NPS Form 10-900
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**United States Department of the Interior**
**National Park Service**

# National Register of Historic Places Inventory—Nomination Form

For NPS use only
received JUL 3
date entered AUG 21 1986

See instructions in *How to Complete National Register Forms*
Type all entries—complete applicable sections

## 1. Name

historic RAPALLO VIADUCT

and/or common RAPALLO VIADUCT

## 2. Location

street & number Flat Brook and former Air Line Railroad Right-of Way N/A not for publication

city, town East Hampton X vicinity of Flat Brook Road

state Connecticut code 09 county Middlesex code 007

## 3. Classification

| Category | Ownership | Status | Present Use | |
|---|---|---|---|---|
| ___ district | X public | ___ occupied | ___ agriculture | ___ museum |
| ___ building(s) | ___ private | X unoccupied | ___ commercial | ___ park |
| X structure | ___ both | ___ work in progress | ___ educational | ___ private residence |
| ___ site | **Public Acquisition** | **Accessible** | ___ entertainment | ___ religious |
| ___ object | ___ in process | ___ yes: restricted | ___ government | ___ scientific |
| | ___ being considered | X yes: unrestricted | ___ industrial | ___ transportation |
| | N/A | ___ no | ___ military | X other: None: Not in Use |

## 4. Owner of Property

name Connecticut Department of Transportation

street & number 24 Wolcott Hill Road

city, town Wethersfield N/A vicinity of state Connecticut

## 5. Location of Legal Description

courthouse, registry of deeds, etc. East Hampton Town Clerk

street & number Town Hall, 20 East High St.

city, town East Hampton state Connecticut

## 6. Representation in Existing Surveys

title State Register of Historic Places has this property been determined eligible? X yes ___ no

date 1986 ___ federal X state ___ county ___ local

depository for survey records Connecticut Historical Commission

city, town 59 South Prospect Street Hartford AUG 15 1986 state Connecticut

# 7. Description

| Condition | | Check one | Check one |
|---|---|---|---|
| ___ excellent | ___ deteriorated | ___ unaltered | _x_ original site |
| ___ good | ___ ruins | _x_ altered | ___ moved date _____ |
| ___ fair | _x_ unexposed | | |

**Describe the present and original (if known) physical appearance**

Rapallo Viaduct, completed in 1873, carried a single track of the Boston and New York Airline Railroad between the two ridges on either side of Flat Brook. Built by Phenix Iron Works and designed by Edward W. Serrell, it is a wrought-iron trestle 1,380 feet long and about 60 feet high. The viaduct is presently hidden within a steep embankment that was created by earth-fill in 1912-1913. The viaduct stands in a wooded area and no buildings are visible from the site.

The principal supports in the viaduct are vertical, 8-inch-diameter Phenix columns, which are composite compression members consisting of four quarter-round rolled wrought-iron sections with flanges for assembly with rivets. Each bent consists of a set of three columns; the side columns are sloped one foot for every foot of height, and the center pieces are precisely vertical. Over the creek, where the structure reaches its greatest depth, there is one 25-feet-high tier of columns, and a bottom tier of variable height to conform to the slope of the ground. Each column is braced horizontally and diagonally at the joints between tiers; the horizontal bracing appears from a post-card view (Figure 1) to consist of rolled channel- or I-sections, and the diagonal bracing appears to be round-section eyebars. The tier-joints probably are cast-iron boxes with slots and holes for the various intersecting members, the typical practice of Phenix Iron Works. At the top of the structure, partially visible horizontal members ("track beams") of 12-inch-deep I-section span in the axial direction between bents. The track beams act as the compression members of king-post deck trusses that run, on both sides of the structure, between the inclined verticals of adjacent bents; the center vertical of each truss is a 6-inch-diameter Phenix column supported by diagonals of flat wrought-iron eyebars. Abutments are mortared ashlar masonry of brownstone blocks.

The embankment containing the viaduct is fine sand with a skin of packed cinders. In 1979 the top of the fill was excavated to a depth of 12 feet for installation of a sewer pipe; the trench was refilled and received a new surface of graded stone.

It is not known how much of Rapallo Viaduct's historic appearance is retained beneath the fill. Wrought iron's limited tendency to oxidize, and the total removal of load from the structure, suggest that it remains substantially intact; Connecticut State Historic Preservation Office file photographs, taken when the excavation was open, show that the diagonal, round eyebar bracing is deformed but the major members retain their shape and placement. The embankment is stable.

6. Representation in Existing Surveys (continued):

Connecticut: An Inventory of Historic Engineering and Industrial Sites.

Federal/State- 1981 Historic American Engineering Record

Records deposited with Connecticut Historical Commission
59 South Prospect Street
Hartford, Connecticut 06106

Historic Structures Investigation Prepared for the Colchester Water Pollution Authority

1979-Local

Records deposited with Connecticut Historical Commission
59 South Prospect Street
Hartford, Connecticut 06106

# 8. Significance

| Period | Areas of Significance—Check and justify below | | | | |
|---|---|---|---|---|---|
| ___ prehistoric | ___ archeology-prehistoric | ___ community planning | ___ landscape architecture | ___ religion | |
| ___ 1400–1499 | ___ archeology-historic | ___ conservation | ___ law | ___ science | |
| ___ 1500–1599 | ___ agriculture | ___ economics | ___ literature | ___ sculpture | |
| ___ 1600–1699 | ___ architecture | ___ education | ___ military | ___ social/ humanitarian | |
| ___ 1700–1799 | ___ art | x engineering | ___ music | ___ theater | |
| x 1800–1899 | ___ commerce | ___ exploration/settlement | ___ philosophy | x transportation | |
| ___ 1900– | ___ communications | ___ industry | ___ politics/government | ___ other (specify) | |
| | | ___ invention | | | |

Criteria A,C,D

**Specific dates** 1872-1873--built **Builder/Architect** Edward W. Serrell/Phenix Iron Works

**Statement of Significance (in one paragraph)**

Rapallo Viaduct is significant on a national basis as a very early, rare surviving example of a major wrought-iron structure that was a pioneering effort in its day (Criterion C). It has the potential to yield important information in the history of structural engineering and bridge fabrication (Criterion D). The viaduct also has historical associations with Phenix Iron Works, a significant firm in the history of American engineering, and with the Boston and New York Air Line Railroad, a company whose failure illuminates the economic history of transportation development in 19th-century Connecticut (Criterion A).

History

The Air Line, which opened its complete route in 1873, was promoted by business interests from the Middletown area, which had been without direct rail service until that time. The ambitious plan never overcame the serious topographical and economic obstacles that had delayed railroad development in the area. The steep and frequent ridges east of Middletown imposed initial capital costs for bridges, viaducts and grading that were far in excess of those for the first two east-west railroad lines in the state: the route along Long Island Sound that came under control of the New York, New Haven and Hartford, and the route through Hartford built by the Hartford, Providence and Fishkill. Hoping to establish a reputation for reliability and technical superiority, the Air Line promoters built all their bridges of iron. Rapallo Viaduct, the smaller but otherwise similar Lyman Viaduct, and the swing bridge over the Connecticut River at Middletown were the most expensive structures. But while the swing bridge used technology that had already benefited from wide and relatively long-term application, the wrought-iron viaducts represented a type of structure first conceived in 1869, just two years before construction began on Rapallo. They contributed significantly to the line's high initial cost. Combined with the difficulties in competing with two other east-west railroads that had been open for at least 20 years, the Air Line's capital cost doomed the railroad to financial ruin.

The Air Line lasted about ten years before succumbing to the inevitable and selling out at bargain rates to the New York, New Haven and Hartford. In 1905, holding a virtual monopoly over rail transport in New England, the New York, New Haven and Hartford set out to rationalize its system and simultaneously to upgrade many of its routes to serve trains that had

(continued)

# 9. Major Bibliographical References

See Continuation Sheet.

# 10. Geographical Data

**Acreage of nominated property** approximately 1 acre

**Quadrangle name** Moodus **Quadrangle scale** 1:24000

**UTM References**

| | Zone | Easting | Northing |
|---|---|---|---|
| A | 18 | 710780 | 4605125 |
| B | 18 | 711210 | 4605035 |
| C | | | |
| D | | | |
| E | | | |
| F | | | |
| G | | | |
| H | | | |

**Verbal boundary description and justification**

The nominated property includes only the viaduct and the ground beneath it. See Figure 1.

**List all states and counties for properties overlapping state or county boundaries** N/A

| state | code | county | code |
|---|---|---|---|
| state | code | county | code |

# 11. Form Prepared By

**name/title** Bruce Clouette and Matthew Roth, edited by John Herzan, National Register Coordinator

**organization** Historic Resource Consultants **date** February 4, 1986

**street & number** The Colt Armory, 55 Van Dyke Avenue **telephone** (203) 547-0268

**city or town** Hartford **state** Connecticut

# 12. State Historic Preservation Officer Certification

**The evaluated significance of this property within the state is:**

_X_ national ___ state ___ local

**As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.**

**State Historic Preservation Officer signature**

**title** Director, Connecticut Historical Commission **date** June 24, 1986

**For NPS use only**

**I hereby certify that this property is included in the National Register**

entered in the National Register

Deborah Byers **date** 8/21/86

**Keeper of the National Register**

**Attest:** **date**

**Chief of Registration**

GPO 894-785

8. Significance (continued):

become both heavier and faster since the acquired lines had been built. In 1911 the railroad submitted improvement plans for the Air Line to the state Railroad Commissioners, including the scheme to channel Flat Brook in a culvert and then fill around Rapallo Viaduct. The viaduct was clearly inadequate for 20th-century rolling stock, and filling it was a much cheaper alternative than building a new span. For two years, 1912-1913, the railroad ran hopper cars loaded with sand over the viaduct, where they dumped their contents. When the embankment was in place its surface was stabilized with a layer of packed cinders. The crossing carried freight traffic for another 30 years, until the route was abandoned.

Technology

The design and fabrication of iron railroad bridges was well-established by the 1860s, but the great majority of long crossings over deep gorges (known as trestles or viaducts) were still built of timber. In the 1850s and 1860s railroad engineers experimented with cross-braced wrought- and cast-iron bents in various combinations, often including high masonry walls or timber members. Since the principal support of viaducts came from fixed bents, concern over proper allowance for expansion and contraction made engineers wary of building monumental examples completely of iron. In 1869 the engineers C. Shaler Smith and Charles H. Latrobe, of the Baltimore Bridge Company, innovated the use of deck trusses to connect the bents of viaducts, with one or both ends of each truss allowed to float to accomodate expansion and contraction of the material. Phenix columns, the composite compression members patented in the 1860s by Phenix Iron Works of southeastern Pennsylvania, contributed crucially to the economy and portability of structural members that made this design feasible. The first structure built on this pattern, the Varrugas Viaduct on the Lima and Oroyo Railroad in Peru, went up in 1871. When Baltimore Bridge won the job designing and building Varrugas, it was the first time that an American firm won a contract in direct competition with British engineers and fabricators, marking a climax in the maturing of the the industry in the United States.

Design for Rapallo and Lyman viaducts began while Varrugas was under construction, placing them close in time to the origin of the all-iron viaduct. The Air Line's engineer, Edward W. Serrell of New York, was quite prominent in the profession by virtue of his bridge over Niagara Falls, but

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8. Significance (continued):

these viaducts strained his ample capabilities. Serrell found himself unable to specify correctly the dead load of the structure or to design the precise configuration the members should take, so the contract with Phenix Iron Works required that Phenix design them.[1] The cautious Serrell apparently lacked confidence in the structure as he saw it take shape, and near the end of construction he decided to run only one track over the span instead of the double track intended originally. The innovative viaduct, perhaps the second or third of its type ever built, also overtaxed the analytical capabilities of the Connecticut Railroad Commissioners, who had the responsibility of approving the work. They hired the eminent engineer James Laurie to investigate the structure. Laurie gave cautious, provisional approval to Rapallo and Lyman viaducts, and the Railroad Commissioners in turn certified the line for operation.

Research Potential

Rapallo and Lyman viaducts are the only surviving, substantially unaltered (except for being buried) examples from this first generation of modern viaduct construction. Varrugas Viaduct collapsed in 1889 as a consequence of the increase in weight and speed of rolling stock in the 20 years since its construction. The only other known contemporary example, Kinzua Viaduct in Pennsylvania, is said to have undergone massive alteration to accomodate heavier loads. While most of the construction details of Rapallo can be inferred from patent records and the Laurie report (citation below), there is no assurance that the actual construction followed the specifications, particularly because the structure was so innovative that unanticipated problems probably arose during construction. Furthermore, no documentary evidence exists for the fabrication details, such as the means of finishing column ends. Pictorial depictions are not large or precise enough to portray the joints and other details. A systematic investigation inside the embankment has the potential to yield well-defined knowledge of state-of-the-art iron fabrication techniques in the crucial period of the early 1870s, an assessment of how those techniques limited or encouraged innovative designs, and the ad hoc adjustments made between theoretical design and practical construction. Rapallo Viaduct has much to tell about technological change in industrializing America.

NOTE

1. James Laurie, [Report on Lyman and Rapallo Viaducts], in Connecticut Railroad Commissioners, Annual Report, 1873, 37-38.

9.Bibliography:

Connecticut Railroad Commissioners, Annual Report, 1873-1912.

Stanley M. Cooper, "The Air Line," 1970, typescript in The Middletown Collection, Russell Library, Middletown, CT.

J.E. Greiner, "The American Railroad Viaduct--Its Origin and Evolution," American Society of Civil Engineers Transactions volume 24 (October 1891): 349-372.

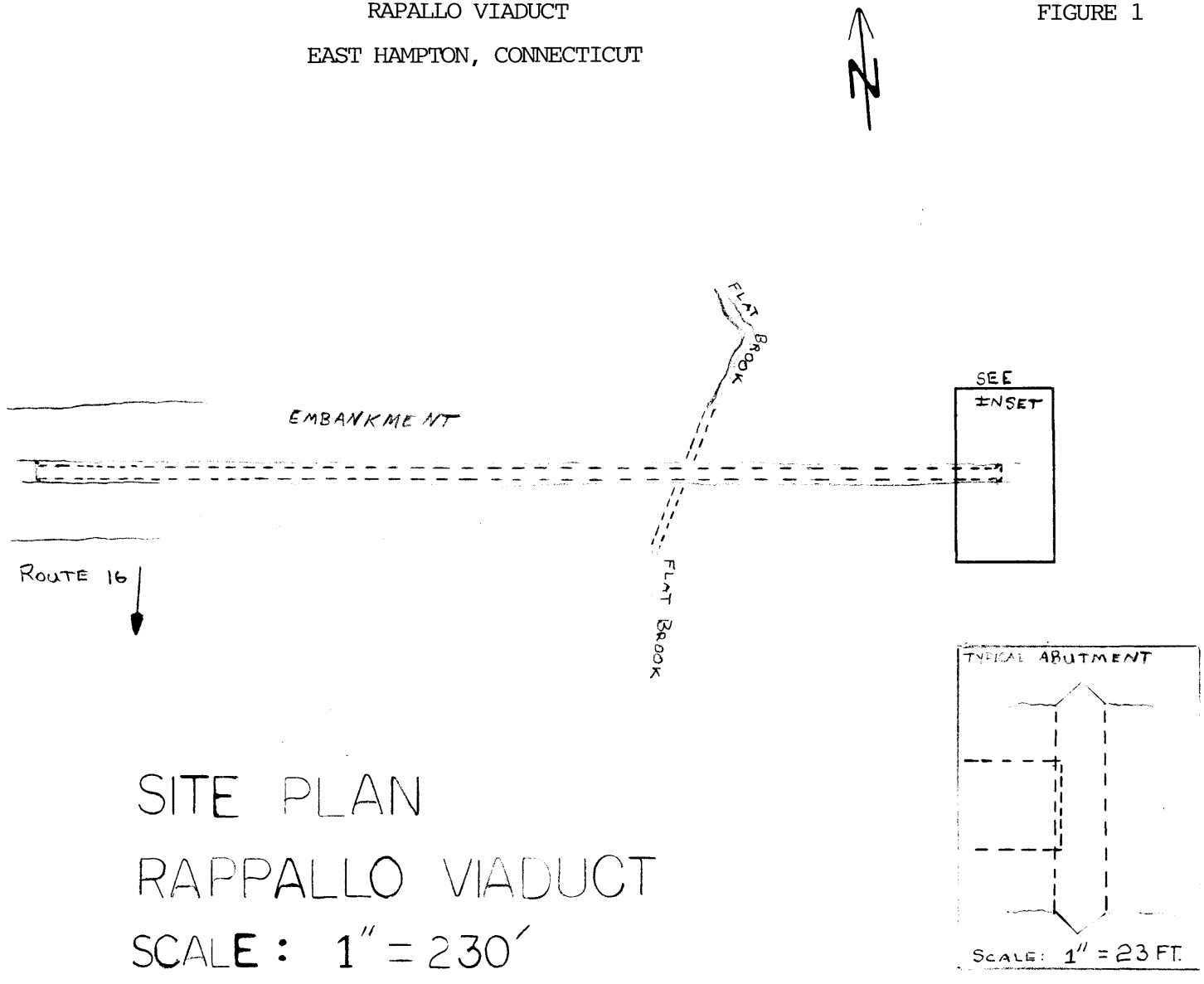
James Laurie, [Report on Lyman and Rapallo Viaducts], in Connecticut Railroad Commissioners, Annual Report, 1873, 30-41.

Album of Designs of the Phenix Bridge Company, Philadelphia, 1885.

RAPALLO VIADUCT

EAST HAMPTON, CONNECTICUT

FIGURE 1




SITE PLAN

RAPPALLO VIADUCT

SCALE: 1" = 230'

1986

Figure 1: Post-card view, c.1905, private collection.

Note that the caption overstates the length by some 220 feet, and that the name of the structure is mis-spelled.