SHORE LINE BRIDGE
Structure No. B-16-475 (A54)
South of MBTA Readville Station at Milepost 219.11
Readville
Boston
Suffolk County
Massachusetts

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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SHORE LINE BRIDGE
STRUCTURE No. B-16-475 (A54)
READVILLE, BOSTON, SUFFOLK COUNTY

Location:	South of MBTA Readville Station at Milepost 219.11 Hyde Park, Boston Suffolk County, Massachusetts Latitude: 42.237563, Longitude: -71.133981 USGS Norwood, MA
Date of Construction:	1896
Engineer:	George Richardson Hardy
Builder:	Pennsylvania Steel Company
Owner:	Massachusetts Bay Transportation Authority (MBTA)
Present Use:	Railroad bridge
Significance:	Bridge No. B-16-475 is the only extant nineteenth-century example of a pin-connected Baltimore truss type on a rail line in eastern Massachusetts
Project Information:	The bridge has critical structural and safety deficiencies, including low bearing capacity of the underlying soil and a superstructure subject to asymmetrical and excessive loading. These issues require that the bridge be replaced. As mitigation for the loss of the historic structure, the Massachusetts Historical Commission (MHC) has requested photo documentation.

DESCRIPTION

Bridge No. B-16-475 is located on the southern side of the MBTA Readville Station in the Hyde Park area of the City of Boston. It carries a single railroad track over the three main-line tracks that form part of Amtrak's Northeast Corridor and the MBTA's regional commuter rail system, also known as the Shore Line (see Location Map and Aerial View, pages 9 and 10). The single-line track carries the Franklin Branch and is an extension of the MBTA Fairmount Line, previously identified as the Dorchester Line, at MBTA Milepost (MP) 219.11.

Bridge No. B-16-475 is a steel, single-span, six-panel, pin-connected eyebar, Baltimore through-truss with a span of 140 feet and a width of 18 feet with a 56-degree skew (see drawings, pages 11-17). The four interior panels have intermediate panel floor beams suspended from sub-tie hangers braced by sub-tie diagonal members that link three floor beams together. The floor beams are built-up steel I-shape sections. Additional eyebars are used as needed according to the load of the particular element of the truss. The sub-ties meet at pinned connections at the center of each panel. Sway bracing and upper lateral bracing, made of built-up beams with lacing bars, provide stability at alternate upper truss panel points. Two built-up steel I-shape stringers are located at approximately the third points below the deck. Angles located below the floor beams and stringers provide lower lateral bracing, linking the three floor beams of each central panel. Portal bracing also provides lateral support at the inclined end posts. The truss compression members are built-up steel sections with lacing bars. The deck is open with tracks supported on timber ties. Timber planks are used as a walkway on each side of the single track.

Located in the middle of the abutment, Bridge No. B-16-475 carries what was once the center track of the five tracks crossing over the Shore Line. A closer examination of the structure reveals that each truss once provided support for the adjacent tracks using continuous floor beams. The additional load of the adjacent tracks was supported by using an increased number of eyebars that share pin connections, vertical members, upper chords, and hangers. Evidence of this method of construction is clearly seen in the cut-off ends of each floor beam. Cut-off gusset plates below the floor beam indicate that bottom lateral bracing was shared across the bridge.

The existing substructure is a gravity abutment constructed of granite masonry blocks. The eastern and western abutments are approximately 170 feet and 154 feet long, respectively. The backs of the abutments are vertical, not battered as is typically the case with gravity abutments. Both abutments have a constant depth of approximately 10 feet over their heights except at the toe, where the overall depth increases to 13 feet and 11 feet for the east and west abutments, respectively. The height of both abutments is approximately 18 feet measured from existing grade to beam seat. The embedment depth at the abutment toe is approximately 6 feet and 5 feet for the eastern and western abutments, respectively. The height of the back wall at both abutments is approximately 3 feet. There are wing walls at each of the four abutment corners.

HISTORY

The Line

This portion of the Franklin Line, extending from Readville to Franklin, was originally conceived of as two short branch lines: the Walpole Railroad, linking Walpole with Dedham; and the Norfolk County Railroad, from Walpole to Franklin. The entire line was completed under the name of the Norfolk County Railroad, opening for service from Dedham to Blackstone in 1849, but it did not have direct access to Boston. In 1855 the Midland Railroad was completed from Boston to allow the Norfolk County Railroad direct access from their line at Islington to Boston. Readville then became a railroad junction with the connection of the Midland Railroad and the Boston & Providence Railroad (completed in 1835), with the Midland always crossing above the Boston & Providence. The Midland Railroad went through several reorganizations, consolidations, and name changes. In 1869, along with the Norfolk County Railroad, it became part of the Boston Hartford & Erie Railroad. It then became part of the New York & New England Railroad in 1875. In 1898 the New York & New England became the last major acquisition of the New York, New Haven & Hartford Railroad (NYNH&H) (Karr 1995:291-298; McGinley Hart & Associates [McGinley Hart] 1990; Tuttle 1901:182).

Grade Crossings

From 1885 onward, the Massachusetts legislature, in reaction to the increasing numbers of deaths at grade crossings as well as crossing conflicts with electric street railways, passed a series of laws to eliminate grade crossings. Bridge construction at the Readville location was part of a massive project to eliminate grade crossings for the Providence Division of the NYNH&H in Boston and approaching Boston from the south as mandated by legislation in 1896 (Allen 1900:55; General Court of Massachusetts 1896 (Acts of 1896, Chapter 321); Tuttle 1901:163). Building on an 1894 law, Chapter 321 was specific to the Providence division and called for the appointment of three commissioners to identify which grade crossings were to be abolished. Under the law the railroad was permitted to acquire any additional land necessary to eliminate the crossings. The state and the city were liable for 45 percent of the cost and the railroad was liable for the remainder. Chapter 321 also called for grade separation of private crossings. Necessary changes in grade closer to Boston resulted in elevating street crossings throughout the area, further depressing the Providence Line. This resulted in further elevating of the Midland Branch over the Providence Line. A freight yard, a transfer yard, and interlocking towers were constructed in conjunction with the new track work. All work was completed by April 1899 (Tuttle 1901:181-189).

The Baltimore Truss

Initially invented in 1871 by engineers of the Pennsylvania Railroad, the Baltimore truss was so named because the Baltimore & Ohio Railroad (B&O) used it extensively. The general design was a major advance in strengthening the Pratt truss design through the use of sub-ties and/or sub-struts. These elements not only stiffened the span but provided intermediate floor beam support to reduce individual stringer span loadings under the heavy moving load of trains. The pin connections allowed easy stress and design calculations for all of the members. The truss tension members, including the bottom chord, diagonals, and floor beam hangers, initially consisted of steel eyebars connected with steel pins. Eyebars

were pioneered by the Pennsylvania Railroad in 1861. The truss compression members were often built-up steel sections with lacing bars. The floor beams and stringers were often built-up steel I-shape sections. In use into the 1930s, the pin connections of this type of bridge were replaced by riveted connections and the eyebars were replaced by I-beams.

This crossing at Readville station originally had five tracks supported by six trusses, as evidenced by the lengthy abutment and described in contemporary accounts (McGinley Hart 1990; Tuttle 1901:182). The sole remnants of the original five-track, six-truss bridge are the two trusses that make up Bridge No. B-16-475. It was fabricated by the Pennsylvania Steel Company, an early pioneer in the production of steel and a well-known bridge design and fabrication company. J.J. O'Brien and Company erected the bridge under the supervision of G.R. Hardy, Bridge Engineer of the NYNH&H (Massachusetts Cultural Resource Information System [MACRIS] 2012; McGinley Hart 1990; Tuttle 1901:182). As the importance of the line as a route to Boston diminished in favor of what is now the main line, the company began to reduce the number of tracks on the line. McGinley Hart's 1990 survey form of the bridge noted that by 1930 the bridge had been reduced to two tracks. By 1941 all of the branches of the former Boston and Providence Railroad had been reduced to a single track (Humphrey and Clark 1985:35).

George Richardson Hardy

The engineer associated with the project, George Richardson Hardy, was a native of Malden. He graduated from the Massachusetts Institute of Technology in 1870 and then went to work as an assistant engineer on the Northern Pacific Railroad in Minnesota. By 1872 he had returned to Boston and formed the firm of Hardy & Kimball. Beginning in 1873 and for the next 13 years, he was employed by the Boston and Albany Railroad and was engaged in the construction of the great grain elevator in Boston, eventually becoming assistant chief engineer of the line. His work included laying out the yard and track approaches to Union Station in Worcester. In 1886 he left the Boston and Albany to become the assistant chief and then chief engineer of the Lake Shore and Michigan Southern. After a brief stint with the Westinghouse Company, he then joined the NYNH&H as an assistant engineer in charge of construction for special work, including the four-track construction work through Stamford, Connecticut. From 1897 to 1899, he was the immediate supervisor for the elimination of grade crossings in Norfolk and Suffolk counties. From 1899 until his death in 1903, he supervised the elimination of the grade crossings in Blackstone, Auburn, Whitinsville, and Readville, including the construction of the train shops there (Bidwell, Turner and Shepard 1903:356)

Fayette S. Curtis

At the time the bridge was built, the chief engineer of the NYNH&H was Fayette Samuel Curtis. Like many engineers of his time, Curtis was largely self-taught. After a brief education in Owego, New York, by 1863 he was a working on laying out a route for the Albany & Susquehanna Railroad between Binghamton and Albany. He continued laying out routes for a number of smaller lines. In 1870 he joined the New York and Harlem Railroad as assistant engineer, and in 1871 helped to lay out the tracks and yards for Grand Central Terminal in New York City. He then became the engineer for the improvements along what is now Park Avenue. He served as chief engineer for the New York & Harlem until he was appointed chief engineer of the NYNH&H in 1883. In this role he supervised the grade separation project

from New York to New Haven. He was then made fourth vice president of the line. He became the president of the Old Colony Line, which was owned by the NYNH&H. He was elected president of the American Society of Civil Engineers in 1919 (*Engineering News Record* 1919:160-162).

Pennsylvania Steel Company

Formed in 1865 and producing steel by 1867, the Pennsylvania Steel Company was eventually part of the Steel Pool, a trust (now illegal) that consisted of 21 steel companies who agreed to control steel output and prices (American Iron and Steel Association [AISA] 1901:101, 102; Johnson et al. 1896:356). The firm initially specialized in the production of steel rail, building the second Bessemer steel converter in America (Misa 1995:21). Starting in 1871, the Pennsylvania Railroad invested heavily in the company to create greater vertical integration and as a means to control the quality of the steel rail production. Pennsylvania Steel also owned the Maryland Steel Company at Sparrows Point. Sometime after 1887, the company began its own bridge fabrication and erection division (AISA 1887, 1900). Although it is in unclear how many bridges were fabricated and erected by the firm, approximately 115 bridges are extant (Bridgehunter.com 2016). In 1917 Pennsylvania Steel merged with the Bethlehem Steel Company and was known as the Bethlehem Steel Bridge Company. The Shore Line Bridge and other MBTA bridges built by Pennsylvania Steel are the oldest extant bridges built by the company.

SIGNIFICANCE

By 1990 Bridge No. B-16-475 was the only extant nineteenth-century example and the only pin-connected example of a Baltimore truss bridge on a rail line in eastern Massachusetts (McGinley Hart 1990). In 1990 two other Baltimore truss bridges were identified in eastern Massachusetts but not specifically named by McGinley Hart in their 1990 survey. Those bridges date to 1924 and 1928 and are of riveted construction. A check of the Massachusetts Department of Transportation (MassDot) Historic Bridge Inventory (MassDot 2012; this listing is not all inclusive) revealed that at least three other Baltimore truss bridges have been listed in or declared eligible for the National Register of Historic Places (NRHP): the Schell Bridge (Petit truss variant) in Northfield (1903), the Southbridge Street Bridge in Worcester (1910), and the Lyman Street Bridge in Holyoke (1928). It was not possible to determine the means of connection on these bridges. This means that Bridge No. B-16-475 may be one of the few pin-connected Baltimore trusses extant in the state. Bridge No. B-16-475 was photographed in 1977 (Historic American Engineering Record [HAER] 1977) as an essential element of the Northeast Corridor (see pages 18-20).

The 1990 cultural resource survey of MBTA properties determined that Bridge No. B-16-475 is eligible for the NRHP as an example of a bridge type that represents an important advance in bridge design (McGinley Hart 1990). This form was filed with the MHC. In 1997 Bridge No. B-16-475 was included in the boundaries of the Readville Industrial Area Survey, but it was not included in the description of the area nor was its significance discussed (MACRIS 2012; Public Archaeology Laboratory [PAL] 1997). Bridge No. B-16-475 may also be considered NRHP eligible for its association with the development of the rail system around Boston and its association with nineteenth-century efforts to improve rail safety.

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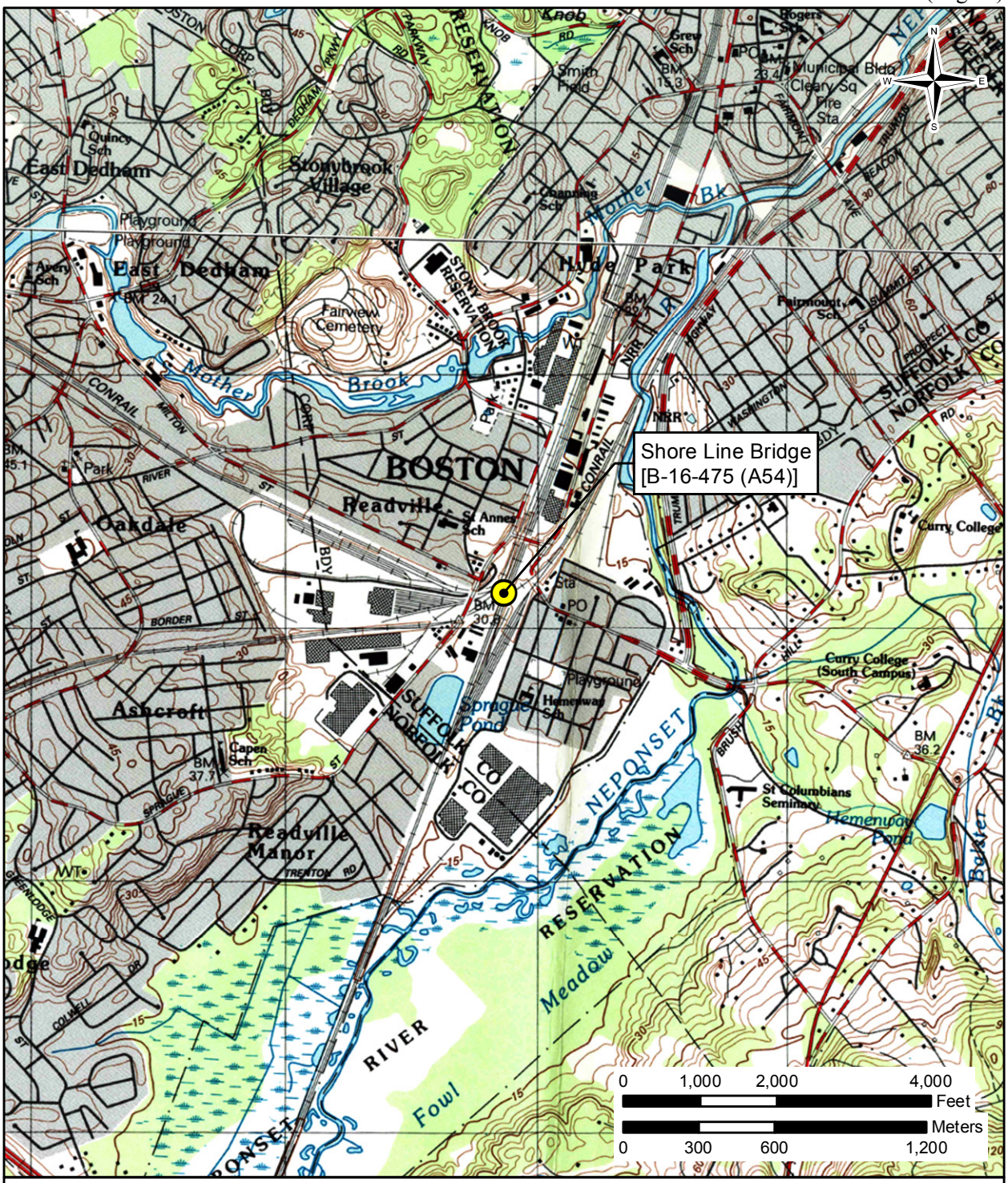
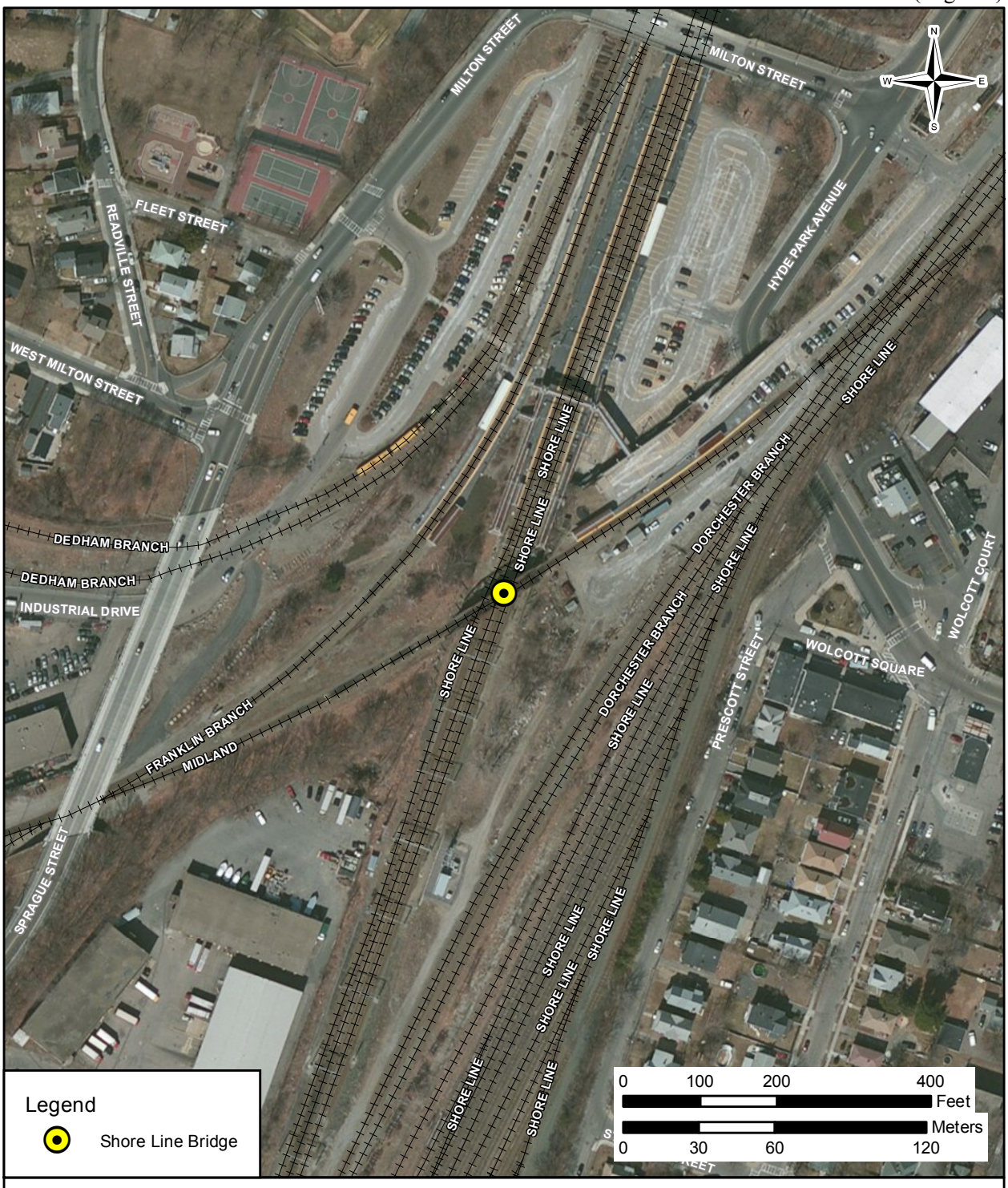
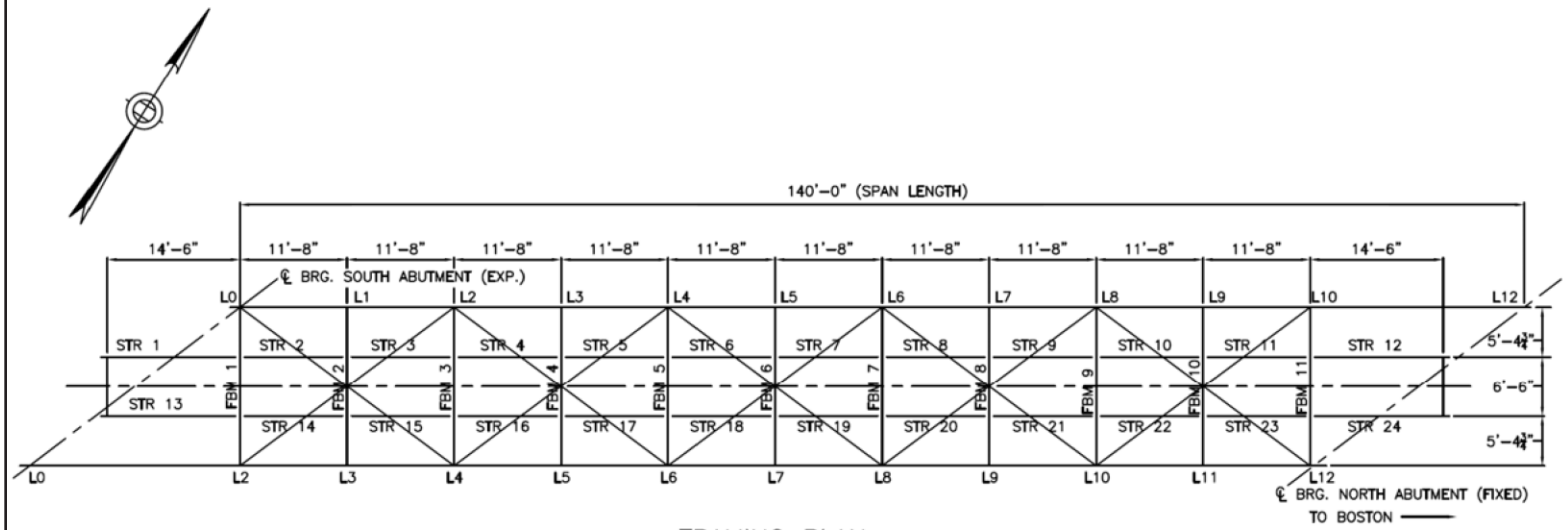


Location Map (USGS Norwood 1985, Boston South 1987)



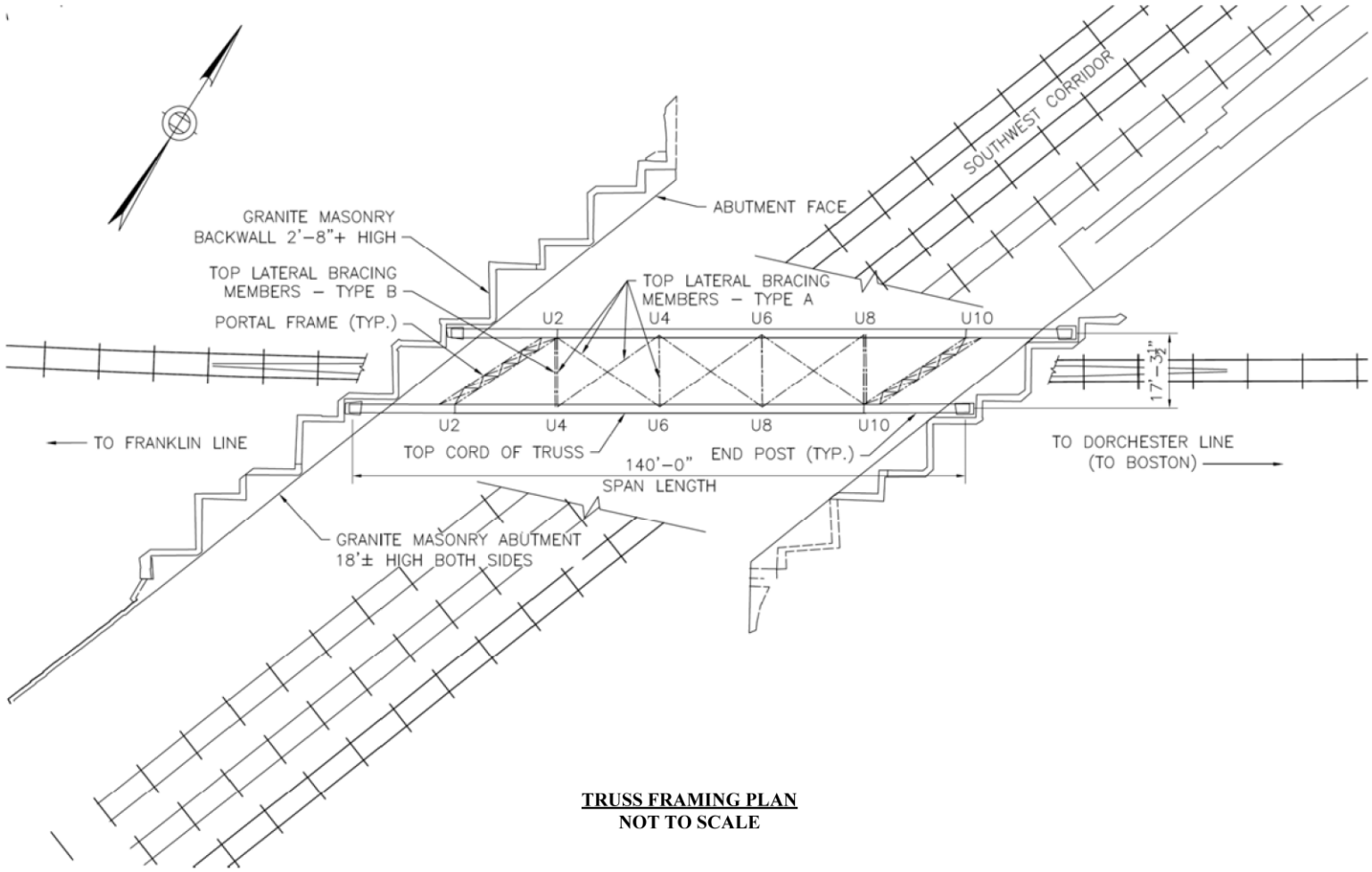
Aerial View (ESRI World Imagery 2014)



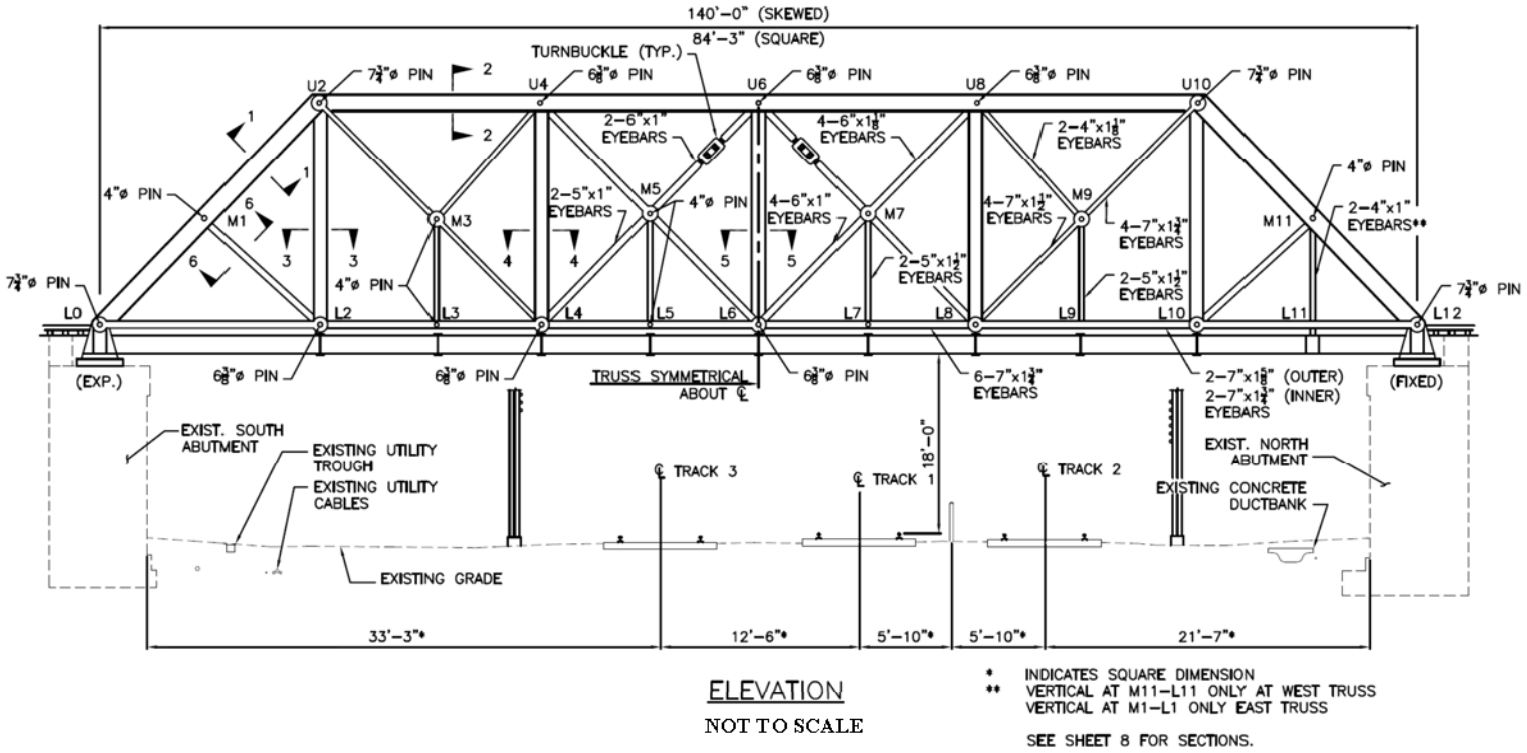
FRAMING PLAN

NOT TO SCALE

Bridge Floor System Framing Plan [MBTA, Redrawn by Louis Berger]



Bridge Truss Framing Plan [MBTA, Redrawn by Louis Berger]



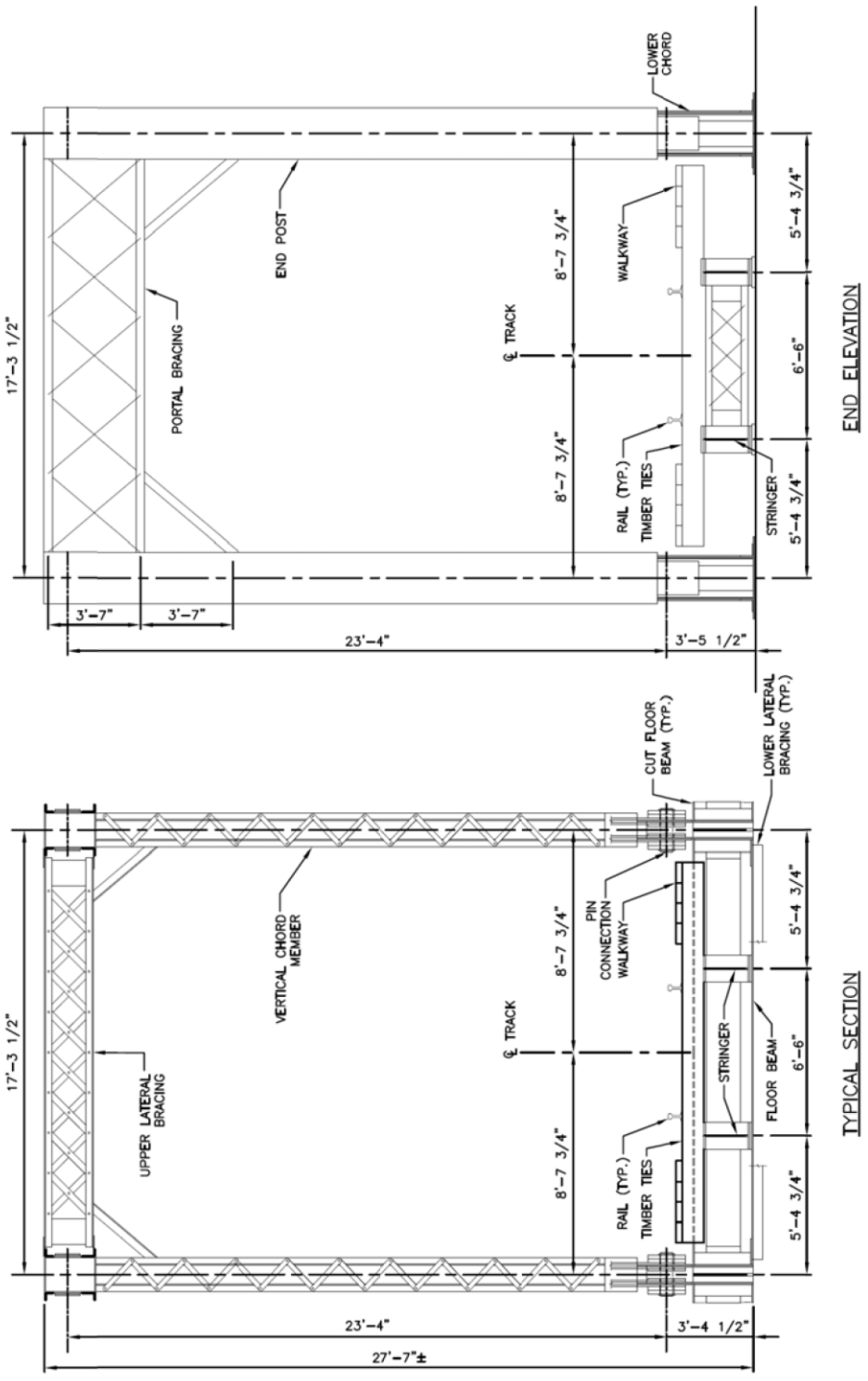
ELEVATION

NOT TO SCALE

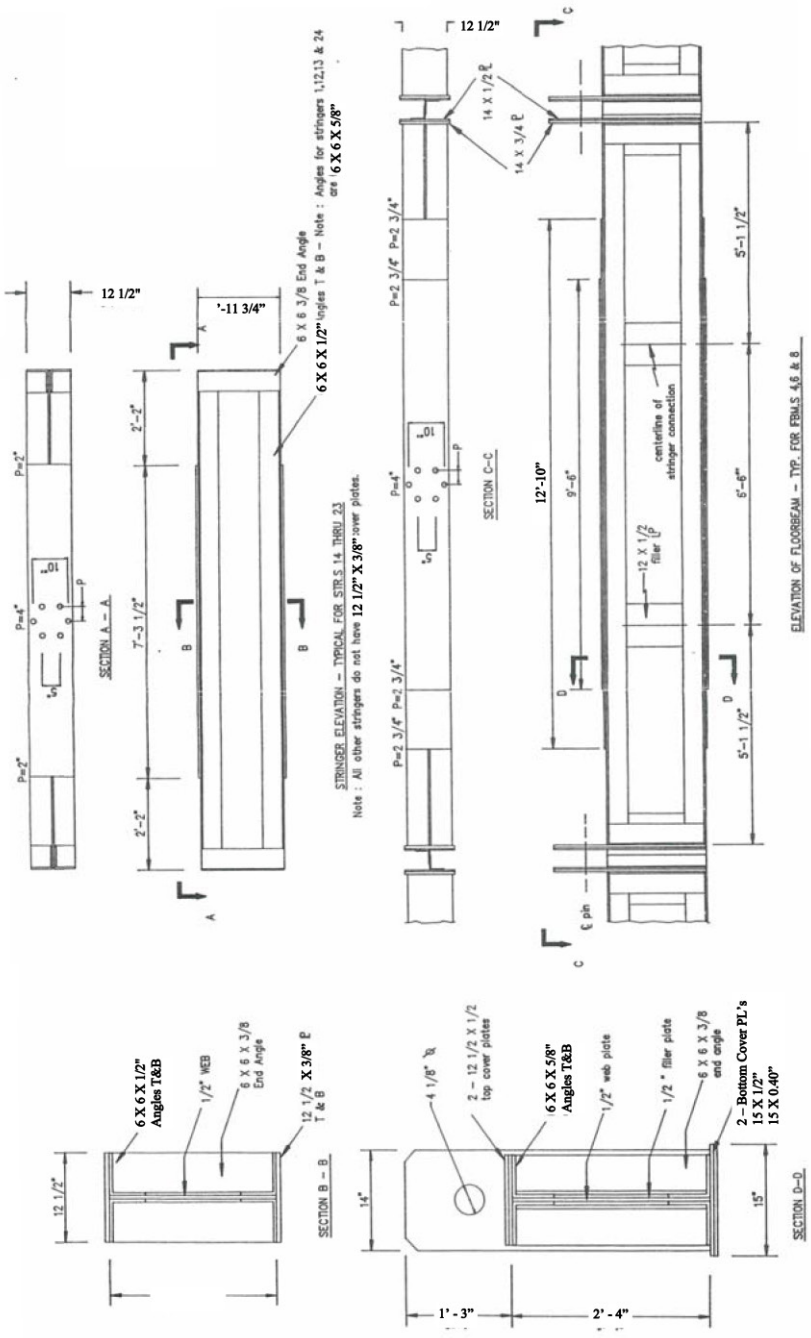
* INDICATES SQUARE DIMENSION
** VERTICAL AT M11-L11 ONLY AT WEST TRUSS
VERTICAL AT M1-L1 ONLY EAST TRUSS

SEE SHEET 8 FOR SECTIONS.

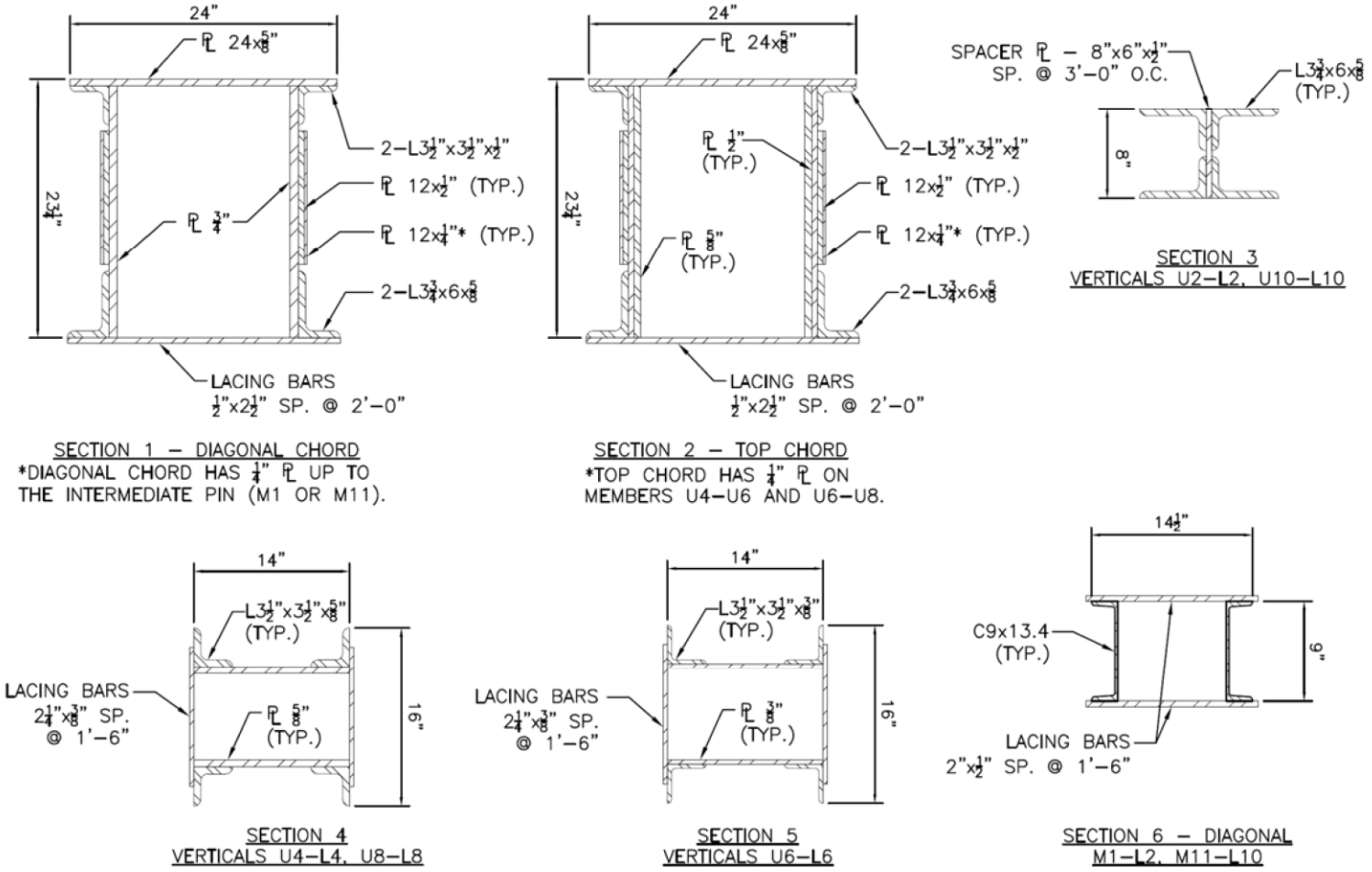
Typical Bridge Elevation [MBTA, Redrawn by Louis Berger]



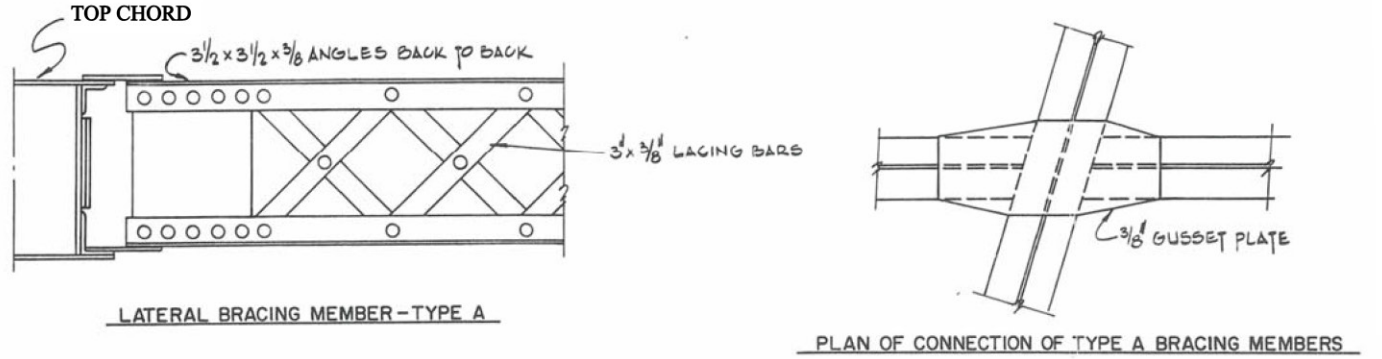
Typical Bridge Cross Section and End Elevation [MBTA, Redrawn by Louis Berger]

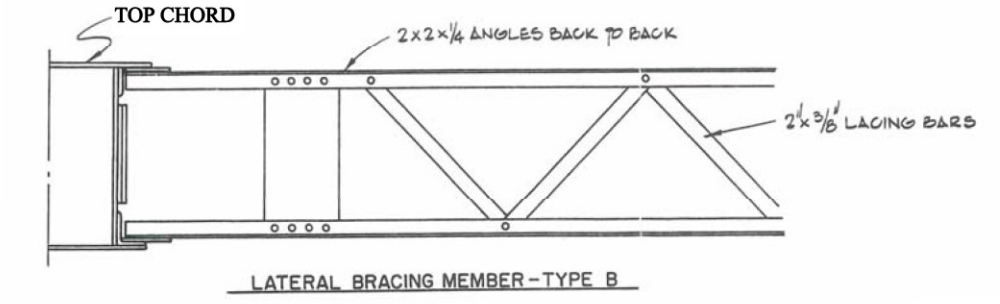


Bridge Floor Beam and Stringer Details [MBTA, Redrawn by Louis Berger]

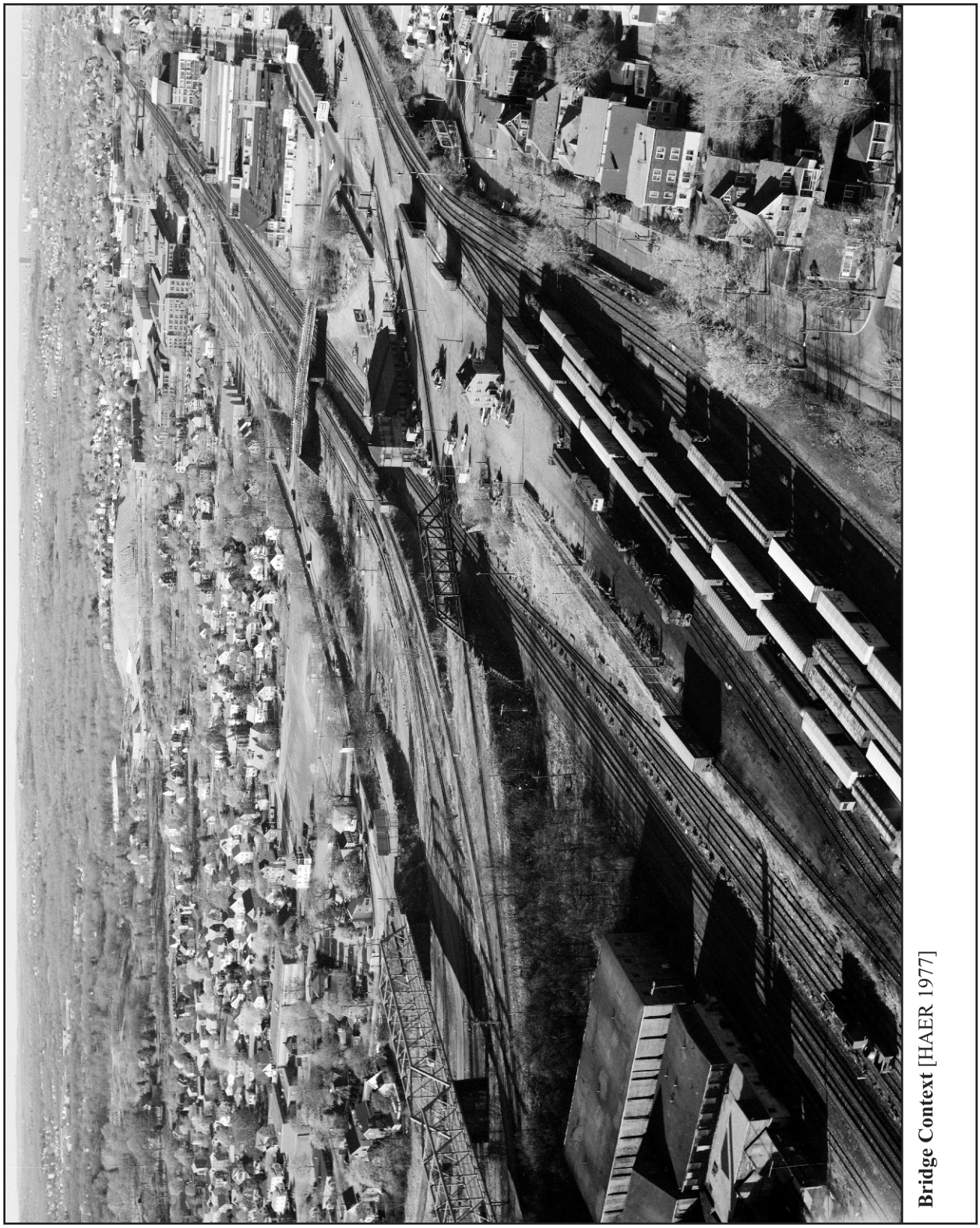


Truss Member Details [MBTA, Redrawn by Louis Berger]



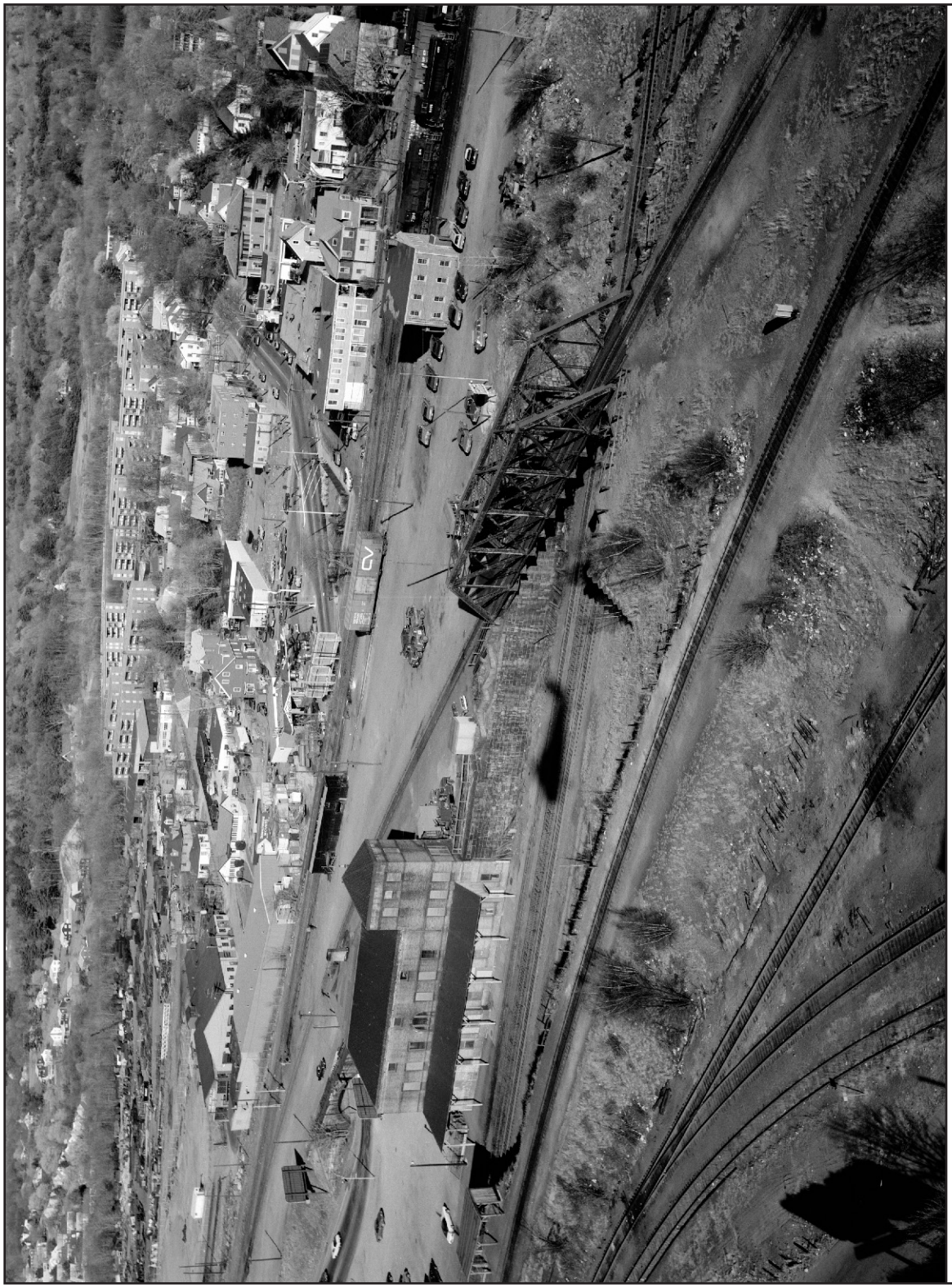


Top Chord Bracing Details [MBTA, Redrawn by Louis Berger]



Bridge Context [HAER 1977]

Historic Aerial, View From West [HAER 1977]

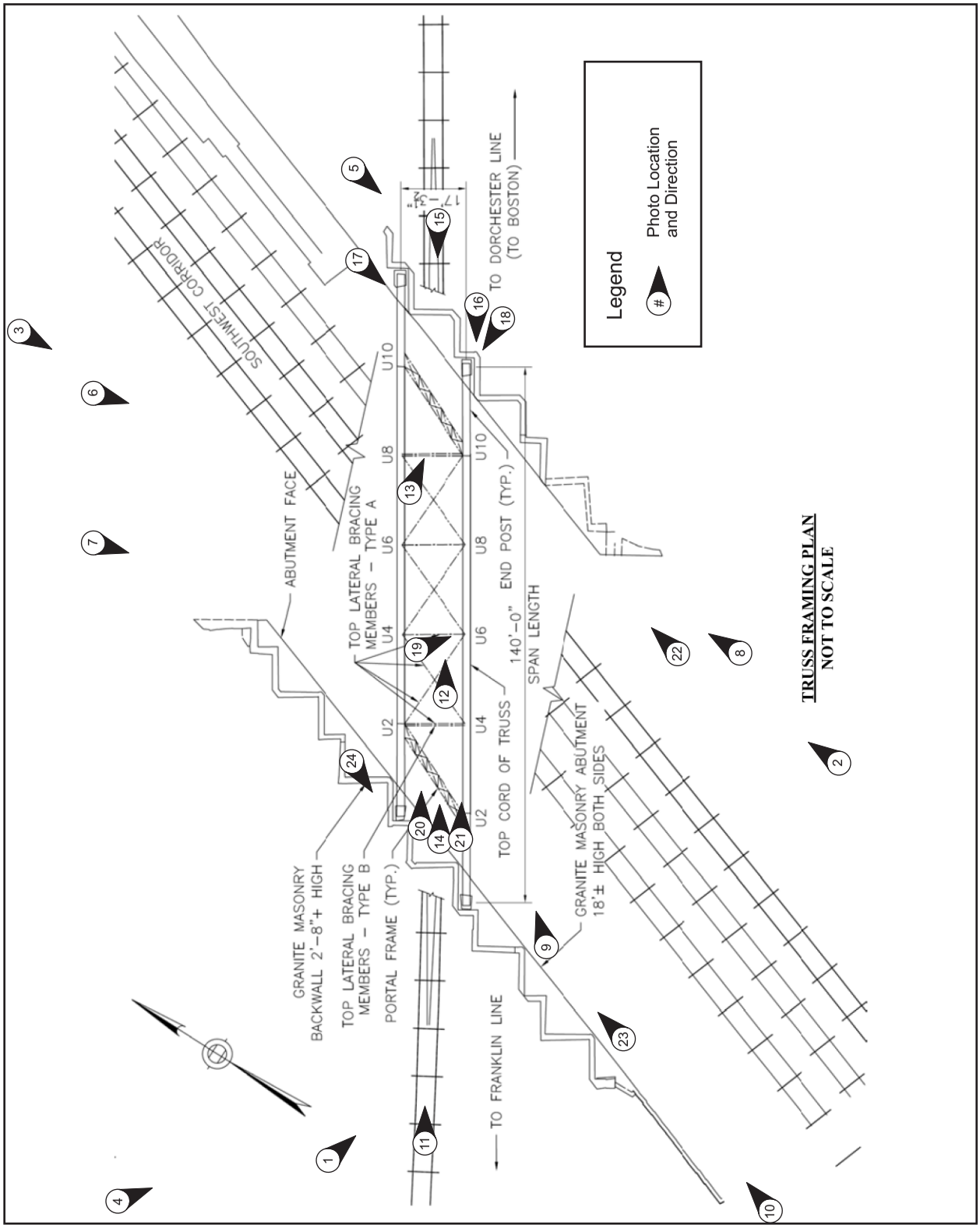


Historic Aerial [HAER 1977]

Shore Line Bridge, Structure No. B-16-475 (A54)
Readville
Boston
Suffolk County

Date of Photography: 2012-2015

1. Context View, Camera Facing East
2. Context View Camera Facing North
3. Context View, Camera Facing South
4. Context View, Camera Facing East
5. Northeast Portal, Camera Facing Southwest
6. Northern Truss, Camera Facing South
7. Northern Truss, Camera Facing Southeast
8. Southern Truss, Camera Facing North
9. Southern Truss, Camera Facing North
10. Southern Truss, Camera Facing North
11. South Portal, Portal Facing Northeast
12. Underside of Bridge, Camera Showing Cut Lateral Connections, Camera Facing Northeast
13. Detail of Underside of Superstructure, Camera Facing East
14. Underside of Superstructure, Camera Facing East
15. View Along Rails, Camera Facing Southwest
16. View Along Lower Chord of Southern Truss, Camera Facing West
17. Northwest Bearing, Camera Facing South
18. Southeast Bearing, Camera Facing West
19. Connection of Top Bracing, Upper Chord and Diagonal Bracing, Camera Facing East
20. View from Top of Portal Arch, Camera Facing East
21. Connection Detail of Top Bracing, Upper Chord and Diagonal Bracing, Camera Facing Northeast
22. East Abutment and Wing Wall, Camera Facing North
23. View Along West Abutment, Camera Facing North
24. West Abutment, Camera from Above


Legend
Photo Location and Direction
#
TO DORCHESTER LINE (TO BOSTON)
TO FRANKLIN LINE
SOUTHWEST CORRIDOR
ABUTMENT FACE
TOP LATERAL BRACING MEMBERS – TYPE A
TOP LATERAL BRACING MEMBERS – TYPE B
PORTAL FRAME (TYP.)
GRANITE MASONRY BACKWALL 2'-8"± HIGH
TOP CORD OF TRUSS
140'-0" END POST (TYP.)
SPAN LENGTH
GRANITE MASONRY ABUTMENT 18'± HIGH BOTH SIDES
17'-3"
U2
U4
U6
U8
U10
TRUSS FRAMING PLAN
NOT TO SCALE

Photograph 1

Photograph 2

Photograph 3

Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8

Photograph 9

Photograph 10

Photograph 11

Photograph 12

Photograph 13

Photograph 14

Photograph 15

Photograph 16

Photograph 17

Photograph 18

Photograph 19

Photograph 20

Photograph 21

Photograph 22

Photograph 23

Photograph 24