New York, New Haven and Hartford
Railroad, Niantic Bridge
(Northeast Corridor Project)
Spanning the Niantic River between
East Lyme and Waterford
New London County
Connecticut

HAER No. CT-27

HAER
CONN,
6-LYME,
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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
MID-ATLANTIC REGION NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR
PHILADELPHIA, PENNSYLVANIA 19106

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HISTORIC AMERICAN ENGINEERING RECORD

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Location: Spanning the Niantic River between East Lyme and Waterford, New London County, Connecticut

UTM Coordinates: 18.736260.4578220
USGS Quandrangle: Niantic

Date of Construction: 1907; alterations in 1934-35, 1948, 1956, 1959-1962, 1965

Present Owner: National Railroad Passenger Corporation
Suburban Station Building
1617 John F. Kennedy Boulevard
Philadelphia, Pennsylvania 19103

Present Use: Railroad bridge

Significance: The Niantic Bridge is a through girder bridge and consists of a movable span and four approach spans on stone masonry piers. The movable span is a chain-driven Scherzer rolling lift bascule span with overhead counterweight. It is significant as part of the transportation link in the shoreline route of the New York, New Haven and Hartford Railroad, and as an individual engineering solution to the need to provide dependable rail service while accommodating river navigation.

Project Information: The Niantic Bridge is to be altered as part of The Northeast Corridor Improvement Project. Under Section 106 of the National Historic Preservation Act of 1966, mitigative documentation was undertaken in April 1983 for the Federal Railroad Administration by historian Janice G. Artemel with the assistnce of Lisa Crye, Ellen Gallagher, and Kristin Heintz.

The national railway network that was to be one of the critical catalysts in the industrialization of the United States was largely completed between 1840 and 1880. Most early railroads were short lines that attempted to tap economic resources of the hinterlands of cities. By the second quarter of the 19th century, cities east of the Mississippi, particularly those in the northeast, began to build longer lines and consolidate shorter ones to tie them more closely together.[1] The New York, New Haven and Hartford Railroad provides an excellent example of how railroad systems were created and how they advanced transportation technology, including movable bridges, with their economic power.

The New York, New Haven and Hartford Railroad was first formed by a consolidation of the Hartford and New Haven Railroad Company with the New York & New Haven Company, when the two railroads entered into a partnership agreement. The capital was divided, and the New York, New Haven & Hartford Railroad was established on August 6, 1892.[2] Lengthy and intricate patterns of acquisiton were common to railroading in the late 19th century. Empires were created as well as monopolies on the transportation of goods. The peak growth years of the American railroads were the early 1900s and, of those, the teens (1911-1919) were the final surge. The decline of the railroads after those years was due partly to the excesses of transportation monopolies in the last quarter of the 19th century and partly to a combination of rising costs and competition from other modes of transportation.[3]

By the end of the 19th century, the New York, New Haven and Hartford Railroad extended from New York to Boston and virtually controlled rail traffic in southern New England, effectively preventing any further major competition along its lines.[4] It then set about to secure its hold with a building program, which occurred mostly between 1911 to 1919. Construction and railroad technologies had advanced to the point that massive quantities of earth and rock could be moved and placed elsewhere; bridges were raised above streets and crossed rivers where bridges had not been possible before. The expenditures were prime examples of the growing capability of an industrialized society to engage in large scale environmental manipulation.[5]

Movable Bridge Types and Technological Developments

Of special significance in the development of railroad technology during this period were the many new bridges built over major water courses, including movable bridges. A movable bridge can be changed in position to allow continued river traffic. There are three types of movable bridges: the swing bridge, in which the movable span turns on a pivot pier; the bascule bridge, which in modern form uses a counterweight to raise one end of the movable span and lift the bridge; and the lift bridge, in which the movable span is actually raised between two towers to open the bridge.

The earlier records of movable iron railway bridges in the United States show the use of the rim-bearing swing type. Among the earliest were a series of parallel swing bridges built across the Charles River in Boston in the early 19th century, which were timber trusses hinged at one end that swun open to allow a narrow channel for navigation.[6] In the 1860s, many of the rim-bearing swing type were built in the Mississippi Valley. The design of the center-bearing swing bridge, which is superior to the rim-bearing in many aspects, was improved greatly between the late 1880s and 1900. After 1900, strong advocacy by C. C. Schneider, a consulting engineer for the American Bridge Company, influenced many engineers to use the center-bearing swing bridge. The modern bascule and lift bridge types were not developed until after 1890, when the electric motor was refined and a method of counter-balancing the weight of a large span had been developed.[7]

Along the eastern seaboard, the large number of navigable rivers and inlets to be crossed resulted in the construction of fifteen movable bridges on what is today the Northeast Corridor rail line: nine bascule bridges, five swing bridges, and one vertical lift bridge. Generally, swing bridge types were preferred over bascule and lift bridges when the waterway was wide enough to allow for clearance on either side. When the waterway was too narrow to provide clearance, as is often the case in the northeast, vertical lift or bascule bridges were used. Bascule bridges are difficult to maintain and repair and present clearance problems for tall vessels, since they cannot be opened to a full 90-degree angle. However, they can be opened and closed more rapidly than swing bridges, which is an advantage to rail operations. Vertical lift bridges also present clearance problems for tall vessels, although they do not need as much maintenance and repair as bascule spans.

The Niantic Bridge is one of four movable bridges built by the New York, New Haven and Hartford Railroad in Connecticut. These bridges are typical examples of engineering practices in the early part of the twentieth century. All four are shoreline bridges, and each was designed for its location, with particular attention to intended function and possible problems. The bridges were prefabricated at the construction company's plant and then built by unskilled labor at the site. The machinery to operate the bridges was not standardized, and each bridge has unique mechanical components. (See New York, New Haven and Hartford Railroad, Shaw's Cove Bridge (HAER No. CT-24), Groton Bridge (HAER No. CT-25), and Mystic River Bridge (HAER No. CT-26).

These bridges reflect the state-of-the-art technology of movable bridges in the period from 1907-1919. Because steamship lines covered Long Island Sound during the 19th century, impetus for completing a through shoreline rail route from New Haven to Boston developed relatively late in the history of New England railroads. Two other rail routes, the Willimantic, Providence and Boston line, and the Springfield line to Hartford, Connecticut, and Springfield, Massachusetts, provided connections between New Haven and Boston that were approximately the same distance in rail miles. It was not until 1889 that an all rail shoreline route was completed. At about the same time, the technology of removable bridges was being greatly advanced. As the older bridges on the shoreline route deteriorated and became outmoded by the need to carry heavier and faster rail traffic along the shoreline route, they were replaced with new movable bridge representative of bridge technology of the day.

Niantic Bridge

The railroad bridge over the Niantic River at East Lyme, Connecticut, was constructed in 1907, replacing a swing-span bridge built in 1891 on a parallel alignment about 49 feet to the south. Although the span of the previous bridge was removed when the new bridge was built, the two stone masonry end abutments, the central swing pier and four fixed span piers of the former bridge still remain. An even earlier structure had been built at this location in 1885 by the Edgemoor Iron Works Company. The earliest record of a crossing at this site dates from 1660, when John Winthrop of New London operated a ferry across the river.

The existing through girder bridge carries two tracks and consists of a movable span and four approach spans on stone masonry piers. The movable span is a chain-driven Scherzer rolling lift bascule span with overhead counterweight. Horizontal clearance is 45 ffeet and vertical clearance in the closed position is 11 fcet at mean high water. There are timber fenders at both channel piers.

The bridge was designed by the Scherzer Rolling Lift Bridge Company of Chicago for the New York, New Haven and Hartford Railroad Company. The Scherzer rolling lift type of bascule was invented by William Scherzer and patented on December 6, 1893. It represented an important development in movable bridges and was characterized by rounded, segmental girders at the rear of the bascule span, which roll back on the stationary track girders when open. The Scherzer Company's design became popular after the success of Chicago's Van Buren Street Bridge in 1893, and was more predominant than variations designed by other bridge companies for rolling lift bascules. Seven of the nine bascule bridges on the Northeast Corridor are Scherzer rolling lift bridges.

Of the bascule bridges on the Northeast Corridor rail line, the Niantic Bridge is the only chain-driven version. The chain-driven bascule was an innovation at the time and was developed to allow the drive mechanism to be located below the track. Normally, the drive mechanism is located with the counterweight on a bascule bridge. By placing the mechanism below the track, maintenance and repairs are much easier. In addition to better accessibility, the below-track location also affords more protection from weather and vibration. These special variations of the bridge for Niantic were designed in January 1907.

In March of that year, a local contractor, John Y. Higginson, constructed the masonry piers. The structure was then erected by the American Contracting Company and the King Bridge Company of Cleveland in August 1907.

The bridge interlocking and signalling system, installed in November 1907, is also of historical interest. Interlocking systems were devised to prevent the throwing of switches or displaying of signals in such a manner as to allow trains to collide or be derailed. At points where control of switches and signals might be unsafe, unless limited in some manner, it became the practice to interlock operating devices, switches and signals, so that their movements must succeed each other in a predetermined order.

The mechanical interlocking machine at Niantic is a Saxby and Farmer type, dating to 1907. There are two dwarf signals, also Saxby and Farmer, located between the two sets of tracks approximately 300 feet on either side of the bridge. Twelve sets of this type of signal exist in the New Haven to Boston communication system. The mechanical bridge locking mechanism includes George T. Styles-type couplers and piping. Track circuit couplers are located in boxes in the center of each set of tracks and are operated by the pipe-work located along one side of the bridge.

The machinery for moving the bascule span is located partially below track level between girders, with drive shafts that pass through the webs of the span to a sprocket and chain drive system. The sprocket and chain drive extend from below and outboard of the track girders up to overhead idler sprockets above the track level, supported by a structural frame. Each of the drive chain ends is attached to a pin socket which is mounted on a common pivot pin secured to the bascule span at the center of the roll of the segmental girder portion of the span.

Rotation of the drive sprockets by the span operating machinery moves the chain and pivot pin back and forth to operted the leaf. The segmental girders roll along a tread plate fixed to the top flange of the track girder span. Lugs or teeth on the tope of the fixed track plate engage pockets or slots in the curved tread plate on the segmental girder to maintain rolling contact and alignment of the moving leaf on the fixed track.

The bridge machinery includes two 20-horsepower, 900 revolutions per minute (rpm), 220-volt, 3-phase, 60 hertz, wound rotor motors. A drive pinion mounted on each of the motor shafts engages a drive gear which is common to each of the motor pinions. This constitutes the first gearset of a three-stage speed reduction between either one of the motor shafts and the drive chain sprocket shaft.

The hand-operated mechanical interlocking machine is located in a small building beside the tracks on the west side of the bridge. The bridge operator's house is on the bridge structure, where the bridge operating controls are located. These consist principally of a vertical control stand with single crank control for opening or shutting, and button controls of brake and other features.

Since its construction, Niantic Bridge has undergone extensive repairs. The piers are repaired by the Division of Engineering of the New York, New Haven and Hartford Railroad Companyt in 1934-35 and, again, by the American Bridge Company in 1959-1962. Repairs to the steel structure, including replacement of some structural members, were undertaken in 1952 and 1956. In 1948, an original equipment, hand-operated band brake and brake wheel were removed from the first stage reduction gear shaft and two new magnetic brakes were added to replace the original motor-mounted solenoid brake. A new braking gearset was provided at the same time and was mounted on the shaft at the same location as the original band brake wheel. Also about 1948, a new span limit switch and selsyn indicator were added to the machinery, along with related gear drives and other appurtenances. The original bridge machinery included only one span drive motor; a second motor was added in 1952, probably as an alternate or spare, since the electrical connection is such that only one motor at a time can be energized for driving the bridge machinery.

In 1956, new flat and curved tread plates were installed on the track and segmental girders, respectively, as replacements for the original treads. The journals also have been extensively repaired, and the master gear and pinion were replaced in 1963. A new first-stage gearset, consisting of a new motor pinion and split gear, replaced the original in 1965.

There have been a number of drive chain breakages reqquiring chain link repairs and replacement. According to Amtrak bridge maintenance personnel, logs or records of chain breaks are not kept at the bridge site; however, it is reported that approximately 10 chain breaks have occurred in the past five years on the south chain, with only one break in the past 22 years on the north chain. There is no mechanical device in the drive machinery for equalizing the torques at the two main drive sprockets. Cast iron chain guide rollers mounted on cold rolled steel pins are provided on the horizontal chain support struts and on the chain support diagonals of the structural frame outboard of the track girders.

A bevel gearset with a vertical capstan shaft and a "T" capstan bar allows manual operation of the leaf from bridge deck level on the 26-foot track girder span.

There is a nose or span lock mechanism on the bascule span consisting of a series of levers, rods, rod roller supports and cranks. The bridge operator must walk out onto the bridge and manually throw a weighted hand lever to drive or draw the nose locks. A signal lock pin is interlocked with the nose lock bar to prevent withdrawal of the bar before proper signalization has occurred. A lock bar socket is mounted on the rest pier near the centerline of the bridge.

There is one air buffer mounted on the nose of the bascule leaf on the inside of the far end floor beam at the centerline of the bridge. Cast steel centering guides, whose purpose is to center the nose of the bascule span in its fully closed position, are mounted on the shoe pedestals that in turn rest on top of the piers.

FOOTNOTES

1 Alfred D. Chandler, "The Beginnings of 'Big Business' in American Industry," Business History Review 33 (Spring 1959): 1-31.

2 George Pierce Baker, Formation of the New England Railroad Systems (New York: Greenwood Prass, 1968), p. 1.

3 John L. Weller, The New Haven Railroad: Its Rise and Fall (New York: Hastings House, 1969).

4 R. Patrick Stanford, Lines of the New York, New Haven & Hartford Railroad Co. (Stanford: Stanford University Press, 1979).

5 Weller.

6 David Plowden, Bridges - The Spans of North America (New York: The Viking Press, 1974)

7 Plowden

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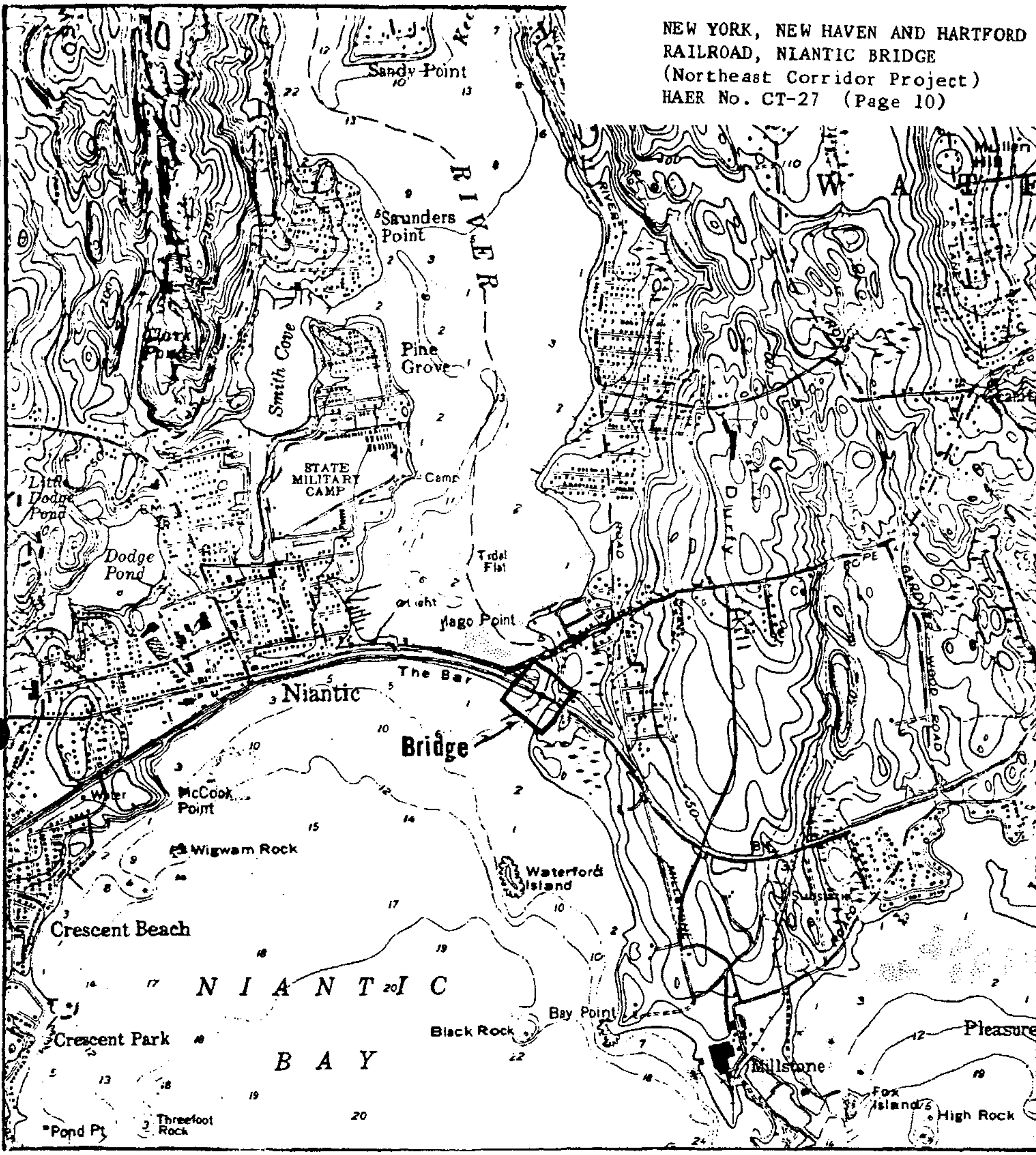

Niantic, Connecticut

Niantic River Bridge

UTM Reference
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Northeast Corridor Improvement Project
Federal Railroad Administration, Department of Transportation

Figure 2
HISTORIC SITES MAP
Cultural Resources