NEW HAMPSHIRE HISTORIC PROPERTY DOCUMENTATION

BOSCAWEN – CANTERBURY BRIDGE

NH State No. 669

LOCATION:	Spanning Merrimack River between the towns of Boscawen and Canterbury, Merrimack County, New Hampshire. USGS Penacook, New Hampshire, Quadrangle. UTM Coordinates: 19.287672.4799189
BUILDER:	Towns of Boscawen and Canterbury.
ENGINEER:	John W. Storrs, consulting engineer.
CONTRACTOR:	Substructure modifications and superstructure: United Construction Company, Albany, NY.
FABRICATOR:	American Bridge Company, Elmira, NY, plant.
DATE:	1907
PRESENT OWNER:	Towns of Boscawen and Canterbury.
PRESENT USE:	None. Bridge closed and barricaded.
SIGNIFICANCE:	The Boscawen-Canterbury Bridge was built on the site of an 18th century ferry crossing and a series of 19th century wood bridges and is importantly associated with the transportation and development history of the two towns. It rests on the stone abutments and pier built in 1857 for the covered wood bridge that preceded it. The cut stonework exhibits the extraordinary masonry skills of the period that developed in the granite quarries near Concord. John W. Storrs, consulting engineer, American Bridge Company, steelwork fabricator, and United Construction Company, erection contractor, all were important to bridge engineering and construction in New Hampshire and elsewhere. It is an unaltered example of all-riveted Parker Truss highway bridge and the oldest remaining bridge of its type in New Hampshire.
PROJECT INFORMATION:	The Boscawen–Canterbury Bridge was documented in accordance with the standards of the Historic American Engineering Record in 2010 by Historic Documentation Company Inc. (HDC), Portsmouth, RI, for the Towns of Boscawen and Canterbury, NH. The report was written and compiled by Richard M. Casella, Engineering Historian, Historic Documentation Company. Rob Tucher Photographic Documentation, High Bridge, NJ, conducted the large-format black and white film photography.

DESCRIPTION

The Boscawen-Canterbury Bridge is a two span riveted steel high truss highway bridge on stone and concrete abutments over the Merrimack River between Boscawen and Canterbury, New Hampshire (see Figures 1 and 2). Depot Street approaches the bridge from the Boscawen (west) side; West Road approaches from the Canterbury (east) side. Completed in 1907, this steel Parker truss bridge replaced a covered wood bridge built in 1857 (see Figures 3 and 4). The bridge has been closed since 1965 due to it deteriorated and unsafe condition. The east end of the bridge is blocked by concrete and steel barricades; the west end is fenced and blocked by a large mound of earth and gravel fill dumped at the portal.

The bridge is 347' long by 20' wide overall, with a maximum truss height of 25'. It sits in a forested river valley with Route 3 and the village of Boscawen located up the hill to the west. To the east there is a broad ancient flood plain with open fields that extend nearly a half-mile to the east slope of the valley. The Merrimack River is roughly 330 feet wide and turns almost a 90-degree angle just upstream of the bridge as it changes course from a southwest to southeast direction.

The area immediately around the east end of the bridge is mostly unimproved town-owned recreational land with pedestrian created and maintained walking paths. On the Boscawen end of the bridge the adjacent land is also town owned but has been improved for recreational purposes with playing fields. Two former residential buildings are located near each end of the bridge. Both are boarded up and unoccupied. The brick house at the Canterbury end is an uncommon and important example of brick Federal-style residential architecture in New Hampshire but has been gutted by fire. The building at the Boscawen end is just barely recognizable as a mid-19th century, one-story side-gable house representative of the vernacular Greek Revival style. It has been extensively altered with the addition of a front shed dormer, replacement wood siding, trim boards, front door and other changes.

Superstructure

Structurally, the trusses are of the polygonal Pratt type, a design patented in 1844 by Thomas Pratt and characterized by a straight bottom chord and a curved or arched top chord connected with vertical posts in compression and diagonals in tension (see Figures 5 and 6). The top chord is composed of straight members that connect the tops of posts of varying height to form polygonal panels. The polygonal Pratt truss is also commonly called a Parker truss, after Charles H. Parker who patented an improved version of the Pratt design in 1870 and built several railroad bridges of the type. Parker's improvements, specifically a wrought-iron I-section top chord of either rolled or built-up members, led to widespread adoption of the type and the term Parker Truss became the common name applied to Pratt trusses with polygonal top chords. Further discussion of Pratt and Parker trusses is given below.

The two truss spans are identical, each 170'-3" in length with a total of nine panels 18'-11" wide. All structural members of the trusses are built-up riveted sections. The bridge roadway (closed, not passable) has a clear width of 17' and clear height of 14'-10".

Top chords and inclined end-posts are built-up members consisting of 10" channels joined back-to-back with 14" wide cover plates on top and with single 2-1/4" lacing bars on the bottom. Bottom chords are built-up H-section members 11" deep by 7" wide, consisting of four 5"x3" angles joined with 7" x 3/8" tie plates, top and bottom, and 11" x 3/8" tie plates on the sides.

Posts are built-up H-section members consisting of four 4"x3" or 3-1/2"x3" angles joined with 7" x 1/2" tie plates. Diagonals all consist of two angles joined with tie plates. There are counter-diagonals in the three center panels and a horizontal strut midway up between the posts in panels four and six.

The portal strut is a lattice truss 3' deep built of angles and gusset plates braced to the end posts with a curved-angle sway brace. The sway-frame struts are also angle-lattice trusses, varying in depth from 5'-2" to 7'-8". Adjustable tie-rods are used for both upper and lower lateral bracing and consist of rods of varying diameter with upset threaded ends and forged and threaded eyes.

The floor system consists of 22" plate girder floorbeams carrying three 12" steel stringers (two outside channels and one centered I-beam). The stringers carry transverse 6" steel I-beam joists, closely spaced, that in-turn carry wood flooring laid longitudinally. The flooring on the east truss is almost entirely gone except a small portion that resembles the original 3" thick by 6" or 8" wide plank shown on the plans. A replacement 2"x4" wood laminated floor was installed on the west truss at some time and is now largely rotted and unsafe.

The bridge drawings indicate that railings originally consisted of three lines of 9"x1-1/2" wood planks bolted to the truss posts and to intermediate wood posts at the center of each panel. Portions of these wood railings remain on the Canterbury span. Photos on the New Hampshire Highway Department (NHHD) Bridge Inventory Card completed in 1940, shows that by that time Boscawen had replaced the wood railings on their span with three lines of 2-1/2" steel pipe railing (Figures 7 and 8). Most of the pipe railing on the downstream side has broke free and is now lying on the deck.

Builder's plaques were mounted on the portal struts at each end of the bridge. The plaque at the Boscawen end is just visible in the 1940 Bridge Inventory Card photo (Figure 7). The plaques were reportedly removed by members of the Boscawen and Canterbury Historical Societies and are stored in their respective collections. The plaque in the Boscawen collection reads:

THE
UNITED CONSTRUCTION CO.
CONTRACTORS, ALBANY, N.Y.
AMERICAN BRIDGE CO. OF N.Y. BUILDERS.
BOSCAWEN, NH
FRANK L. GERRISH,
B. F. BUTLER, SELECTMEN
C. W. CARTER.
JOHN W. STORRS, CONSULTING ENGINEER.

According to the original drawings, the plaque at the Canterbury end differed only with the town name and the Selectmen who included Lowell T. Mason, Frank S. Davis and Frank C. Partridge.

Substructure

The bridge was built on the same alignment as the 1857 covered bridge and the same stone abutments and pier built in 1857 were used to support the new steel trusses. The dry-laid split granite abutments were capped with reinforced concrete bearing seats and backwalls. According to the plans the concrete caps are 18" thick and reinforced with 60 pound railroad rails spaced 12" apart in two crosswise layers. A raised concrete shelf, integral with the caps, takes the place of a steel end floorbeam to carry the lower set of stringers. The abutment caps also have integral backwalls, 3' high.

The pier is constructed of tightly fitted cut granite ashlar with a sharp 45-degree angle nosing on the upstream end. The nosing, also called a cutwater or ice breaker, is battered at a 50-degree angle to allow ice to be pushed up the incline to be split and forced aside. Loose rubble stone is piled around the base of the pier for scour protection.

The abutment stonework is of a lesser quality than that of the pier. The large blocks appear to been laid and joined on split faces, with a minimal of cutting and squaring. Known as quarry-run ashlar, it allows for somewhat uneven coursing and wider joints than cut ashlar, but when skillfully matched and laid it remains permanently solid and tight as shown by these abutments.

Condition and Repairs

The 1940 Bridge Inventory Card prepared for the Boscawen-Canterbury Bridge by the NH Highway Department during its first statewide bridge inspection and inventory, included the following note: "general condition very poor." The NHDOT bridge inspection records show that fifteen years later (1955) emergency repairs were made by welding steel "patches" onto rusted-through members.

In 1958 the bridge was ordered closed by the Selectmen of both towns upon the recommendation of the State Highway Department. More temporary repairs were made shortly thereafter and the bridge was reopened and posted at 3 tons.

In 1965 the bridge was permanently closed and barricaded.

In 1995 an opinion was sought from the NHDOT regarding the possible rehabilitation of the bridge as a trail for pedestrian and snowmobile use only. The report found "both layers of floorbeams severely rusted with numerous holes; trusses in extremely poor condition with lower chord section loss of 20-80%; several instances where 3 out of 4 lower chord angles completely rusted through." [1]

A 2009 engineering study examined the condition of the trusses and the rehabilitation options and costs, concluding that removal was the only feasible option.[2]

HISTORICAL BACKGROUND

History of the Crossing and Prior Bridges

The site of the Boscawen-Canterbury Bridge was used as a ferry crossing prior to 1780 operating under the name Fosses Ferry from the farm of Nathaniel Clement on the Canterbury side. In 1780 Clement petitioned the Legislature for the exclusive rights to the ferry, which were granted, within a mile of his property, if "constantly attended and well kept."[3] The ferry shuttled passengers traveling between Boscawen and Canterbury Village, three miles to the northeast. The landing on the Boscawen side gave direct access to the Portsmouth Road (now Route 3) about a half-mile south of the Boscawen Meeting House. The area became known as Boscawen Plains. Another ferry known as Blanchard's Ferry operated at the same time about 2.5 miles south where the Portsmouth Road crossed Merrimack River just above the confluence with the Contoocook River.

In 1802 the citizens of both towns were granted permission by the Legislature to build a toll bridge at Blanchard's Ferry. The bridge was built that year and became known as the Boscawen Bridge. This motivated Col. David McCrillis, a leading citizen of Canterbury to seek a charter for a toll bridge at Clement's Ferry, which was granted in 1803 to the Proprietors of Canterbury Bridge.[4] The first Canterbury Bridge and the Boscawen Bridge to the south of it are depicted on the 1806 map of Boscawen (see Figure 9).

The first Canterbury Bridge was destroyed in the Great Freshet of 1819, rebuilt in 1820 and destroyed again in February 1824.

The third Canterbury Bridge was built in 1825 and destroyed in the freshet of 1839, which also destroyed the Boscawen Bridge. The Proprietors erected the fourth Canterbury Bridge in 1840 only to see it again destroyed by the mighty Merrimack in 1848. The Boscawen Bridge had not been rebuilt so this left the towns without a bridge between them.

> By this time the citizens of the section had lost much of their enthusiasm and for the time being, further bridge building was not attempted. Occasionally a small portion of the residents of the twin towns, urged by David M. Clough and Worcester Webster, two leading citizens, would agitate the project of erecting a new toll bridge, but the towns as a whole could not agree upon the question, neither wanting the other a partner to the project. One of the towns attempted to construct the bridge, without obtaining the consent of its neighbor, and ordered the county commissioners to commence work on it. The other town took high-handed method in the matter, too, but stopped all proceedings by the serving of an injunction upon the commissioners. Litigation ensued, and continued for about two years. At the end of this time the construction of the present bridge was demanded by the county court and "Honest John" Abbott, mayor of Concord and the court's commissioner in the matter, was instructed to see that each of the towns contributed its share toward the work and expense of construction. W. L. Childs of Concord had direct charge of the work.[5]

Construction of the fifth Canterbury Bridge was started in June 1857 and completed in the fall of the same year. It was built as a free bridge at the expense of the two towns along with the Boscawen bridge to the south of it, also completed in 1857. Both bridges are shown on the 1858

Walling map (see Figure 10). The Canterbury Bridge was a two span covered bridge of unusual design with a slightly arched roof over each span (see Figure 3). It was described in a news article just before its demolition on August 21, 1907 to make way for the construction of the new steel truss bridge in it place:

> The bridge is of a style entirely unfamiliar in New England. It is covered and is after the architecture of an old English bridge, with two curving camel's back spans, and is believed to be one of a very few bridges, perhaps the only one, of the kind in the United States.[6]

The covered bridge was built at a cost of $8000 that included stone abutments and a massive stone pier in the center of the river. Previous piers of wood construction had all been pushed down by floods and ice and the taxpayers demanded supports of truly permanent construction. So the pier was constructed of large precisely cut and tightly fitted blocks of granite, with a sharp upstream nosing to resist and brush aside the water, ice and logs hurled at it year after year by the river. Resist it did: fifty years later the pier and the abutments as well were determined to be "in such a splendid state of preservation" that they were left in position to carry the new steel truss bridge designed to fit them. But the wooden bridge itself was so poorly maintained it had "declined to a state of extreme dilapidation and was condemned by the bridge commissioners." [7]

Design

When it became apparent to the Towns of Canterbury and Boscawen that the old covered bridge was becoming unsafe, they turned to consulting engineer John W. Storrs of Concord for advice. The Annual Town Reports for Canterbury and Boscawen show that "J.W. Storrs, bridge engineer," was paid $30 ($15 by each town) for "inspecting bridge" on October 27, 1906. A copy of Storrs' inspection report has not been located, but it probably consisted of a one or two page letter explaining his findings on the structural condition and load capacity of the bridge with recommendations for repair or replacement.[8] Evidently the recommendation was to replace the covered bridge with a new bridge of greater capacity and the two towns agreed to hire Storrs to oversee its design and construction. A sketch in Storrs' field notebook indicates he returned to the site in December 1907 to take measurements for the design of a new bridge.

Storrs was well qualified for the undertaking, having worked for the Boston and Maine Railroad "fifteen years as assistant engineer and bridge inspector"[9] and then as a New Hampshire state engineer for Carroll, Coos, and Grafton counties. He established a private engineering practice in his hometown of Concord in 1905, beginning what would become a long thriving career specializing in designing modern highway bridges across New Hampshire and neighboring states. He designed a large number of steel truss bridges in New Hampshire including ones over the Connecticut River at Claremont and Woodsville; over the Merrimack River at Concord, Boscawen and Hooksett; over the Androscoggin River at Berlin; and the Pemigewasset River at Hill and Sanbornton. Storrs' longer trusses were mostly riveted Pratt or Parker trusses.[10] [see additional information on John W. Storrs below].

By February 15, 1907 (the end of the fiscal year for both towns) the towns had paid Storrs $327.50, apparently one-half of his engineering fee to design the new bridge.[11] Storrs prepared four sheets of drawings, undated, showing the overall elevation and plan of the bridge, a sheet showing the reinforced concrete bridge seats to be added to the abutments and pier, and two sheets covering all the truss, floor and bracing details. [see Original Drawings in the Graphics section of this document].

Storrs chose a Pratt truss with a polygonal top chord as the most cost effective bridge type for the site. The Pratt is a quadrilateral truss (four-sided panels) with vertical posts in compression and diagonals in tension. The type was invented and patented by Thomas Pratt in 1844 and is generally referred to by engineers as a Pratt truss with a polygonal top chord or as a polygonal Pratt truss. The polygonal top chord gives the truss a slightly arched profile and as a result the bridge form has been loosely called a variety of common names in the literature including a Bowstring truss, a curved-chord Pratt truss, and a Parker truss.[12] The Parker truss, as bridge historians often refer to the polygonal Pratt, is named after Charles H. Parker who essentially "re-invented" the polygonal Pratt in the 1870s after Pratt's patent expired and added some patentable and important features that popularized its use. The term Parker Truss best suits the several patent trusses built by Parker that still survive today, but its use as a common name for the polygonal Pratt truss is applicable and widely accepted among bridge historians. [see Note 5 and additional information on Pratt and Parker trusses below].

The Pratt truss bridge was well suited to all-metal construction and was widely built by the railroads with cast iron posts and wrought iron ties prior to the introduction of structural steel in the late 1800s. The truss was easily structurally analyzed by either the graphic or the mathematical methods in use by 1850. Structural analysis permitted the stresses in each member to be calculated under various conditions of loading and led to the development of the polygonal form in which the height of the panels increased toward the center of the span where the stresses are highest. The increasing use of Bessemer steel for bridge building in the United States in the 1890s further increased the use of the Pratt truss, which was readily adaptable to both to pin-connected and riveted-connection spans.

By 1900, truss bridges with all-riveted connections – a superior design in widespread use in Europe at the time – were finding increasing acceptance with American railroad engineers. Riveted connections provided a stiffer bridge and allowed for greater distribution of stresses at the joints and a subsequent savings in metal costs. The introduction of the portable air powered riveting gun in the early part of the century allowed for the field assembly of riveted connections, eliminating the expensive and high maintenance pin connected joints. By the 1920s riveted connections had replaced pin connections as the primary method of metal truss bridge construction in the U.S.

The Parker truss proved to be an economical design and after 1890 were "widely built for both highway and railroad service."[13] [Parker's patents would have expired in 1887]. The Parker truss was widely adopted for spans exceeding 200 or 250 feet and by 1904 had been built with a span that exceeded 400 feet.[14]

Storrs' prior experience as a bridge engineer with the Boston & Maine Railroad would have made him knowledgeable of the benefits of an all-riveted bridge. By 1901 riveted highway bridges were being built with the same design and construction practices that Storrs would use for the Boscawen-Canterbury Bridge. The Chippewa Falls highway bridge over the Chippewa River at Chippewa Falls, Wisconsin, is an example of a riveted modified Parker truss with a span of 169'-1" that was assembled by air-driven field riveting on the existing abutments and piers of the bridge it was replacing. An article on the bridge appeared in the journal *The Engineering Record*, a publication wide read by professional engineers across the country.[15]

Most moderate to long-span highway bridges built in New Hampshire during the 1920s and 1930s adopted the Parker truss design. Several bridges of the type were built as a direct result of severe floods that affected Vermont and northwestern New Hampshire in November 1927 including Central Street Bridge, a 240-foot span over the Pemigewasset River between Bristol and New Hampton; Beacon Street Bridge, a 220-foot span over the Ammonoosuc River in Littleton, and Main Street Bridge, a 220-foot span over the Connecticut River between West Stewartstown, New Hampshire, and Canaan, Vermont. All of these bridges have been demolished and replaced [see additional information on comparable Parker Truss bridges in New Hampshire, below].

Fabrication and Construction

The five original shop drawings on file with the Storrs drawings at NHDOT were produced by the engineering department of American Bridge Company and note that the bridge was fabricated at the company's Elmira, New York plant.[16] Lettering added to the plans indicates that the bridge was erected by The United Construction Co., of Albany, New York under Contract No. 1211. The shop drawings are dated February 14, 1907, indicating that Storrs wasted little time between taking his field measurements in December 1906 to having the necessary contractual agreements in place for American Bridge to begin the drawings only two months later. Presumably the job was advertised for bid and awarded to United Construction Company who then contracted American Bridge Company to fabricate the steelwork; however no documentary evidence was found to support that conclusion.

The American Bridge Company was incorporated in 1900 by J.P. Morgan as a consolidation of twenty-eight bridge companies representing eighty-percent of the structural steel fabricating capacity of the United States, immediately making it the largest bridge fabrication and building company in the world. The United Construction Company was closely affiliated with the American Bridge Company, which fabricated most bridges built by the company.[17] [see additional information on American Bridge Company and United Construction Company below]

Since the new bridge was to be in the same location as the covered bridge and carried on the existing stone pier and abutments supporting it, the job commenced on August 21, 1907 with the demolition of the old bridge.[18] Construction was completed in just over three months on November 26, 1907.[19]

Prior to the end of the 1907 fiscal year (February 15, 1908) the towns each paid their half-share of the total cost of the bridge, $13,100 to the contractor, United Construction Company of Albany, New York. Storrs was paid the remaining balance of $327.50 due for his services, which would have included inspection and approval of the bridge steel supplied by American Bridge Company and the substructure work and steel erection done by United Construction Company.[20] The bridge apparently served the two communities well but was not maintained and in 1965 it was found unsafe and permanently closed.

Significance

The Boscawen-Canterbury Parker Truss Bridge was built in 1907 at the site of an 18th century ferry crossing and a series of 19th century wood bridges and is therefore associated with the transportation and development history of the towns of Boscawen and Canterbury.

The bridge rests on the stone abutments and pier built in 1857 for the covered wood bridge that preceded it. The stonework exhibits the extraordinary stone masonry skills of the period, demonstrated by the 150 years of abuse by the Merrimack River they have endured with little or no damage. The bridge was designed by John W. Storrs, an engineer important to the engineering history of bridges in New Hampshire and neighboring states. American Bridge Company, the fabricator of the bridge, and United Construction Company, the builder and general contractor that erected the bridge, have also made important contributions to the history of bridge engineering and bridge construction in New Hampshire and elsewhere.

The bridge itself is an unaltered example of an all-riveted Parker Truss highway bridge. It is the oldest Parker truss bridge left standing in New Hampshire and one of only two remaining designed by the Storrs/American Bridge/United Construction team. Although typical of thousands built in the U.S. during the first half of the twentieth century, it belongs to the relatively small group of all-riveted Parker truss highway bridges built before about 1915 when the need for longer span, higher capacity highway bridges grew exponentially.

ADDITIONAL BACKGROUND INFORMATION

The Pratt Truss

Thomas Pratt was born in Boston in 1812, entered Rensselaer Polytechnic Institute at age 14, became an engineer with the United States Army Engineers at 18, and began a professional engineering career with Boston & Maine Railroad at age 21. Pratt worked his entire life in the employ of various New England railroad companies.[21] Pratt is famous for a bridge truss design he patented in 1844, consisting of two parallel chords connected by vertical wood posts in compression and double wrought iron diagonals in tension. Pratt's design was similar in appearance to an earlier truss patented by William Howe, but functioned structurally opposite. The Howe design put the verticals in tension and the diagonals in compression. The Pratt truss is considered to be the first scientifically designed truss, incorporating what are now considered basic structural engineering principles. Pratt used shorter compression members, allowing members of smaller cross section to be used without sacrificing overall strength. This innovation provided a lighter truss requiring less material yet offered greater span and load bearing capability than the other truss designs of the time.[22]

Pratt's 1844 patent also diagramed and set forth claims to a truss design with a polygonal top chord. The polygonal version reflected Pratt's understanding of the application of mathematical principles in calculating the forces involved and the precise strength of material required to counter those forces. The center panels, where the stresses were the greatest required the tallest panels, with the posts getting successively shorter towards the ends of the bridge. The primary advantage of the design was a reduction in the weight of the bridge, or dead load, allowing for greater spans without increasing the sectional area of the bridge's structural members. A savings in material cost was a direct result; however, this advantage was largely offset by the cost of having to fabricate a greater variety of members.[23] The cost advantage increased with longer spans, and by the early twentieth century designers improved the economy of the polygonal truss by limiting the number of variations in the slope of the top chord to three, for a total of five polygonal segments.[24]

The use of the Pratt truss for the deck of John Roebling's Niagara River Suspension Bridge in 1855 drew worldwide attention to the design and undoubtedly contributed to its increased use. By 1889 the truss in its iron form ranked first in usage for railroad bridges. Tens of thousands of bridges, both highway and railroad have been built following the Pratt design or some variation.[25]

The Parker Truss

Charles H. Parker is another Massachusetts bridge designer and builder of renown, deservingly for the fact that several of his patent bridges incorporated clever solutions to bridge design, fabrication and construction problems. He is widely thought to have conceived of the idea of adding a polygonal top chord to a Pratt truss. This he did not do; however, his improvements to Pratt's original design ultimately led to the rapid adoption of the type and the association of his name with it.

Parker was born ca. 1842 at Ashburnham, Massachusetts. It appears he was born into a family with a manufacturing and engineering background, having begun his engineering career in the firm of J. B. Parker, designing textile and shoe making machinery.[26]

Parker was involved in the establishment of the National Bridge and Iron Works, which operated out of 15 State Street in Boston between 1868 and 1875. He apparently served as consulting engineer to the firm initially, but in 1873 was a co-owner with Cadwallader Curry. During this period he was responsible for the design and building of over 150 bridges including bridges over the Merrimack at Haverhill, Lowell and Tyngsboro. Parker was also associated with the Solid Lever Bridge Company of Boston from 1867-

1871. Parker was responsible for the design of the structural ironwork for numerous important buildings and structures throughout the Northeast, including the Boston and Providence Depot, the Boston and Lowell Depot, the Museum of Fine Arts, the Boston Post Office and Providence City Hall. He was also interested in the design of mechanical and industrial systems including oil refineries, tankage pipe lines, blast furnace works, mining and hoisting machinery and power plants.[27]

In 1869 and 1870 Parker was awarded four patents for bridge designs that included a wire-cable suspended cantilever bridge, Patent No. 98,620; an unusual drawbridge consisting of a variation of his patented wire-cable suspended cantilever bridge in which the suspended center span could be swung or drawn back to allow tall masts to pass through, Patent No. 103,233; an even more unconventional design combining a suspended cantilever with a bowstring truss, Patent No. 93,638; and finally Patent 100,185 for which he is remembered, consisting of a Pratt truss design "composed of a curved top member, a straight bottom member, and vertical posts or compression members, with the usual system of longitudinal diagonal rods or braces".[28]

Parker did not claim priority for the idea of a curved top chord in any of his patents; the primary claim in Patent No. 100,185 was for an adjustable endpost that allowed simple variation of the overall length of the bridge in small increments. This made the bridge easily adaptable and suited as a replacement structure that could be dropped onto existing abutments without altering the structural characteristics of all the other truss panels. Parker's second claim was for a wrought-iron compression member, for the top chord or post, "formed of an I-section beam either rolled or built-up of plates and angles."[29] The other five claims related to the specific design of various connections for bridge members. According to Dennis Zembala who documented an authentic Parker patent truss in Vermont for the Historic American Engineering Record (HAER) in 1983, Parker's adjustable endpost gave his company a competitive edge, but it was his use of wrought-iron I-section compression members that was his greatest contribution to bridge design.[30]

Using Pratt's polygonal truss as a starting point (Pratt's patent having expired) Parker added wrought-iron I-section compression members, either rolled or built-up, that could be easily manufactured and standardized. He built several bridges of the type for railroad use during the 1870s and thereafter was associated with the design. According to bridge engineers Mansfield Merriman and Henry S. Jacoby, who assigned the name Parker Truss to the polygonal Pratt in their *Text-Book on Roofs and Bridges*, the type became "widely built for both highway and railroad service" after 1890.[31] This date would have roughly coincided with the expiration of Parker's patents.

Perhaps a vague recollection of Parker's work and unfamiliarity with Pratt's original patent claims and drawings, led noted bridge engineer J.A.L Waddell to state the following in his 1916 treatise on bridge engineering which incorrectly attributed the invention to Parker:

> During the seventies the Pratt, the Whipple, and the Warren, or Triangular trusses became the favorite types, although several large Post-truss bridges were then built. For a short span a single intersection type was found preferable, and for the long ones, the double or triple intersection. During this period C. H. Parker introduced the plan of making the top chord of through [high] trusses polygonal, thus effecting quite an economy in weight of metal for long spans; and this modification of the Pratt truss is often termed the "Parker Truss".[32]

Early twentieth century designers improved the economy of the polygonal truss by limiting the number of variations in the slope of the top chord to three, for a total of five polygonal segments. This variation of the "Parker truss" was developed by "a large bridge company" and called a Camelback truss.[33] The method was soon applied to the simpler triangular or Warren truss, and the names Camelback and Parker became applied to the various types, often interchangeably.

John W. Storrs, Consulting Engineer

John W. Storrs worked as a bridge engineer for the Boston and Maine Railroad in the 1890s, as the state engineer for Carroll, Coos, and Grafton counties in 1903, and established a private engineering practice in Concord in 1905. He designed a large number of steel truss bridges in New Hampshire including ones over the Connecticut River at Claremont and Woodsville; over the Merrimack River at Concord, Boscawen and Hooksett; over the Androscoggin River at Berlin; and the Pemigewasset River at Hill and Sanbornton. Storrs' longer trusses were mostly riveted Pratt or Parker trusses.[34]

In addition to the Boscawen-Canterbury Bridge, Storrs designed at least two other Parker truss spans that were fabricated by American Bridge Company and built by United Construction Company of Albany, New York: a three-span pin-connected Parker truss bridge over the Connecticut River between Claremont and Springfield, Vermont, no longer extant, and a single-span riveted Parker truss, built 1920, over the Connecticut River between Hinsdale and Brattleboro, Vermont, (NH Bridge 042/044).[35]

The following information is an excerpt from *Builders of Bridges in New Hampshire* (Garvin 1999).

> Consulting engineers like John Storrs also had a powerful effect on towns that were striving to replace aging bridges with new spans that met state weight standards. Storrs left state employment in 1905 to establish his own engineering firm in Concord, N.H., soon taking his son Edward as his partner and becoming “the only engineering firm in New England making a specialty of bridge design.” Many of Storrs’ office records survive and show that his practice included the structural evaluation of innumerable wooden bridges throughout the state.[36] Storrs found many of these to have been neglected and overstressed by excessive loading.
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> To assist towns in improving the bridges for which they were responsible, Storrs took the unusual step of publishing a non-technical book on bridge design in 1918. Entitled *Storrs: A Handbook for the Use of Those Interested in the Construction of Short Span Bridges*, the 75-page volume was “intended to be of some assistance to road agents, town clerks, selectmen and others who may be interested in the designing and construction of small bridges, culverts, etc.”[37] Most of the bridge designs in Storrs’ book were calculated for loads ranging from twelve to fifteen tons, thus offering a comfortable margin of safety against legal liability to towns that built spans according to Storrs’ designs.
>
> Storrs’ book emphasized the use of concrete, which Storrs had pioneered in his work in the White Mountains fifteen years earlier. The book illustrated steel I-beam stringer bridges with concrete jack arches spanning the intervals between the beams and supporting the bridge deck; bridges with reinforced concrete girders and concrete decks; reinforced concrete slab bridges; and concrete arches and pipe culverts. Storrs’ handbook was instrumental in introducing contractors and road agents to concrete as a construction material.
>
> Storrs’ private engineering practice emphasized steel truss bridges of widely varying designs. His bridges spanned the Connecticut River at Claremont and Woodsville; the Merrimack at Concord, Boscawen and Hooksett; the Androscoggin at Berlin; the Pemigewasset at Hill and Sanbornton; and many other streams throughout New Hampshire and neighboring states. Most of Storrs’ longer trusses were riveted Pratt or Parker trusses, but he designed a number of low Warren truss bridges and the dramatic steel arched deck span (originally a railroad bridge and now a highway span) 165 feet above Quechee Gorge in Vermont.

American Bridge Company, New York, New York, Fabricator

American Bridge has fabricated and erected the steel for a major portion of the world's greatest bridges and tallest buildings.[38] The American Bridge Company was incorporated in 1900 by J.P. Morgan as a consolidation of twenty-eight bridge companies, representing eighty-percent of the structural steel fabricating capacity of the United States. The following year Morgan folded ownership of the American Bridge Company into his newly formed United States Steel Company in the form of a subsidiary. Four other bridge companies were purchased and added to the firm over the years and included the Toledo Bridge Company in 1901, the Detroit Bridge and Iron Company in 1902, the Koken Iron Works of St. Louis in 1912 and the Virginia Bridge and Iron Company of Roanoke in 1936.[39]

The company operated out of New York until 1904 when the headquarters were moved to Pittsburgh. In 1902, American Bridge began construction of a huge new plant outside Pittsburgh near the town of Economy, alongside the Ohio River. This facility was the largest of its kind in the world with a structural steel capacity of 20,000 tons per month.[40] The new town of Ambridge was eventually formed around the plant. In 1909 a new ninety-acre fabrication plant was built at Gary, Indiana.[41]

Among the firms acquired by American Bridge were four leaders in the field of movable bridges: the Edge Moor Bridge Works, the Detroit Bridge and Iron Works, the Union Bridge Company, and the Pencoyd Iron Works. American Bridge Company was quickly established as the largest builder of heavy long span movable bridges in the world. This expertise in movable structures helped American Bridge win the contract for the building of the lockgates, dams, shop buildings and other structures of the Panama Canal between 1910 and 1913. [42] By 1926, American Bridge's parent company, U. S. Steel, had become the largest company in the world, with assets of nearly 2.5 billion dollars.[43] During World War II the American Bridge Company was primarily responsible for the nearly two-fold expansion of America's steel industry, regarded as an important factor in the outcome of the War. The company produced over 350 electric steel making furnaces during the war years.

Through the twentieth century many of the original plants acquired at the time of formation of the company were subsequently closed as their equipment and production methods became obsolete. In 1975 American Bridge operated ten plants in the United States located at Ambridge and Harrisburg, Pennsylvania; Antioch, Fresno and Los Angeles, California; Elmira, New York; Gary, Indiana; Orange, Texas; Birmingham, Alabama; Memphis, Tennessee; and Roanoke, Virginia.[44] In 1987 United State Steel sold American Bridge to an employee group. The company was again sold in 1989 to the Ing family of Taiwan who holds the company today as a long-term investment. American Bridge continues to be one of the world's foremost builders of large and complex steel structures. [45]

United Construction Company, Albany, New York, Contractor

The United Construction Company was apparently formed in 1902 as a direct result of the creation of the American Bridge Company in 1900 and its acquisition of the Berlin Iron Bridge Company of East Berlin Connecticut that year. Between 1907 and 1920 the firm was led by James R. Watt, president and treasurer; Walter R. Marden, vice president and chief engineer; and A. H. Kittredge, secretary.[46] Walter R. Marden left his job as a highway bridge engineer for the American Bridge Company in Pittsburg to become vice-president and chief engineer of United Construction in 1902, a position he held into the 1930s.[47] The American Bridge Company reportedly "fabricated most bridges built by United Construction Company."[48] Whether this was because Marden was most comfortable working with his former employer or due to a formal agreement between the companies is not known.

An article by Walter Marden published in *The Engineering Record* in 1903 describes in detail the design of a all-riveted high Pratt truss highway bridge with a span of 143' built by United Construction in Springfield, New York. The purpose of the article appears to be to promote the company rather than introduce any innovative or novel design features. Like most bridge building companies, the firm drew upon standard bridge designs that could be easily modified in length and width to meet the requirements of each site. "The former Prescott Road Bridge in Raymond (1916) was an example of their "Standard Two-Beam Girder Bridge;" the former Bosco Bell Bridge in Barnstead (1916) was an example of their "Standard 4 Panel" low Warren truss; and the former Mary's or Bridge Street Bridge in Pittsfield (1909) may have been an example of a standardized low Parker truss."[49]

United Construction Company worked closely with consulting engineer John W. Storrs of Concord, NH and built numerous bridges in NH designed by Storrs including the Winnisquam Bridge over Lake Winnisquam a five-span low Warren truss between Tilton and Belmont; the former three-span pin-connected Parker truss bridge over the Connecticut River between Claremont and Springfield, Vermont; the former Union Bridge, a two-span riveted Pratt truss over the Pemigewasset River between Ashland and Bridgewater; the former Mason Street Bridge over the Androscoggin River in Berlin; the three-span Pratt truss bridge over the Merrimack River at Hooksett; a high Warren truss bridge in Wentworth (1909); and a single-span high Parker truss (1920) over the Connecticut River between Hinsdale and Brattleboro, Vermont. Other low Warren truss bridges known to have been built by United Construction Company in New Hampshire include those built in Thornton (1907), Stark (1909), Danbury (1913), Goshen (1913), Carroll (1915), and Hebron (1921) and Canaan (1921).[50]

Comparable Bridges

From the table of Parker truss bridge information below, it can be seen that the Boscawen-Canterbury Bridge is relatively unique in age and size compared to the other New Hampshire Parker truss bridges that survived until 1990. The bridge is most similar, in age, length and other characteristics to the Hinsdale bridge, built thirteen years later and with a clear span greater by thirty feet. The Hinsdale bridge was also engineered by John Storrs, fabricated by American Bridge Company and erected by the United Construction Company. It was also constructed entirely with built-up structural members as opposed to the bridges built after the 1927 flood that utilized rolled wide flange beams for posts, diagonals and chords. After about 1930 the load capacity increased from 10 tons to 15 tons and the roadway width steadily increased, from 18 feet (Boscawen-Canterbury) to 33 feet (Lancaster-Lutenburg).

NEW HAMPSHIRE PARKER TRUSS BRIDGES
(Pratt Truss With Polygonal Top Chord)

Town	Bridge No.	Year	Carrying/Over	Spans	Max Spn Lgt.	Disposition (January 2011)
Boscawen – Canterbury	132/085	1907	Old Rt. 3-B/ Merrimack River	2	170'	Closed since 1965
Hinsdale	042/044	1920	NH Rt. 119/ channel of Connecticut R.	1	200'	In service.
Bristol – New Hampton	113/064	1928	Central St./ Pemigewasset R.	1	240'	Demolished & Replaced 2009
Littleton	220/056	1928	Beacon St./ Ammonoosuc R.	1	220	Demolished & Replaced 2001
Stewartstown – Canaan, Vt.	028/146	1928	Main St/ Connecticut R.	1	220	Demolished & Replaced 1990
Monroe – Barnet, VT	081/106	1930	McIndoes Rd./ Connecticut R.	1	305'	In service. Rehabilitated.
Holderness – Plymouth	046/139	1934	NH Rt. 175A/ Pemigewasset R.	1	250'	Demolished and Replaced 2005
Monroe – Barnet, VT	110/125	1937	Barnet Rd. / Connecticut R.	1	264'	In service. Rehabilitated.
Lyme – Thetford, VT	053/112	1937	E. Thetford Rd./ Connecticut R.	2	232'	In service.
Lancaster – Lunenburg, VT	111/129	1950	US Rt. 2/ Connecticut R.	2	198'	In service.

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[3] James O. Lyford. *History of Canterbury, New Hampshire 1727-1912.* Concord: Rumford Press, 1912, p. 232-233.
[4] *Ibid.*
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[9] The quote was printed on Storrs letterhead.
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[11] Annual Reports of the Town of Boscawen 1907, pp. 9, 12; Annual Reports of the Town of Canterbury 1907, p. 5.
[12] To some degree, these names leave room for assumptions and confusion with other similar and not-so-similar truss types. The Bowstring truss, defined by bridge engineer and historian J.A.L. Waddell as "a truss in which the lower chord is horizontal and the upper chord joints lie in the arc of a parabola, or similar curve," describes the Pratt truss with a polygonal top chord in certain cases, but is more often used to describe the continuous arched laminated wood members found in covered wooden bridges, or a tubular wrought iron tied arch of the type patented by Thomas W. H. Moseley and Zenas King in the late 1850s and early 1860s. The term "curved-chord" could be taken to imply smoothly curved members like those of an arched truss, but the polygonal Pratt truss is composed of all straight structural members. See: John A. L. Waddell, *Bridge Engineering* (New York: John Wiley and Sons, 1916): 2101; David A. Simmons, "Bridges and Boilers: Americans Discover the Wrought-Iron Tubular Bow-String Bridge," *Industrial Archaeology* 19 (1993): 63-76.
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[16] The original drawings are held by NHDOT. Scans of the plans are contained in the Request for Project Review Form submitted to NHDHR by Eckman Engineering, LLC on March 25, 2009 and are not included with this form.
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[43] Stuart Chase, "Ten Companies Reach the Billion Dollar Mark. *The New York Times* (March 27, 1927): S8: 1.

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[45] American Bridge corporate information available at http://www.americanbridge.net

[46] Garvin, 1999, n.p.

[47] W. R. Marden (1865-1934) worked as a bridge engineer for various companies in New York, New Jersey, Virginia and Pennsylvania between 1888 and 1900 when he joined the American Bridge Company in Pittsburgh. From 1902 until 1931 he was vice president and chief engineer of the United Construction Company of Albany, NY. ("Walter R. Marden" in Downs, Winfield Scott, Editor, *Who's Who in Engineering.* New York: Lewis Historical Publishing Company, 1931, p. 858). Upon his death, February 7, 1934, Marden was vice president and chief engineer of the Standard Engineering Corporation, also of Albany, NY. ("Walter R. Marden." Obituary in *New York Times*, February 10, 1934, p. 7).

[48] Garvin, 1999.

[49] *Ibid.*

[50] *Ibid.*

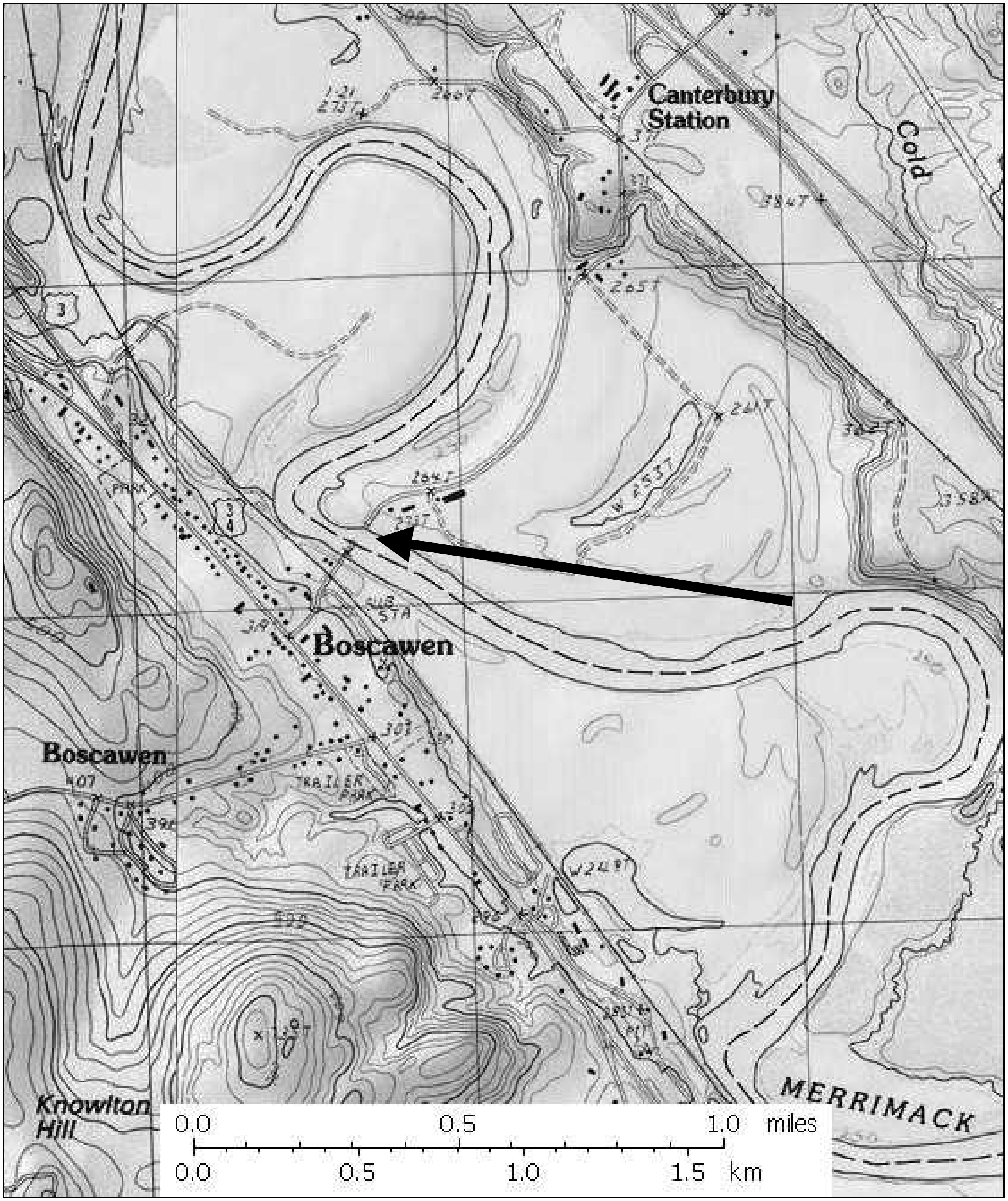


FIGURE 1: Location Map USGS Webster and Penacook, NH quads.

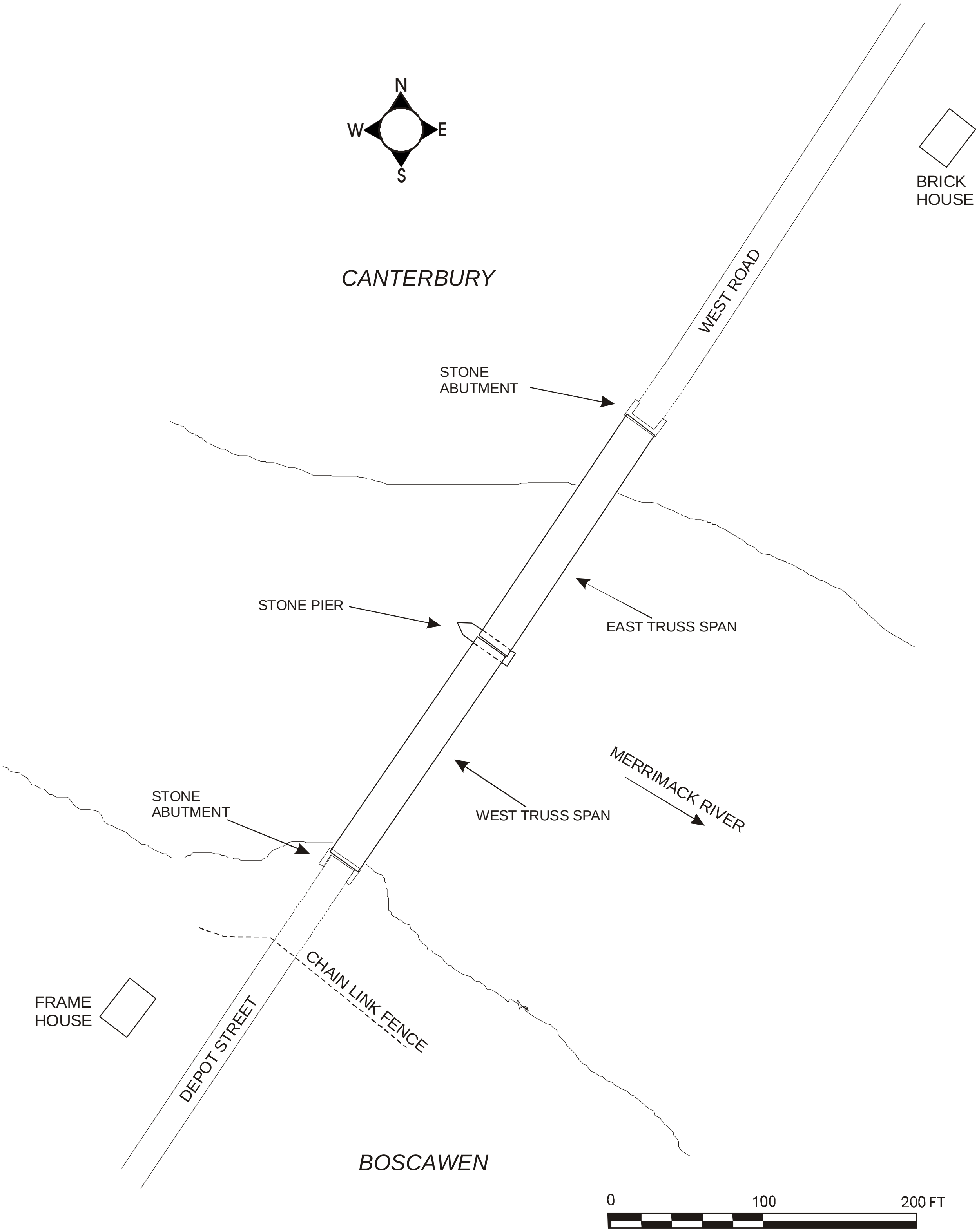


FIGURE 2: Site Sketch

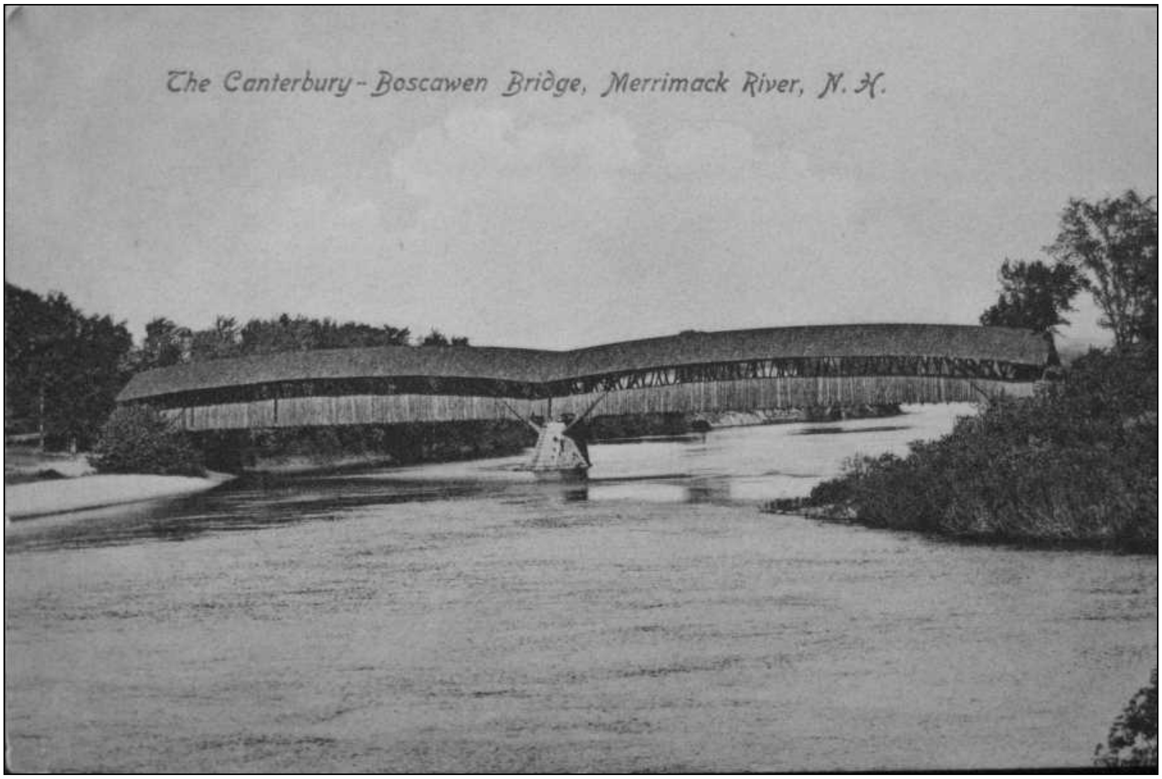


FIGURE 3: Postcard of 1857 Covered Bridge. Photo before 1907. Canterbury Historical Society Collection.

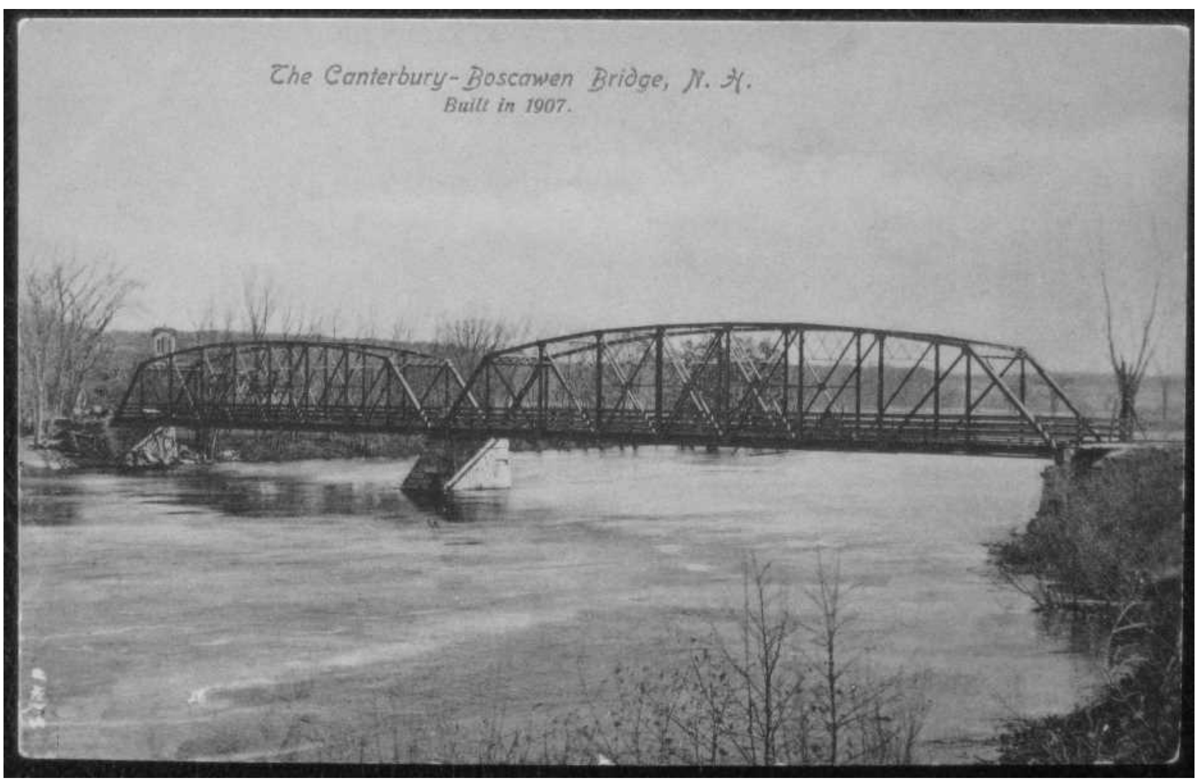


FIGURE 4: Postcard of steel truss bridge. Photo 1907 or after. Canterbury Historical Society Collection.

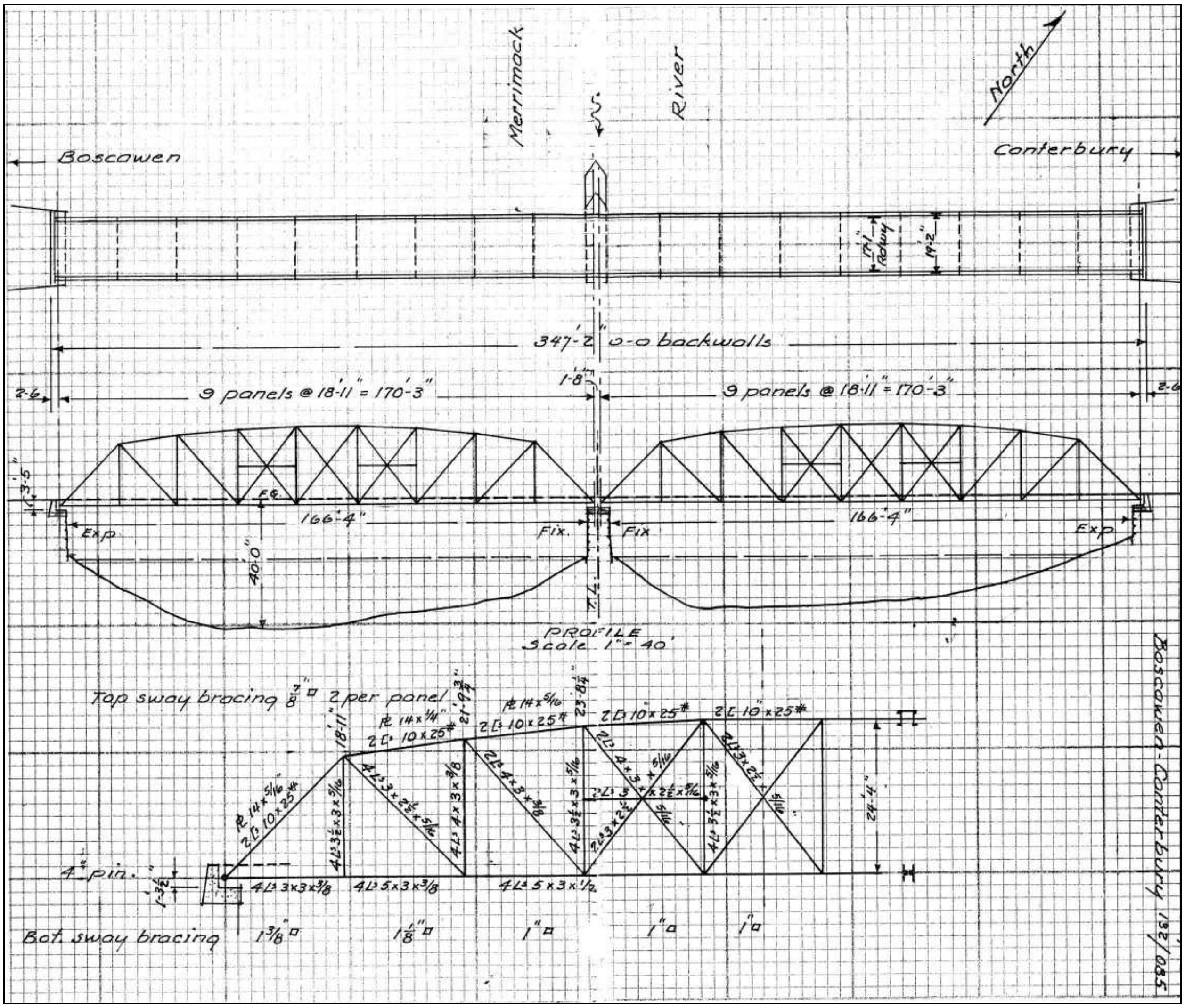


FIGURE 5: Bridge Plan and Profile sketch from NHHD Bridge Inventory Card (1940).

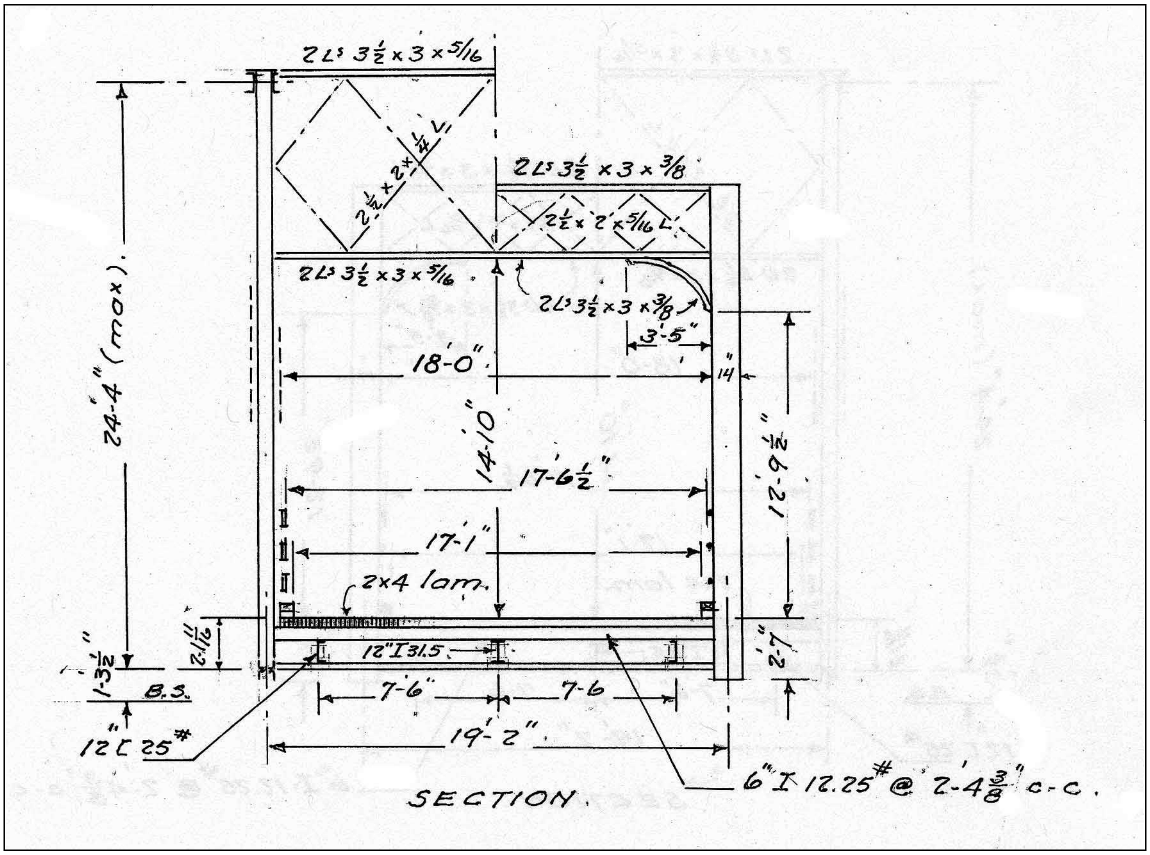


FIGURE 6: Bridge Cross-Section sketch from NHHD Bridge Inventory Card (1940).

FIGURE 7: 1940 Photo of Boscawen approach, looking northeast (NHHD Bridge Inventory Card).

FIGURE 8: 1940 Photo of bridge, upstream side, view from Canterbury, looking southeast (NHHD Bridge Inventory Card).

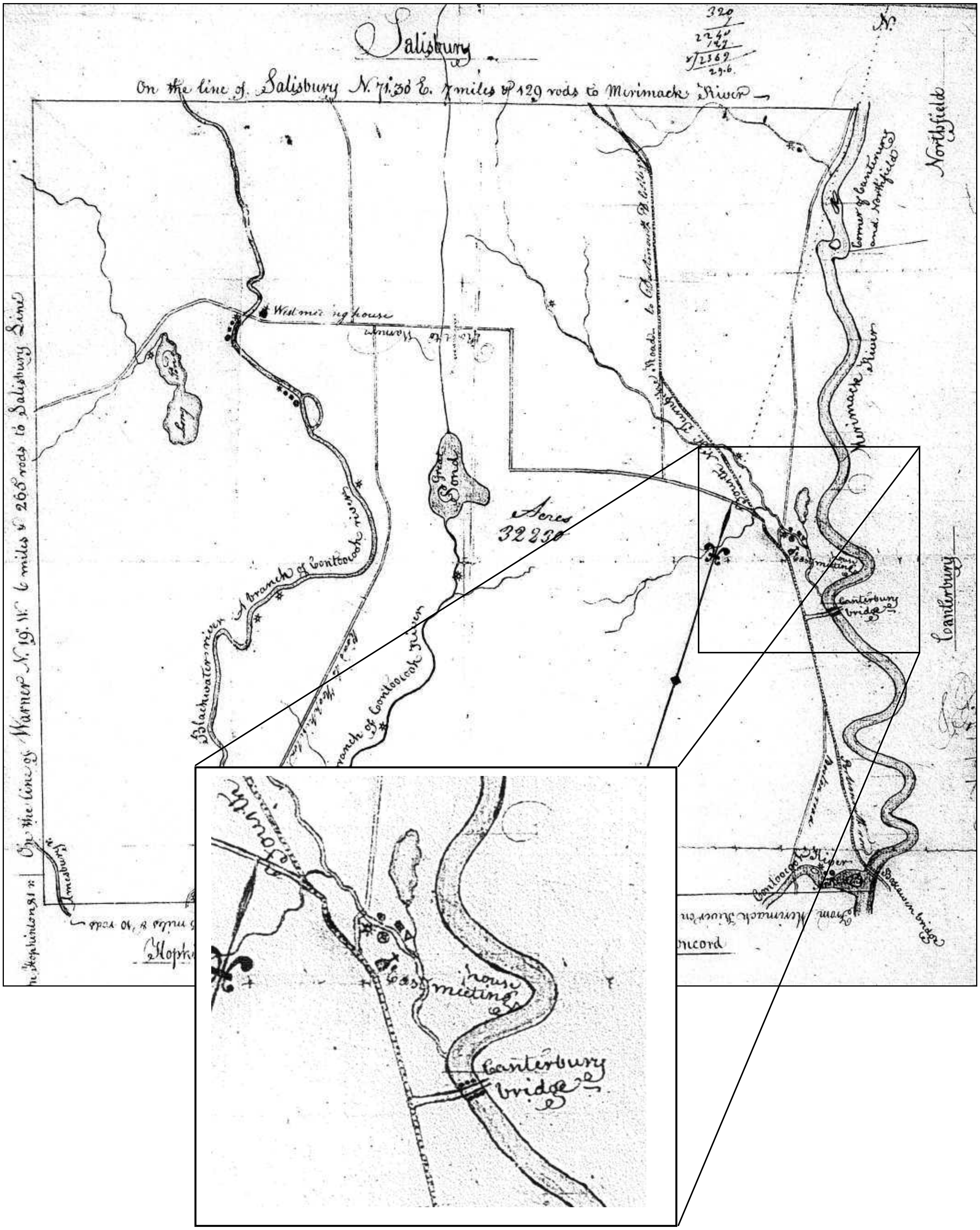


FIGURE 9: 1806 Map of the Town of Boscawen by Joshua Crane, showing location of the Canterbury Bridge, circa 1804, first bridge built at the site of the Boscawen-Canterbury bridge.

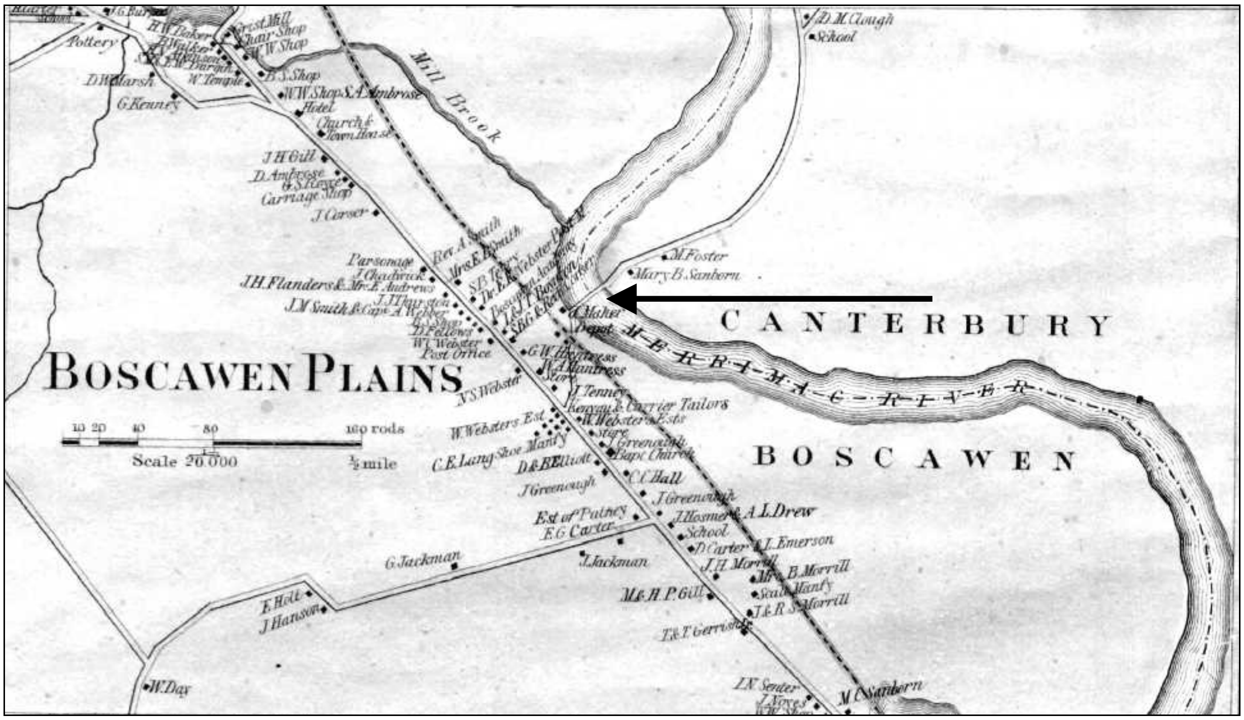


FIGURE 10: 1858 Map of Merrimack County by H.F. Walling, showing the newly re-established bridge crossing. The "Canterbury-Boscawen" bridge, a two-span covered bridge of so-called English hump-back design (depicted in Figure 3) had just been completed the year before.

INDEX TO PHOTOGRAPHS

BOSCAWEN-CANTERBURY BRIDGE (132/085)
Parker Truss Bridge over Merrimack River
Boscawen and Canterbury
Merrimack County
New Hampshire

New Hampshire State No. 669
Photographer: Rob Tucher
Media: 4"x5" film negative, contact printed.
May 2009

NH-669-1	East approach to bridge (Canterbury end). Looking southwest.
NH-669-2	West approach to bridge (Boscawen end). Looking northeast.
NH-669-3	View of bridge in context from downstream. Looking west.
NH-669-4	View of bridge in context from downstream. Looking northwest.
NH-669-5	View of bridge in context from upstream. Looking east.
NH-669-6	View of underside of west span showing floor system. Looking northeast.
NH-669-7	Upstream elevation of bridge spans. Looking southeast.
NH-669-8	Upstream elevation of west span. Looking southeast.
NH-669-9	West (Boscawen) portal and barrel view through trusses. Looking northeast.
NH-669-10	East (Canterbury) portal and barrel view through trusses. Looking southwest.
NH-669-11	View of truss members, upper lateral bracing, deck, and portals over pier, from west span. Looking northeast.
NH-669-12	View of truss and floor members, east span. Looking southwest.
NH-669-13	West (Boscawen) abutment. Looking south.
NH-669-14	East (Canterbury) abutment. Looking northeast.
NH-669-15	Pier, from downstream. Looking southwest.
NH-669-16	Pier, west elevation. Looking northeast.

NH-669-17 Pier, east elevation. Looking south.

NH-669-18 Detail of pier upstream nosing, showing stonework. Looking southeast.

NH-669-19 Detail of west abutment, showing concrete bridge seat and bearing. Looking northwest.

NH-669-20 Detail of truss endposts and bearings on pier, upstream trusses. Looking west.

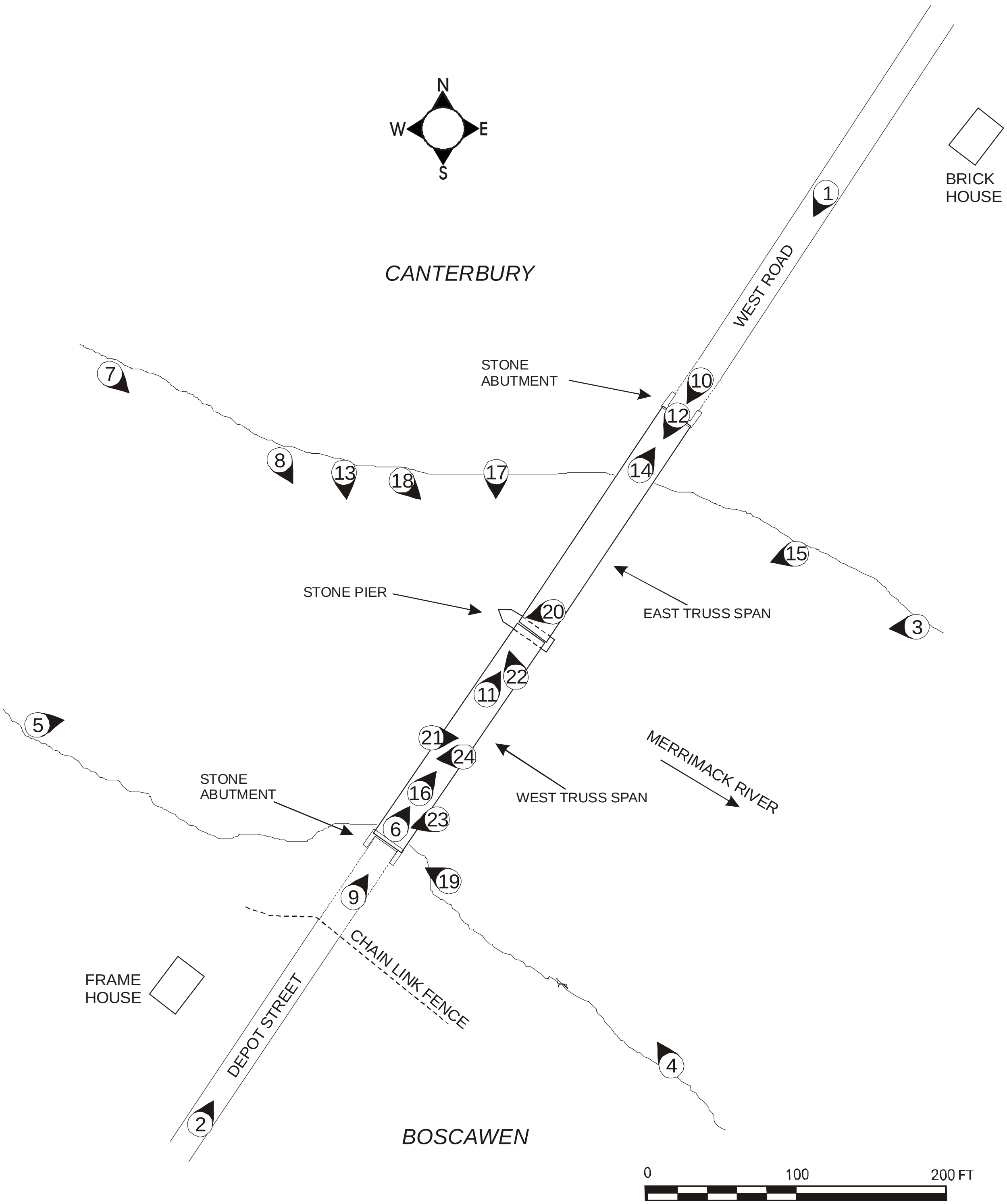
NH-669-21 Detail of truss posts, diagonals, and bracing connections. Looking east.

NH-669-22 Detail of lower cord, floorbeam, post and stringer connections. Looking north.

NH-669-23 Detail of upper chord, endpost and portal connections, west portal. Looking west.

NH-669-24 Detail of upper chord, lateral and bracing connections to post. Looking west.

BOSCAWEN-CANTERBURY BRIDGE
NH State No. 669
Key to Photographs



NH-669-1 East approach to bridge (Canterbury end). Looking southwest.

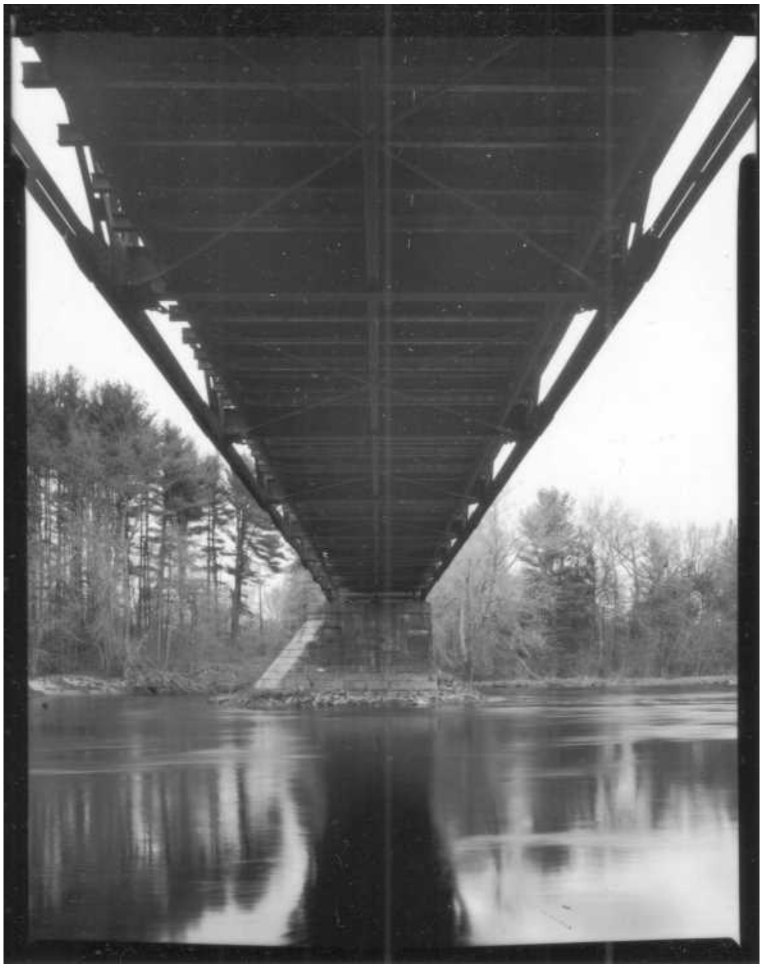
NH-669-2 West approach to bridge (Boscawen end). Looking northeast.

NH-669-3 View of bridge in context from downstream. Looking west.

NH-669-4 View of bridge in context from downstream. Looking northwest.

NH-669-5 View of bridge in context from upstream. Looking east.

NH-669-6 View of underside of west span showing floor system. Looking northeast.



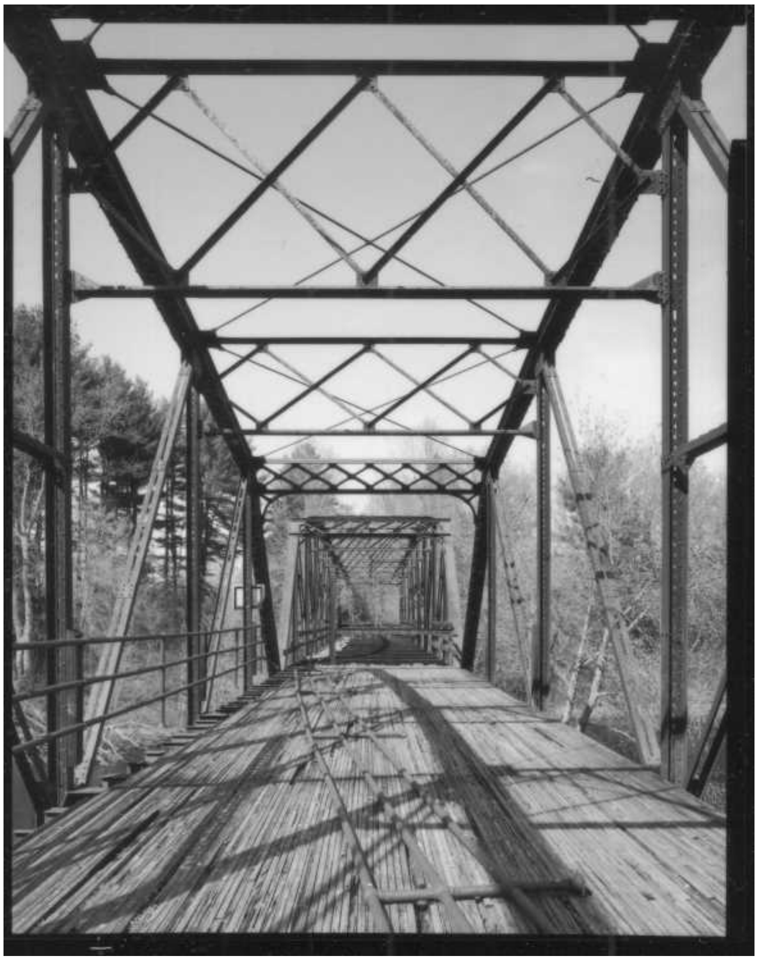
NH-669-7 Upstream elevation of bridge spans. Looking southeast.

NH-669-8 Upstream elevation of west span. Looking southeast.

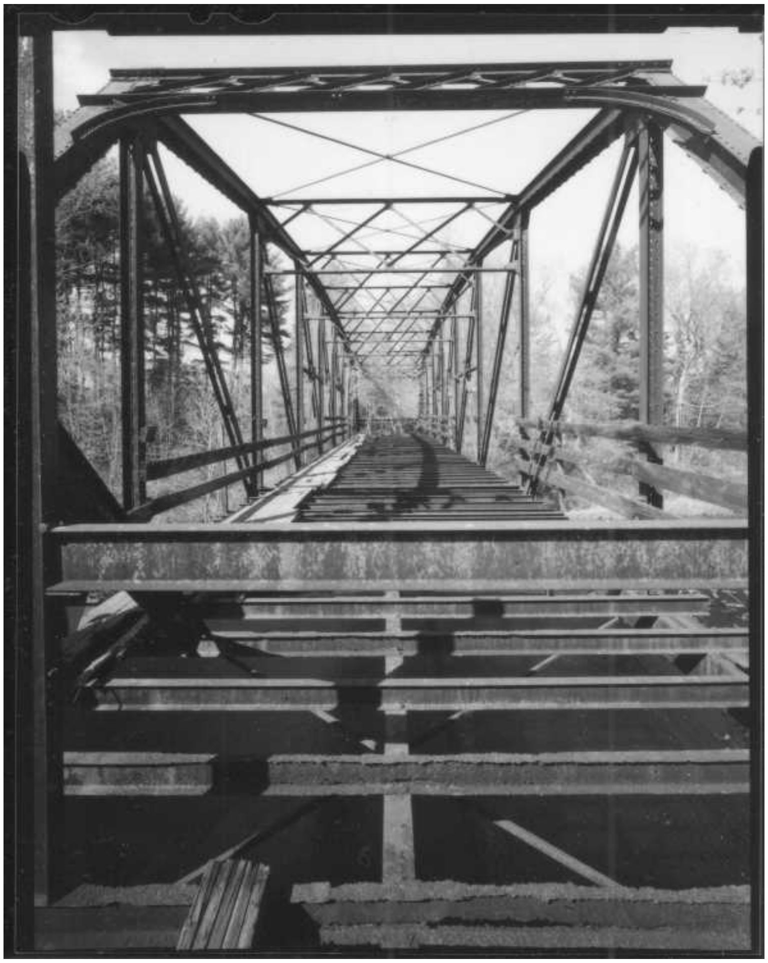
NH-669-9 West (Boscawen) portal and barrel view through trusses. Looking northeast.

NH-669-10 East (Canterbury) portal and barrel view through trusses. Looking southwest.

NH-669-11 View of truss members, upper lateral bracing, deck, and portals over pier, from west span. Looking northeast.



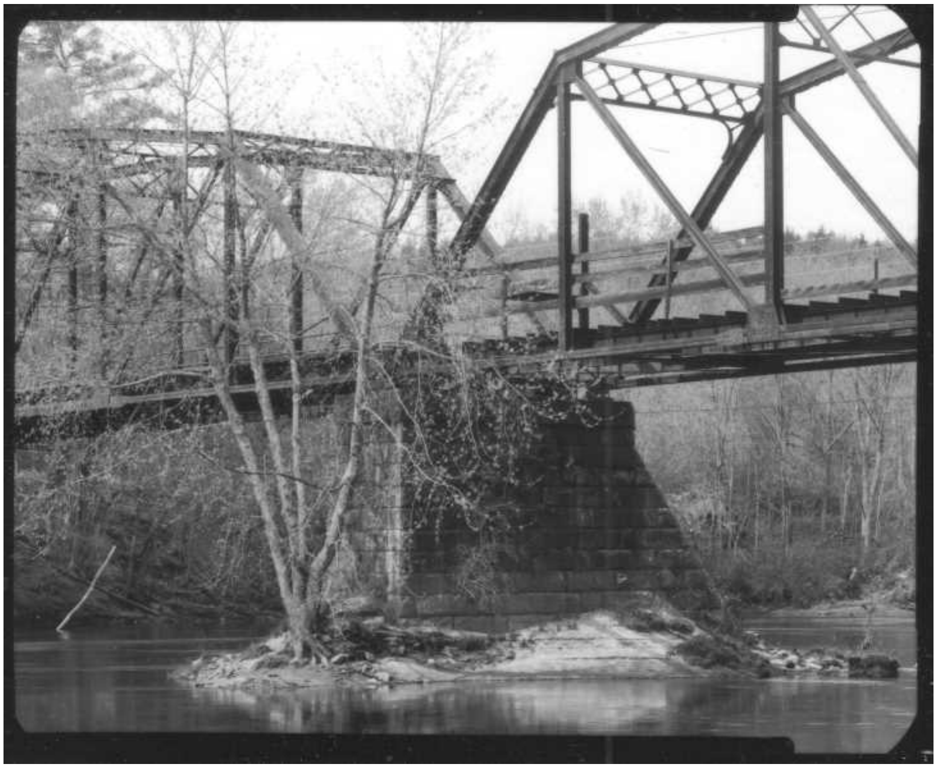
NH-669-12 View of truss and floor members, east span. Looking southwest.



NH-669-13 West (Boscawen) abutment. Looking south.

NH-669-14 East (Canterbury) abutment. Looking northeast.

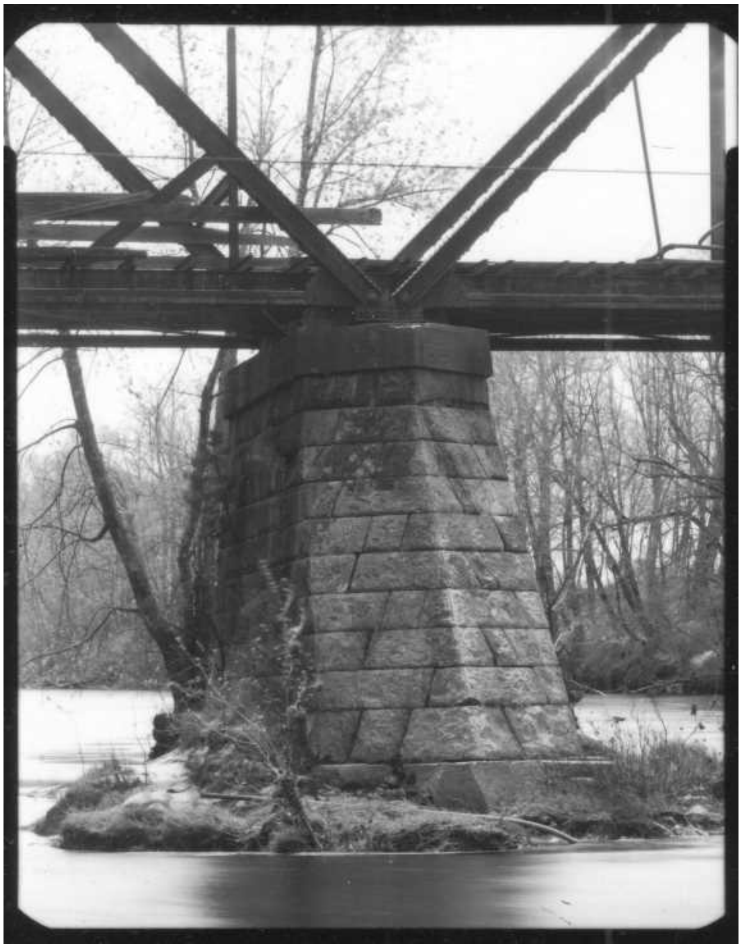
NH-669-15 Pier, from downstream. Looking southwest.



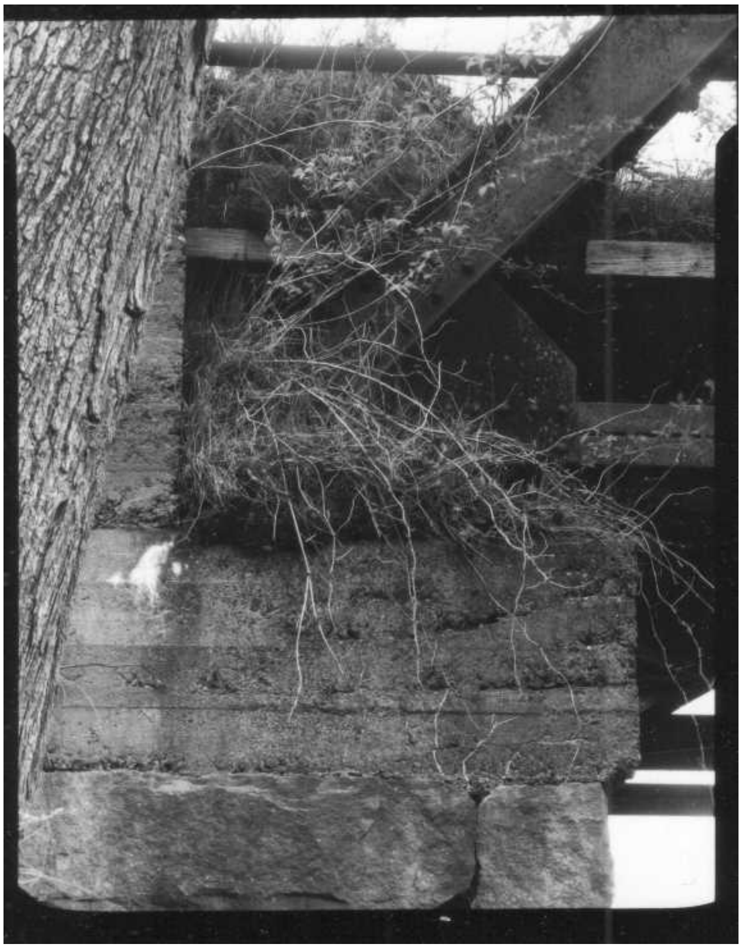
NH-669-16 Pier, west elevation. Looking northeast.

NH-669-17 Pier, east elevation. Looking south.

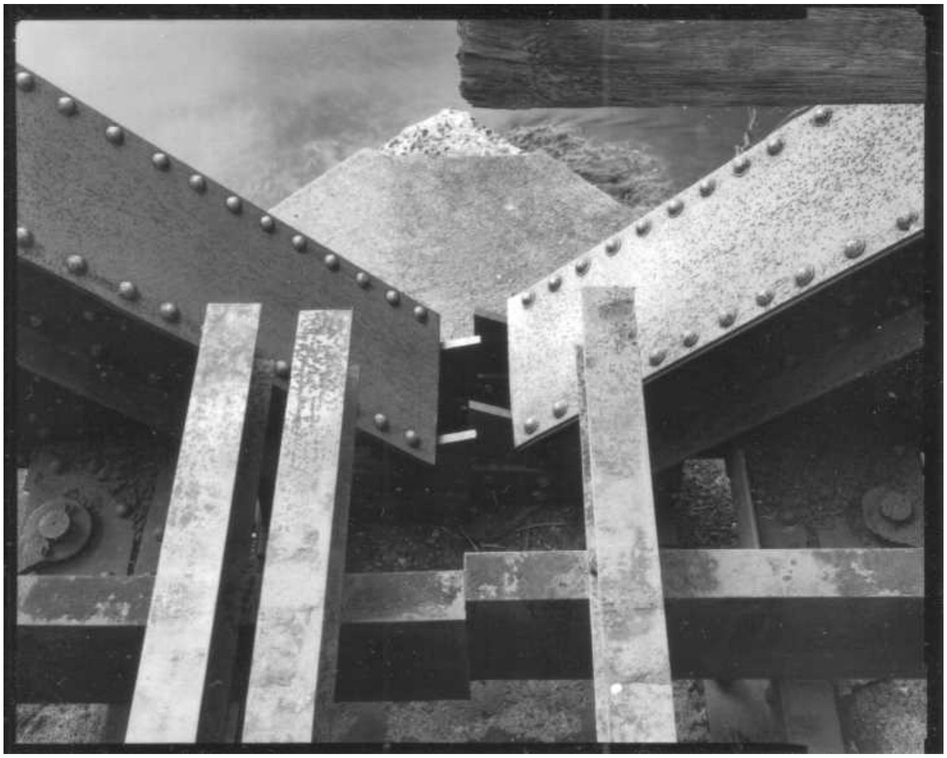
NH-669-18 Detail of pier upstream nosing, showing stonework. Looking southeast.



NH-669-19 Detail of west abutment, showing concrete bridge seat and bearing. Looking northwest.



NH-669-20 Detail of truss endposts and bearings on pier, upstream trusses. Looking west.

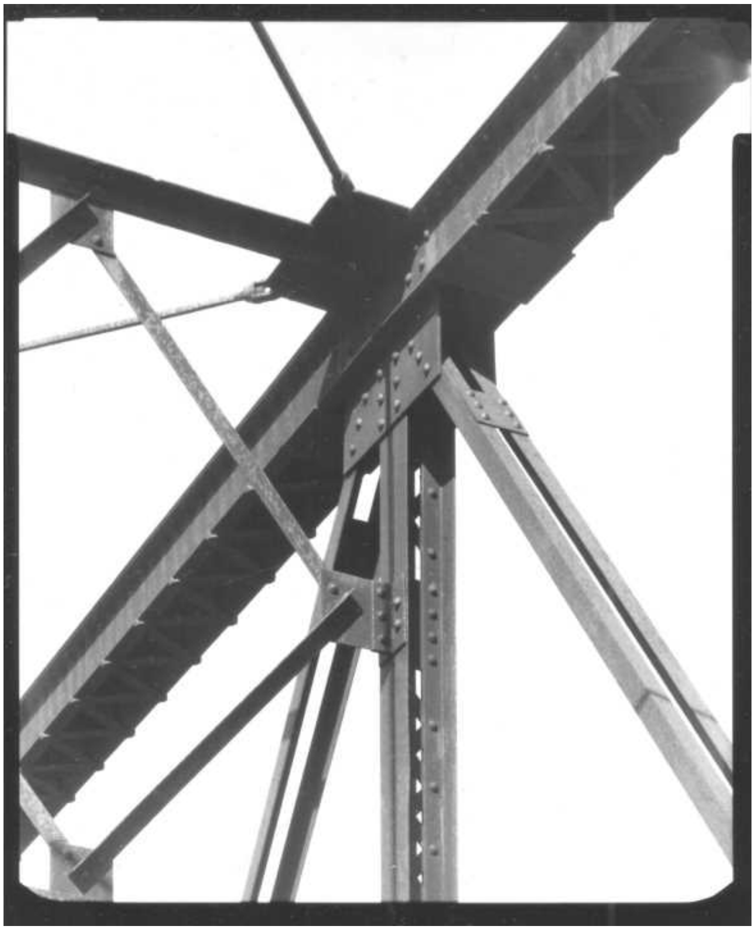


NH-669-21 Detail of truss posts, diagonals, and bracing connections. Looking east.

NH-669-22 Detail of lower cord, floorbeam, post and stringer connections. Looking north.

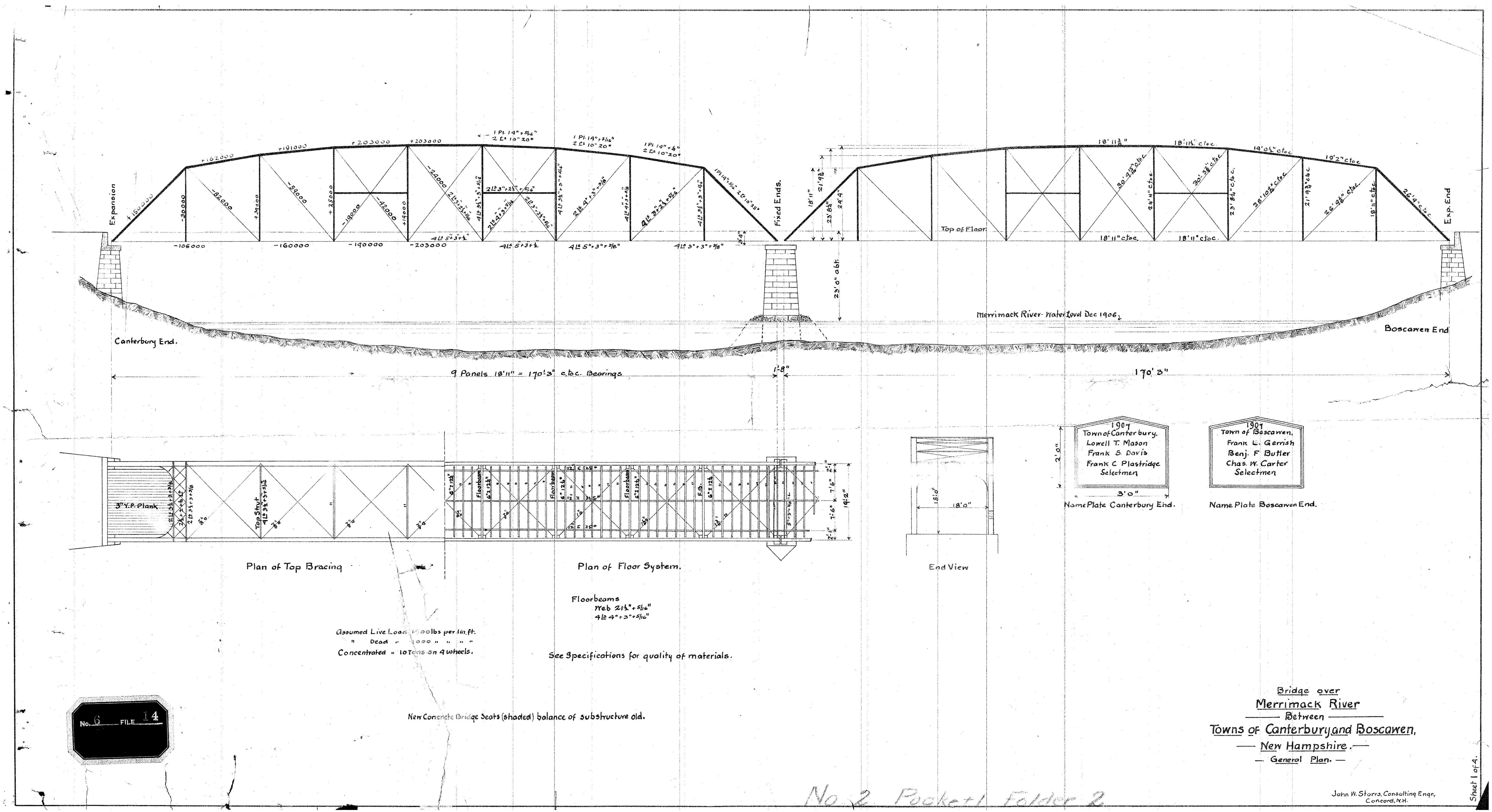
NH-669-23 Detail of upper chord, endpost and portal connections, west portal. Looking west.

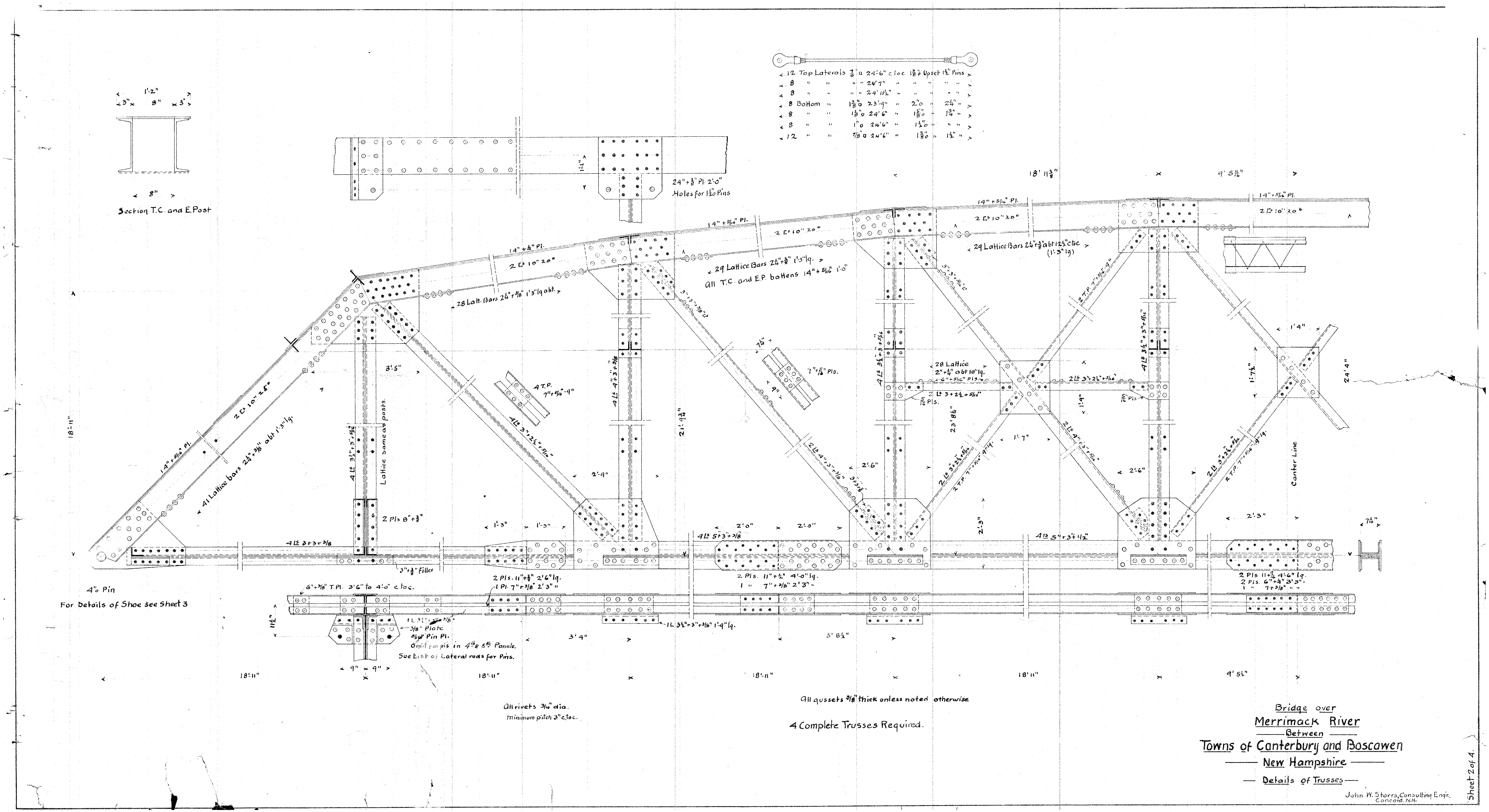
NH-669-24 Detail of upper chord, lateral and bracing connections to post. Looking west.

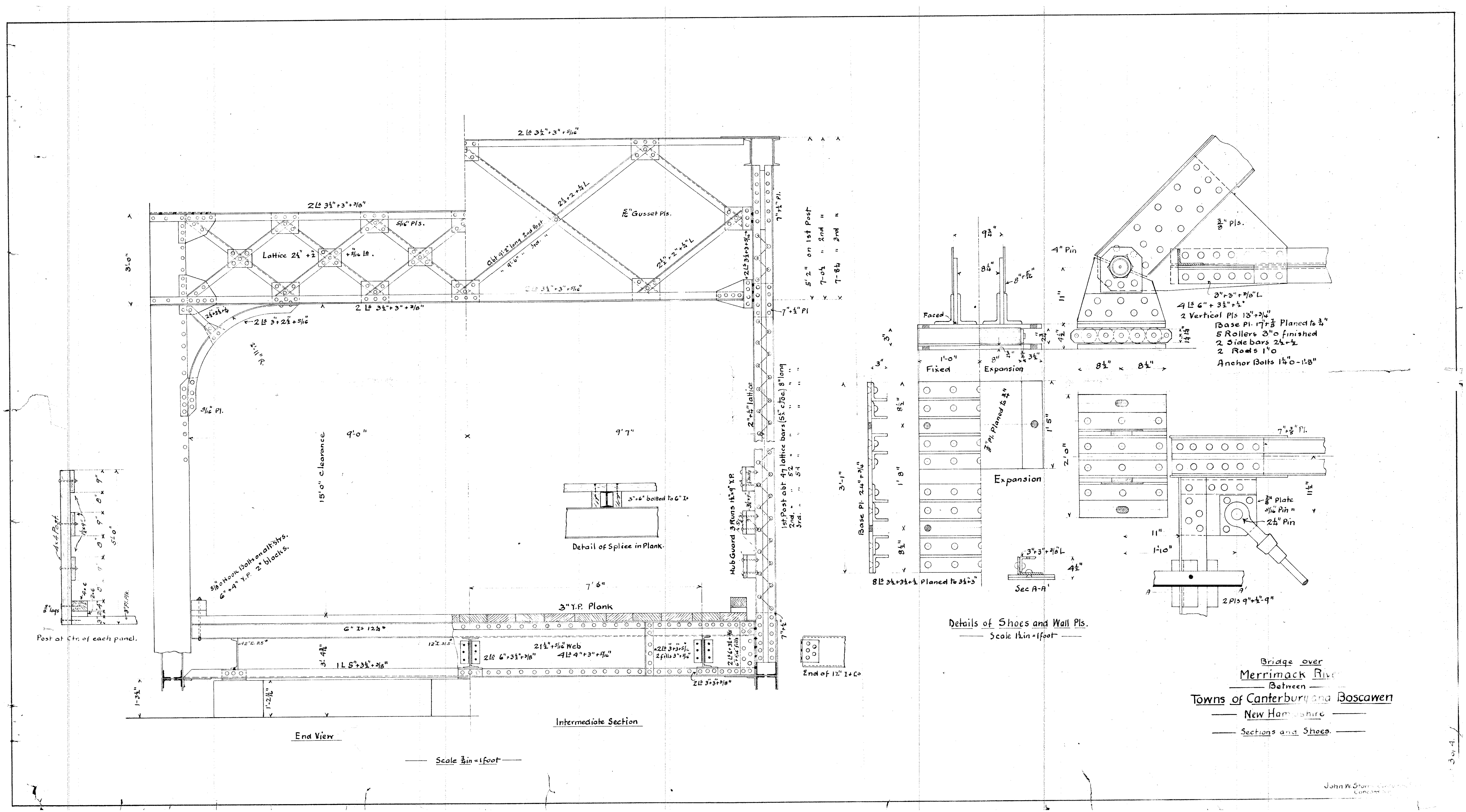


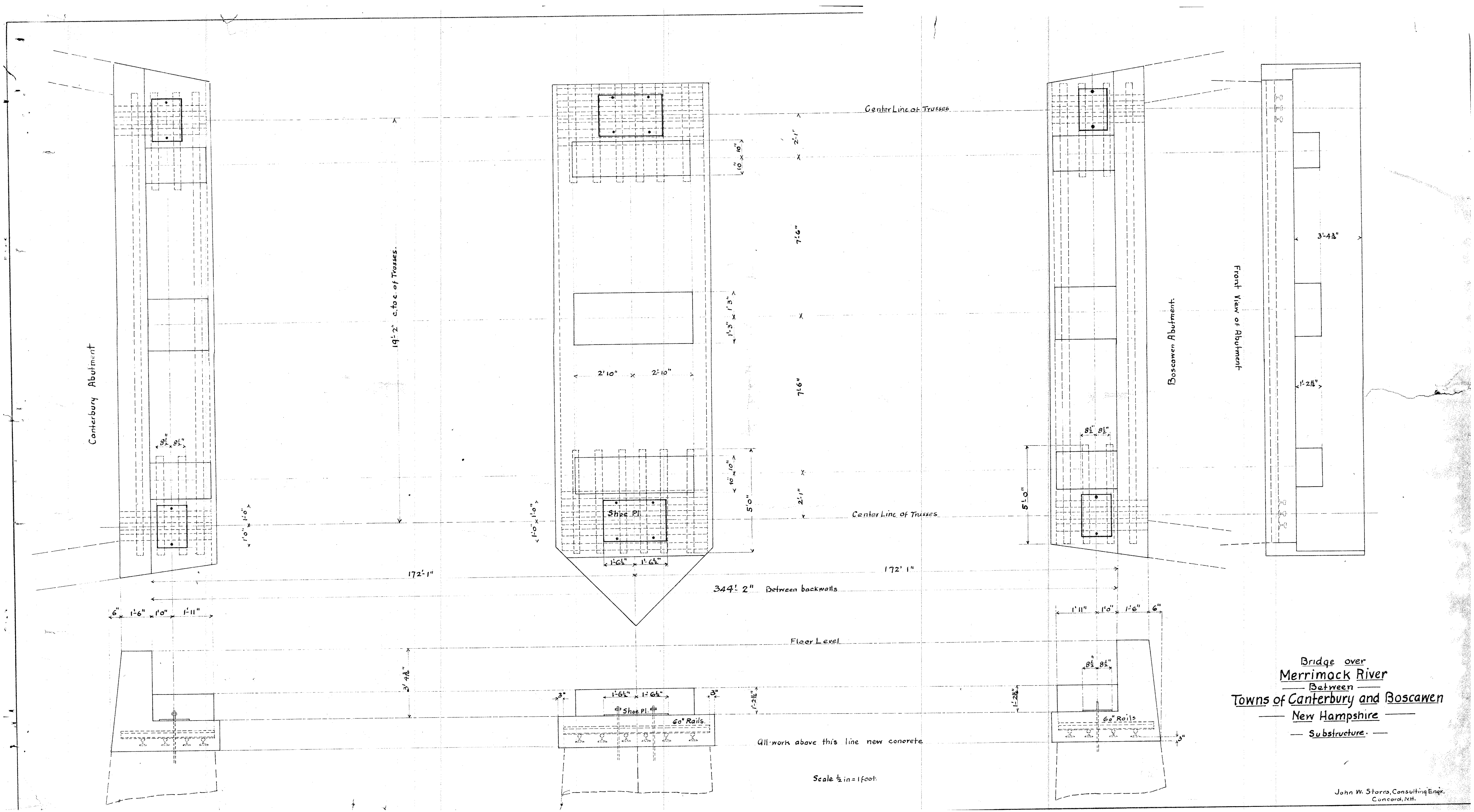
INDEX TO ORIGINAL DRAWINGS

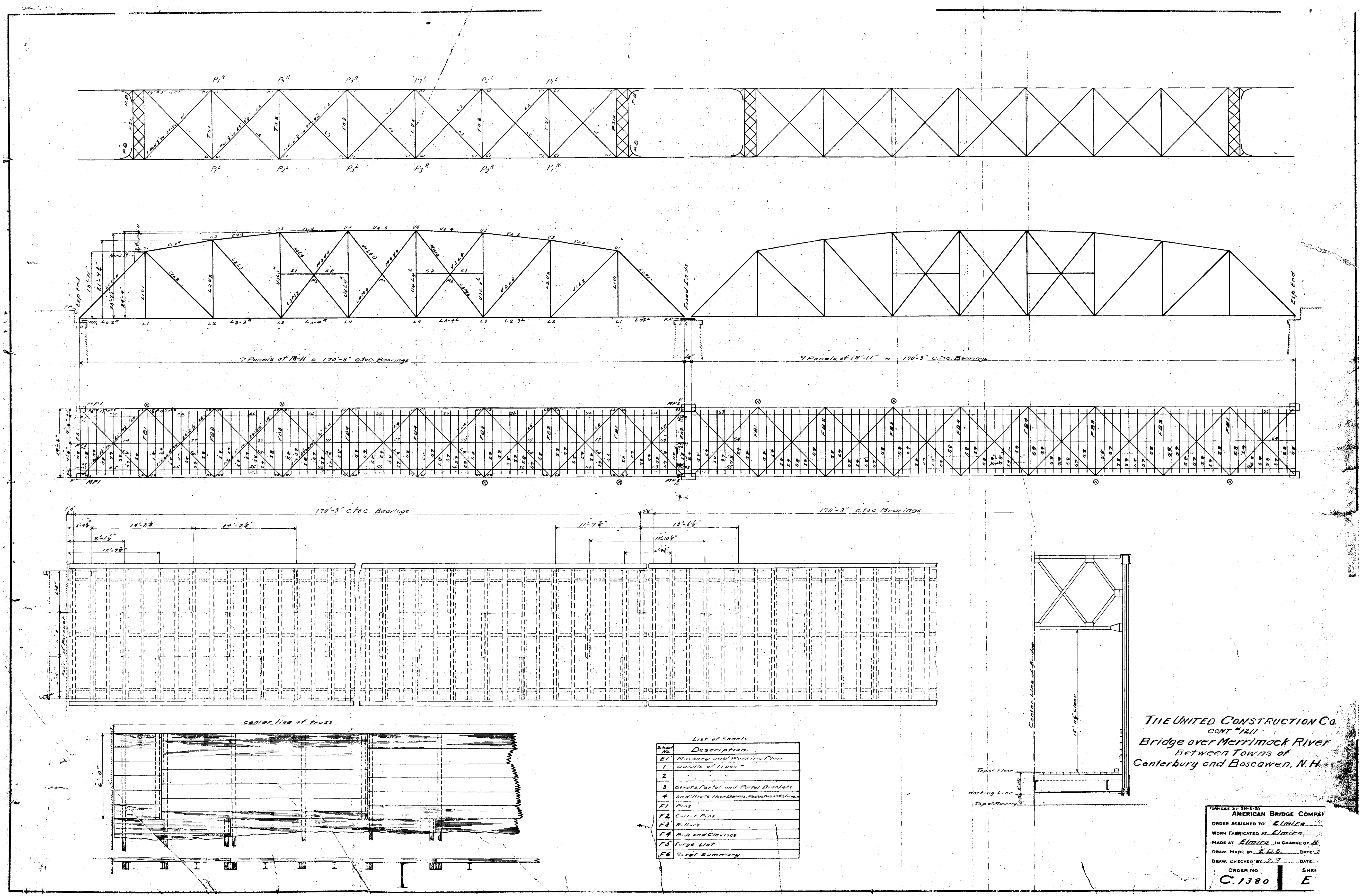
NH-669-1	Bridge over Merrimack River Between Towns of Canterbury and Boscawen New Hampshire. John W. Storrs. General Plan, Sheet 1 of 4. No date. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-2	Bridge over Merrimack River Between Towns of Canterbury and Boscawen New Hampshire. John W. Storrs. Details of Trusses, Sheet 2 of 4. No date. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-3	Bridge over Merrimack River Between Towns of Canterbury and Boscawen New Hampshire. John W. Storrs. Sections and Shoes, Sheet 3 of 4. No date. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-4	Bridge over Merrimack River Between Towns of Canterbury and Boscawen New Hampshire. John W. Storrs. Substructure, Sheet 4 of 4. No date. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-5	United Construction Co. Contract 1211. Bridge over Merrimack River Between Towns of Canterbury and Boscawen NH. Cover Sheet. American Bridge Company. Shop drawing of general plan and layout of members. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-6	United Construction Co. Contract 1211. Bridge over Merrimack River Between Towns of Canterbury and Boscawen NH. Sheet 1. American Bridge Company. Shop drawing of end post and panels 1 and 2. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-7	United Construction Co. Contract 1211. Bridge over Merrimack River Between Towns of Canterbury and Boscawen NH. Sheet 2. American Bridge Company. Shop drawing of panels 3, 4, 5. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-8	United Construction Co. Contract 1211. Bridge over Merrimack River Between Towns of Canterbury and Boscawen NH. Sheet 3. American Bridge Company. Shop drawing of portal strut and upper struts. Original on file at New Hampshire Department of Transportation, Concord, NH.
NH-669-9	United Construction Co. Contract 1211. Bridge over Merrimack River Between Towns of Canterbury and Boscawen NH. Sheet 4. American Bridge Company. Shop drawing of floor beams, stringers, shoes and other details. Original on file at New Hampshire Department of Transportation, Concord, NH.

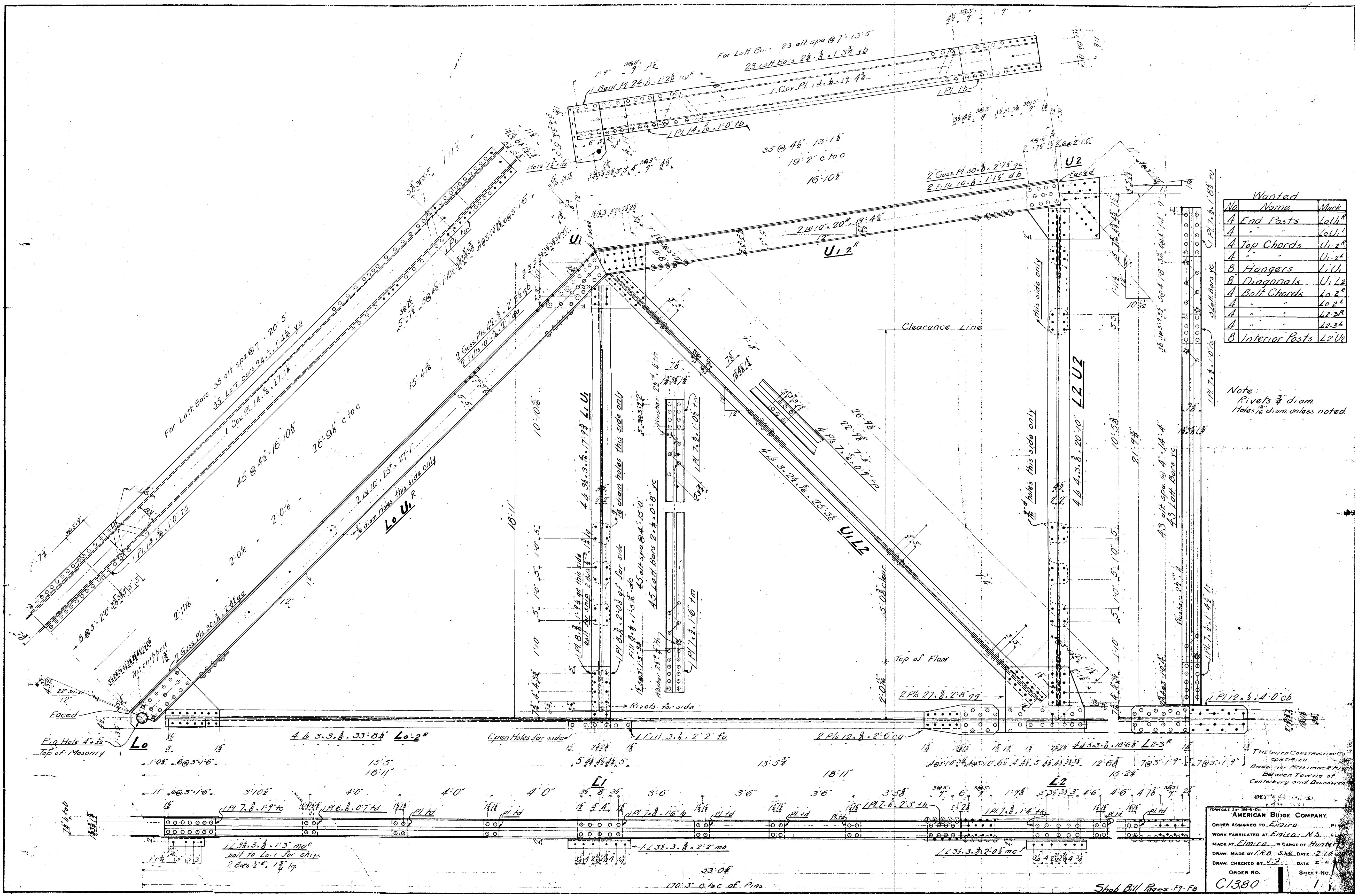

Expansion
Fixed Ends.
Exp. End
Top of Floor.
Merrimack River - Water Level Dec 1906
Canterbury End.
Boscawen End
9 Panels 18'11" = 170'3" c.to c. Bearings
1'8"
170'3"
23'0" abt.
1907
Town of Canterbury.
Lowell T. Mason
Frank S. Davis
Frank C. Plastridge
Selectmen
3'0"
2'0"
Name Plate Canterbury End.
1907
Town of Boscawen.
Frank L. Gerrish
Benj. F. Butler
Chas. W. Carter
Selectmen
Name Plate Boscawen End.
3" Y.P. Plank
Top Strut
Floorbeam
Plan of Top Bracing
Plan of Floor System.
18'0"
End View
Floorbeams
Web 21½" × 5/16"
4 Ls 4" × 3" × 5/16"
See Specifications for quality of materials.
Concentrated = 10 Tons on 4 wheels.
New Concrete Bridge Seats (shaded) balance of substructure old.
No. 6 FILE 14
Bridge over
Merrimack River
Between
Towns of Canterbury and Boscawen,
New Hampshire.
General Plan.
John W. Storrs, Consulting Engr.
Concord, N.H.
Sheet 1 of 4.
No. 2 Pocket 1 Folder 2

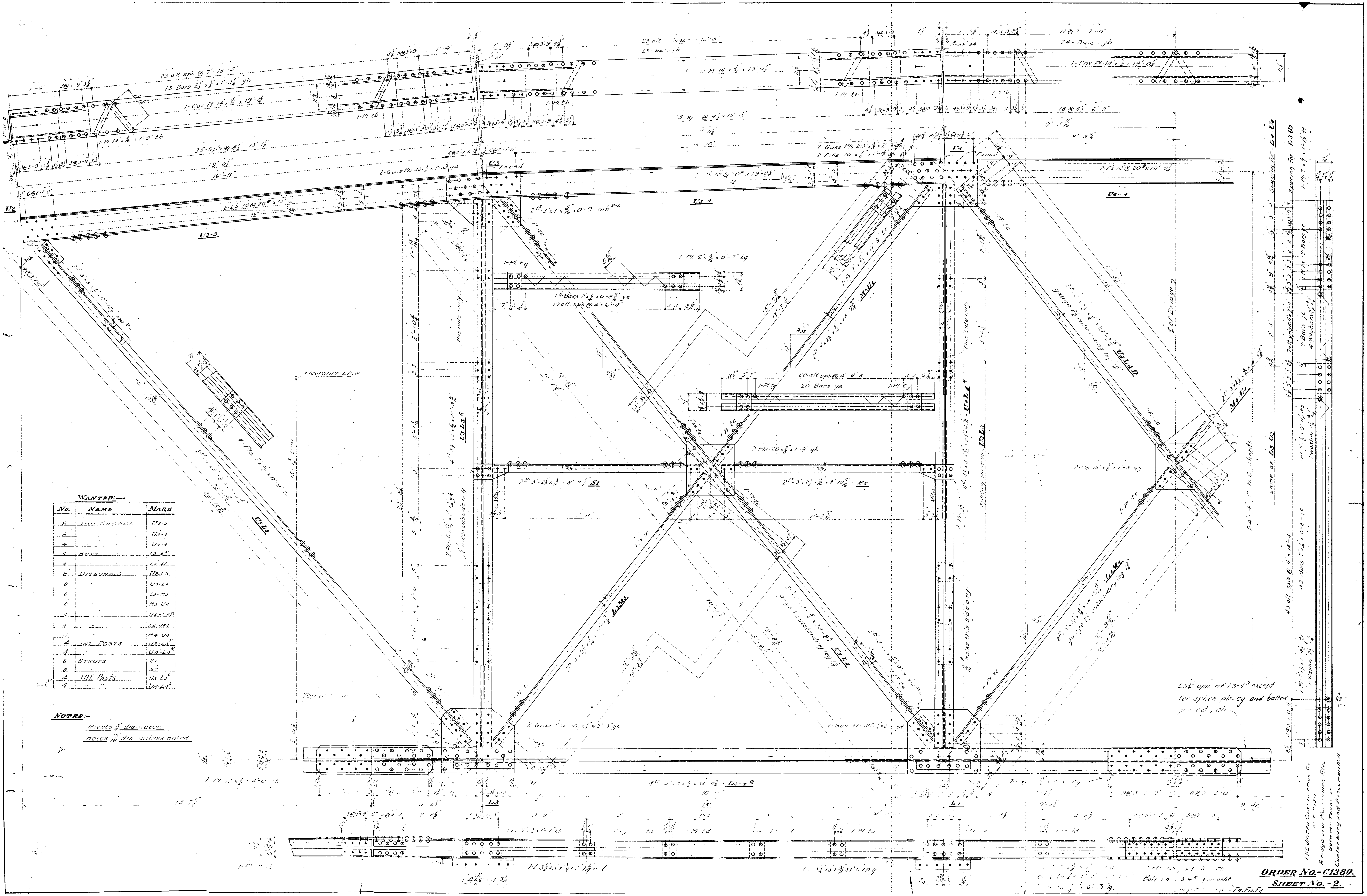

Section T.C. and E. Post
24" x 3/8" Pl. 2'-0"
Holes for 1 3/8" Pins
28 Latt. Bars
29 Lattice Bars
All T.C. and E.P. battens 14" x 5/16" 1'-0"
41 Lattice bars
Lattice same as posts.
4" Pin
For Details of Shoe see Sheet 3
Omit pin pls. in 4th & 5th Panels.
See List of Lateral rods for Pins.
Center Line
All rivets 3/4" dia.
Minimum pitch 3" c. toc.
All gussets 3/8" thick unless noted otherwise
4 Complete Trusses Required.
Bridge over
Merrimack River
Between
Towns of Canterbury and Boscawen
New Hampshire
Details of Trusses
John W. Storrs, Consulting Engr.
Concord, N.H.
Sheet 2 of 4.

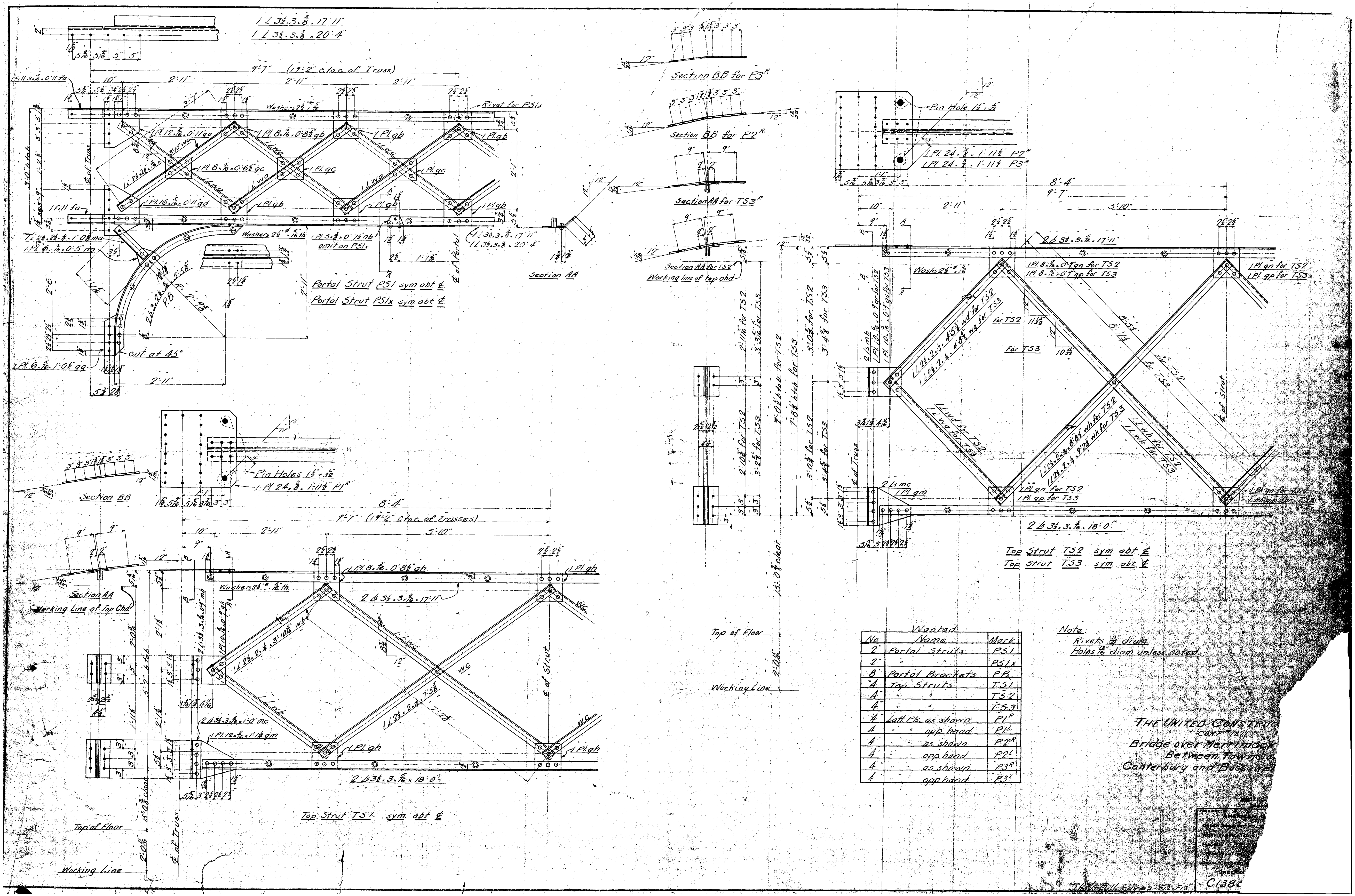

End View
Intermediate Section
Scale 3/4 in = 1 foot
Details of Shoes and Wall Pls.
Scale 1 1/2 in = 1 foot
Detail of Splice in Plank.
Post at Ctr. of each panel.
15'0" Clearance
3" Y.P. Plank
Fixed
Expansion
Sec A-A'
Bridge over
Merrimack Riv
Between
Towns of Canterbury and Boscawen
New Hampshire
Sections and Shoes.

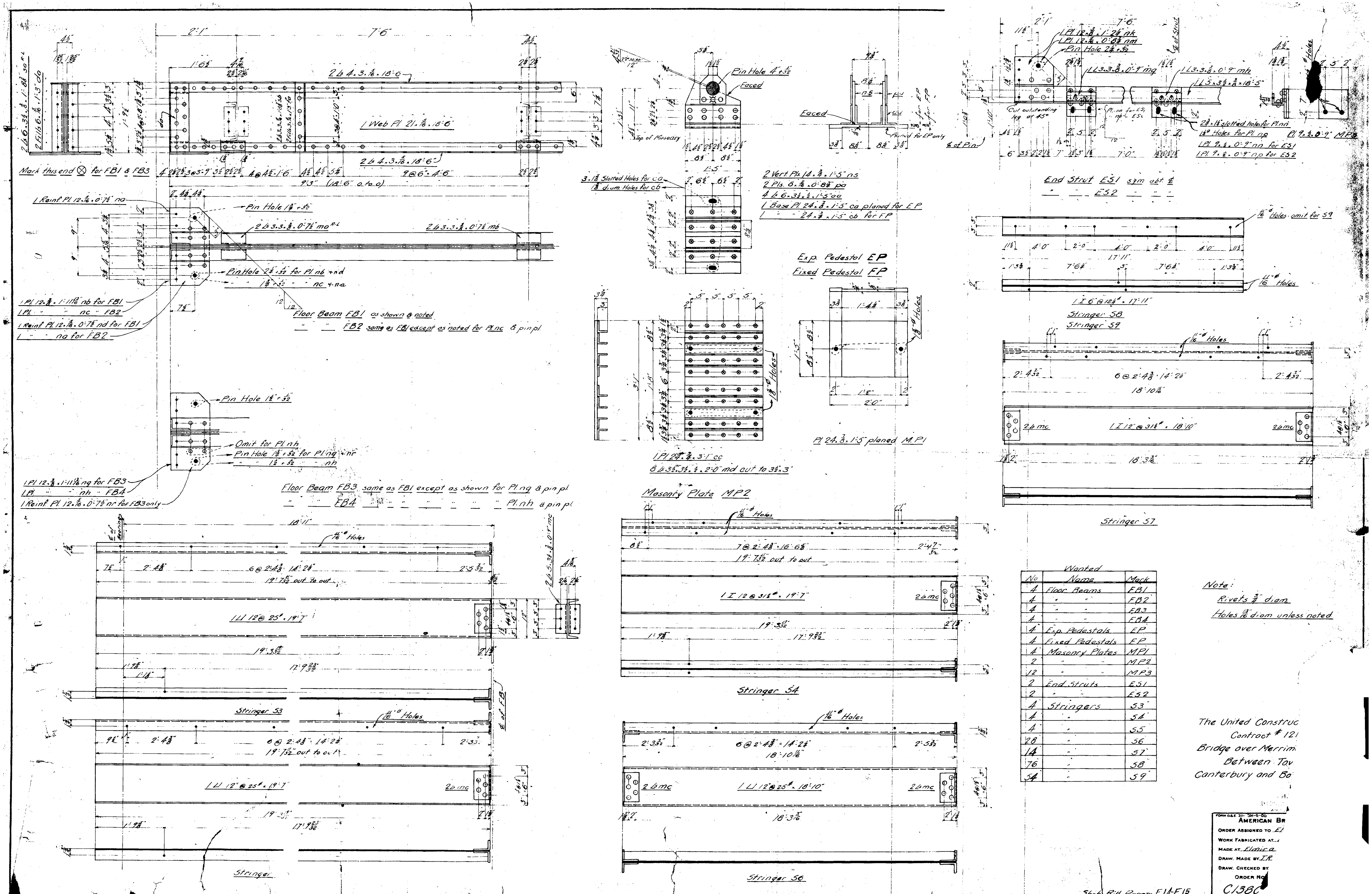

Center Line of Trusses
Canterbury Abutment
19' 2" c. to c. of Trusses
2'-1"
7'-6"
1'-3" x 1'-3"
2'10"
2'10"
7'-6"
2'-1"
5'0"
Shoe Pl.
1'-6½"
1'-6½"
172'-1"
172' 1"
344' 2" Between backwalls
Boscawen Abutment
Front View of Abutment
3'-4½"
1'-2½"
Floor Level
3' 4½"
Shoe Pl.
60# Rails
All work above this line new concrete
Scale ½ in = 1 foot.
60# Rails
Bridge over
Merrimack River
Between
Towns of Canterbury and Boscawen
New Hampshire
Substructure.
John W. Storrs, Consulting Engr.
Concord, N.H.


9 Panels of 18'-11" = 170'-3" c to c Bearings
9 Panels of 18'-11" = 170'-3" c to c Bearings
Exp. End
Fixed Ends
Exp. End
170'-3" c to c Bearings
170'-3" c to c Bearings
center line of truss
Center Line of Bridge
Top of Floor
Working Line
Top of Masonry
List of Sheets.
Sheet No. | Description.
E1 | Masonry and Working Plan
1 | Details of Truss
2 | " " "
3 | Struts, Portal and Portal Brackets
4 | End Struts, Floor Beams, Pedestals and String...
F1 | Pins
F2 | Cotter Pins
F3 | Rollers
F4 | Rods and Clevises
F5 | Forge List
F6 | Rivet Summary
THE UNITED CONSTRUCTION Co.
CONT. #1211
Bridge over Merrimack River
Between Towns of
Canterbury and Boscawen, N.H.
FORM O&E 311- 5M-5-06
AMERICAN BRIDGE COMPA
ORDER ASSIGNED TO Elmira
WORK FABRICATED AT Elmira
MADE AT Elmira IN CHARGE OF
DRAW. MADE BY E.D.S. DATE
DRAW. CHECKED BY S.T. DATE
ORDER NO.
C.1380
SHEE
E


Wanted
No | Name | Mark
4 End Posts
4 Top Chords
8 Hangers
8 Diagonals
4 Bott. Chords
8 Interior Posts
Note:
Rivets 3/4" diam.
Holes 13/16 diam. unless noted.
Clearance Line
Top of Floor
Faced
Pin Hole
Top of Masonry
Rivets far side
Open Holes far side
L0
L1
L2
U1
U2
L0 U1 R
U1-2 R
U1 L2
L1 U1
L2 U2
170'3" c. to c. of Pins
Shop Bill Pages F7-F8
AMERICAN BRIDGE COMPANY
Between Towns of
Canterbury and Boscawen
C1380


WANTED:—
No.
NAME
MARK
TOP CHORDS
DIAGONALS
INT. POSTS
STRUTS
NOTES:—
Rivets 3/4 diameter
Holes 13/16 dia. unless noted.
Clearance Line
ORDER NO.-C1380.
SHEET NO.-2.


Portal Strut PS1 sym abt ℄
Portal Strut PS1x sym abt ℄
Section AA
Section BB for P3R
Section BB for P2R
Section AA for TS3R
Section AA for TS2R
Working line of top chd
Section BB
Pin Holes
cut at 45°
Top Strut TS1 sym abt ℄
Top Strut TS2 sym abt ℄
Top Strut TS3 sym abt ℄
Top of Floor
Working Line
Wanted
No | Name | Mark
2 | Portal Struts | PS1
2 | " " | PS1x
8 | Portal Brackets | PB
4 | Top Struts | TS1
4 | " | TS2
4 | " | TS3
4 | Latt Pls. as shown | P1R
4 | opp hand | P1L
4 | as shown | P2R
4 | opp hand | P2L
4 | as shown | P3R
4 | opp hand | P3L
Note:
Rivets 3/4" diam
Holes 13/16" diam unless noted
THE UNITED CONSTRU
Bridge over Merrimack
Between Towns o
Canterbury and Boscawe



Wanted

No	Name	Mark
4	Floor Beams	FB1
4	" "	FB2
4	" "	FB3
4	" "	FB4
4	Exp. Pedestals	EP
4	Fixed Pedestals	FP
4	Masonry Plates	MP1
2	" "	MP2
12	" "	MP3
2	End Struts	ES1
2	" "	ES2
4	Stringers	S3
4	"	S4
4	"	S5
28	"	S6
14	"	S7
76	"	S8
54	"	S9