BROADWAY BRIDGE
Broadway, over Foundry Street, MBTA Yard,
Fort Point Channel, and Lehigh Street
Boston
Suffolk County
Massachusetts

HAER No. MA-129

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

HAER MASS 13-BOST, 135-

HISTORIC AMERICAN ENGINEERING RECORD

Broadway Bridge HAER No. MA-129

Location: Broadway, over Foundry Street, MBTA Yard, Fort Point Channel, and Lehigh Street; Boston and South Boston, Suffolk County, Massachusetts

Massachusetts Highway Department No.: B-16-125

UTM Map Coordinates: 19.330920.4689890
USGS Quadrangle: BOSTON SOUTH, MA

Dates: Center draw pier: 1874-75
Approach spans: 1901-02
Swing span: 1914-1915

Builder: Boston Bridge Works

Owners: Draw Span, Spans 1-2, 13-17: City of Boston Spans 3-12: Massachusetts Bay Transportation Authority; Spans 18-19: Massachusetts Highway Department.

Present Use: Vehicular and pedestrian bridge.

Significance: The drawspan of the Broadway Bridge is the largest and best example of the four surviving center-bearing swing bridges in the state, another of which is Fort Point Channel's Northern Avenue Bridge (1908) which is a rim bearing swing span.

The substructure of the span, built for the previous swing span in 1874-75, is also significant as the last survivor of the City of Boston's early attempts in large-scale iron bridge construction.

Project Information: This mitigative documentation was undertaken in 1992-1993 in accordance with a 1984 Memorandum of Agreement among the Massachusetts Highway Department, Massachusetts Historical Commission, Boston Landmarks Commission and the Advisory Council for Historic Preservation for the Central Artery/Tunnel Project.

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Introduction

The original Broadway Bridge (Massachusetts Highway Department No. B-16-125), which spans Fort Point Channel, was completed in 1870 and was one of the first bridges in the City of Boston built under the jurisdiction of the City Engineer's office, which was previously charged with designing and building the city's water supply system. Due to a poor design, the bridge failed, and by 1875 the superstructure was almost totally rebuilt. In 1902 the approaches were replaced to provide greater clearance over railroad tracks in South Boston. In 1915 the drawspan was again replaced, this time due to the addition of street car tracks. Although much of the bridge has been substantially redesigned and rebuilt since the 1870s, it is one of only four surviving center-bearing swing bridges within the Massachusetts Highway Department's bridge survey.

Historic Overview

Fort Point Channel is a channelized waterway separating downtown Boston from South Boston. Today, the water passage terminates three hundred yards south of the Broadway Bridge crossing. In the eighteenth century, this waterway was a wide inlet leading to Roxbury Harbor, a large shallow body of water and mudflats fed by tides and, at its southern end, by Dorchester Brook. On the west was the neck of the Shawmut Peninsula, and on the east were the farms of Dorchester Neck (now South Boston). In the nineteenth century, as South Boston and Roxbury developed, this harbor experienced a series of names reflecting its changing use and public perception: Gallows Bay, South Bay, and South Cove. In the years immediately preceding and following the Civil War, coal yards and heavy industry took advantage of both rail and water connections here to make the district a major industrial zone. Indeed, South Station, and its rail yards, which consolidated rail service from the south and west, was completed in 1898 and located just north of the Broadway Bridge.

As commercial development spread along the Boston and South Boston shores, the channel leading to South Bay narrowed through a number of filling episodes. In the first half of the nineteenth century, the name "Fort Point Channel" was given to the water passage, after the promontory near Rowe's Wharf, east of Fort Hill.[1]

Prior to the Civil War, there were frequent demands to fill in both South Cove and Fort Point Channel to gain more buildable land. But in the years following the Civil War, as the demand for coal, building supplies, and other bulk materials grew, commerce in both the cove and channel greatly increased. In 1887, as part of a program in harbor improvements, the Federal Government deepened the channel as far as the Congress Street Bridge. Today, Fort Point Channel effectively ends at West Fourth Street, and only a culvert beneath the road embankment there marks the spot where Dorchester Brook now flows into Fort Point Channel.

Fort Point Channel is crossed by numerous bridges and at one time, nine bridges crossed the 1-1/4-mile channel concurrently. The first bridge was the South Boston Bridge, a 1,551-foot long toll bridge built in 1805, on piles about 300 yards west of the present Broadway Bridge. Renamed and rebuilt as Dover Street in 1857, the alignment (with a new bridge in 1989), still carries West Fourth Street over the railroad yards of the Massachusetts Bay Transportation Authority. The Broadway Bridge, first constructed in 1869-71, was the fourth highway bridge to be constructed across the channel.

In the decade immediately following the Civil War, the topography of Boston experienced dramatic changes, as hills were leveled, streets widened, and grade levels raised. The work was not a gradual evolution, but rather a concerted effort by the city, made possible by the passage in 1866 of the "Betterment Act." The act gave the City Board of Aldermen broad authority to take property for the laying out of streets and improving Boston.[2] Thomas W. Davies, the City Surveyor, was the individual responsible for coordinating much of this work, and his annual reports to the Mayor and Aldermen provide a first-hand glimpse of the work going on. In his annual report prepared in January 1868 he described the effects of the Betterment Act, which included the leveling of Fort Hill, surveys for the massive releveling of the Church Street district, the widening of Federal and Tremont streets, and other projects. More surveys for street improvements were made in 1867, Davies wrote, "than have been made during any one year since the City Engineer's Office was established in 1850."[3]

One of these projects was better access to South Boston from Boston proper.

> The plan called for the extension of Broadway from Federal Street [now Dorchester Avenue] in South Boston to Albany Street [in Boston proper; today Albany parallels the Southeast Expressway]. . . thence to a point on Washington . . . . It called for a high grade crossing of Foundry Street, the Old Colony and Newport Railroad, Fort Point Channel, Lehigh Street [now under the Southeast Expressway] and the Boston and Albany Railroad bridges.[4]

Much of the structure was built on cast-iron columns, and the City Engineer likened it to the recently constructed Berkeley Street bridge over the Boston & Providence Railroad.[5] Although the original bridge has been rebuilt, the essential features of that project, a long viaduct and a drawspan over Fort Point Channel, remain today.

The Broadway Bridge connects Boston Proper with South Boston. When the bridge was completed in 1875, South Boston was a heavily industrialized area with a large, Irish immigrant population, most of whom worked in the local factories. Prior to the nineteenth century, however, there was little activity in South Boston except for the role its geographical features played in the Revolutionary War, when Dorchester Heights was fortified and the British were turned back. In 1804, South Boston was annexed by the city of Boston, spurred in part by local real estate developers. In 1805, a street grid was laid out

but little activity occurred until 1828 when the Free Bridge was opened connecting South Boston to Boston.[6]

Between about 1830 and 1870, South Boston's population rose from 2,200 to 39,215. Attracted by the water access of Fort Point channel and without being restricted by an existing residential neighborhood, heavy industry was able to grow without interference. This, in turn, attracted a large, mostly Irish, immigrant labor force. One of the earliest companies to be established (in the early 1830s) was the Cyrus Alger Iron Company on Foundry Street at a location which would eventually be the foot of the Broadway Bridge. Alger produced iron products for building construction and machinery. By 1850, he was the largest iron producer in the country. He shipped his goods via ship through Fort Point Channel and through the railroads that established rail and freight yards in South Boston. These included the Boston and Worcester Railroad and the Old Colony Railroad.

Additional industries serviced and supplied by the ships of Fort Point Channel and the railroads included the Adams Machine Shop, manufacturers of heavy machinery such as printing presses, sugar mills and steam engines and Anderson Electric Company, an early manufacturer of electrical products including trolley poles, insulating systems for wires and switching equipment for telephones. Other industries in South Boston were locomotive manufacturers, iron steam ship builders, and builders of a variety of railroad related products.

Toward the latter part of the nineteenth century the Boston Wharf Company was instrumental in filling, developing and building large wharves and factories along Fort Point Channel in South Boston. They were particularly active in the sugar, warehouse and real estate industries.[7]

South Boston still has a gritty air about it, mostly due to the many industrial structures standing, although the majority of industry had left. Rail yards have become parking lots, loft buildings have been turned into housing, but the residential areas have remained intact.

In 1875, immediately surrounding the Broadway Bridge on the South Boston side, were the Boston and Worcester rail yard and Alger's iron foundry. Although the iron foundry is gone, the rail yards are still intact and today are owned by the Massachusetts Bay Transit Authority (MBTA).

The Boston side of the Broadway Bridge exited into an area called South Cove and later, the New York Streets. By the early 1700s, South Cove began to be filled with wharves and industrial activities such as distilleries. Small areas of the cove began to be filled in and wharves built and new streets laid out by 1804. Development was spurred by the building of the South Boston Bridge in 1804 and the Free Bridge in 1828 which directly connected the area with South Boston. In 1833, a large portion of South Cove was filled to provide space for the Boston and Worcester Railroad Terminal. Tenement housing was built on

some of this land as well. In the 1840s, more of the cove was filled, streets laid out and tenements built. By that time the Boston and Worcester Railroad had reached Albany and the railroad was renamed the Boston and Albany. In honor of that feat, the streets around the terminal were renamed after towns in New York State, hence the designation: New York Streets. In 1847, the Old Colony railroad also built a terminal in South Cove as well as a bridge over Fort Point Channel.

By the mid-nineteenth century, South Cove was associated with railroads and immigrants. During the booming industrial years of the late nineteenth century, South Cove was populated by large immigrant populations including Irish, Eastern European, Italian and Armenians, most of whom worked on the railroads. In the twentieth century, the area filled with Chinese. From 1898 through 1900, South Station was rebuilt and the western and southern railroads consolidated. This resulted in rerouting many of the railroad tracks through South Cove. In 1957, an urban renewal project completely removed the New York Streets and in 1959, the original Central Artery and then the extension of the Massachusetts Turnpike destroyed any remaining housing. Today the area is dominated by roadways and Amtrack tracks.

The area immediately surrounding the Broadway Bridge approach was filled with rail yards until the 1950s and 1960s when the Central Artery and the Turnpike were constructed.[8]

The First Broadway Bridge, 1869-1871

The story of the first Broadway Bridge is one of the most dramatic in the annals of bridge building in Boston. It involved the careers of several nationally-known engineers, as well as the reputation of Boston's City Engineering office. It is also a revealing example of both the state of civil engineering in Boston city government and the unrestrained free-for-all that existed in bridge design and construction in the 1860s and '70s. Not until several catastrophic bridge failures had taken place did state and municipal authorities establish regulating commissions to approve bridge design and construction.

Bridges, or even roads, were not the main concern of the City Engineer's Office when the first Broadway Bridge was commissioned. The office had been established in 1850 by a city ordinance providing for the care and management of the Boston Water Works. Although the ordinance also required the Engineer to have charge of all plans of streets, and to perform such services as might be required by the Mayor and the Board of Aldermen, its emphasis was clearly on the maintenance and expansion of Boston's water supply. Given this concern, it is not surprising that for thirty-five years, the Chief Engineer was chosen from the ranks of water works engineers. The first City Engineer was E.S. Chesbrough (1813-1886), later a nationally known water works engineer, who had overseen construction of Boston's Cochituate water system, the city's earliest water supply.

The City Engineer in the late 1860s was Nathaniel Henry Crafts (1828-1908). Crafts, who was named to the position in 1864, had been Chesbrough's assistant since 1849. His term of office saw the completion of the Chestnut Hill Reservoir, extension of the Boston water supply into Roxbury and Dorchester (with the annexation of those places by Boston), and the establishment of a separate high-service system to provide water to the higher elevations of metropolitan Boston.[9]

Responsibility for bridges seems to have come to the department only as an afterthought. In 1867, the city passed a new "Ordinance Relating to the Department of Engineering and Surveying."[10] Section 6 of the ordinance made it the duty of the City Engineer to make an examination, annually or oftener of all bridges and to report as to their condition. "This duty," Crafts wrote, "is a new one, imposed upon this department, and, so far as the Report is concerned, has never been assigned to any department."[11] The engineer went on to list all the bridges the city was then responsible for: three over Fort Point Channel to South Boston, and six to East Boston from Chelsea.

The Broadway Bridge was one of the earliest bridge projects to be completed with the City Engineer's office. Probably the engineer with the most bridge experience in Crafts' department was T. Willis Pratt (1812-1875), who was selected to be resident engineer for the Broadway Bridge. Pratt is today best known for the "Pratt" truss, a very successful and widely used type of bridge truss which he patented in 1844.[12] In the 1860s he patented portions of the retractile draw mechanism for moveable bridges, as an engineer in a city office, it may have been Pratt who popularized their use.

Another engineer engaged by the city for the Broadway Bridge project was the consulting engineer, Clemens Herschel (1842-1930). Born in Germany, Herschel graduated from Harvard's Lawrence Scientific School in 1860, and about 1864 opened an office in Boston as a consulting engineer. One of his first projects was the eye-bar suspension bridge which he designed with William Preston for the Boston Public Garden in 1867, still a prominent structure within that landscape. Herschel was later known as a hydraulic engineer, but in his early years, his practice embraced all branches of civil engineering.[13] Herschel had been asked to prepare plans and specifications for the Broadway Bridge, but before he could complete the design, a full set of plans and specifications were given to the department by the Moseley Iron Bridge Works Company of Roxbury.

When the Moseley company presented their plans to the City Engineer. they were readily accepted and the department immediately advertised for proposals. After the proposals were received, the construction contract was awarded to the Moseley Iron Bridge Company. The Moseley Iron Bridge Works Company, organized by General Thomas W. H. Moseley (1813-1880), was one of a large number of new firms organized in the years during and immediately following the Civil War to use cast and wrought iron in bridge construction. Cast or wrought iron could be molded or rolled into a variety of shapes of great compressive strength, and with its introduction, first in conjunction with wood, and soon replacing it.

bridge design exploded into a variety of new configurations.[14] At first builders were conservative, adopting iron to the traditional forms of wood and stone. As the spans grew longer and iron production increased during the Civil War, bridge companies sprang up across the country to build all-iron railroad and highway bridges. The post-Civil War period was one of tremendous innovation in bridge design, but it was equally famous for its bridge failures, as iron came to be used increasingly by builders with little experience in its properties.

In 1857, T.W.H. Moseley had patented an unusual tied arch design.[15] By riveting strips of rolled wrought-iron into a hollow tube with triangular cross section, Moseley achieved compressive strength that was not possible with wrought-iron rods. Four years later, he organized the Moseley Iron Building Works, (variously listed as the "Moseley Iron Bridge Company" as the occasion warranted). With his own rolling mill established on a railroad site south of Hyde Park, Moseley began producing bridges based on his patent design for locations throughout the east.[16] (Until recently, two Moseley bowstring trusses carried local streets over the canals of Lawrence, Massachusetts.) The Broadway Bridge employed several Moseley trusses.

City Engineer Crafts considered the bridge "one of the most important structures of the bridge kind [sic] ever erected in the city,"[17]and devoted twelve pages of his annual report to a detailed description of its features. The design included a trussed arch over Foundry Street, a long viaduct on Phoenix columns, flanged wrought-iron segments, another trussed arch of 100-feet span over the railroad tracks, an 80-foot rim-bearing swing span over Fort Point Channel (also using Moseley arched trusses), a viaduct to Lehigh Street, and another trussed arch similar to that at Foundry Street over Lehigh Street. Altogether the structure was 1,117 feet in length. The Phoenix columns were 12 inches in diameter and 1/4-inch thick, coated with a coal-pitch varnish.

Work on the bridge was begun in 1869. At the end of December 1870, resident engineer Pratt wrote confidently that completion was only two months away. The work had taken longer than originally predicted, and Pratt explained the delay:

> Owing to the very confident proposition of the contractor in the first instance, to finish the work on the first of December 1869, the impression on the public mind was that it was work of not much magnitude, for which a high price was to be paid. In reality, it is the greatest iron bridge ever undertaken in New England, embracing some of the most intricate engineering operations, requiring great care and prudence in conducting the preparations, and constant watchfulness at all times.[18]

Moseley, however, was no longer on the job. The unanticipated expense of the work had bankrupted the company, and the firm had surrendered its contract the previous September. [19]

No annual report was filed the following year. City engineer Crafts and resident engineer Pratt had resigned, and no successor had been appointed. In November 1872, Joseph P. Davis (1837-1917) was named to succeed Crafts.[20] Davis's first report, dated January 20, 1873, is dominated by the Broadway Bridge debacle. The bridge was eventually completed by the City of Boston, but in only two years the drawspan had settled, putting the truss members out of plumb and making much extra work for the drawspan engine. (To level the drawspan, the bridge superintendent was forced to apply increasingly heavy weights to opposite corners of the span.) Expansion in hot weather bound the drawspan so tightly that adjacent chords had to be cut short. Cold weather contraction did not return the bridge to its original position before expansion. The 1/4-inch thick Phoenix columns, on which much of the bridge was supported, were rusting away at the ground level. The arched spans over Lehigh and Foundry streets were leaning eastward.

By July 1873, the situation had further deteriorated.

> The whole structure [assistant engineer Henry Manley reported] has moved towards the South Boston end. Second, the towers, and trusses with them, have also had an independent motion -- the westerly tower to the north, and the easterly tower to the south. ....There is no cross-bracing in the floor of the draw, nor anything but the weight of the draw to prevent this warping motion.[21]

Distortion of the swing span's track was causing part of the wheels to bear only on their outer edges, with the result that they were continually breaking and crumbling. Manley's report cites numerous other problems. By the following January, the city recognized that repairs were impossible. In May 1874, the bridge was closed to traffic. Money was appropriated for an entirely new structure, and work began on the new replacement span in August 1874.

The 1875 Bridge

The central pier of the drawspan, which was built in 1874-75, is the oldest part of the present Broadway Bridge. With the previous bridge failure fresh at hand, extra care was given to the substructure of the new bridge. Into a circular excavation 54 feet in diameter, spruce piles were driven in concentric circles about 3 feet apart, to an average depth of 12 feet 4 inches. The piles, 10 inches in diameter, were cut off at grade 2 feet below mean low water. After enclosing the piles with a curb, the entire space was then filled to the top of the piles with hydraulic cement. Above this concrete core, six courses of rock-faced Gloucester granite were laid in a circular wall 12 feet high. The base for the central pivot, laid within the area enclosed by the wall, was laid in six courses of circular and octagonal stone courses, each with enscribed circles smaller than the one before. The topmost course, level with the outer wall, was 12 feet in diameter. A central column about 8 feet high was

erected on this base, each course being octagonal in form except the top course. which was a circular stone 6 feet in diameter.

The superintendent's quarters and engine room were built around the center column, occupying the space between the top of the granite wall and the track circle that supported the revolving swing span. This circular space, eight feet high and sheathed in wood, was itself surrounded by sixteen cast-iron columns supporting the track ring, which was fitted into the cast-iron caps of the columns.

The iron draw span, built by the Watson Manufacturing Company of Paterson, New Jersey, was composed of two 159-foot 6-inch bowstring trusses, 40 feet apart, with 10-foot sidewalks cantilevered from the outside. Like the present drawspan, the swing was a center-pivot type swing span. The trusses were carried on the ends of two plate girders, which transmitted the whole weight of the superstructure to the center column. The new bridge opened for travel May 7, 1875.[22]

Approach Spans

Nineteen plate-girder approach spans make up the bulk of the 1,121 feet of this bridge. Almost all date to 1902 and a request by the New England Railroad Company for greater clearance over its tracks.[23] In October 1901, contractor Patrick McGovern, of Boston, was awarded the contract for building the South Boston piers. Altogether twelve piers were constructed between Foundry Street and the draw: five were of masonry, and seven sets of steel columns. Four additional piers were built between the drawbridge and Lehigh Street in Boston.

The plate girder superstructure was constructed by the Boston Bridge Works. All are deck plate girders of varying lengths except the twelfth span, an 84-foot-long through plate girder carrying the roadway over the mainline railroad tracks.[24]

In the 1950s, Boston underwent tremendous physical change resulting in the demolition of its New York Streets section and its West End section under a massive slum clearance program, and the construction of what was then also called the Central Artery. Between 1958 and 1959, the construction of the new roadway resulted in the reconfiguring of the bridge approach to accommodate the new highway and its off and on ramps. The piers affected were those built in 1901 by Patrick McGovern which were located between the drawbridge and Lehigh Streets in Boston. The part of Broadway Bridge that went over Lehigh Street was removed, as was most of Lehigh Street, and the expressway built. This resulted in the demolition of Pier 20, the most northern pier, although Pier 19 was reused as a support for the new road.[25]

Replacement of the Draw Span, 1915

The present steel drawspan was built in 1914-1915 by the Boston Bridge Works. The span appears to have been replaced due to increased use of the bridge, which by the early twentieth century, carried trolley tracks and was the primary route from Boston to South Boston. Since the 1875 masonry piers were still in good condition, it was decided to reuse them rather than replace them. The reuse of the 1875 masonry substructure determined that the swing span would be a center-pivot-type, as opposed to the more common rim-bearing swing span. Although both types of turning mechanisms were adequate to the job (and the Boston Bridge Works was using both at the time) the circular pier and works left over from the 1875 span dictated the use of a center-pivot mechanism.

The span, as built, is 210 feet long and 60 feet wide. Forty feet was allowed to hold two streetcar tracks and two lanes of traffic. Two overhanging sidewalks were each 7 feet wide. The two riveted steel trusses, each 120 feet long, are of the Warren type with the top chord rising to a central 47-foot high tower.

The new span raised the height of the masonry drum 4 feet 6 inches with a reinforced concrete wing wall, upon which rested the circular steel drum 40 feet in diameter and 4 feet 6-1/2 inches deep. The six trucks which ran on a track on the drum served to keep the draw properly balanced. When the draw span was open, its weight was supported entirely by the center pier and a 26-inch diameter phosphor bronze disc, placed between two hardened steel discs. When closed, the dead load on the center was partially relieved by the bridge seats at either end of the span, wedges being driven to raise the ends.

The draw was powered by two 20-horsepower electric motors suspended from the cross girders. Through a set of steel gears, a pinion engaged a rack on the fixed foundation drum. The bridge ends were lifted by 5-horsepower motors, similar to those used in the construction of the draw over Chelsea Creek the year before. Endlifts and turntable engine were controlled from an operating cabinet on the sidewalk near the center of the draw. Both the motors and pinions have since been removed and the endlifts disabled.[26]

Later History

The drawspans of Fort Point Channel saw their greatest usage in the late nineteenth century due to the heavy industry in the area. In the twentieth century, however, as industry in South Boston declined on the channel, the number of openings were more infrequent. In 1906, the drawtender at the Broadway Bridge reported opening the bridge 2,381 times -- an average of 6-1/2 times a day. For the City Engineer's report, he broke down the types of vessels passing through or beneath the Broadway Bridge as follows:

26 steamers
955 sailing vessels
4,015 tugs
1,798 others[27]

By 1929, the annual number of openings had been reduced to 813, and a decade later to 518, the fewest number of openings of any of the fourteen drawbridges then operated by the City of Boston.[28] By the early 1950s the Broadway Bridge draw operated only on a standby basis and mostly for garbage scows going to the Albany Street disposal station. In 1952 to 1953 the trolley tracks were removed (having been replaced by buses) and the bridge was resurfaced. On May 13, 1955 the Federal Government declared Fort Point channel nonnavigable and the disposal station was closed in 1956. The bridge was not operated as a drawbridge after 1955 but it was kept in working order until the completion of the Central Artery in 1959. This was done in case the construction necessitated movement of materials by water but this option was never utilized. Upon completion of the roadway the draw was fixed and the draw house, fender system and machinery were demolished.[29]

Boston Bridge Works

The Boston Bridge Works, builder of both the approach spans and the present drawspan of the Broadway Bridge, was one of the most prolific New England bridge builders. The firm is credited with constructing half of all the railroad and highway bridges built in New England during the first half of the twentieth century.[30]

The company was founded by Massachusetts native, David H. Andrews, who was born in 1844.[31] Andrews began his career by working in several of the many machine shops of Worcester and Fitchburg, MA, receiving invaluable "hands-on" training. In 1869 he received a Bachelor of Science degree from the Chandler School of Science and Arts, a school connected to Dartmouth College. The addition of a formal degree to his machine shop training was a decided advantage over most self-taught engineers of the period. After receiving his degree, Andrews worked for Kendall and Roberts, a Cambridge, MA company which made boilers and hoisting engines and for the National Bridge and Iron Works company, located in Boston.

In 1874 Andrews left National Bridge and became a consulting engineer in Boston and Cambridge. Two years later, utilizing his connections from his former employees, borrowed money from Kendall and Roberts to buy the tools and machinery of the National Bridge company (which had gone into receivership in 1876) with the intention of forming his own bridge manufacturing company. In 1878, Andrews named the company Boston Bridge Works and completed his first bridge (which survives today), a bowstring truss, located in Framingham MA.

In the first few years of his business Andrews was located in Cambridgeport, MA, but in 1882 he built a factory on Binney Street in East Cambridge, MA, a location that was to remain home to the company until it closed in the 1930s. (None of the buildings remain today.) While the manufacturing plant was located in Cambridge, the business offices were in downtown Boston.[32]

During the 1880s and 1890s the company, as stated in their advertising, built,

> Wrought-iron railway and highway bridges, draw bridges, long span iron roofs, iron trusses and girders of all descriptions for sustaining or moving fixed loads. . . .[33]

The company had also patented a locomotive turntable that the company claimed did not tilt as engines moved over it.

During this time period the company kept expanding their facilities and had added 25.000 square feet of space by 1888. By the early 1890s the company covered 140,00 square feet and employed 300, and at busy times, 400 people.

In addition to building bridges, Andrews realized the potential of the new steel frame buildings being constructed in the late nineteenth century as a source of business: the company built the framing for the Worthington Building, Boston's second steel framed structure (which is still standing today).

In 1896 a fire destroyed the company's Cambridge works but the firm began rebuilding almost immediately. Andrews used the disaster as an opportunity to reconfigure and modernize the plant and he and his engineers designed many of the new structures. The new plant was completed in 1902.

In the late nineteenth century, when there were over 700 small bridge construction companies throughout the country, bridge building companies tended to focus their operations in regions, which is what Boston Bridge did, mostly building in the New England states and occasionally in other areas of the country. But at the beginning of the twentieth century many bridge companies faced the threat of trusts, i.e. one company buying and consolidating many smaller ones. The American Bridge Company, which in 1901, was bought by U.S. Steel, began to buy many of the smaller bridge companies throughout the United States; in one year they bought 24 companies. They certainly must have been in discussion with Andrews but he resisted and the Boston Bridge Works remained an independent operation.

David Andrews died in 1921 and the company, without apparent interruption, taken over by his son, John G. Andrews. In 1930, at the beginning of the Great Depression, a company profile indicated that the firm had expanded again, to 4.5 acres and still employed about 300

people. But the impact of the Depression could not be avoided. In 1929 the company moved its business office from Boston to Cambridge, and in 1930 they stopped all advertising, although they continued to stay in business. In 1932 the firm suffered another fire and a large building was torn down but not replaced. In 1937 the company built their last bridge; in 1938 they designed a bridge but it was built by another firm.[34]

The Boston Bridge Works survived for over sixty years and built many bridges throughout New England that are still extant.[35] Today, of the highway bridges in the state, 76 have been identified as being constructed by the Boston Bridge Works. In addition to the fixed spans, the firm built at least four swing spans: two each of the rim-bearing and center-pivot varieties. (In addition to the Broadway Bridge, the company also built the Bridge Street span over the Bass River in Beverly (1929) as a center-pivot swing.)[36]

Significance

As identified by the Massachusetts Historic Bridge Inventory, conducted by the Massachusetts Highway Department:

> The drawspan of the Broadway Bridge [Massachusetts Highway Department No. B-16-125] is the largest and most impressive of the four surviving center-bearing swing bridges identified in the MDPW computer print-out. Although a total of thirteen surviving swing bridges (some of them no longer operable) have been identified in the MDPW print-out, the large majority (nine) are of the rim-bearing type. Only the Congress Street Bridge in Salem (ca.1916), the Main Street Bridge in Amesbury (rebuilt 1966, possibly reusing an 1882 pier and bearing), and the Bass River Bridge in Beverly (1929) share the center-bearing configuration.[37]

The construction of the trusses themselves is typical of much steel bridge construction in the early twentieth century, when elements of bridge structure -- rolled channels, steel angles, lacing bars, built up channels and box girders -- had all been largely standardized. The significance of the structure lies in its identity as a movable lift bridge.

Added significance is given by the context of the bridge. Fort Point Channel is today spanned by five moveable bridges, all examples of different types of 19th-century moveable bridge technology (HAER Documentation MA-130). With the exception of the 1930 Congress Street bridge, all were built in the period 1898-1915. Two different types of bascule bridges (Congress Street, a trunnion bascule; New Haven Railroad bridge, a rolling lift bascule, HAER Documentation MA-35) flank a rare retractile drawspan (Summer Street). All three are flanked by the two swing spans located at either end of the channel: Northern Avenue on the north end, and Broadway at the south end. The two are classic examples of the two principal types of swing spans, the rim bearing swing and the center pivot swing. In these two examples it is possible to clearly see the difference in truss construction. Whereas

the load carried by the Northern Avenue bridge is transmitted to the rim by a four-posted tower (thus spreading the load to four points on the rim), the Broadway bridge transmits the entire load via a pair of diagonals and single pair of posts at the center of the trusses.

More abstractly, but no less important than the physical structure of the bridge, is the substructure of the original Broadway Bridge span, built in 1874-1875. It is the last surviving reminder of Boston's first trials in large-scale iron bridge construction and the consequent failure from faulty construction and administration.

ENDNOTES

1. Shurtleff, 107. Fort Point itself took its name from its proximity to the first fort erected on the peninsula.

2. Chapter 174, Acts of 1866: "An Act Concerning the Laying Out, Altering, Widening, and Improving the Streets of Boston."

3. Annual Report of the City Engineer and Surveyor, 1868. City Document No. 22, p. 32.

4. City of Boston, Department of Public Works, Works Progress Administration, Broadway Bridge, p.2.

5. Ibid., p. 14.

6. Walter Muir Whitehill, A Topographical History of Boston, (Cambridge: Harvard University Press), pp. 77-78.

7. Ricardo J. Elia, et al, Phase I Archaeological Investigations of the Central Artery/Third Harbor Tunnel Project in Boston, Massachusetts (Boston MA: Office of Public Archaeology, Boston University),pp. 207, 213.

8. Ibid., pp. 180, 185; City of Boston, Annual Report of the Department of Public Works, 1957, p. 23.

9. "Nathaniel Henry Crafts," Boston Evening Transcript 15 June 1908. p. 12,

10. The Ordinance is reprinted as Doc. no. 110 in the Boston City Documents of 1868. The ordinance also required annual reports, and the 1868 collection of city documents included the first Annual Report of the City Engineer (Doc. no. 22), which provides a useful history of the department to that time.

11. Annual Report of the City Engineer and Surveyor, 1868. City Doc. No. 22, p. 15.

12. "Thomas Willis Pratt," American Society of Civil Engineers Proceedings 1 (1876), 332-335.

13. National Cyclopedia of American Biography (hereafter NCAB), 22 (1932), p. 342.

14. One of the more successful users of this material was Samuel Reeves (1818-1878), who invented the "Phoenix Column" in 1862, using flanged wrought-iron segments to construct compressive members of great strength. Phoenix columns, produced by the Phoenix Iron Company were widely used around the country in the 1879s and 1880s in both railroad and highway spans.

15. Patent # 16,572 (3 February 1858).

16. Victor C. Darnell, A Directory of American Bridge-Building Companies, 1840-1900. Society for Industrial Archeology Occasional Publication No. 4 (Washington, D.C., 1984), pp. 23, 88. Three examples of Moseley trusses are known to survive: in Wayne County, IL (1865); in Lawrence. MA (1867), now relocated; and in Claremont, NH (1870). (See Simmons, "Bridges and Boilers.")

17. Annual Report of the City Engineer, 1870. City Document No. 14, p. 17.

18. Annual Report of the City Engineer, 1871. City Document No. 15, p. 45.

19. Ibid. The company's Hyde Park property was taken over by the New England Iron Company.

20. Davis was no exception to the water works hiring policy, but his experience had been out of state -- Brooklyn, Peru, and St. Louis -- until he had been called to study the prospect of building a new water supply from the Sudbury River system. During Davis' term of office, 1872-1880, the Sudbury system was completed. (See NCAB 25 (1936), p. 51.

21. Annual Report of the City Engineer, 1874. City Doc. No. 20, p. 51.

22. Annual Report of the City Engineer, 1876. City Doc. No. 24, pp. 14-20.

23. Chapter 143 of the Laws of 1902 order the railroad company to pay the city of Boston for raising the bridge. as petitioned by the company.

24. Stephen J. Roper, "Broadway Bridge, B-16-125,"Massachusetts Highway Department, Historic Bridge Inventory Form. 9 August 1984, n.p.

25. City of Boston, Annual Report of the Department of Public Works, 1949-1959, specifically 1957, p. 22.

26. Roper, 1984; Peter Stott, Sunday Morning Tour Brochure, June 17, 1984; 13th Annual Conference (Washington, DC: Society for Industrial Archaeology),n.p.

27. Annual Report of the City Engineer, 1907. Boston City Documents.

28. Boston Municipal Research Bureau, "Boston Drawbridges" (1940), p.1.

29. City of Boston, Annual Report of the Department of Public Works, 1957, p. 21.

30. Orra Stone, History of Massachusetts Industries (Boston. 1930), p. 818; cited in

Gregory J. Galer, "The Boston Bridge Works in Rhode Island," 1987. typescript, courtesy of the author.

31. Darnell, p. 78.

32. Gregory J. Galer, "The Boston Bridge Works and the Evolution of Truss Building Technology," 1989, unpublished undergraduate thesis, courtesy of the author. pp. 20-26.

33. Ibid., p. 33.

34. Ibid., p. 28-55.

35. Ibid., Appendix B - Extant Boston Bridge Works Bridges in Massachusetts. Rhode Island and Vermont, pp.108-113.

36. Stephen J. Roper, "Boston Bridge Works in the MHD Data Base," three-page list dated 2-16-88, prepared for the Massachusetts Highway Department Historic Bridge Survey. Courtesy of the author.

37. Stephen J. Roper, "Broadway Bridge, B-16-125,"Massachusetts Dept. of Public Works Historic Bridge Inventory form, 9 August 1984.

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"Rebuilding Drawspan. General Plan of Turning Mechanism." August 1, 1913. Blueprint. Bridge Division, Boston Department of Public Works.

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Broadway Bridge, view toward Boston. Repairing Elevated trolley tracks, ca. 1920. Photocopy from original photograph. Located at Archives, Society for the Preservation of New England Antiquities, Boston, Massachusetts.

Broadway Bridge, trolley station, outbound (from Boston out) platform, March 6, 1950. Photocopy from original photograph. Located at Archives, Society for the Preservation of New England Antiquities, Boston, Massachusetts.

Broadway Bridge, South Boston trolley station, between 1911 and 1917. Photocopy from original photograph. Located at Archives, Society for the Preservation of New England Antiquities, Boston, Massachusetts.

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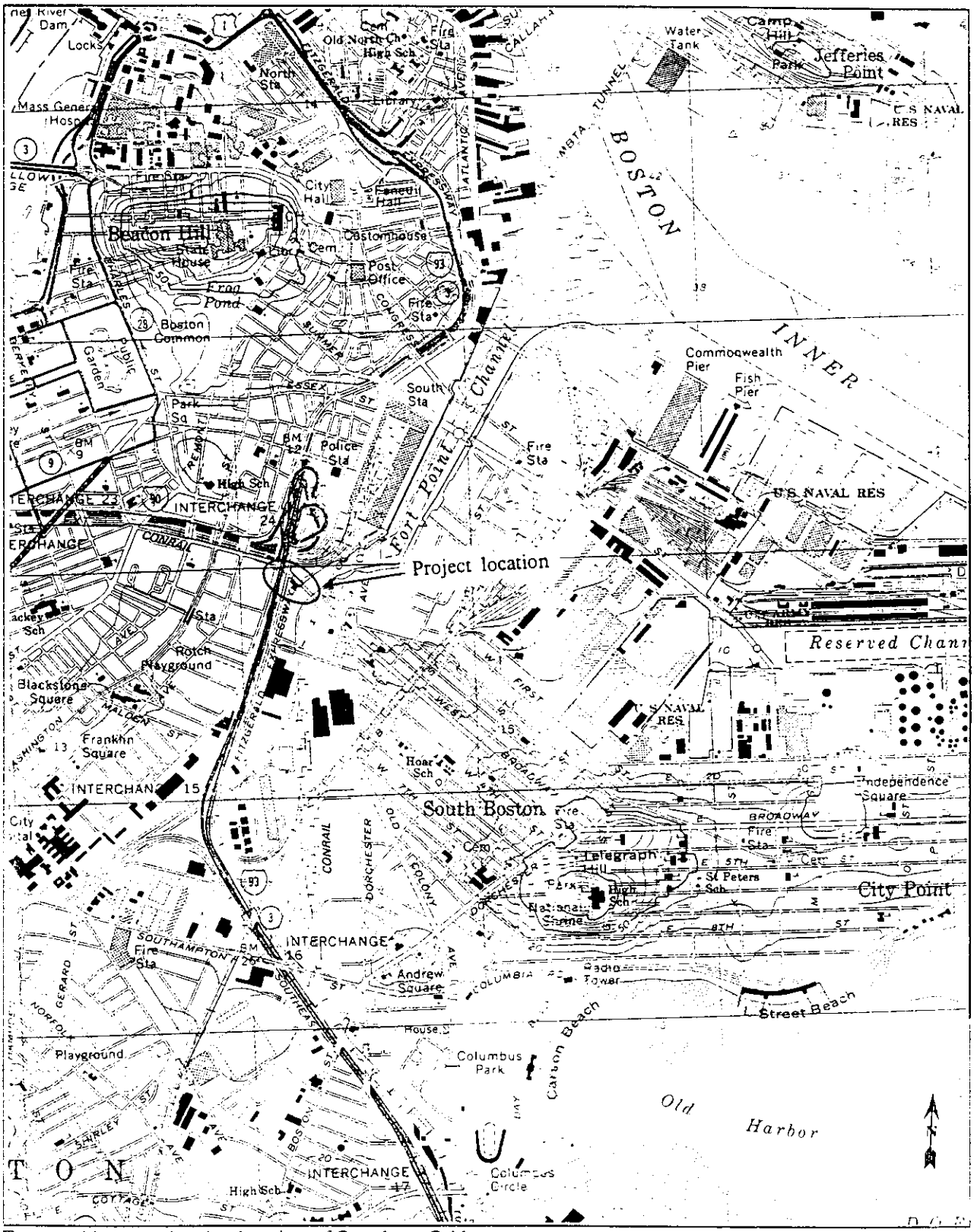
Broadway Bridge Drawings Located at the City of Boston Department of Public Works Bridge Division. Frontage Road, Boston, MA.

Date	No. of Plans
1867	1
1901	
1901	1
1901	1
1901	1
1902	2
1902	4
1902	4
1902	55
1903	1
1903	8
1911	1
1913	1
1913	26
1914	1
1914	4
1915	2
1917	1
1926	25
1927	4
1952	10
1952	10
1953	1 & 3
1956	4
1959	1
total:	172

Date	1867
No. of Plans	1
Type	Plan traced from Surveyor's Plan #L-362 dated 5/11/1867 - Broadway Extension Taking Plan. Shows property lots and owners.
Date	1901
No. of Plans	
Type	Construction Accounts for Piers between Draw & Foundry [Street] with data on excavation, piles, etc.
Date	1901
No. of Plans	1
Type	Proposed elevation of tracks in Railroad Yard.
Date	1901
No. of Plans	1
Type	Proposed rebuilding
Date	1901
No. of Plans	1
Type	Showing proposed wall on harbor line.
Date	1901
No. of Plans	2
Type	Piers between Draw and Foundry Street.
Date	1902
No. of Plans	4
Type	Masonry west of draw, 18, 19, 10 & 21.
Date	1902
No. of Plans	4
Type	Piers 13 & 14; masonry of the retaining walls. pier 17.
Date	1902
No. of Plans	55
Type	Superstructure, sway bracing, floor plates. column brackets, general elevation & trestle bents for Sections A & B.

Date	1903
No. of Plans	1
Type	Additional pier masonry.
Date	1903
No. of Plans	8
Type	General flooring plan, probably not all: "Broadway Bridge Flooring."
Date	1911
No. of Plans	1
Type	Structure at the draw.
Date	1913
No. of Plans	1
Type	Details of Gears for the Broadway Bridge for the Boston Bridge Works (Fawcus Machine Company, Engineers).
Date	1913
No. of Plans	26
Type	Rebuilding the Draw Span, detailed look at draw span and all parts, ie. turning mechanism, masonry, general plan.
Date	1914
No. of Plans	1
Type	Fender pier, wharf & fender guard.
Date	1914
No. of Plans	4
Type	BOSTON BRIDGE WORKS plans for additional iron & steel approaches, air compression platform, machinery cover.
Date	1915
No. of Plans	2
Type	Navigation lights & ladders & platforms - General Plan.
Date	1917
No. of Plans	1
Type	Section F-Dorchester Tunnel.

Date	1926
No. of Plans	25
Type	Elevations & Profiles Spans 11 & 12; Steel plan and section columns, column bracing. sidewalk brackets, typical floor section: girder C floor beams.
Date	1927
No. of Plans	4
Type	BOSTON BRIDGE WORKS plans for spans 11-12, details of girders A & B.
Date	1952
No. of Plans	10
Type	Concrete deck and details of spans.
Date	1952
No. of Plans	10
Type	Construction of concrete floor; expansion joints, bearing plates; drainage layout at roadway; spans 1-2, 11-12, 19-20.
Date	1953
No. of Plans	1 & 3 supplemental
Type	Construction of concrete deck. Also draw span, steel decking & guard rail.
Date	1956
No. of Plans	4
Type	Kneeland to Dover Street alternations to Broadway Bridge, Sections, JFK Expressway.
Date	1959
No. of Plans	1
Type	Converting the Draw Span to a Fixed Span. Broadway Bridge, Sections, JFK Expressway.



Topographic map showing location of Broadway Bridge.