New York, New Haven and Hartford
Railroad, Mystic River Bridge
(Northeast Corridor Project)
Spanning the Mystic River between
Groton (and Stonington)
New London County
Connecticut

HAER No. CT-26

HAER
CONN,
6-GROT,
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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

HISTORIC AMERICAN ENGINEERING RECORD

New York, New Haven and Hartford Railroad, Mystic River Bridge
(Northeast Corridor Project)

HAER CT-26

Location:	Spanning the Mystic River between Groton and Stonington, New London County, Connecticut UTM Coordinates: 19.251460.458150 USGS Quandrangle: Mystic
Date of Construction:	1919; alterations in 1919, 1945, 1951, 1955-1956
Present Owner:	National Railroad Passenger Corporation Suburban Station Building 1617 John F. Kennedy Boulevard Philadelphia, Pennsylvania 19103
Present Use:	Railroad bridge
Significance:	The Mystic River Bridge is a center bearing, through truss swing bridge. 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 Mystic River Bridge is to be replaced 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 Janice G. Artemel, with the assistance of Lisa Brye, 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 Mystic River 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 Niantic Bridge (HAER No. CT-27).

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.

Mystic River Bridge

At the same time the New York, New Haven and Hartford Railroad was building a new bridge in Groton, it was also planning and constructing a railroad bridge over the Mystic River in Mystic, Connecticut. The earliest bridge at this site (approximately 2.4 miles above the mouth of the Mystic River) was a wooden drawbridge built in 1819, which was followed by an iron bridge in 1866. A later drawbridge (1905) was built by the Berlin Construction Company. The center pier and some trestles of this 1905 bridge were used in constructing the present bridge.

The existing bridge was designed in 1917 by the Edgemoor plant of the American Bridge Company, under the direction of Mr. Searles, Chief Engineer, and W. H. Moore, Bridge Engineer for the New York, New Haven and Hartford Railroad. The Pencoyd plant of the American Bridge Company fabricated the machinery. While not unique as an engineering type, the center bearing, through truss swing bridge is a form of movable bridge that is rapidly becoming less common. The entire structure is 277 feet long. The swing span is 181 feet long and carries two tracks by means of stringers and floor beams that frame into the lower chord of the trusses. The center pier is circular and constructed of stone. Drive machinery is located below track level over the center pier. By the time Mystic Bridge was designed and built, the rim-bearing bridge type had come into some disfavor due to its complicated machinery and the difficulties encountered in maintenance and repair. Since the center-bearing bridge has much simpler machinery and is less expensive to build and maintain, it became increasingly popular. These factors may explain why the center bearing design was chosen for the Mystic site.

The dead loads from the through trusses are transferred by a cross girder to a center bearing on the circular center pier. A circular drum girder at the center pier frames into the cross girder. The drum rolls on steel rollers that ride in a track secured to the masonry. When the bridge is opened, the dead load of the bridge is carried by the center bearing, and the rollers balance the bridge. Some dead load may be transmitted by the rollers, depending on the stiffness of the cross girders, but the center bearing provides much of the support.

In the close position, wedges are driven under the cross girder at the connection to the trusses, forming a point of support for the trusses. The live load on the bridge is carried by the wedges and not the center bearing or rollers. Wedges are also driven under the ends of the through trusses at the end piers. This causes the bridge to function as two simply-supported trusses in the closed position. The piers at the ends of the span consist of stone masonry with steel members on the top forming a grillage at the bearings. A deeper steel member forms the end bearing for the timber approach span.

The drive machinery below track level terminates at two final drive pinions on vertical shafts which engage a circular rack anchored to the center pier. These pinions are mounted on opposite sides of the drum. To open the bridge, the rail locks are disengaged, the end rails are lifted, the wedge locks are withdrawn, and the bridge locks are released. The drive pinions then rotate the bridge to the open position.

The main drive motor is a 25-horse-power electric motor. The motor is coupled to an equalizer and then to the final drive pinions which engage the fixed circular rack. The wedge locks, rail lifts, and bridge locks are driven by a separate 25-horse-power electric motor.

Electric service for bridge operation is supplied by a local private utility. The bridge receives this power through a submarine cable to the center pier. This cable leads to an equipment house located on the top lateral system of the bridge which contains the resistance banks for motor speed controls. The bridge is controlled from the operator's house on the north shore. The old operator's house, located above the trusses, is now used only for electrical equipment and storage.

As in the case of the Niantic River Bridge, the interlocking system at Mystic is as significant as the bridge itself. The interlocking system at Mystic performs its functions electrically. It consists of a "Style B" electro-mechanical interlocking machine that was manufactured by the Union Switch and Signal Company of Swissvale, Pennsylvania. First put into service in October 1906, the machine controls the switches, derails, bridge locks, and H-5 searchlight signals. The H-5 signals, which use a lamp and lens system to project three colors, replaced earlier semaphore type signals. The interlocking machine, the only one of its kind on the Northeast Corridor, has 29 levers, 11 of which are currently employed. It was designed by one of the foremost signal companies of the 19th and 20th centuries and has not been altered since its installation. The interlocking controls one mainline crossover and one mainline turnout, in addition to bridge interlocks and signals. The house contains the reversing drum controllers for both turn and lock motors, foot-operated limit override switches, meter board, disconnect switches, signal model board, and signal lock relays.

The bridge has undergone numerous repairs. In 1919, the piers were reconstructed. In 1945, the stringers, stairways, railings, and top laterals were repaired. Repairs were made to the center pier in 1951 and 1955; and in 1956, the machinery and center fenders were repaired. Since the bridge is structurally deteriorated, it is to be replaced with a new bridge, similar in design, which will improve operational reliability for the railroad. It is being replaced as part of the Northeast Corridor Improvement Project.

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

BIBLIOGRAPHY

Baker, George Pierce. Formation of the New England Railroad System. New York: Greenwood Press, 1968.

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

Connecticut Gazette. Published 1873-1909.

Decker, Robert Owen. The Whaling City. Chester, Connecticut: Pequot Press, 1976.

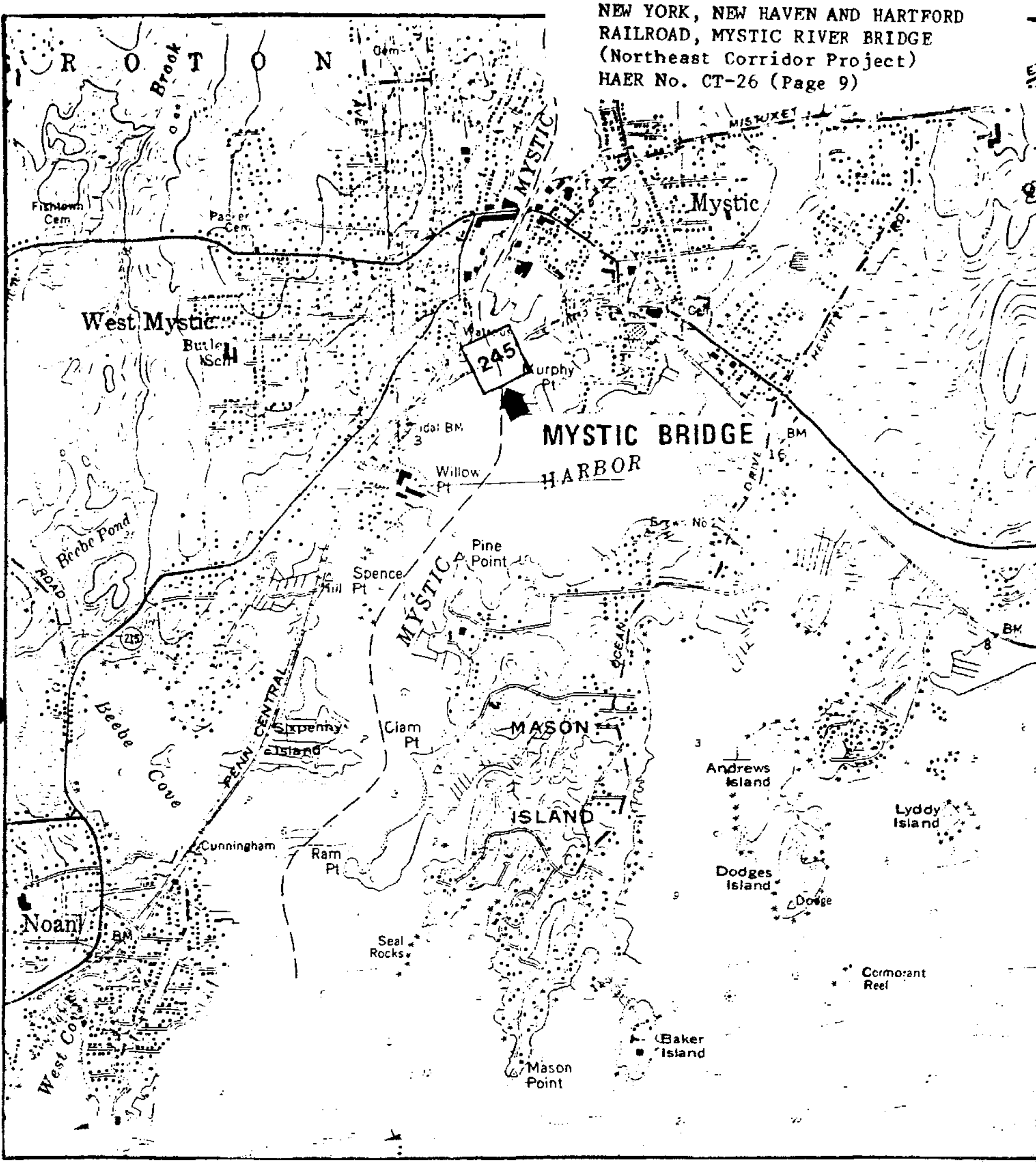
"Improvements on the New York, New Haven & Hartford." The Railroad Gazette 38 (March 17, 1905): 242-246.

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

Rollins, James W. "Thames River Bridge," Journal of the Boston Society of Civil Engineers 7 (June 1920): 177-199.

Stanford, Patrick R. Lines of the New York, New Haven & Hartford Railroad Co. Stanford: Stanford University Press, 1976.

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



Mystic, Connecticut

Mystic River Bridge

UTM Reference
19/251460/458150

SCALE 1:24,000

Northeast Corridor Improvement Project
Federal Railroad Administration, Department of Transportation

HISTORIC SITES MAP
Cultural Resources