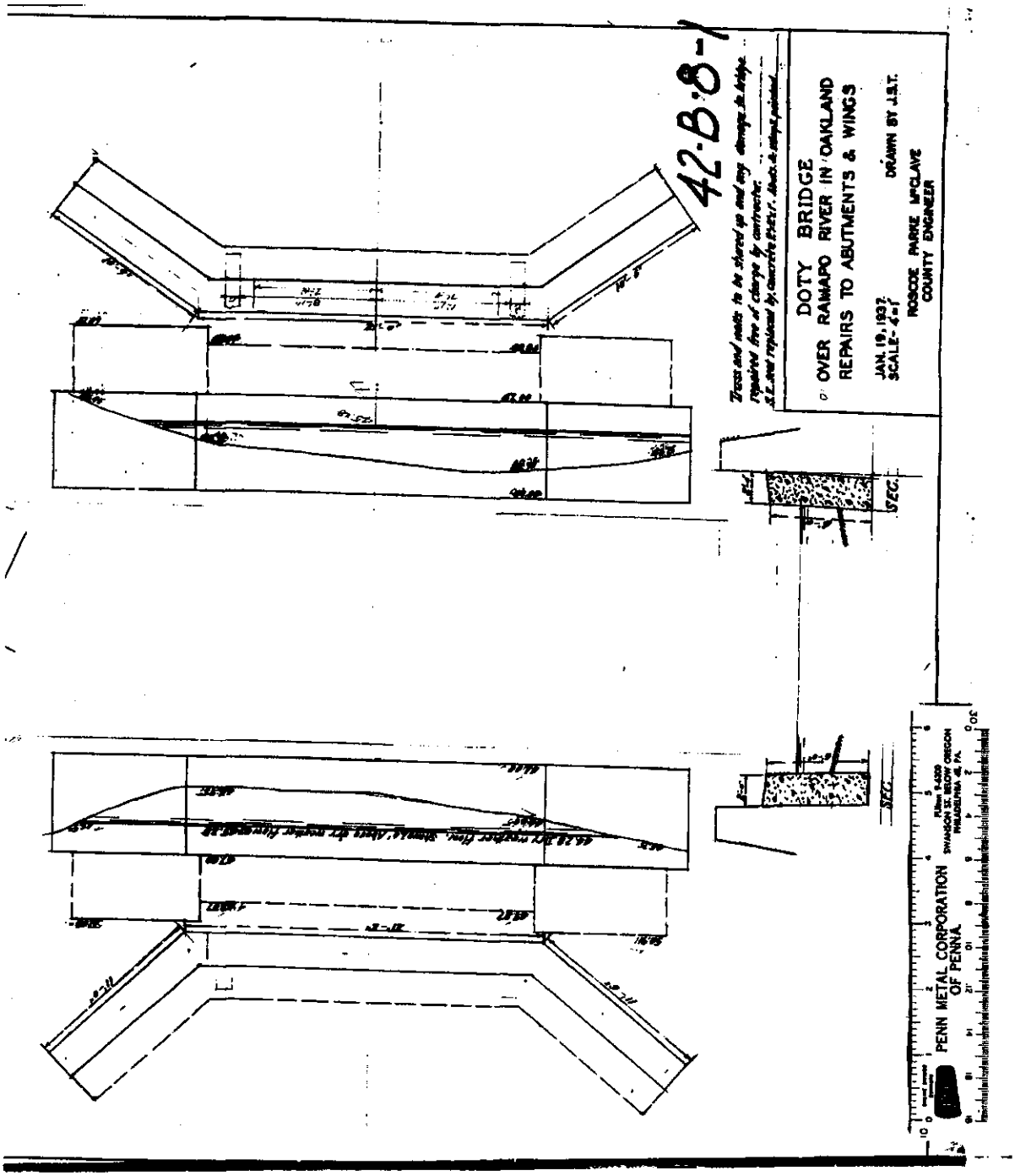
This recordation could not have been completed without the assistance of a number of individuals including: Ms. Lynn Rakos, Archaeologist, USACE, New York District; Ms. Andrea Tingey, Bridge Specialist, New Jersey HPO; Mr. Edward Ranuska, Bergen County Engineer; Ms. Pat Garbe Morille, Ms. Janet Stron, and Mr. Schuyler Warmflash, Bergen County Historic Resources; the staff of the Oakland Borough Hall; the librarians and staff at the Hackensack Free Library and the Oakland Library; and Mr. Christopher Baer, Archivist, Hagley Library.



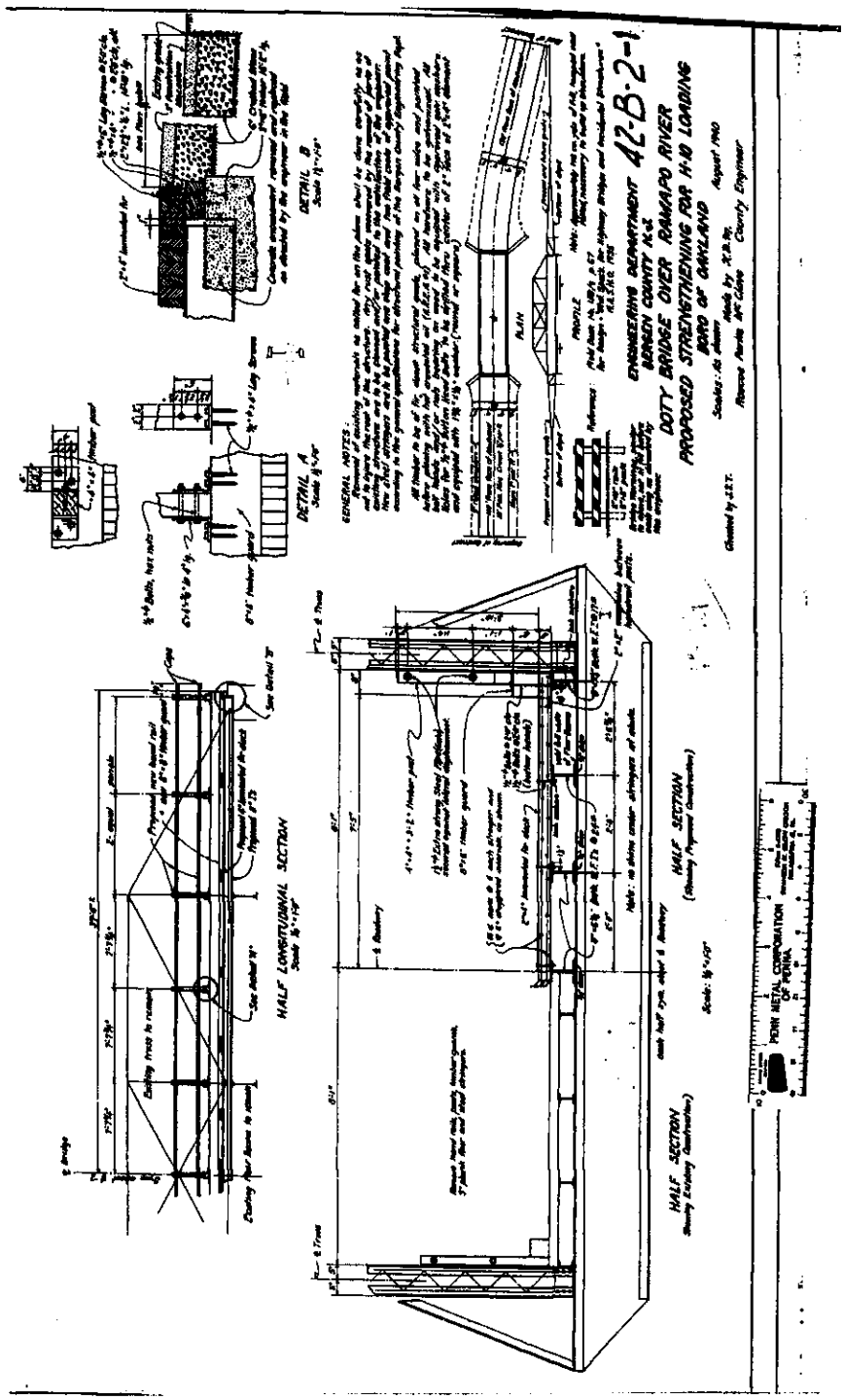

Location of the Doty Road Bridge (HAER No. NJ-93), spanning the Ramapo River, Bergen County, New Jersey as depicted on the 1955 USGS Wanaque, New Jersey, 7.5 minute topographic quadrangle, photorevised 1971.



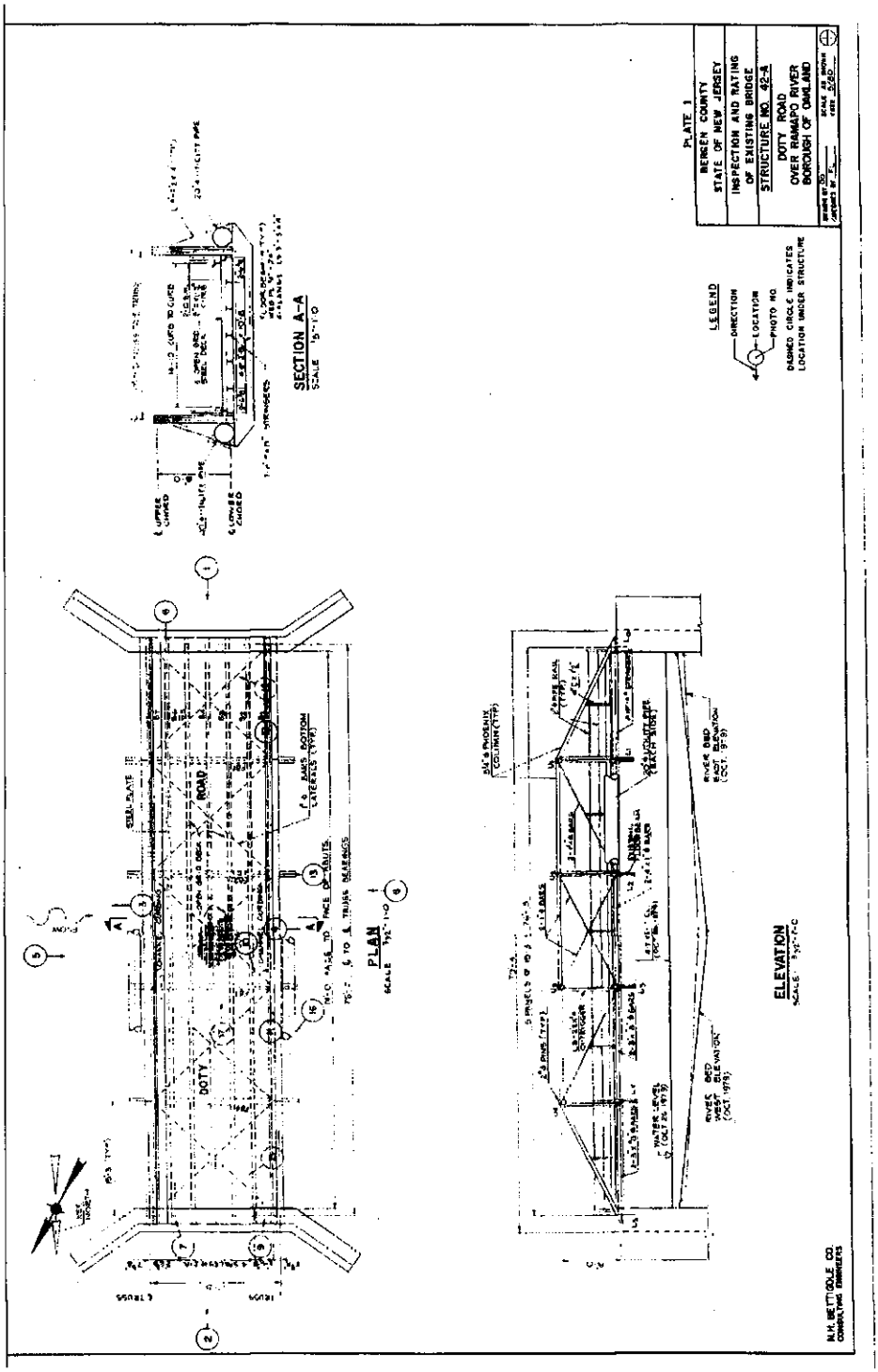

Map of Borough of Oakland from *Atlas of Bergen County New Jersey 1776-1867* (Walker 1876:121).



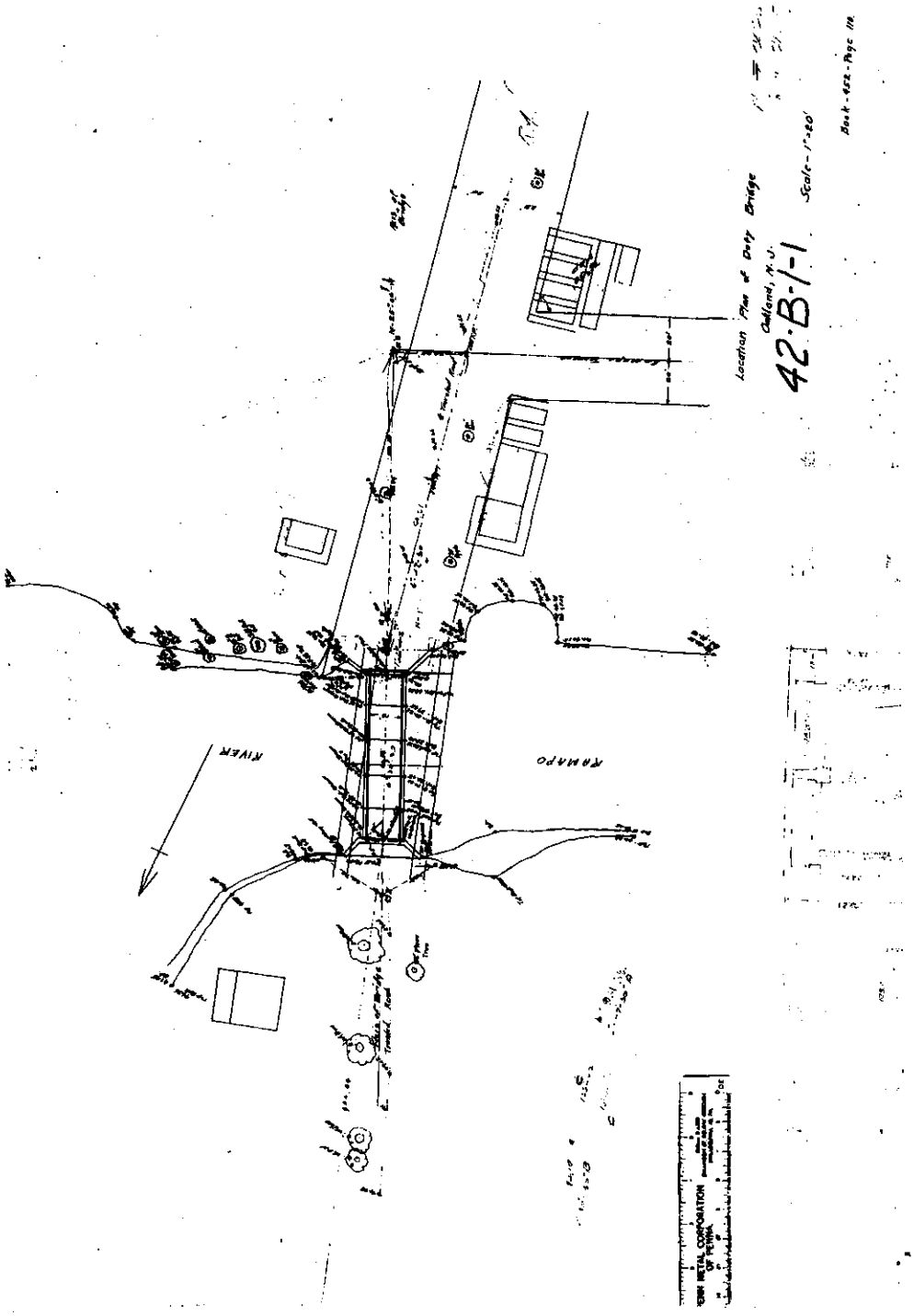

*Doty Bridge Over Ramapo River in Oakland, Repairs to Abutments & Wings.* Blueprint Plan 42-B-8-1, dated January 19, 1937. Roscoe Parke McClave, Bergen County Engineer, Bergen County, NJ (Bergen County Engineer's Office, Hackensack, NJ). Reprinted with permission and may be reproduced.



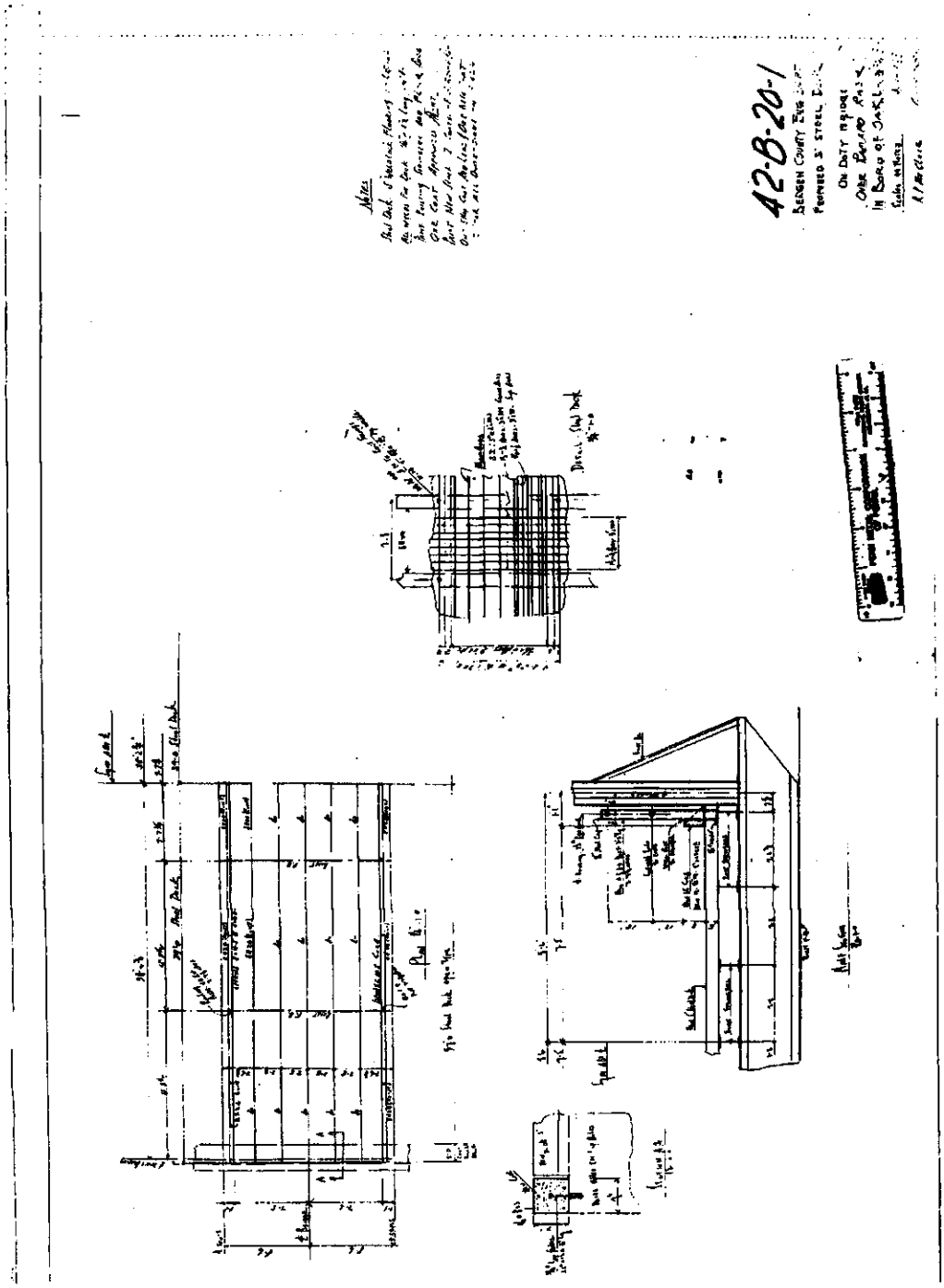

*Doty Bridge over Ramapo River, Proposed Strengthening for H-10 Loading.* Blueprint Plan 42-B-2-1, dated August 1940. Roscoe Parke McClave, Bergen County Engineer, Bergen County, NJ (Bergen County Engineer's Office, Hackensack, NJ). Reprinted with permission and may be reproduced.




*Inspection and Rating of Existing Bridge, Structure No. 42-A, Doty Road over Ramapo River, Borough of Oakland.* Blueprint, dated May 1980. N.H. Bettigole Co., Consulting Engineers, n.p (Bergen County Engineer's Office, Hackensack, NJ). Reprinted with permission and may be reproduced.

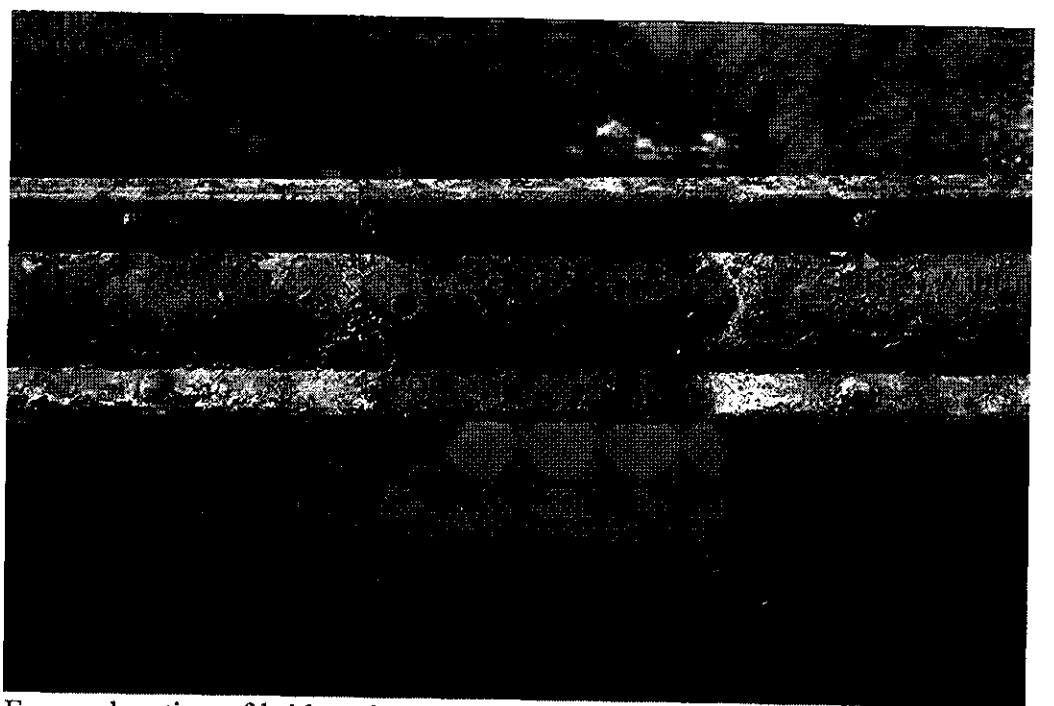



*ILocation Plan of Doty Bridge, Oakland, NJ.* Blueprint Plan 42-B-1-1, no date. No architect or engineer listed (Bergen County Engineer's Office, Hackensack, NJ). Reprinted with permission and may be reproduced.




*Proposed 5' Steel Deck on Doty Bridge over Ramapo River.* Blueprint Plan 42-B-20-1, no date. Roscoe Parke McClave, Bergen County Engineer, Hackensack, NJ (Bergen County Engineer's Office, Hackensack, NJ). Reprinted with permission and may be reproduced.

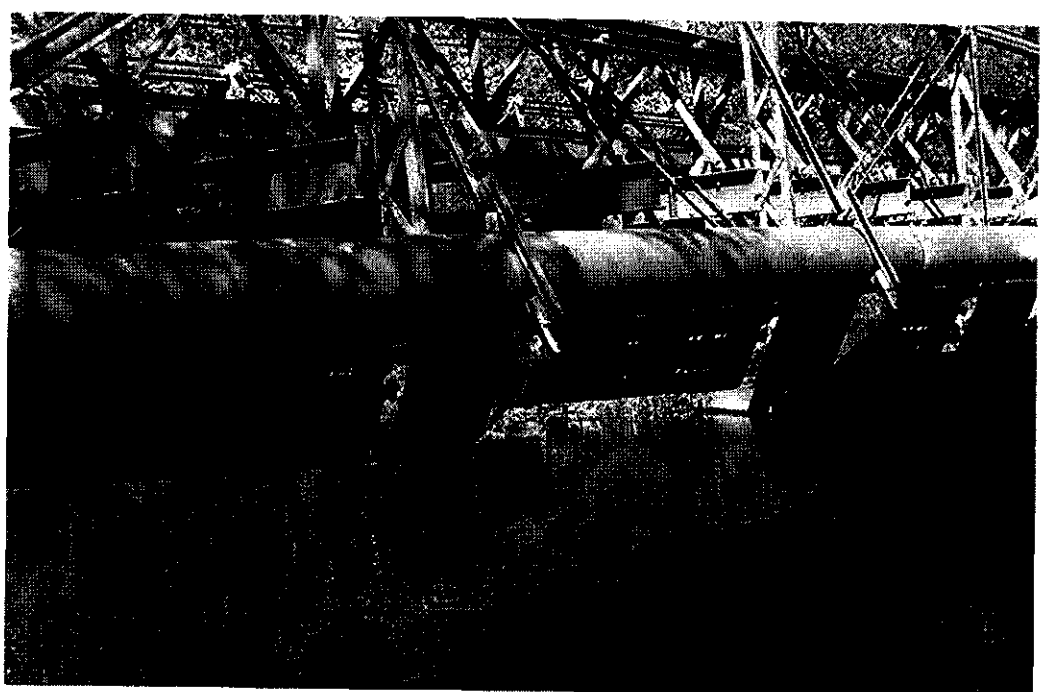
Phoenix Iron Co. inscription on Phoenix Column, west side upper chord, Doty Road Bridge, facing southwest (Nolte, PCI 1999).



Former location of bridge plaque on the upper east chord, Doty Road Bridge, facing northeast (Nolte, PCI 1999).

Former location of bridge plaque on the upper west chord, Doty Road Bridge, facing southwest (Nolte, PCI 1999).

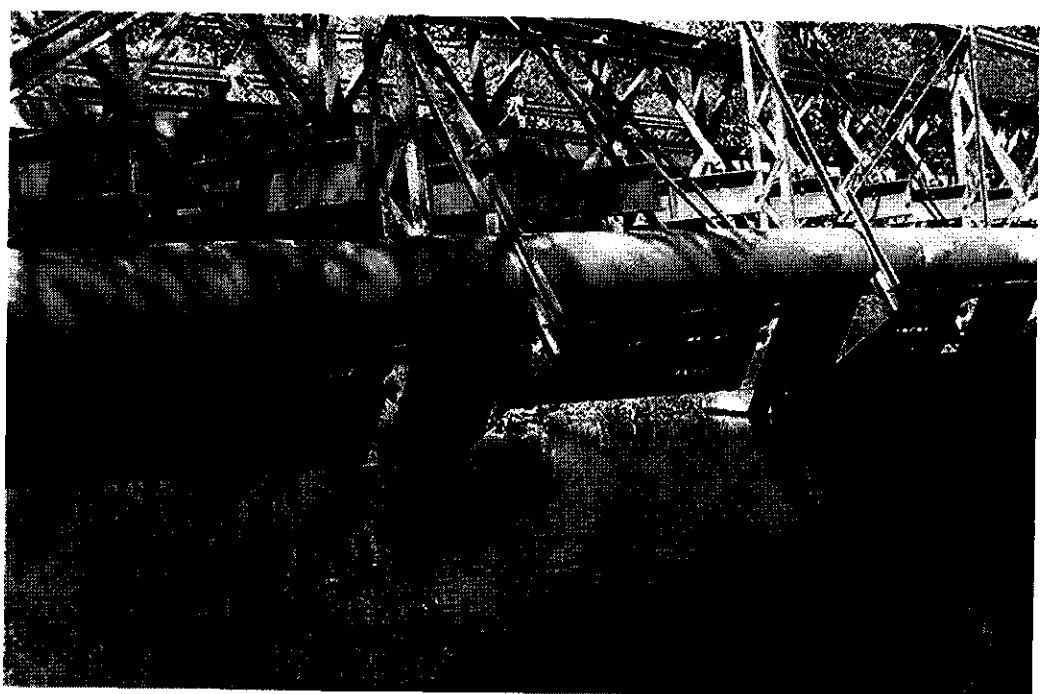
Stone wingwall with concrete facing, southeast abutment, Doty Road Bridge, facing southwest (Nolte, PCI 1999).



Outrigger with 20" utility pipe, east side, Doty Road Bridge, facing west (Nolte, PCI 1999).

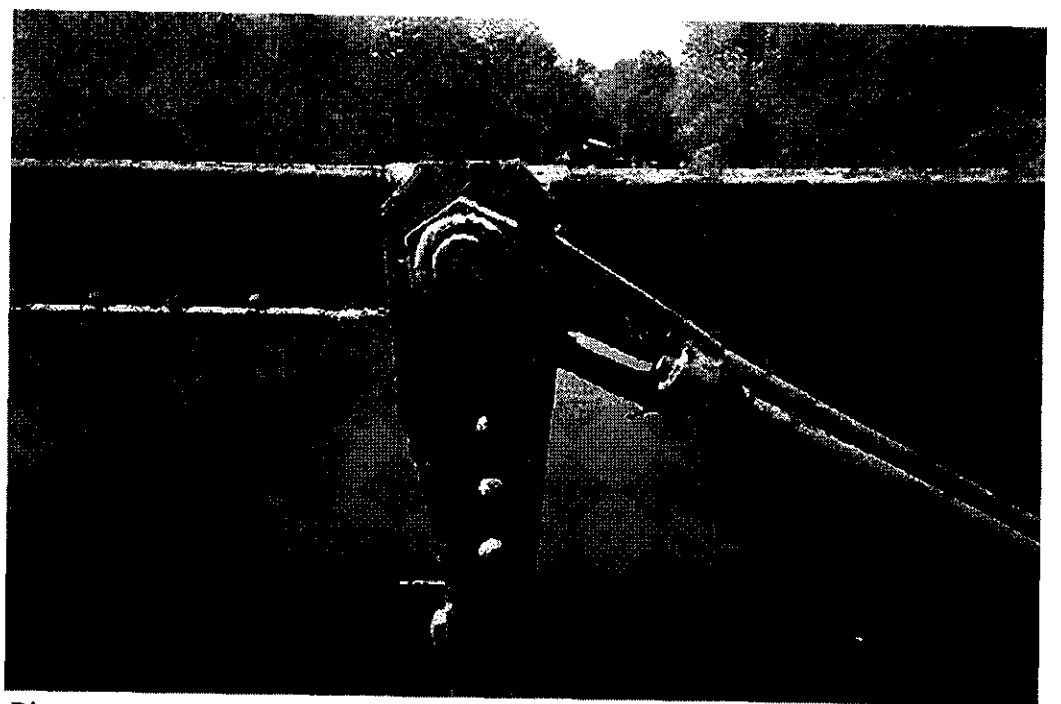
Bailey Bridge through Doty Road Bridge, facing northwest (Nolte, PCI 1999).

Flange on Phoenix Column, upper chord, north end, west side, Doty Road Bridge (Nolte, PCI 1999).



Tie bar connections pinned at floor beam, west side, Doty Road Bridge (Nolte, PCI 1999).

Pin connections to sway beam, west side, upper chord, Doty Road Bridge, facing northwest (Nolte, PCI 1999).



Pin connection detail on west side, upper chord, Doty Road Bridge, facing southwest (Nolte, PCI 1999).