FORM F – STRUCTURE (BRIDGE)

MASSACHUSETTS HISTORICAL COMMISSION
MASSACHUSETTS ARCHIVES BUILDING
220 MORRISSEY BOULEVARD
BOSTON, MASSACHUSETTS 02125

Assessor's Number	USGS Quad	Area(s)	Form Number
	Springfield North		

Town Chicopee-Holyoke

Place *(neighborhood or village)* Willimansett Station

Photograph

- Site Sketch & Key to Photos, see Continuation Sheet 2

- Photographs, see Continuation Sheets 3-6

Topographic or Assessor's Map

- Topographic Location Map, see Continuation Sheet 1

- GIS Tax Assessor's Map, see Continuation Sheet 2

UTM Reference 19.266494.4715626

Recorded by Richard M. Casella

Organization: Historic Documentation Company, Inc.

Date (*month / year)* 09/2014

Street/Route Pan Am Southern Railroad [former Connecticut River Railroad (CRRR); Boston & Maine Railroad (B&MRR)]

Carried over Connecticut River
(Railroad, river, brook, canal or road)

Historic/Common name Connecticut River RR Willimansett Bridge; B&MRR Bridge 7.09/ Pan Am Southern RR Bridge 7.09

Ownership Private: Pan Am Southern Railroad
(Name of state agency or municipality)

Mass. Highway bridge no. N/A

Bridge type Deck plate girder

Bridge typology code **1** **2** **1** **18**

Date of Construction 1845, 1883, 1921

Source Historical information; original plans

Engineer/Designer 1883: unknown
1921: B&MRR Engineering Department: Pusey Jones, Bridge Engineer; Benjamin W. Guppy, Engineer of Structures; A.B. Corthell, Chief Engineer

Bridge company/Contractor 1883: G.E. Lyons, substructure, A.H. Wright, superstructure;
1921: Wilson & English Construction Co., substructure, American Bridge Co., superstructure.

Material (s) Steel, wood, stone, concrete

Alterations *(with dates)* 1883 5-span truss bridge rebuilt in 1921 as 10-span deck girder on existing stone substructure plus added concrete intermediate piers.

Posted load limit *(if any)* N/A

Condition Fair. Bridge is in use by Pan Am Southern Railroad for freight traffic. Areas of deterioration are visually apparent.

Moved _X_ **no** ___ **yes** **Date**

Acreage less than 1 acre; part of linear railroad parcel

Setting Urban mixed-use area with industrial, commercial and residential land uses.

STRUCTURE FORM (BRIDGE)

Superstructure

Overall length: 754'-10"   Deck width: 25'   Skew: abutments 0, piers 18

Main unit No. of spans: 10   Span length: 75' (1), 74' (7), 99' (1) , 50' (1)

Approaches: No. of spans: 0   Span length

Substructure *(structure below deck)*

Height above feature spanned: 28'   Material of abutments or piers: Stone, concrete

ENGINEERING/DESIGN ASSESSMENT __Y_ *see continuation sheet*

Describe important design features and evaluate in terms of other bridges within the community or region.

Pan Am Bridge 07.09 is a riveted steel deck plate girder bridge consisting of two interconnected 10-span superstructure units, each designed to carry a single track. The bridge is 755' in length overall [Refer to Figures 3-7]. Each track unit consists of two built-up plate girders, spaced 6'-6" apart, joined with cross frames and bracing of built-up angles. The two girder-span units are also spaced 6'-6" apart and similarly framed together. Each track span carries an open timber deck of 8"x10"x12'-6" treated timber ties spaced 14" (±1") on-center; the bridge has an overall deck width of 25 feet. The bridge is aligned north-northwest. The west track unit carries an active freight track; the rails have been removed from the east track unit. Span 1 girders are 8'-1" deep and span 75'-10"; Span 2 thru Span 8 girders are 9'-1" deep and span 74'-1"; Span 9 girders are 9'-7" deep and span 99'-5"; Span 10 girders are 4'-1" deep and span 49'-7".

The bridge spans are carried on two cut granite abutments with wingwalls, four granite masonry piers with concrete caps (Piers 2, 4, 6, & 8) , and five reinforced concrete piers (1, 3, 5, 7, & 9). [Piers and spans are numbered south to north]. The stone masonry abutments and piers date to 1883 and supported the previous 5-span iron truss bridge that the present girder superstructure replaced. The masonry consists of large cut and squared granite blocks with split faces (a.k.a. quarry faced) approximately 24" thick, laid in tight and even courses. The concrete piers were placed at the midpoint between the existing stones piers to enable the use of plate girder spans one-half the length of the truss spans. A unique method of construction was employed that did not require falsework and did not interrupt traffic (see History Narrative).

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HISTORICAL NARRATIVE _Y_ *see continuation sheet*

Explain the history of bridge and how it relates to the development of the community.

Pan Am Bridge 07.09 was built in part in 1883 (substructure) by the Connecticut River Railroad, and in part in 1929 (superstructure and additional substructure) by the Boston & Maine Railroad (Connecticut River Line, Fitchburg Division). The line operated independently as the Connecticut River Railroad (CRRR), from 1846 until 1893 when the Boston & Maine Railroad (B&MRR) acquired operation of the line through a lease arrangement. The origin of the CRRR began in 1842 when the Northampton & Springfield Railroad was chartered to build a line along the Connecticut River between those towns. In 1845, with construction nearly completed, the line merged with the chartered but unbuilt Greenfield and Northampton Railroad, forming the Connecticut River Railroad Company. The line opened to Northampton in late 1845, to Deerfield in August 1846, to Greenfield in November 1846, and to South Vernon, Vermont in January 1849. At South Vernon the CRRR joined the Vermont & Massachusetts Railroad, giving the line thru service between Springfield and Brattleboro beginning in 1850. In 1877 the CRRR began a program of expansion, first acquiring the Vermont Valley Railroad from Brattleboro to Bellows Falls, then the Sullivan County Railroad from Bellows Falls to Windsor, Vermont, then the Connecticut & Passumpsic Rivers Railroad from White River Junction to the Canadian border at Newport, and finally the St. Johnsbury & Lake Champlain Railroad from St. Johnsbury west to Swanton.

►***Go to Continuation Sheet Page 8***

BIBLIOGRAPHY and/or REFERENCES ___Y_ *see continuation sheet*

Massachusetts Bay Transportation Authority Structures Inspection Field Report, Pan Am Bridge No. 07.09 dated November 12, 2012.

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__✓_ Recommended for listing in the National Register of Historic Places. *If checked, you must attach a completed National Register Criteria Statement form.*

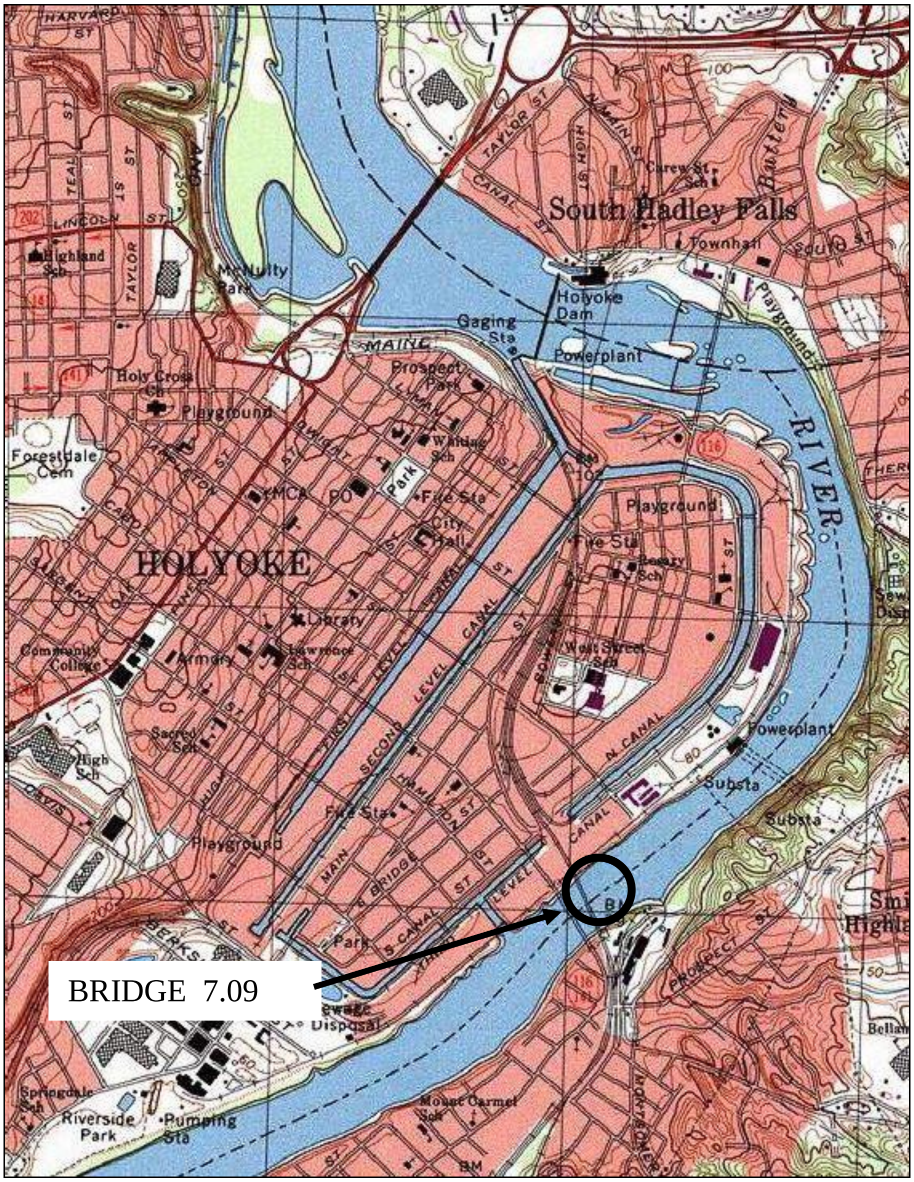

Figure 1: Topographic Location Map (source: Springfield North MA 7.5 min. quadrangle 1979).

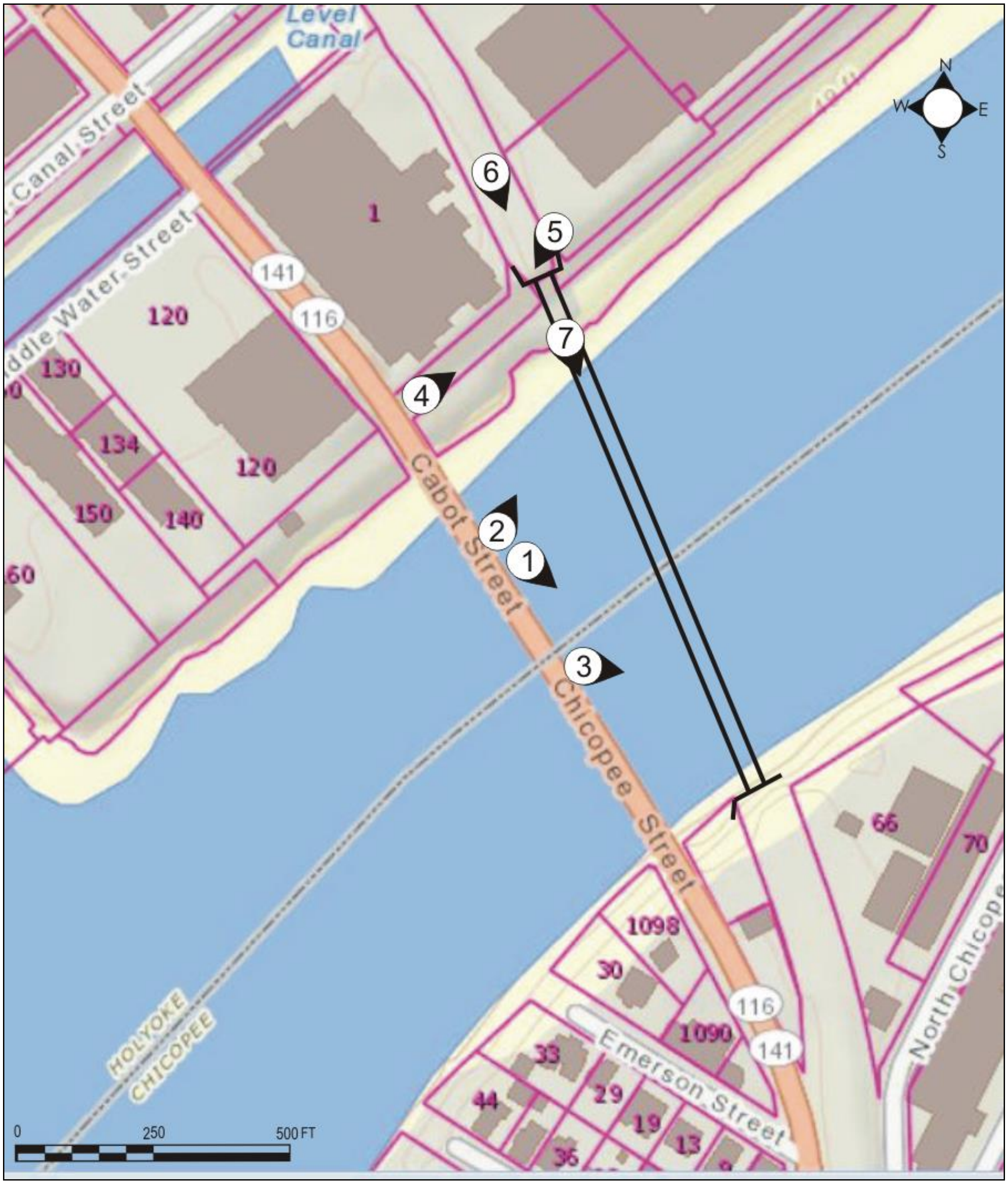

Figure 2: Location Map with Tax Parcel overlay & Key to Photos (source: OLIVER: MassGIS Online Mapping).

Photo No. 1: Downstream (west) elevation, view to Chicopee, showing Pier 1 (concrete) at far right, Pier 6 (stone) at left, looking SE.

Photo No. 2: Downstream (west) elevation, view to Holyoke, showing Pier 6 (stone) at right, and Piers 7 and 8; concrete river wall (Pier 9 integral with wall, obscured by vegetation), looking N.

Photo No. 3: Detail of Piers 3 (concrete) and 4 (stone) and Span 4, looking E.

Photo No. 4: Concrete flood control wall, showing Pier 9 integral with wall; north abutment (Holyoke) obscured by vegetation, looking NE.

Photo No. 5: North end of bridge deck (Holyoke) in context with concrete river wall and Route 141/116 highway bridge, looking SW.

Photo No. 6: View of bridge deck from Holyoke, showing east track removed; new section of welded track laid alongside active west track, looking SE.

Photo No. 7: Detail of bridge deck, looking SE.

ENGINEERING/DESIGN ASSESSMENT (continued).

Plate Girder Railroad Bridge History & Technology

In 1846-1847 the first American plate girder bridge was built by the Baltimore and Susquehanna Railroad. It was a one-track deck span, 55' long by 6' wide, with two box-type plate girders 6' deep. Girders with flat-plate flanges and multiple web plates soon evolved into a single web with angles riveted along the top and bottom to form **T**-section flanges, giving the girder its overall **I**-shape. The plate girder was quickly adopted for a variety of structural uses in buildings and bridges. As the depth of the girder was increased to achieve greater span length, regularly spaced vertical angles were riveted to the webs to stiffen them and cover plates were added to the flanges. By the 1880s, "the qualities of cheapness, endurance and simplicity of construction, combined in the so-called plate girder bridge to such a remarkable extent, as to secure its almost exclusive adoption upon railways for spans ranging from 15 to 75 feet."[1]

By the 1890s plate girders were increasingly being fitted with solid floors and ballast instead of open tie floors, an improvement that offered several advantages including reduced vibration and effect from impact loads.[2] Plate girders were widely used for highway overpass and underpass bridges to eliminate grade crossings. Up until the late 1920's, they were used almost exclusively by the railroads who could handle their massive size and weight. When used for highway bridges, the most common application was for railroad overpasses where they were easily delivered by rail and dropped into place by a derrick car.

By the early 20th century the design of plate girders was essentially standardized and described in most structural engineering textbooks. In 1906 bridge engineer Frank Skinner explained the popularity of plate girders:

The stresses in plate girders are somewhat indeterminate and the weight of materials is generally in excess of the theoretical amount required except in very short spans, but they are largely used instead of trusses because of their simplicity, ease of construction, shipment and erection, durability and less liable to injury by accident, more effective mass and rigidity, and best suited for use into positions of small clearance. Almost exclusively used for spans of 30-60 feet, generally used for spans 20-100 feet and occasionally for spans up to 130 feet.[3]

In his 1908 text *The Design of Typical Steel Railway Bridge*, Canadian bridge engineer W. Chase Thompson, writes:

> The plate girder is the commonest, as well as one of the most useful types of railway bridges. It is suitable for spans of from about 20'-90' or 100'. Plate girders considerably longer than 100' have been built, but they are seldom economical. The chief advantages are rigidity and lasting qualities. Its rivets seldom work loose, and it is easy to paint. As a permanent structure it ranks next to the masonry arch. Although comparatively simple to construct, the stress in a plate girder are somewhat complex; and there are many points in its design that require careful attention.[4]

From the late 1920s up to World War II, the railroads built thousands of plate girder bridges to replace not only aging spans but also for grade crossing elimination projects funded in part by the Federal government during the Depression.

Engineering/Design Significance Summary:

The superstructure of Pan Am Bridge 07.09 is large example of early 20th century railroad deck plate girder technology. Although it does not possess innovative engineering technology for its time, it does represent the economical application of deep heavy girders to achieve Coopers E-60 railroad bridge loading as part of a system-wide upgrade done by B&MRR as well as other railroads nationwide at the time. The stone substructure of the bridge dates to the 1883 when it was built to carry a 5-span iron truss bridge; it survives in its original condition with the exception of concrete caps added in 1921 to accommodate the conversion to a deck girder bridge. The high integrity and quality of the stone work stands as an exceptional and increasingly rare example of 19th century masonry craftsmanship. The bridge therefore possesses the necessary engineering and design distinction for listing in the National Register under Criterion C.

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1 M. J. Becker, "Plate Girder Bridges," *Engineering News* 13 (January 17, 1885), pp. 33.
2 Ibid.
3 Skinner, 1906, pp. 3-4.
4 W. C. Thompson, *The Design of Typical Steel Railway Bridges,* (New York: McGraw-Hill Book Company 1908), p. 17.

HISTORICAL NARRATIVE (continued)

The first bridge at this location was a single track covered wood bridge built in 1845 by the Northampton & Springfield Railroad Corporation. The bridge was part of a single contract awarded in October 1844 to construct nearly the entire line, including the "Graduation, Masonry & Bridging" from the Chicopee River to Northampton, about 13 miles, including a bridge over the Connecticut River."[5] A year later, on 1 October 1845, the *Springfield Republican* reported "The bridge over the Connecticut River at Willimansett is nearly completed – the piers wholly so. It is to be a covered bridge similar to that for the Western Railroad in this town." [6] In July 1882 the Connecticut River Railroad contracted with Greenfield contractors A.H. Wright and George E. Lyons to construct a new double track iron truss bridge at Willimansett to replace the 1845 covered span. The stonework, consisting of abutments and four piers was done by Lyons, using large cut granite blocks quarried from his recently purchased quarry in West Dummerston, Vermont. Wright built the superstructure, consisting of five pin-connected Pratt Truss spans, each about 150 feet in length. The bridge was completed at a cost of about $40,000 and load tested and opened December 24, 1883. It was equipped with a sidewalk for foot passengers who paid a two-cent toll.[7] In 1884 the public began calling for a passenger and highway bridge, free of toll, to be built between Willimansett (Chicopee) and Holyoke and in 1891 Wright and Lyons were awarded a contract to build a four-span truss highway bridge just south of the railroad bridge. [The highway bridge carries Cabot Street/MA116/MA141 and is currently closed and under reconstruction].
In 1920 the B&MRR ordered 20 new locomotives of the Santa Fe type, a heavier more powerful engine capable of hauling trains of 3000 tons versus trains of 1775 tons with their existing locomotives. In advance of the new locomotives, bridges were inspected to determine their need for strengthening or replacement. In 1918 the Willimansett Bridge was inspected and found badly overstressed; trains were restricted to one track and limited to 10 miles per hour. A study of alternatives showed it would be cheaper to build five additional concrete piers between the existing stone piers to carry 10 plate girder deck spans ($476,000) than to build five through truss spans ($588,000).[8] Plans for the reconstructing the Willimansett bridge using plate girders carried on the existing substructure plus new concrete piers were drawn up by the B&MRR in 1919 and finalized in early 1920. A contract for the fabrication and erection of the steelwork was awarded in March 1920 to American Bridge Company, and for the substructure to Wilson & English Construction Company in May. A great cost to be avoided in any railroad bridge repair or replacement is the interruption of train traffic. In the case of the Willimansett Bridge great ingenuity, engineering, and erection skills were employed to avoid those costs. A unique method of erection was designed by B&MRR engineers under the direction of Chief Engineer Arthur B. Corthell. The method called for the girder spans to be fully assembled – including deck and track – on flat cars that were then hauled out on the bridge by locomotive. "By the use of hoisting machinery on the shore, the [girder] span was then picked up and suspended from the top of the old trusses by means of bridle beams, clamps and cables." The adjacent girder span for the second track was then delivered and suspended. The floor system of the truss span was then removed using acetylene torches and the girder spans lowered into place on the piers. "When the girders were installed for a complete truss span, the trusses were picked up by two derrick cars, carried to shore, burned apart and shipped away." [9] The actual steel erection began April 17, 1921 and was completed on May 22, 1921.

Historical Significance Summary:
Pan Am Bridge 07.09 is importantly associated with the building and operation of the Connecticut River Railroad, a railroad significant in the transportation and development history of Massachusetts. It was the largest bridge along the rail line. The upgrading of the bridge in 1883 to an iron-truss double-track structure increased capacity and profitable operation of the line. That event is embodied in the 1883 granite abutments and piers that survive intact. The second reconstruction in 1921 by the Boston & Maine Railroad is associated with the efforts of the B&M and other railroads at the time to invest in heavier and more efficient trains in and increasingly competitive market. The bridge is therefore associated with events important to state and local history and possesses the necessary historical significance for listing in the National Register under Criterion A.

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[5] *Springfield Republican.* "Notice to Railroad contractors and Bridge Builders." October 7, 1844, p.3.
[6] *Springfield Republican.* "Conn. River Railroad." October 1, 1845, p.6.
[7] *Springfield Republican.* July 14, 1882, p.6; December 24, 1883, p.6.
[8] A.B. Corthell. "Renewing a Bridge Without Falsework. Boston & Maine Develops Unique Methods to Overcome Erection Difficulties at Willimansett, Mass." *Railway Maintenance Engineer, Railway track & Structures,* vol. 18, January 1922, pp. 4-5.
[9] *Ibid.*,p. 5.

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Boston and Maine Railroad. 1910. *Corporate History of the Boston and Maine Railroad Company (System) including Owned, Leased and Controlled Lines as of Dates of Valuation June 30, 1914 and June 30, 1916.* [See, Connecticut River Railroad Company, pp. 240-244]. Typed manuscript located in Boston & Maine Historical Society Archives, at Center for Lowell History, Lowell, MA.

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W. C. Thompson. *The Design of Typical Steel Railway Bridges.* (New York: McGraw-Hill Book Company 1908), p. 17.

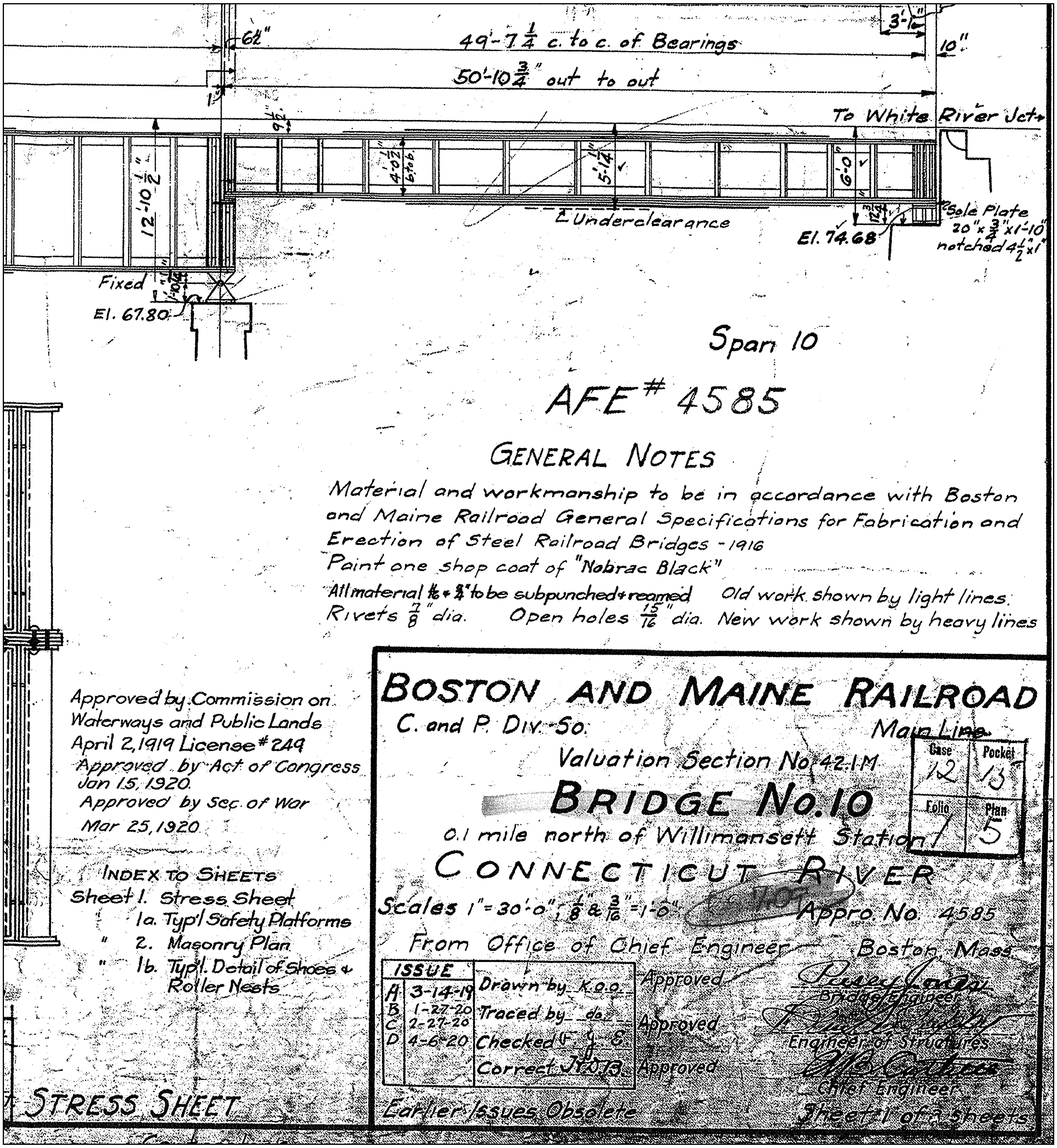

Figure 3: Portion of original plan sheet showing title block, general notes, and elevation of Span 10. (source: Massachusetts Bay Transportation Authority files).

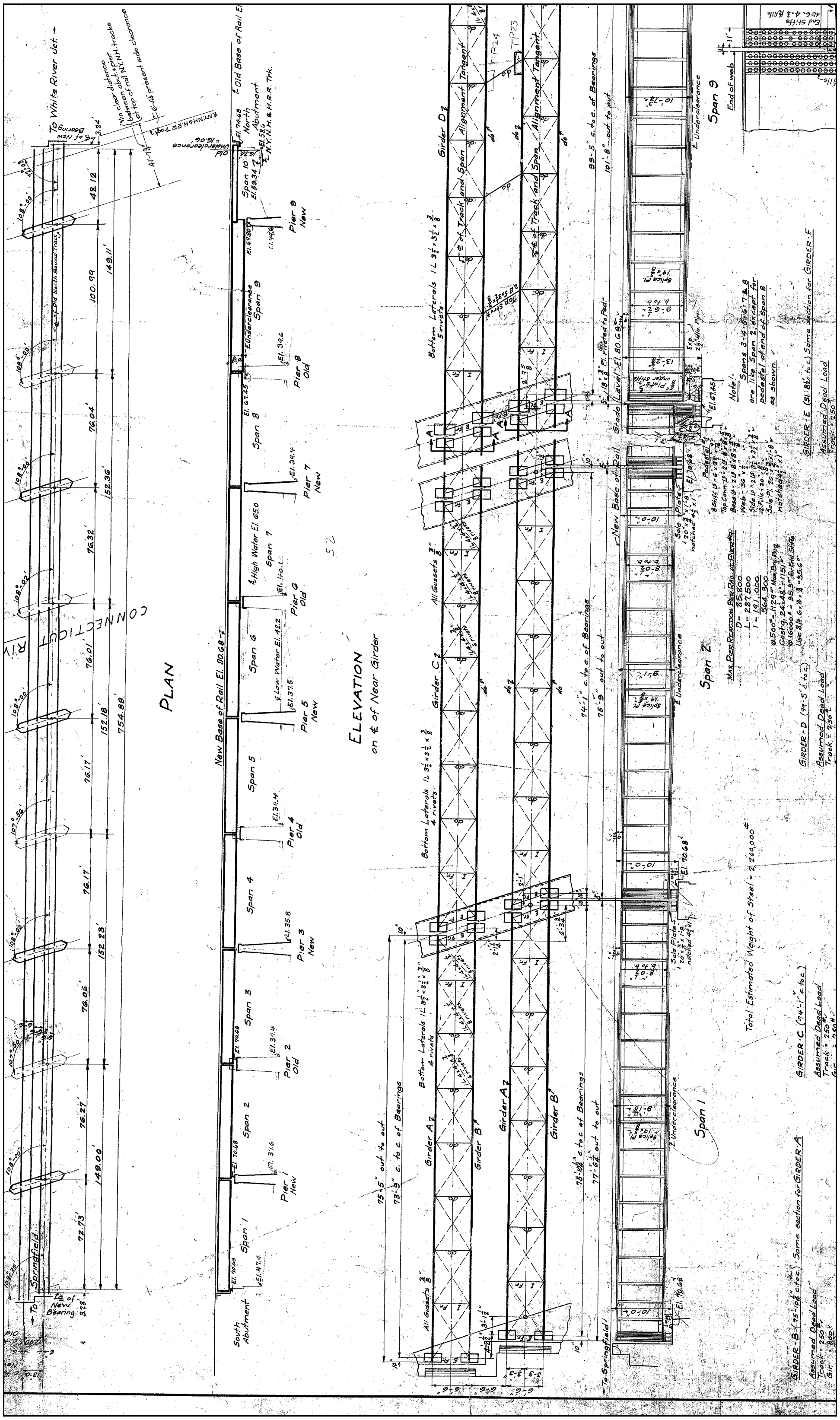

Figure 4: Portion of original plan sheet showing overall plan and elevation of bridge (source: Massachusetts Bay Transportation Authority files).

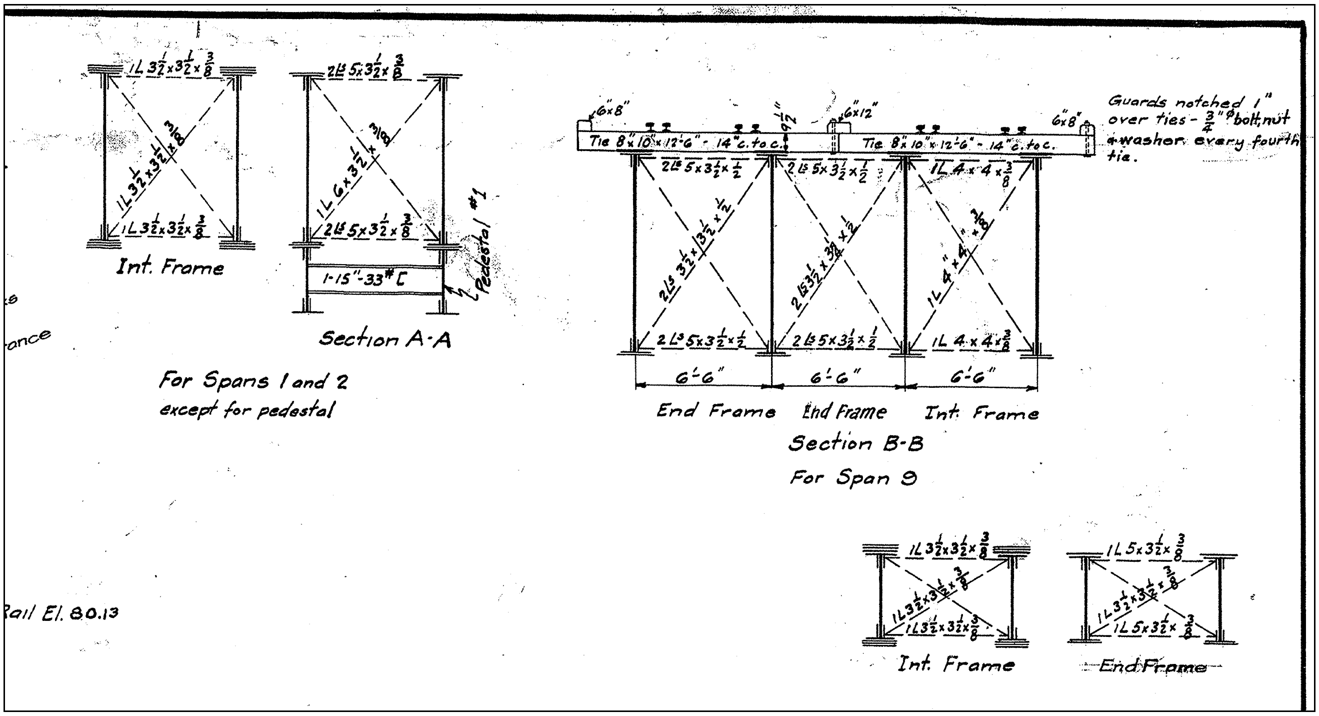

Figure 5: Portion of original plan sheet showing sections of girder spans (source: Massachusetts Bay Transportation Authority files).

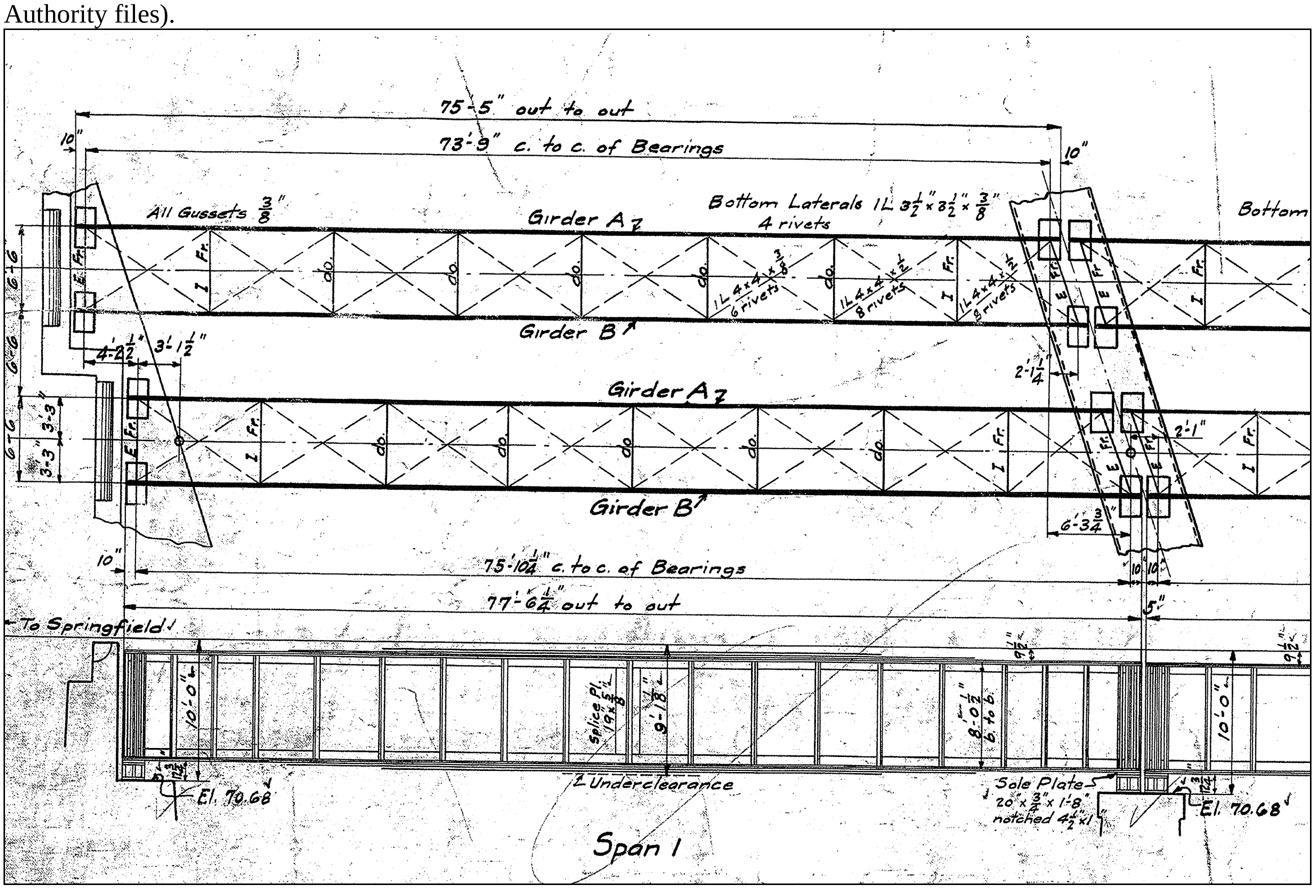

Figure 6: Enlarged portion of original plan sheet showing plan and elevation of Span 1 (source: Massachusetts Bay Transportation Authority files).

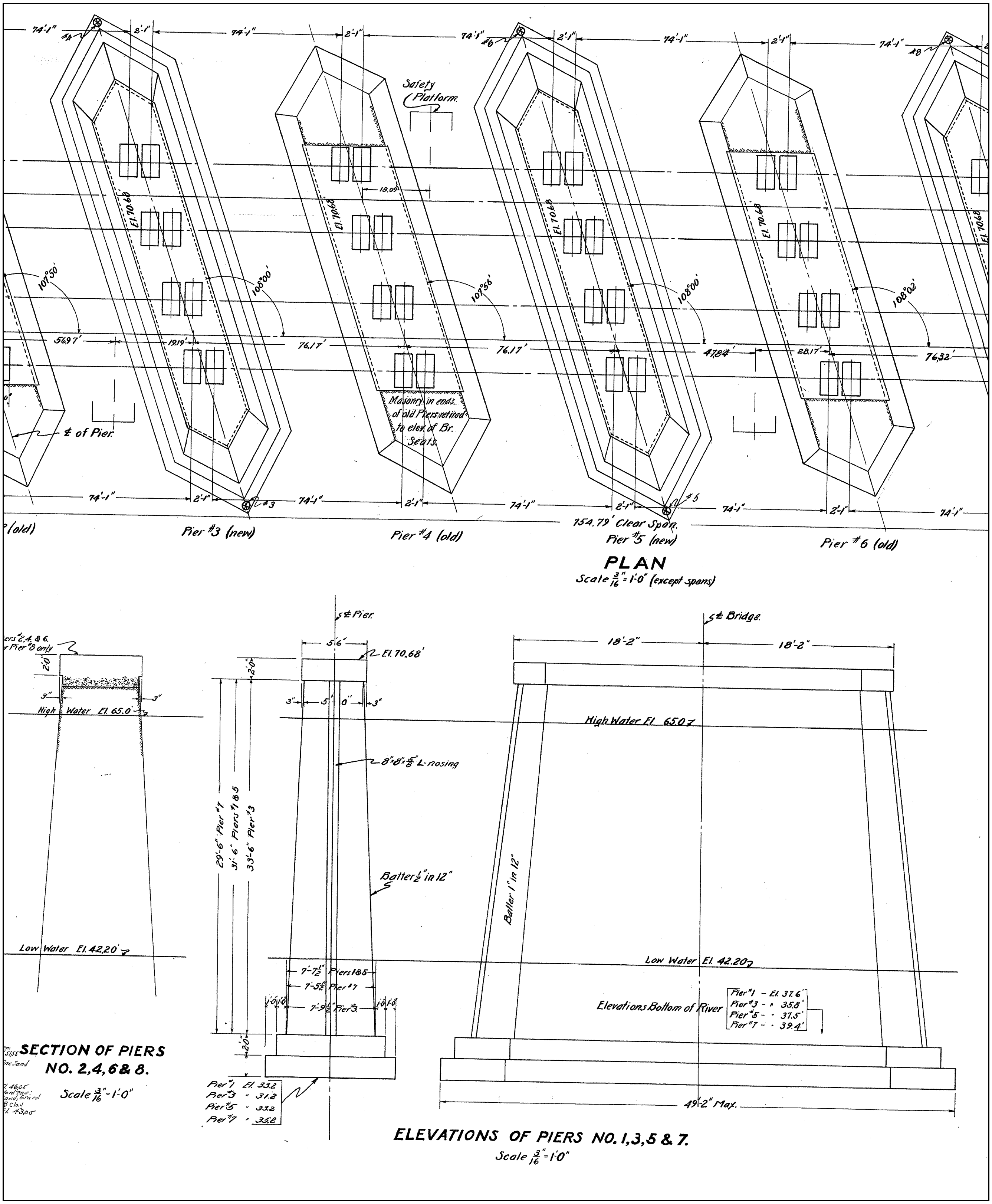

Figure 7: Portion of original plan sheet showing plan and elevation of typical stone and concrete piers (source: Massachusetts Bay Transportation Authority files).

National Register of Historic Places Criteria Statement Form

Check all that apply:

☒ Individually eligible ☐ Eligible **only** in a historic district

☐ Contributing to a potential historic district ☐ Potential historic district

Criteria: ☒ **A** ☐ **B** ☒ **C** ☐ **D**

Criteria Considerations: ☐ **A** ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐ **F** ☐ **G**

Statement of Significance by Richard M. Casella

The criteria that are checked in the above sections must be justified here.

Pan Am Bridge 07.09 is importantly associated with the building and operation of the Connecticut River Railroad, a railroad significant in the transportation and development history of Massachusetts. It was the largest bridge along the rail line. The upgrading of the bridge in 1883 to an iron-truss double-track structure increased capacity and profitable operation of the line. That event is embodied in the 1883 granite abutments and piers that survive intact. The second reconstruction in 1921 by the Boston & Maine Railroad is associated with the efforts of the B&M and other railroads at the time to invest in heavier and more efficient trains in and increasingly competitive market. The bridge is therefore associated with events important to state and local history and possesses the necessary historical significance for listing in the National Register under Criterion A.

The superstructure of Pan Am Bridge 07.09 is large example of early 20th century railroad deck plate girder technology. Although it does not possess innovative engineering technology for its time, it does represent the economical application of deep heavy girders to achieve Coopers E-60 railroad bridge loading as part of a system-wide upgrade done by B&MRR as well as other railroads nationwide at the time. The stone substructure of the bridge dates to the 1883 when it was built to carry a 5-span iron truss bridge; it survives in its original condition with the exception of concrete caps added in 1921 to accommodate the conversion to a deck girder bridge. The high integrity and quality of the stone work stands as an exceptional and increasingly rare example of 19th century masonry craftsmanship. The bridge therefore possesses the necessary engineering and design distinction for listing in the National Register under Criterion C.

Pan Am Bridge 7.09 therefore meet the necessary historical significance for listing in the National Register under Criterion A and C.