NEW HAMPSHIRE HISTORIC PROPERTY DOCUMENTATION

SEWALL'S FALLS BRIDGE

NH State No. 727

LOCATION: Sewall's Falls road over Merrimack River
Concord, Merrimack County, New Hampshire.
USGS Penacook, New Hampshire, Quadrangle.
UTM Coordinates: 19.291874.4794111
State Plane Coordinates (NAD 83 feet): x 1,011,407.65 y 281,047.06

DATES: 1873 (substructure), 1915 (superstructure), 1936 (south approach trestle), 1984 (north abutment).

BUILDER: City of Concord

ENGINEER: Will B. Howe, Concord City Engineer and John W. Storrs, Consulting Engineer (1915).
New Hampshire Highway Department (1936).
Tewksbury Engineering Consultants, Concord, NH (1984)

CONTRACTOR/ FABRICATOR: Lyman R. Fellows, (substructure, 1873).
Berlin Construction Company, Berlin, CT (fabricator & contractor, superstructure, 1915).
Bethlehem Steel Co., Bethlehem, PA (fabricator, south approach trestle, 1937).
Simpson Brothers Corporation, Boston, MA (contractor, south approach trestle, 1937).

OWNER: City of Concord

PRESENT USE: Bridge closed 1915; removed and replaced 2016.

SIGNIFICANCE: The Sewall's Falls Bridge was built in 1915 on the site of the preceding 1873 covered bridge and earlier toll bridges dating from 1835 and is therefore importantly associated with the transportation and development history of Concord. It is an intact example of a riveted Pratt Truss highway bridge, a type important to the history of transportation engineering. The bridge rests on the stone abutments and piers built in 1873 that exhibit the exceptional stone masonry skills of the period. It was designed by John W. Storrs, an engineer important to the engineering history of bridges in New Hampshire and neighboring states. Berlin Construction Company, the steel fabricator and general contractor that erected the bridge made important contributions to the history of bridge construction in New Hampshire and elsewhere. The bridge was determined important to the history of the state and eligible for listing in the State and National Register of Historic Places in 2009.

PROJECT INFORMATION: The Sewall's Falls Bridge was documented in accordance with the standards of the Historic American Engineering Record in 2016 by Historic Documentation Company Inc. (HDC), Portsmouth, RI, for the City of Concord, NH. The documentation fulfills Stipulation No. 3 of the project Memorandum of Agreement, NHDOT Project # 12004, BFR-X5099 (021), signed 4 April 2014. 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

Sewall's Falls Bridge (NHDOT Bridge # Concord 070/117) consists of a two- riveted steel high Pratt truss spans, built 1915, and eight steel stringer approach spans, built 1937. The spans (superstructure) are carried on piers and abutments (substructure) of both stone and concrete construction. The bridge spans the Merrimack River approximately three-quarters of a mile upstream from the Sewall's Falls Dam, a mile east of U.S. Routes 3 and 4, and one-quarter mile west of Interstate I-93 (Figure 1; Figures for this section begin on page 6). The bridge joins the villages of West Concord and East Concord at a sharp bend in the river where the Merrimack River takes one of its many meanders from its north-south course to run west-east for about a quarter-mile. The bridge is oriented in a northeast-southwest direction and therefore the spans and abutments and areas immediately adjacent are referred to as either north or south; however, the banks of the Merrimack are naturally known as east or west and areas beyond the bridge vicinity are referred to accordingly (Figure 2). The area north of the bridge, (the east bank) has light commercial and residential development; the area south (the west bank) features a public park and protected woodlands.

Superstructure

Sewall's Falls Bridge has an overall length of approximately 660' which includes the eight south-approach spans that total 319'-6", two truss spans that total 331'-8", plus the small spacing between the spans at the piers and abutments. Refer to Figures 3-17 that accompany this description section and Drawings 1-16. The truss spans are of the Pratt type, a design patented in 1844 by Thomas Pratt and characterized by parallel top and bottom chords connected with vertical posts in compression and diagonals in tension. As originally designed by Pratt, the primary structural members of the truss were joined with pin connections; the Sewall's Falls trusses are joined with rigid riveted connections, typical of Pratt-type trusses built after about 1900. The trusses are further categorized as high or thru trusses, meaning they are of such a height – correlating with their long span length – that they must be laterally braced together with overhead members above the roadway.[1] The history and technology of the Pratt truss is further discussed below.

The two truss spans are essentially identical in their materials of construction, being entirely of built-up riveted rolled steel members connected by riveted gusset plates at all panel points. The north and south truss spans do however differ in length by 2 feet in order to fit the distances between the pre-existing stone pier and abutments that were reused from the preceding wood covered bridge. The south truss measures approximately 166'-10" from center-to-center of bearings, consisting of nine panels each 18'-6.5" wide (Figure 3). The north truss measures 164'-10", consisting of seven intermediate panels each 18'-6.5" wide and two end panels each 17'-6.5" wide. The shorter end panels on the north span give the inclined end post a slightly steeper slope, but the difference is not readily apparent.

Each truss span is made up of a right and left truss frame spaced 19'-6" apart on centers, providing a 16'-6" roadway between the curbs (Figure 4). The truss frames are 23'-1" high overall, which,

[1] The terms thru-truss or through-truss are used interchangeably. Low or "pony" trusses are used for shorter spans and their height does not require nor can accommodate bracing.

after subtracting the depth of the floor system and the overhead lateral bracing frames that join them, leaves 15'-4" clearance above the roadway for the passage of vehicles.

The top chords and inclined end-posts are built-up members consisting of 12" channels joined back-to-back with 18" wide cover plates on top and with both tie-plates (18" x 1'-6") and double lattice lacing bars (2¼" x $^{3}/_{8}$") on the bottom. Bottom chords consist of double- angle pairs (5x3") joined with tie plates to form an H-section member. The chord assembly is strengthened in the central 5 panels of the truss with continuous 11" wide outer side plates. Posts are built-up H-sections consisting of four angles (varying in size from approximately 3x3" to 4x5") joined with single lacing bars. The first and last interior panel points (where the top chord meets the inclined endpost) have a vertical I-section member (constructed of two angle pairs joined with tie plates) known as a hip-vertical that serves as a floorbeam hanger. Diagonals consist of single-angle pairs or double-angle pairs of varying sizes joined with tie plates or single lacing bars. Diagonal counters form an "X" in the three center panels.

Field sketches of the trusses made by the New Hampshire Highway Department (NHHD) are presented in Figures 3 and 4 below and provide additional information on the type and dimensions of individual truss members beyond the summary description in this section.

The sway-frame struts (part of the overhead bracing that joins the upstream and downstream trusses) are 5'-6" deep and built entirely of angles, with single 3x3" angle diagonal members joining paired 4x3" top and bottom members. Upper lateral bracing consists of single angles, varying from 5x3" to 3x3½", crossing diagonally between panel points (top of posts). Lower lateral bracing is configured the same as the upper laterals consisting of 3x3"or 3x3½" angles.

Portal bracing consists of a double-intersecting Warren truss strut with T-section flanges (paired-5x3" angles) joined with diagonal 3x3" angles members and gusset plates. The strut is joined to the end posts with a curved sway brace of deformed angle and flat-plate construction (Figures 4, 8).

A builder's plaque is mounted on the portal strut at each end of the bridge and reads

1915
CHARLES J. FRENCH, MAYOR.
BOARD OF PUBLIC WORKS.
F.I BLACKWOOD. R.A. BROWN.
E.L. DAVIS. M.J. LEE.
N.W. HOBBS. H.F STURTEVANT.
W.B. HOWE, CITY ENGINEER.
STORRS & STORRS, BRIDGE ENGINEERS.
CONCORD, N.H.
BUILT BY
BERLIN CONSTRUCTION CO.
BERLIN, CONN.

The floor system consists of 8" x 26" riveted plate-girder floor beams carrying eight lines of 15" x 36 p.l.f. I-beam stringers spaced 2'-4" on centers. Inspection conducted in 2012 found the stringers and floorbeams extensively modified with the addition of welded flange cover plates and web

repair plates, possibly from multiple repair efforts.[2] As originally designed, a 4x6" timber sleeper was attached to the top of the stringers to which 3" thick timber sub-decking was nailed transversely, then overlaid with a 1-½" timber-plank wearing surface nailed longitudinally. This original decking was in 1949-1950 with the present 5" deep "I-Beam Loc Open Grid Floor" system (Drawing 16). Attachment of the steel grid floor required various clips and spacers to be welded on to the stringers and floor beams.

Roadway guardrails along the inside of the trusses consist of three lines of 2" steel pipe railing mounted with U-bolts to the truss posts and intermediate steel-angle posts. Cast iron spacers or "stand-offs" are used at the intermediate posts to align the rail with the wider end posts (Photo No. 27). The railings originally terminated at the abutments into cast iron posts, one of which remains at the south-east truss end (Figure 9, Drawing 6 and Photos 13 & 26). Where the other three original posts are missing, apparently destroyed by vehicle impacts judging by the bent railings, alternative supports have been added. The bridge was never equipped with sidewalks.

Substructure

Sewall's Falls Bridge was built on the same alignment as the preceding covered bridge in order to utilize the well-built granite abutments and pier erected by the City of Concord in 1873. Concrete caps were added to the pier and abutments at the time (1915) to provide raised seats for the bearing shoes and floor stringers of the two steel trusses. When the 1936 flood washed out sections of the south approach, a new freestanding masonry pier (south pier) was built in place of the south abutment to carry not only the south truss but also the end span of the new steel trestle approach (described separately below). The north abutment from 1873 was removed and replaced with a concrete abutment in 1984.

River Pier: With the exception of the concrete caps mentioned above, the river pier remains unaltered from its original 1873 construction. It is constructed of cut granite blocks of nearly uniform thickness, with quarry-split faces and narrow tightly-fitted joints bedded in mortar. The upstream face of the pier is beveled to a sharp edge and vertically battered at roughly a 50-degree incline. This feature is known as a cutwater or ice breaker, its purpose to divert the impact of water, logs, and particularly ice, which pushes up the inclined nosing to split and fall aside. Five courses down from the top, on both sides of pier, are two stones with angled faces to serve as seats for the reinforcing arches of the 1873 covered bridge.[3] Iron rods about 6' long with forged eyes at each end that apparently served to anchor the covered bridge to the pier, remain embedded in both pier faces near the upstream end.

South Pier: Plans prepared by the NHHD for repairs and reconstruction of the bridge following the 1936 flood include drawings and specifications for a new south pier constructed in place of the south abutment (Figure 16, Drawing 11). The south pier was to be of "ranged mortar squared stone masonry" with the allowance that "suitable stone removed from the present abutment may be used in proposed pier." The outward appearance of the stone very closely matches that of

[2] Clough Harbour & Associates. *Sewalls Falls Bridge In-Depth Inspection* (March 2012).

[3] The fact that the stone arch seats were built into the pier indicates the reinforcing archers were original to the 1873 covered bridge design, as opposed to added later, typically around the turn of the century, as seen in earlier covered bridges built in the 1840s and 1850s.

the river pier in size and finish, suggesting that most if not all of it was salvaged from the original 1873 abutment. This conclusion is supported by a sketch of the 1873 bridge substructure prepared in 1914 by Concord City Engineer W. B. Howe that depicts the abutment with wing walls of sufficient length to provide all the material necessary to build the pier (Drawing 1). The cutwater of the south pier is battered at about a 75 degree angle, much steeper than the river pier, and the only visual clue that pier is not from the original 1873 construction. The dimensions of the pier and the design of the concrete cap to accept both the truss bearings and the new approach span bearings are shown in Drawing 11.

North abutment: The 1914 substructure drawing (cited above) shows the original 1873 north abutment of typical bevel-wing design with a bridge seat roughly 25' wide and symmetrical wing walls roughly 50' in length. This abutment was replaced by the city of Concord in 1984 with a reinforced concrete abutment with roughly the same foot print. Information regarding the specific reasons for the replacement of the abutment were not obtained.

South Approach Spans

In 1937, as a result of flooding and washout of the south approach road during the March 1936 flood, a new south approach trestle 400 feet in length was constructed with funding by the Works Progress Administration. The trestle originally consisted of ten steel stringer spans carried on structural steel bents. The trestle mated up to the new south pier, constructed in the place of the former south abutment. The trestle spans have a length of 40' center-to-center of the bents except for the north span which is 39'-8" in length. The spans consist of seven 18" x 55# wide-flange stringers spaced on 3'-6" centers and braced with 8" I-beam diaphragms. The deck of the trestle spans was originally wood, consisting of 4x6" x 22'-long spruce or western fir timbers laid on edge and nail-laminated. A one-inch thick asphalt plank wearing surfaced was applied over the wood deck.

In 1964 the wood deck was replaced with a composite concrete deck with 1.5" asphalt overlay. Under the same contract the south abutment and two adjoining approach spans were removed and replaced with a new west abutment and solid fill approach, shortening the overall length of the trestle to about 319 feet.

The trestle bents consist four 8" x 36# H-piles spaced on roughly 7' centers, cross braced with angles welded to the piles. In the case of seven of the bents, the pilings were driven to 20-ton bearing capacity and then concrete encased at ground level. In the case of the two northern-most bents, the piles terminate in concrete footings bearing on ledge.

The approach trestle was not equipped with sidewalks. It retains its original steel guardrails along each side of the 21-foot wide roadway which consist of a single line of 8" steel channel bolted to 5" H-section posts. The original wood curbing was replaced with concrete curbs integral with the slab deck in 1946.

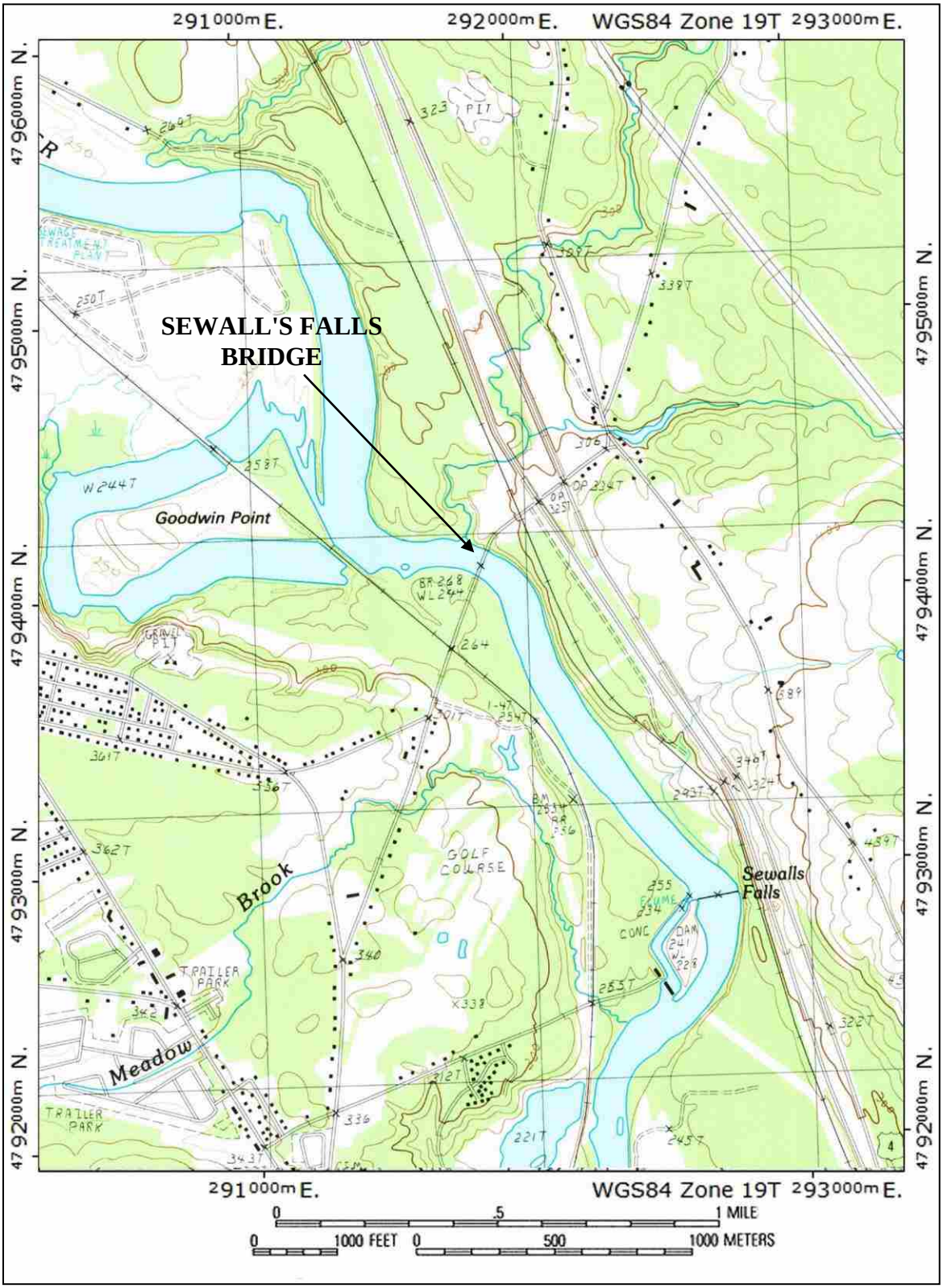


FIGURE 1: Location Map (USGS quadrangle Penacook, NH 1987).

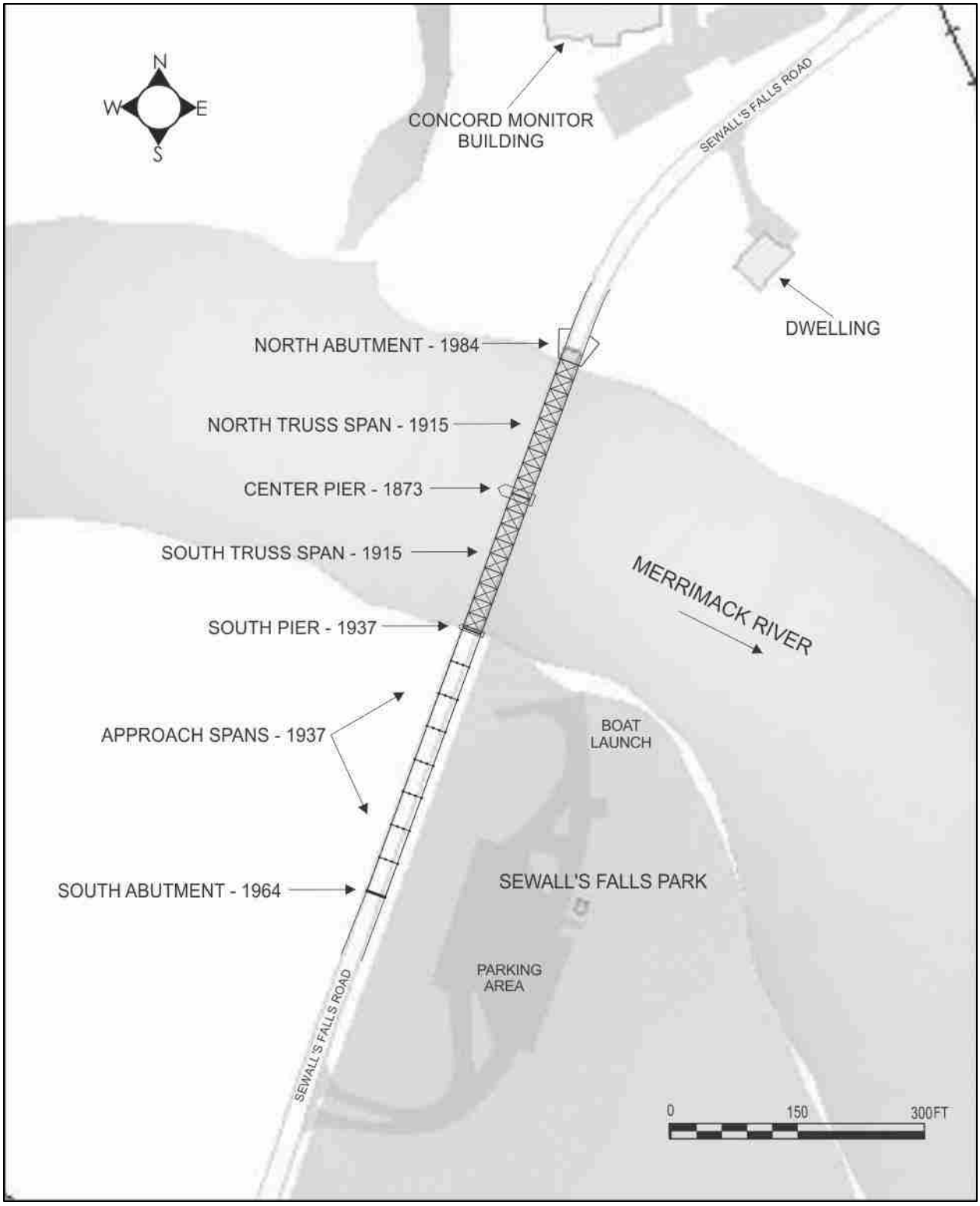


FIGURE 2: Site Sketch

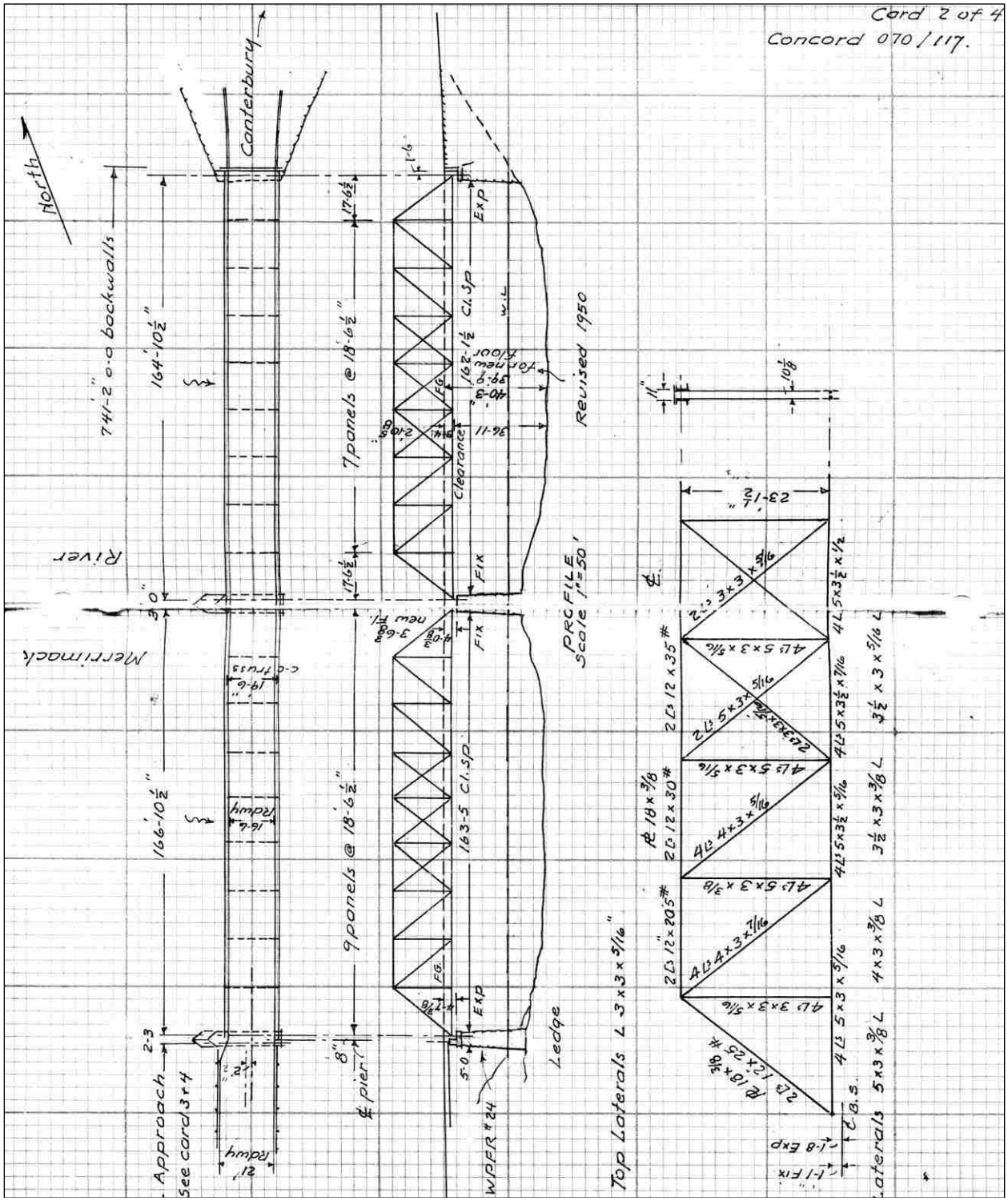


FIGURE 3: Sewall's Falls Bridge, plan, elevation and truss members. Field inspection sketches made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

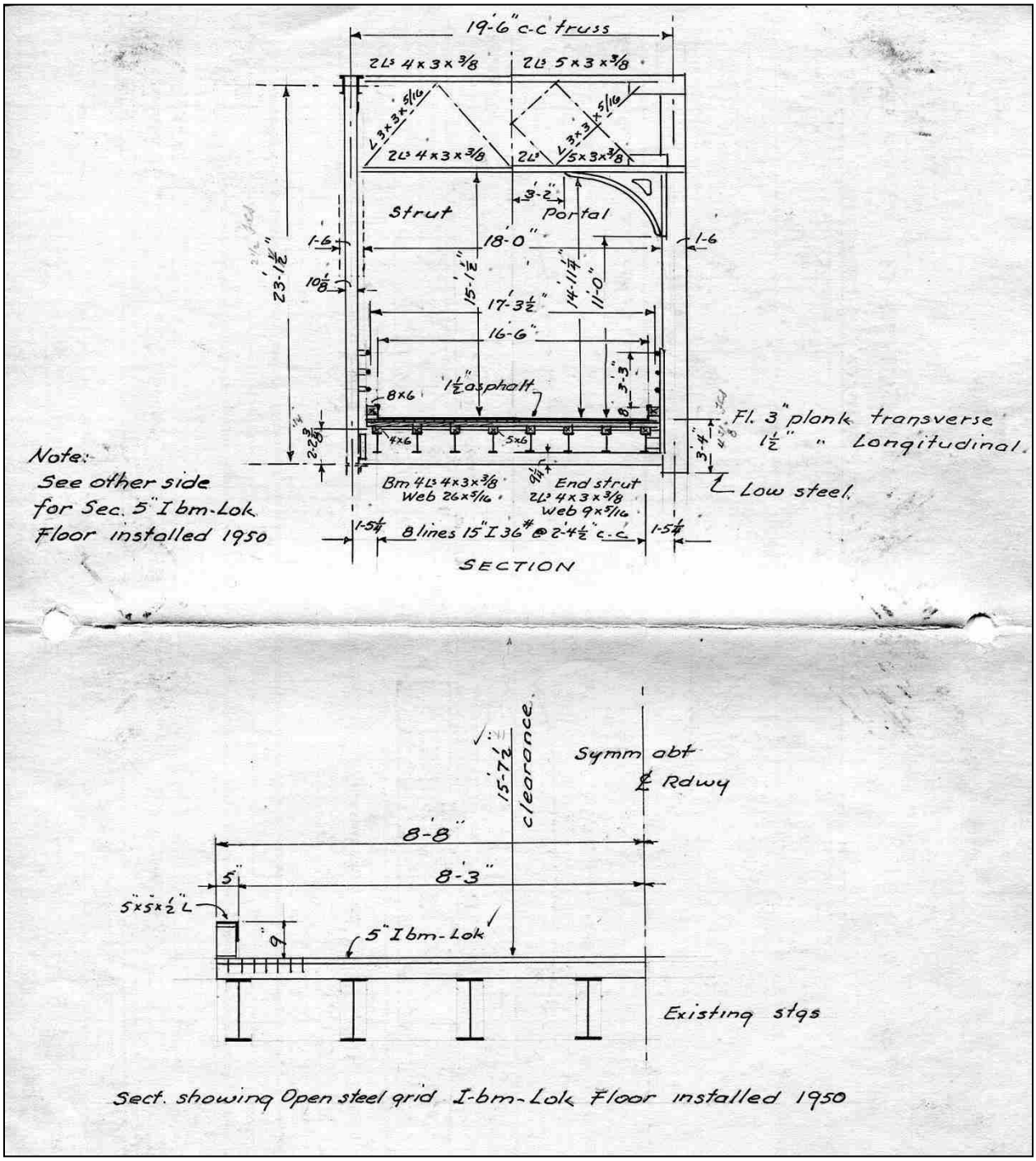
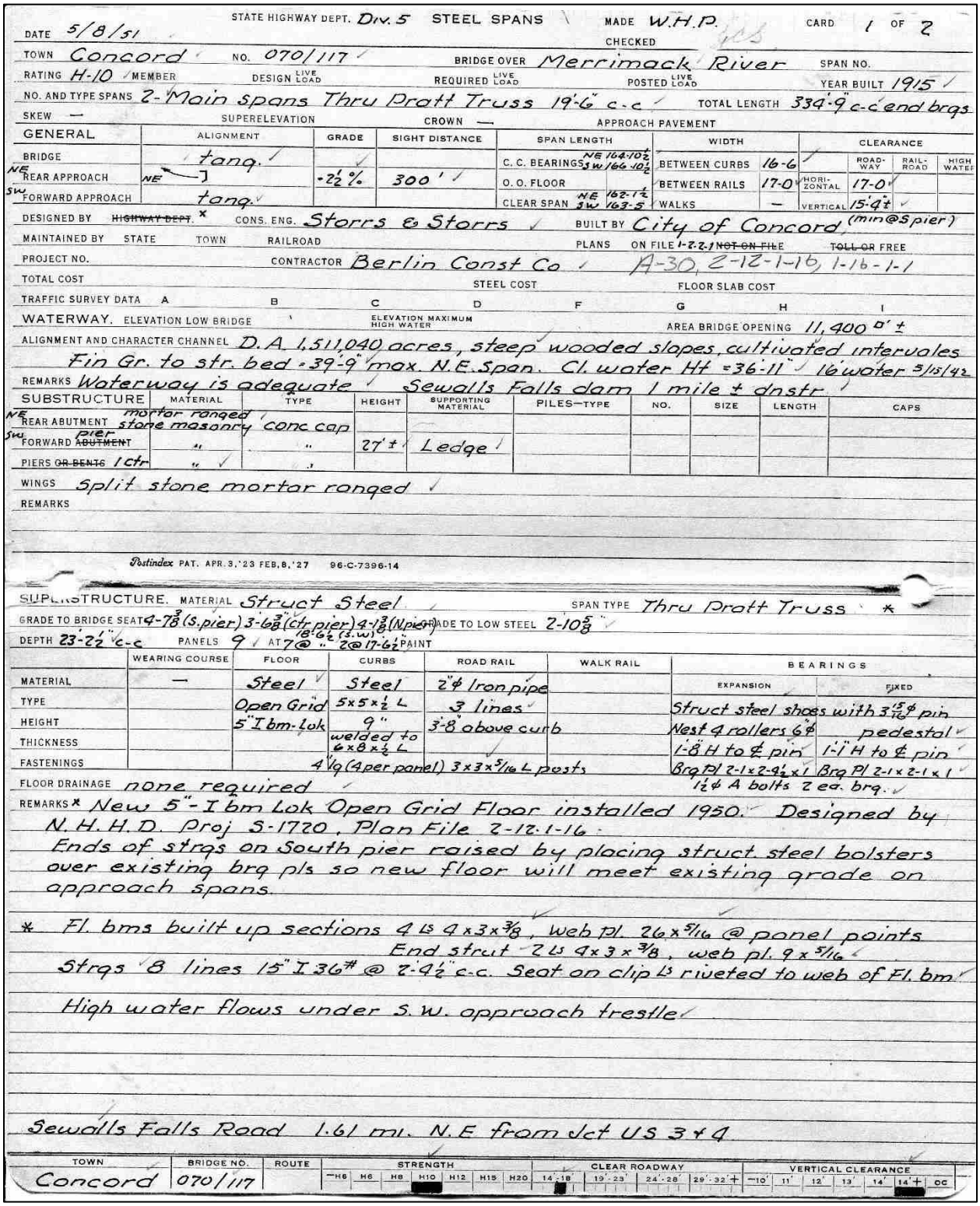


FIGURE 4: Sewall's Falls Bridge, section drawings. Field inspection sketches made by NHHD engineer Wendell H. Piper. Top sketch showing section through truss made May 15, 1942; bottom sketch showing section through steel deck added in 1950, made May 8, 1951 (NHHD Bridge Inventory Card, Concord 070/117).



STATE HIGHWAY DEPT. Div. 5 STEEL SPANS MADE W.H.P. CARD 1 OF 2
DATE 5/8/51 CHECKED
TOWN Concord NO. 070/117 BRIDGE OVER Merrimack River SPAN NO.
RATING H-10 MEMBER DESIGN LIVE LOAD REQUIRED LIVE LOAD POSTED LIVE LOAD YEAR BUILT 1915
NO. AND TYPE SPANS 2-Main spans Thru Pratt Truss 19'-6" c-c TOTAL LENGTH 334'-9" c-c end brgs
SKEW — SUPERELEVATION CROWN — APPROACH PAVEMENT

GENERAL	ALIGNMENT	GRADE	SIGHT DISTANCE	SPAN LENGTH	WIDTH	CLEARANCE
BRIDGE	tang.			C. C. BEARINGS NE 164-10½ SW 166-10½	BETWEEN CURBS 16-6	ROAD-WAY / RAIL-ROAD / HIGH WATER
NE REAR APPROACH	NE ~	-2½%	300'	O. O. FLOOR	BETWEEN RAILS 17-0	HORIZONTAL 17-0
SW FORWARD APPROACH	tang.			CLEAR SPAN NE 162-1½ SW 163-5	WALKS —	VERTICAL 15'-9±

DESIGNED BY ~~HIGHWAY DEPT.~~ CONS. ENG. Storrs & Storrs BUILT BY City of Concord (min@Spier)
MAINTAINED BY STATE TOWN RAILROAD PLANS ON FILE 1-2-2-1 ~~NOT ON FILE~~ TOLL OR FREE
PROJECT NO. CONTRACTOR Berlin Const Co A-30, 2-12-1-16, 1-16-1-1
TOTAL COST STEEL COST FLOOR SLAB COST
TRAFFIC SURVEY DATA A B C D F G H I
WATERWAY. ELEVATION LOW BRIDGE ELEVATION MAXIMUM HIGH WATER AREA BRIDGE OPENING 11,400 0' ±
ALIGNMENT AND CHARACTER CHANNEL D.A. 1,511,040 acres, steep wooded slopes, cultivated intervales
Fin Gr. to str. bed = 39'-9" max. N.E. Span. Cl. water Ht = 36'-11" 16 water 5/15/42
REMARKS Waterway is adequate Sewalls Falls dam 1 mile ± dnstr

SUBSTRUCTURE	MATERIAL	TYPE	HEIGHT	SUPPORTING MATERIAL	PILES—TYPE	NO.	SIZE	LENGTH	CAPS
NE REAR ABUTMENT	mortar ranged stone masonry	conc cap							
SW FORWARD ~~ABUTMENT~~ pier	"	"	27'±	Ledge					
PIERS ~~OR BENTS~~ 1 Ctr	"	"							

WINGS Split stone mortar ranged
REMARKS

Postindex PAT. APR. 3, '23 FEB. 8, '27 96-C-7396-14

SUPERSTRUCTURE. MATERIAL Struct Steel SPAN TYPE Thru Pratt Truss *
GRADE TO BRIDGE SEAT 4-7⅜ (S. pier) 3-6⅜ (ctr. pier) 4-1⅜ (N pier) GRADE TO LOW STEEL 2-10⅝
DEPTH 23-2½" c-c PANELS 9 AT 7@ 18'-6½ (S.W.) 2@17-6½" PAINT

	WEARING COURSE	FLOOR	CURBS	ROAD RAIL	WALK RAIL	BEARINGS EXPANSION	BEARINGS FIXED
MATERIAL	—	Steel	Steel	2" ϕ Iron pipe		Struct steel shoes with 3 5/16 ϕ pin	
TYPE		Open Grid	5x5x½ L	3 lines		Nest 4 rollers 6" ϕ	pedestal
HEIGHT		5" I bm-Lok	9" welded to 6x8x½ L	3'-8" above curb		1'-8" H to ϕ pin	1'-1" H to ϕ pin
THICKNESS							
FASTENINGS			4 9/16 (4 per panel) 3x3x5/16 L posts			Brg Pl 2-1x2-9½x1 1½ ϕ A bolts 2 ea. brg.	Brg Pl 2-1x2-1x1

FLOOR DRAINAGE none required
REMARKS * New 5"-I bm Lok Open Grid Floor installed 1950. Designed by N.H.H.D. Proj S-1720, Plan File 2-12.1-16.
Ends of strgs on South pier raised by placing struct. steel bolsters over existing brg pls so new floor will meet existing grade on approach spans.

* Fl. bms built up sections 4 Ls 4x3x⅜, web pl. 26x5/16 @ panel points
End strut 2 Ls 4x3x⅜, web pl. 9x5/16
Strgs 8 lines 15" I 36# @ 7'-9½" c-c. Seat on clip Ls riveted to web of Fl. bm.

High water flows under S.W. approach trestle

Sewalls Falls Road 1.61 mi. N.E from Jct US 3 & 4

TOWN	BRIDGE NO.	ROUTE	STRENGTH	CLEAR ROADWAY	VERTICAL CLEARANCE
Concord	070/117		—H6 H6 H8 H10 H12 H15 H20	14'-18' 19'-23' 24'-28' 29'-32'+	—10' 11' 12' 13' 14' 14'+ OC

FIGURE 5: Sewall's Falls Bridge, Inventory Card inspection data compiled by NHHD engineer Wendell H. Piper, May 8, 1951 (NHHD Bridge Inventory Card, Concord 070-117).

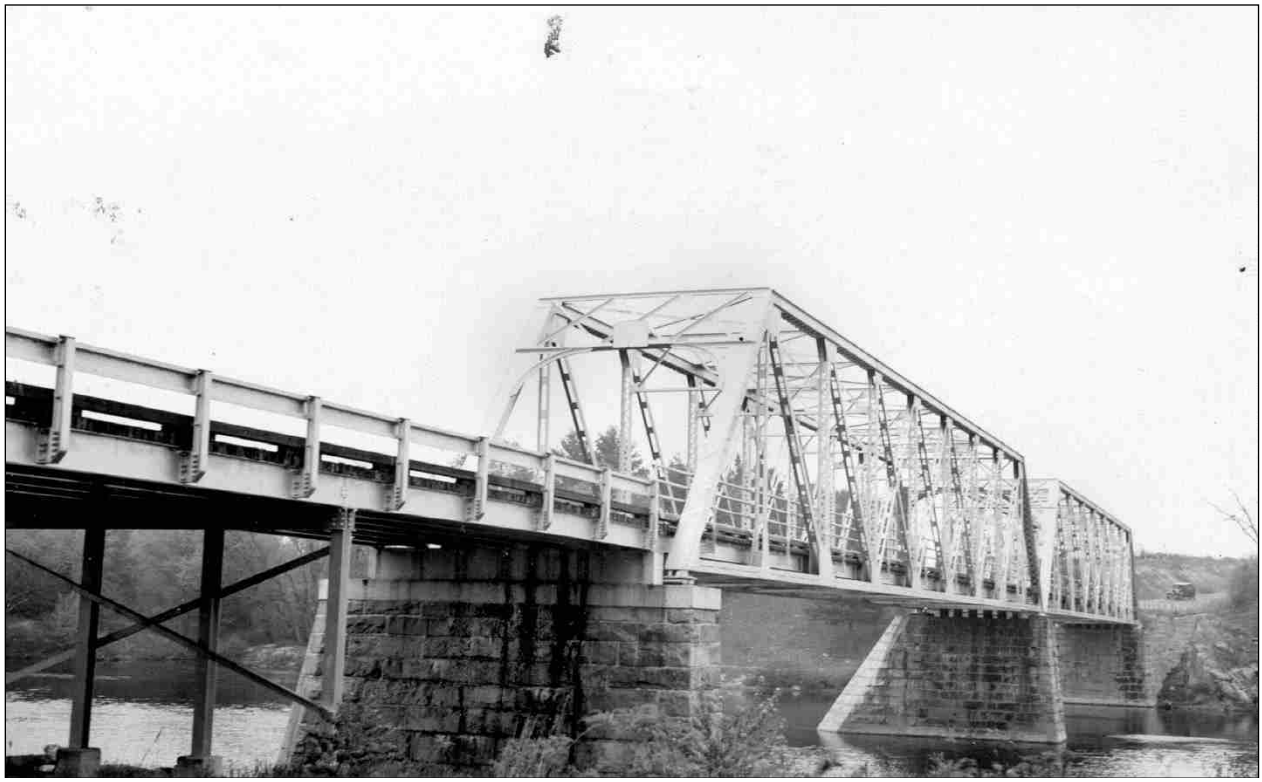


FIGURE 6: Sewall's Falls Bridge, downstream elevation. Field inspection photo made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

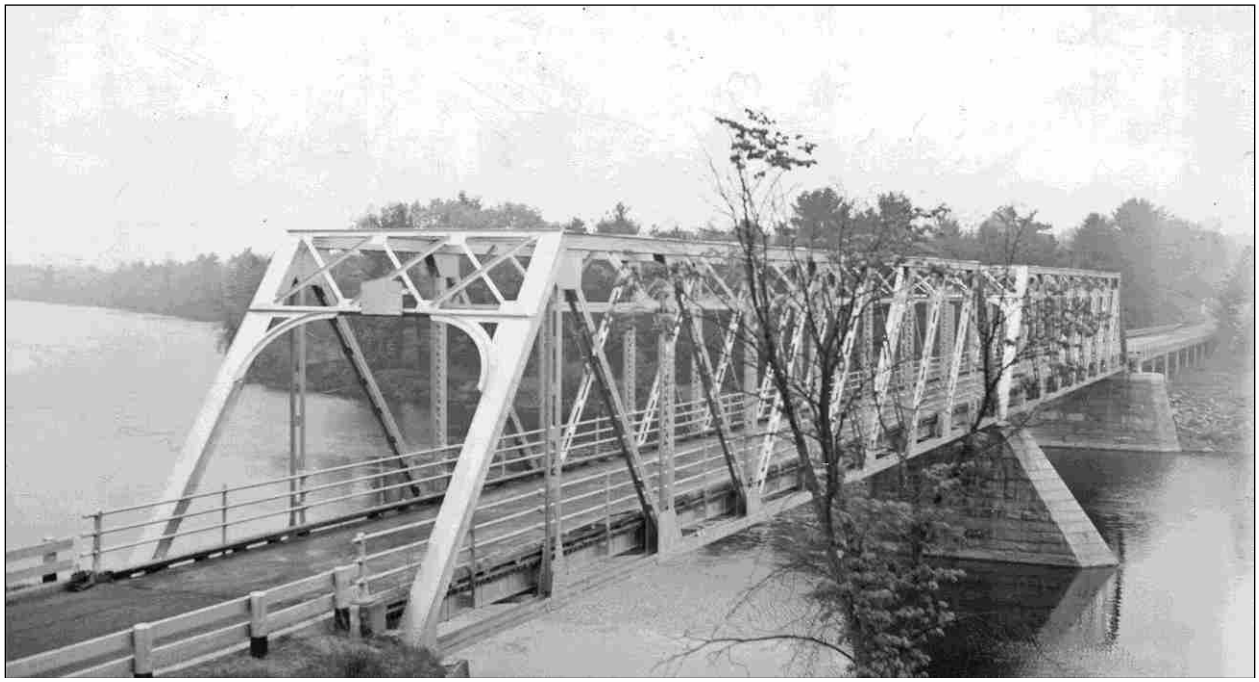


FIGURE 7: Sewall's Falls Bridge, upstream elevation. Field inspection photo made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

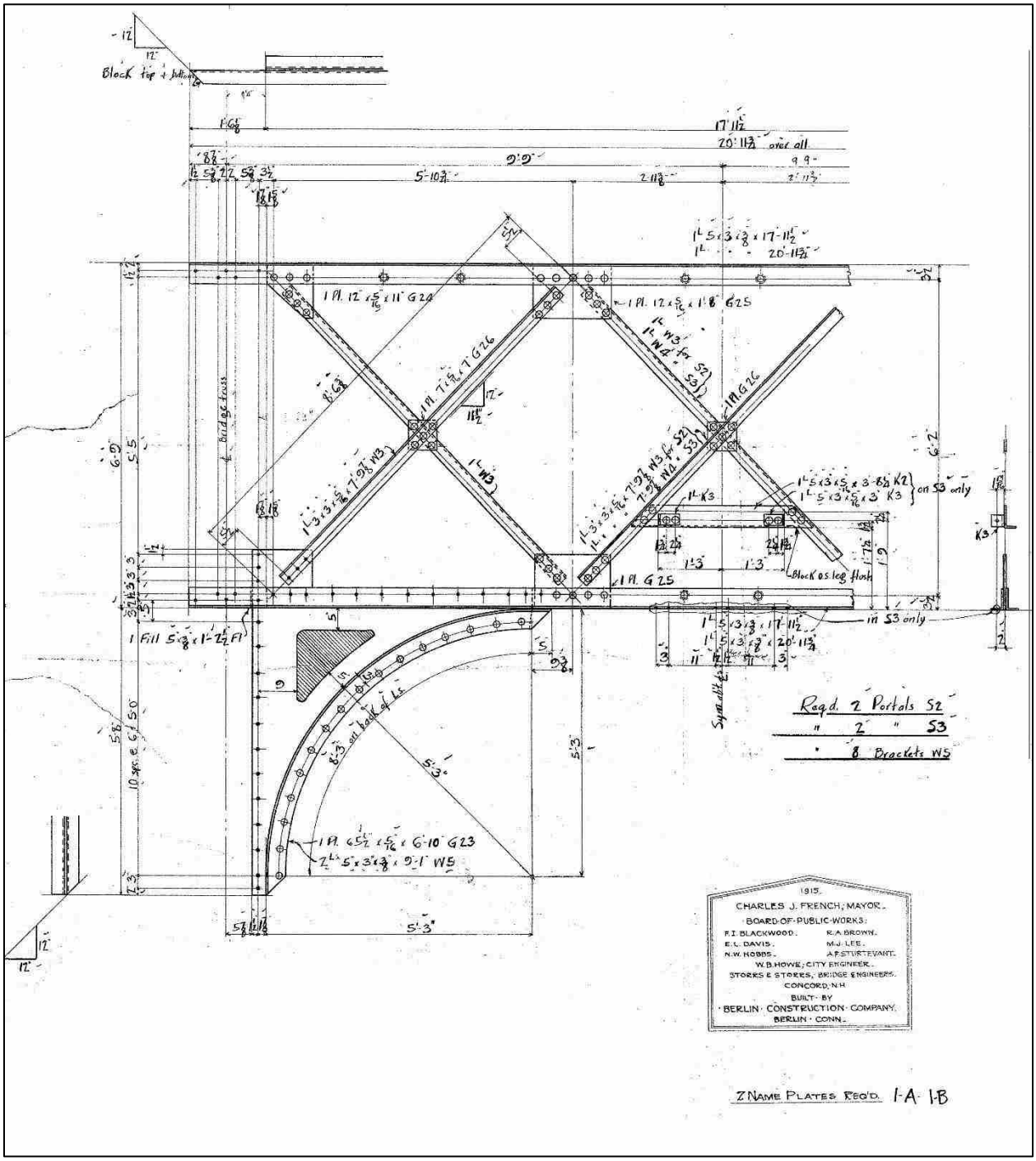


FIGURE 8: Sewall's Falls Bridge, portal framing and name plate details. Clip from Berlin Construction Company plan sheet 3 of 4, dated April 22, 1915. See attached documentation Drawing 4 (NHDOT Bureau of Bridge Design).

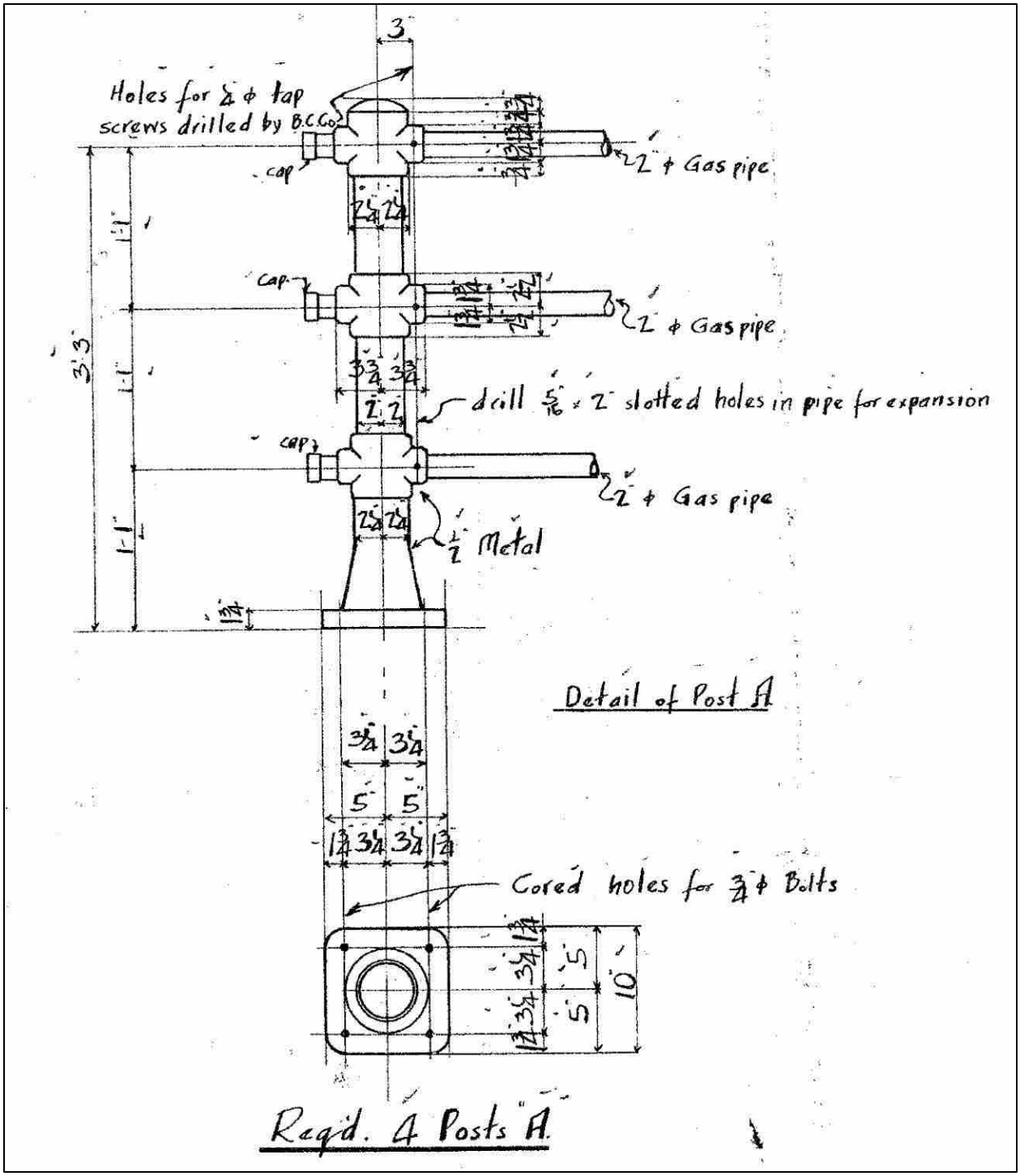


FIGURE 9: Sewall's Falls Bridge, railing end post detail. Clip from Berlin Construction Company plan sheet 4 of 4, dated May 4, 1915. See attached documentation Drawing 6 (NHDOT Bureau of Bridge Design).

FIGURE 10: Sewall's Falls Bridge, north approach. Field inspection photo made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

FIGURE 11: Sewall's Falls Bridge, south approach. Field inspection photo made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

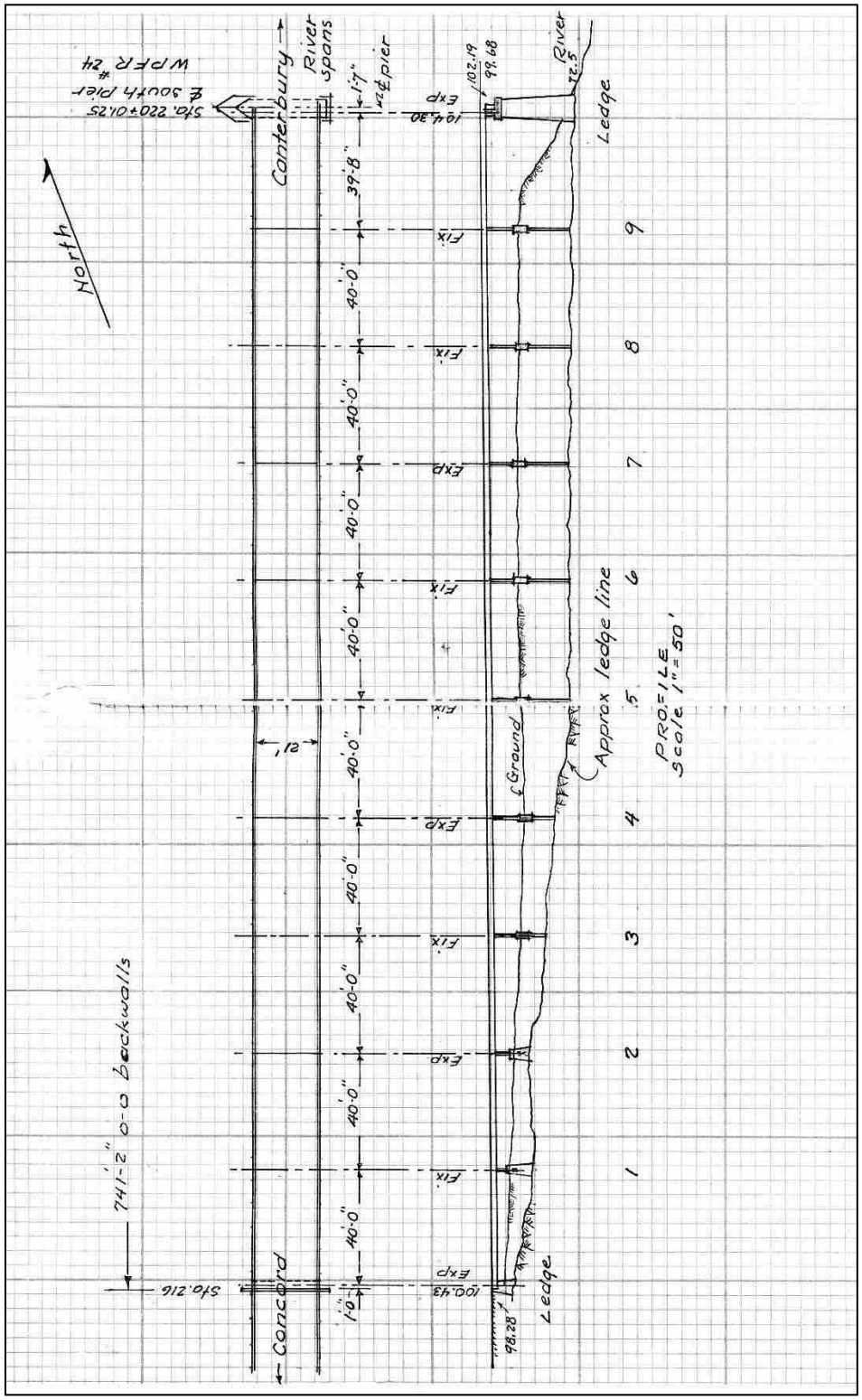


FIGURE 12: Sewall's Falls Bridge, plan, elevation of south approach trestle built 1937. Field inspection sketch made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

DATE 5/15/42 STATE HIGHWAY DEPT. NH Div 5 STEEL SPANS MADE WHP CHECKED JRB CARD 3 OF 4

TOWN Concord NO. 070/117 BRIDGE OVER Merrimack River SPAN NO. approach trestle

RATING H-10 MEMBER DESIGN LIVE LOAD H-10 REQUIRED LIVE LOAD POSTED LIVE LOAD 31 YEAR BUILT 1937

NO. AND TYPE SPANS 10-Plank on I bm strgs Steel Bent Trestle TOTAL LENGTH 399-8 c-c end brgs

SKEW 0 SUPERELEVATION CROWN APPROACH PAVEMENT STG (south).

GENERAL	ALIGNMENT	GRADE	SIGHT DISTANCE	SPAN LENGTH	WIDTH	CLEARANCE
BRIDGE	tan	+3¼% → E		C. C. BEARINGS 9 @ 40-0 1 @ 39-8	BETWEEN CURBS 21-0	ROAD-WAY / RAIL-ROAD / HIGH WATER
NE REAR APPROACH	"	2-Truss spans		O. O. FLOOR	BETWEEN RAILS 21-10	HORIZONTAL 21-10
SW FORWARD APPROACH	"	+1%	500'+	CLEAR SPAN	WALKS	VERTICAL open

DESIGNED BY HIGHWAY DEPT. ~~CONS. ENG.~~ BUILT BY NHHD

MAINTAINED BY ~~STATE~~ # TOWN RAILROAD PLANS ON FILE 1-16-1-1 ~~NOT ON FILE~~ ~~TOLL OR~~ FREE

PROJECT NO. WPA 10067 '37 CONTRACTOR Simpson Bros. Corp, Bethlehem Steel Co. (Fab.)

TOTAL COST WPFR #24 (South pier). STEEL COST FLOOR SLAB COST

TRAFFIC SURVEY DATA A B C D F G H I

WATERWAY. ELEVATION LOW BRIDGE ELEVATION MAXIMUM HIGH WATER AREA BRIDGE OPENING

ALIGNMENT AND CHARACTER CHANNEL

REMARKS

SUBSTRUCTURE	MATERIAL	TYPE	HEIGHT	SUPPORTING MATERIAL	PILES—TYPE	NO.	SIZE	LENGTH	CAPS
NE REAR ~~ABUTMENT~~ PIER	mortar ranged stone masonry	conc. cap	30'±	Ledge					
SW FORWARD ABUTMENT	conc	mass		"					
~~PIERS OR~~ BENTS 9	steel			"	H Col. BP	4 per bent	8" 36#	varies	2 ⊐ 12x20.7# PL ½"x15"

WINGS

REMARKS condition good

Testindex PAT. APR. 3, '23 FEB. 8, '27 96-C-7396-14

SUPERSTRUCTURE. MATERIAL Struct Steel + wood SPAN TYPE Lom. plank on Is *

GRADE TO BRIDGE SEAT 2'-2" GRADE TO LOW STEEL 2'-1"

DEPTH PANELS AT PAINT Aluminum Paint damaged by leakage.

	WEARING COURSE	FLOOR	CURBS	ROAD RAIL	WALK RAIL	BEARINGS EXPANSION	BEARINGS FIXED
MATERIAL	Asphalt	Wood	Wood	Struct Steel			
TYPE	plank	lam.	Felloe Gd	Single 8"C		Sliding on bents 2, 4, 7 &	
HEIGHT		6"x	0-9"	1-8" above curb		S.W. abut + truss pier	
THICKNESS	1"	4"	8x6 on	3"		slotted holes in bm flg	
FASTENINGS			4x6 blks	5"H 18.9# posts @ 8-0" c-c		Bevel Brg Pls	

FLOOR DRAINAGE none.

REMARKS General condition good.

Strgs 7 lines Beth WF 18⅜" 55# I @ 3'-6½" c-c. Diaphragms 8"I 18.4#.
Wood floor + felloe guard is spruce or Western Fir. creosote treated.

Asphalt plank poor condition 5/15/42. Leakage thru floor damages paint on strgs.

New West Abut. New deck on Approach Spans 1964
(2 Westerly approach spans removed at this time)

Sewalls Falls Road 1.61 mi. N.E. from Jct. U.S. 3+4.

TOWN	BRIDGE NO.	ROUTE	STRENGTH	CLEAR ROADWAY	VERTICAL CLEARANCE
Concord	070/117	SAY 50	—H6 H6 H8 H10 H12 H15 H20	14'-18' 19'-23' 24'-28' 29'-32'+	—10' 11' 12' 13' 14' 14'+ OC

FIGURE 13: Sewall's Falls Bridge, Inventory Card inspection data for 1937 south approach spans, compiled by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

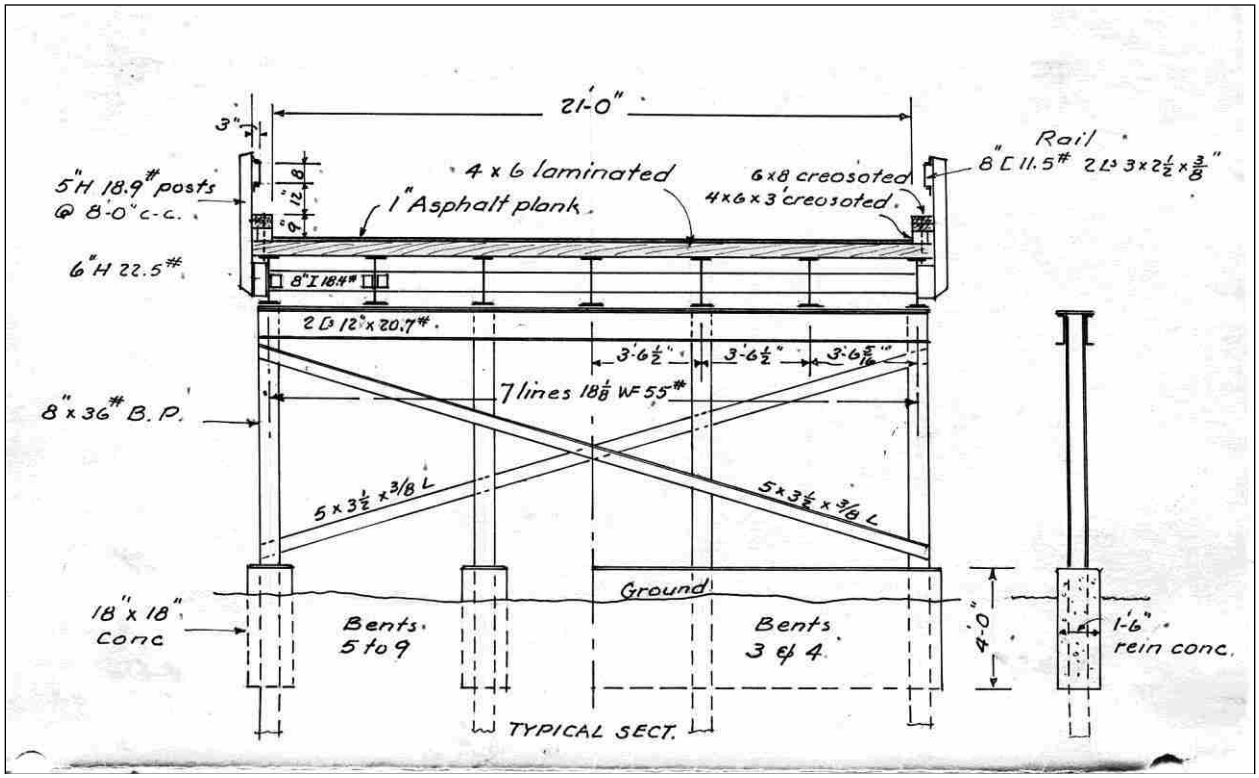


FIGURE 14: Sewall's Falls Bridge, plan, section through south approach trestle built 1937. Field inspection sketch made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

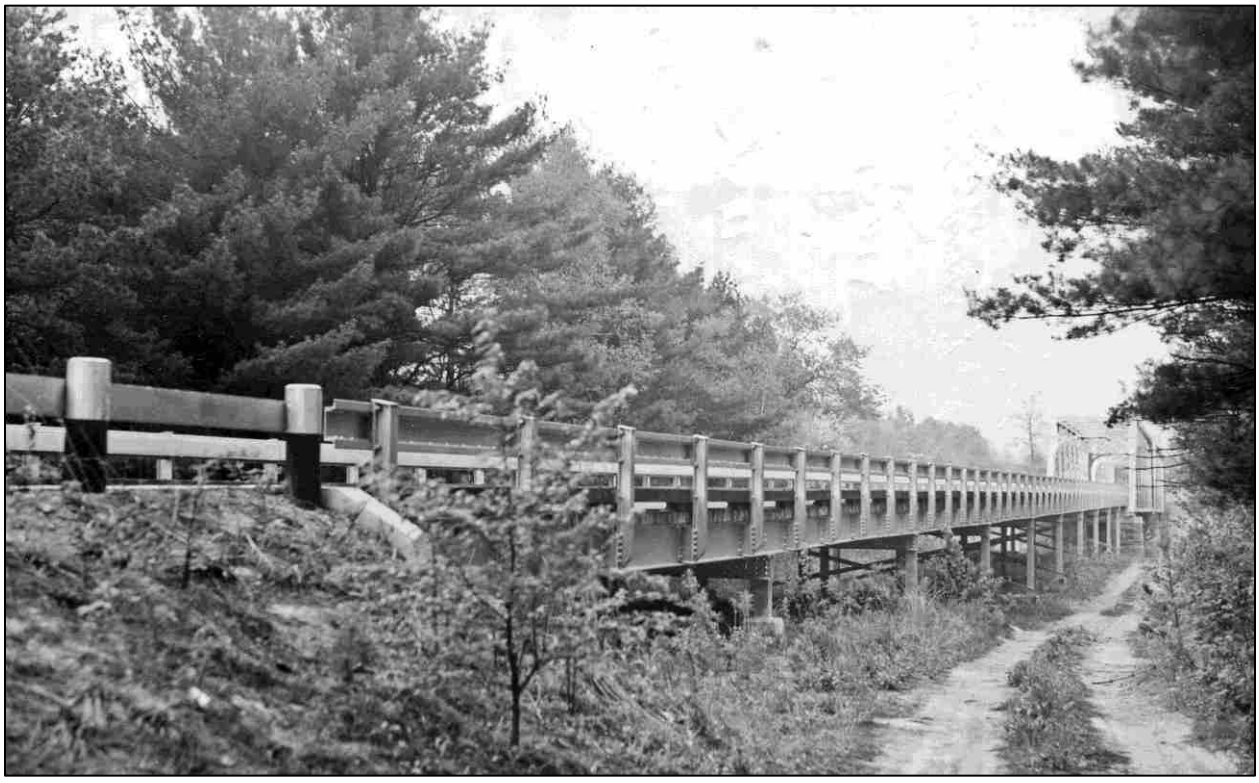


FIGURE 15: Sewall's Falls Bridge, south approach trestle built 1937. Field inspection photo made by NHHD engineer Wendell H. Piper, May 15, 1942 (NHHD Bridge Inventory Card, Concord 070/117).

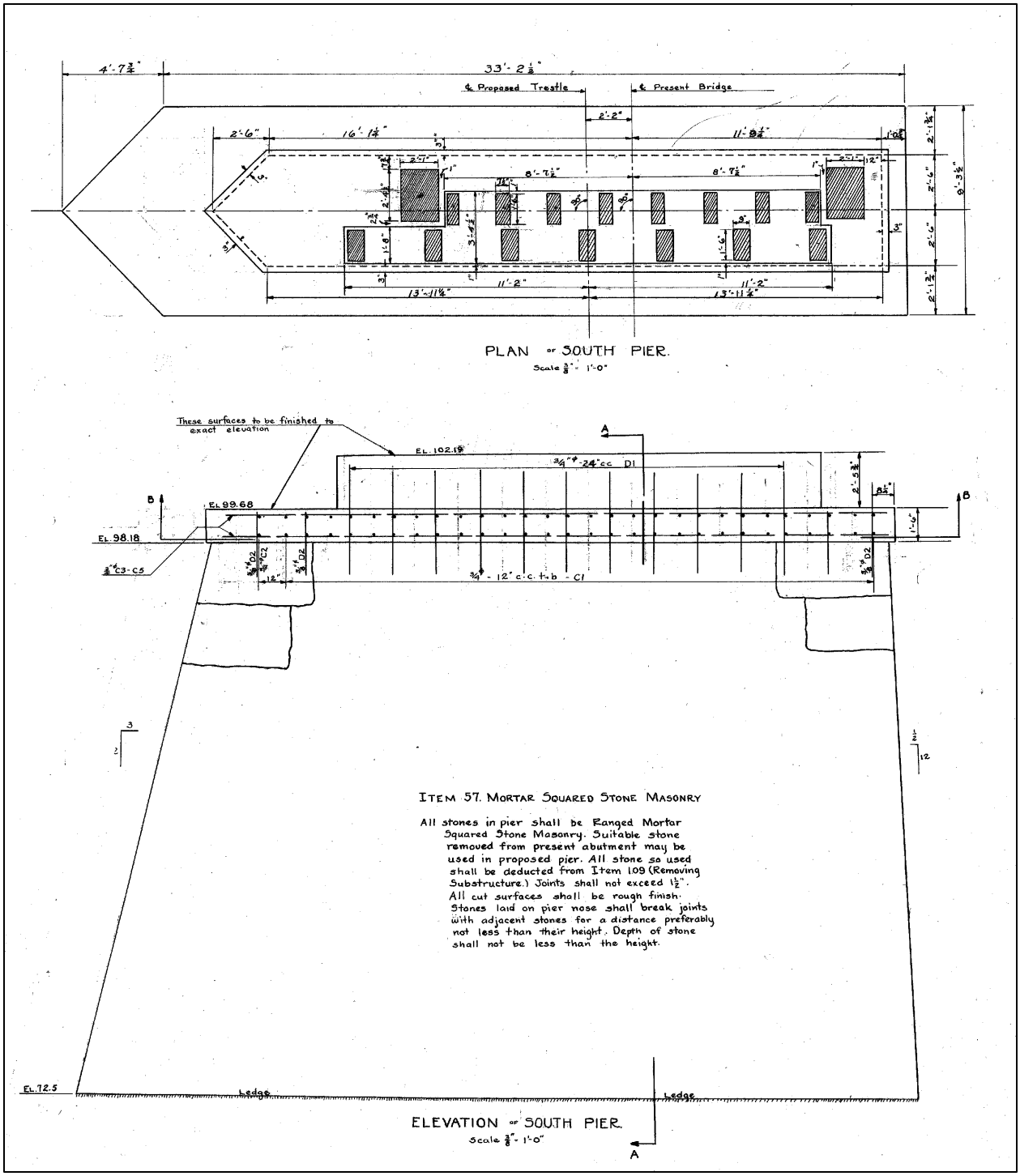


FIGURE 16: Sewall's Falls Bridge, south pier built 1937 from stone salvaged from 1873 abutment. Clip from New Hampshire Highway Department plan sheet 3 of 4, dated 12/15/1936. See attached documentation Drawing 11 (NHDOT Bureau of Bridge Design).

FIGURE 17: Sewall's Falls Bridge, north approach and upstream side, no date. Photograph courtesy of Concord Public Library Photograph Collection.

HISTORICAL CONTEXT

Concord was granted by the Province of Massachusetts as the Plantation of Penacook in 1725 and settled that same year by Captain Ebenezer Eastman and others from Haverhill Massachusetts. It was known as Penny Cook in the early records of the town. In 1734 it was incorporated as the town of Rumford and renamed Concord in 1765 following resolution of the boundary with the town of Bow.

As the town was bisected by the Merrimack River, there was an immediate need for a means of communication across it when it was not sufficiently frozen to bear traffic. A 1726 map of the town shows ferries crossing the Merrimack at the north and south end of town (Figure 18; Figures for this section begin on page 48).[1] These were evidently private ferries, probably small and of limited capacity, built and operated by the first settlers. In 1728 the Proprietors established a committee to officially establish a public ferry and the following year funds were appropriated to build and operate it. The exact outcome of those actions is not known but the south ferry, first known as Merrill's ferry, was apparently operated by Deacon John Merrill who arrived in town in 1729. It was later operated by Samuel Butters and known as Butters' ferry. The north ferry was first known as Eastman's ferry, then Tucker's ferry, after Lemuel Tucker who obtained a charter from the legislature in 1785 for its operation. A third ferry was established roughly half-way between the two by Benjamin Kimball, crossing the river between Hales Point and Sugar Ball roughly where Route 4/393 crosses the river today. Kimball's ferry operated until 1831.[2]

Plans for the first bridge in Concord also closely followed settlement of the village. In March of 1730, the proprietors voted to "amend and repair the necessary roads in Penny Cook…at settlers cost, and also built a good bridge over Sow Cook river, as soon as may be, at the cost of the settlers also."[3] It was not until 1735 that money to construct the bridge was appropriated and a committee appointed "to take care the bridge over the Suncook be well done."[4]

Over the remainder of the 18th century it can be assumed that small log bridges were thrown over brooks and streams about the town, but no mention is made of them in the two principal town histories by Bouton (1856) and Lyford (1903). The first organized effort to bridge the Merrimack was made in 1781 when Col. Timothy Walker was appointed agent for the town to petition the General Court to "make a lottery for building a bridge over the Merrimack river."[5] The petition was apparently never submitted, most likely due to a perception that "bridge stocks were not tempting investments" and that "a general lack of uninvested capital" prevailed at the time.[6]

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[1] The 1726 map was created by S. C. Badger in 1855 and appears in Bouton's 1856 History of Concord.
[2] Lyford, 1903, pp. 33-34.
[3] Bouton, 1856, p. 98.
[4] *Ibid*, p. 143. Known as the Sow Cook river and Suncook river, the name Soucook River, as it is known today, appears on the 1803 Leavitt map of Concord.
[5] Bouton, 1856, p. 283.
[6] Lyford, 1903, p. 35.

Concord Bridge, 1795

The *Federal Mirror* newspaper reported on November 19, 1792 that "a number of wealthy gentlemen of respectability have it in contemplation to erect a bridge over the Merrimack river near Mr. Butters' ferry" and that they would meet at Butters' Inn "to consult on the expediency of the matter."[7] A petition was drawn and submitted to the Legislature stating "That public convenience requires that a bridge be erected over the Merrimack river within the town of Concord … that erection of a suitable bridge will meet with the encouragement of the Genl. Court [and] your petitioners therefore pray that they and their associates may have a grant of the exclusive privilege of erecting a bridge at the rocks below Butters' Ferry, so called, and they pray for such grant under such regulations as to your Honors shall appear proper…"[8] (Figure 19).

The petition was granted by the Court in January 1795. The petitioners met at Butter's Inn in February and March of 1795 to choose directors for the incorporation of Concord Bridge and draw contracts for construction. Work commenced in the spring and the bridge opened October 29, 1795 with ceremonies and a dinner for the Proprietors and Workmen at the tavern of William Stickney. The total cost of the bridge was $13,000, including $1500 paid to Samuel Butters for his ferry rights. In 1796 the Concord Bridge company issued 100 shares of stock for sale at the cost of $130 each. Original stock certificate No. 19, issued to Richard Bartlett, is located in the NH State Archives (Figure 20).

The exact design and construction of the Concord bridge is not known other than it was a timber stringer deck bridge of the so-called "balance beam" type, characterized by massive timbers centered on (balanced on) the piers and cantilevering out to either side. The long stringers spanned the distance between the abutments and piers and rested on these huge beams that provided additional support. Etchings of the bridge confirm this arrangement, depicting a stone center pier carrying deep beams that almost meet near the center of the spans (Figures 21, 22). The balance beam bridge type was in use until about 1850 when timber trusses capable of greater spans and suited to being housed from the weather, replaced them.

Federal Bridge, 1798

"So pleased were the people of Concord and vicinity with the great conveniences afforded by this [Concord] bridge that they called for another to take the place of Tucker's ferry at East Concord."[9] On December 28, 1795, just 2 months from the opening of the Concord bridge, the Legislature authorized the incorporation of the Proprietors of Federal Bridge to erect a bridge over the Merrimack within three years and to pay the owner of Tucker's Ferry the sum of 450 dollars for the right. The law authorized the tolls that could be charged, including one cent for a foot passenger, three cents for a horse and rider, and twenty cents for a four-wheeled carriage for passengers drawn by more than one horse. Persons going to and from church on Sundays were allowed to pass free between 9 am and 5 pm. Federal Bridge, as it was known, opened in the fall of 1798, having suffered from numerous construction delays. The abutments, piers and superstructure were of timber construction, completed at a cost of $4,000. A map of the town of

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[7] Bouton, 1856, p. 312.
[8] Concord Bridge Corporation, 1795.
[9] Lyford, 1903, p. 360.

Concord prepared by Edmund Leavitt shows the location of the Concord and Federal bridges and the layout of the roads at the time (Figure 23).

Freshets, floods and log drives were hard on the early bridges that were carried on wood piers closely spaced across the river channel. Federal Bridge was partly swept away by a freshet in 1803. It was rebuilt at a cost of twenty-three hundred dollars and re-opened in September of the same year. On April 12th of 1812 "about 100 feet of Concord Bridge was carried away by ice."[10] The spring freshet of 1818 completely destroyed Federal Bridge. The south abutment was susceptible to undermining and had been continually reinforced with large stones around its base, but finally collapsed taking the entire structure with it. It was decided that the third edition of Federal Bridge should be erected with a pier and south abutment of split stone instead of wood. Leban Page was employed to lay the stone work and the bridge was opened later in the year at a cost of $5,500.[11] In 1824 Benjamin Kimball recorded in his diary that ice carried away "one wooden pier and about two thirds of the superstructure."[12] A ferry was operated while repairs were made at a cost of $1,200.

In 1827 there was agitation among regular users of Federal Bridge that passage be made free at the expense of the town. Seeing an opportunity for steady and predictable income, the Proprietors offered to allow free passage for all citizens of Concord for the amount of $400 per year, paid quarterly by the town. Voters rejected the offer, "as the majority of its citizens had but little occasion to use the bridge, and did not care to be assessed towards paying the toll for those who used it frequently."[13]

The bridge apparently served largely unscathed until 1834 when an inspection at the behest of the owners found the structure in need of entire replacement which was undertaken and completed the following year at a cost of $3,600. During the great ice freshest of January 8, 1841 a pier and two spans of Federal bridge were carried away but "repaired at no very large expense."

In March 1850 the Merrimack County road commissioners exercised their authority to lay out and approve a new highway leading to Federal Bridge and across the river "where the bridge stood," effectively condemning and taking the bridge for public property. The Proprietors were paid damages of $1,200, later increased to $1,500 by the town when a law suit was threatened.[14]

In 1851, voters approved the complete replacement of the old Federal Bridge with an entirely new bridge free of tolls. The contract for the superstructure was given to Peter Paddleford to erect three covered timber spans of his own arch-reinforced-truss design to be carried on stone piers and abutments.[15] The bridge was completed the same year at a cost of $14,830.14.

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[10] Bouton, 1856, p. 354.
[11] Lyford, 1903, p. 38.
[12] *Ibid*, p. 39.
[13] *Ibid.*
[14] NHHD ROW Source Record 4686: Merrimack County, Book 2, page 182, October 28, 1850. [Located at NH State Archives].
[15] See note 33 below for discussion of Paddleford. The contractor for the stonework was not determined.

Sewall's Falls Toll Bridge, 1835

On January 3rd 1832 the Legislature approved the petition, submitted by Ebenezer Eastman, Abraham Bean, Samuel Tilton, Hugh McAllaster, Daniel C. Atkinson, and Orlando Brown, for the incorporation of the body politic by the name of the Proprietors of Sewall's Falls Bridge. The Proprietors were authorized to "build, maintain and keep in repair a Bridge over Merrimack River at any place within half a mile from the head of Sewall's Falls in the northerly part of Concord… [and] That to reimburse the Proprietors the moneys, by them expended in building and keeping said Bridge in repair, a toll be and hereby is granted and established." [16]

The tolls to be charged for all forms of traffic are specified in the charter, reproduced in its entirety in Figure 24. The law also included conditions that are not typically found in earlier bridge legislation, including the provision that when the toll collector is not on duty the bridge gates will be left open, and a requirement that no part of the bridge will obstruct navigation of the Merrimack and a clear passage of no less than eighty feet in width must be provided.

Construction of the bridge did not begin immediately. According to a legal advertisement in the newspaper made by Albe Cady, Clerk of the corporation, the first meeting of the stockholders was held on September 2, 1833 at Samuel Carter's Tavern in Concord. "At that time it is expected the proprietors will view the Falls and select the most suitable place for the Bridge."[17] The project apparently failed to move forward until the annual meeting of January 7, 1835 when it was voted to proceed with construction of the piers and abutments.[18] Disagreement arose over the proposed location of the bridge, and a special meeting of the Proprietors was called for and held at Orlando Brown's Tavern in Concord on Saturday the 27th of June. The business of the meeting would be "to alter the location of said Bridge, if deemed expedient, by erecting it at the upper Pitch, so called," and to "order a second assessment for such sum as may be necessary for completing said Bridge."[19]

Construction commenced shortly after the June meeting under the superintendence of Abel Baker and the bridge and toll house was completed before winter at a cost of about $4,600. "The piers were of wood, with heavy oak timbers extending up the stream to break the ice. The bridge consisted of balance beams, resting on the piers, upon which were laid long stringers, being the plan generally adopted at that time, called the balance beam and string bridge."[20]

Less than four years later Sewall's Falls Bridge was destroyed in the great gale of Saturday, January 26, 1839, in which properties were flooded and bridges and mills destroyed throughout the northeast. All bridges over the Merrimack from Concord north to Plymouth were destroyed wholly or in part. The heavy rain and warm weather was preceded by a stretch of extreme cold that formed unusually thick ice in the rivers. The rising waters broke-up the ice and carried massive ice floes downstream. All three of Concord's bridges succumbed to the onslaught of the ice that had reached

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[16] *Laws of New Hampshire, Volume 10, Second Constitutional Period, 1829-1835.* Concord, N.H.: Evans Printing Co., p. 405.
[17] *New-Hampshire Statesman and State Journal* (Concord, New Hampshire), August 24, 1833.
[18] John Kimball. *Annual Report of the Receipts and Expenditures of the City of Concord for the fiscal year ending February 1, 1875.* Concord, N.H.: Republican Press Association, 1875, p. 69.
[19] *New Hampshire Statesman and State Journal* (Concord, New Hampshire), June 20, 1835.
[20] *Annual Report of the Receipts and Expenditures of the City of Concord*, 1875, p. 70.

several feet in thickness and began breaking and moving late Sunday morning. Canterbury Bridge at Boscawen Plain was torn away, followed by Boscawen Bridge at Gage Mills. The "middle pier and greater part of Sewall's Falls bridge" was destroyed just after noon.[21] The middle pier of the Federal Bridge was also carried away, leaving the superstructure sagging but still suspended. A jam then developed below Federal Bridge, flooding the intervals and piling them with ice. The Concord bridge survived into the evening until "the loosening of a great jam, about a half mile above it, left a powerful body of ice to be borne with irresistible force against it – before which its stone piers, even clamped as they were with bars of iron – were speedily carried away."[22]

The destruction of Sewall's Falls Bridge, coupled with its unprofitable operation over the preceding four years of service, motivated a number of stockholders to sell out. Fifty-nine of the 100 shares of stock issued were sold at auction on July 17, 1839 at George Brown's Tavern in West Concord.[23] How the makeup of the proprietors changed as a result of the sale was not determined, but by the next annual meeting in January 1840, a majority of the stockholders voted in favor of rebuilding. George W. Brown was given the contract for $1,500, and utilized much of the original timbers which had been salvaged after the flood.[24]

Sewall's Falls Toll Bridge served another eight years until May 15, 1849 when a log drive owned by Fisk & Norcross carried it away. Each spring since about 1845, Fisk and Norcross ran logs from northern New Hampshire down the Merrimack to their huge new saw mill in Lowell, Massachusetts. Fisk and Norcross were well known "lumber barons" with large operations in Maine as well as New Hampshire. They later operated under the name Merrimack Lumber Company. Their 1847 "drive" down the Merrimack was claimed to have amassed 10 million logs.[25] The Sewall's Falls bridge proprietors did not rebuild but instead filed suit in Superior Court, $2,000 in damages, claiming the bridge was "entirely demolished, swept away and destroyed, wholly by the carelessness, negligence and fault of the defendants…" [26] An additional $2,000 was claimed for the loss of tolls and other damages and expenses. Fisk and Norcross argued that Sewall's Falls Bridge was at fault for being improperly located in a way that impeded the free navigation of the river, in this case the transportation of logs to market. A jury found for the plaintiff, but the court limited damages to the value of the bridge and to a small amount for the lost tolls; the exact monetary award not specified in the record. *Sewall's Falls Bridge v. Fisk and Norcross* (23 N.H. 171, 178-79, 1851) became an oft-cited foundation of today's case law regarding the doctrine of [exercising] reasonable care to prevent injury, and how the cost of doing so is weighed in determining negligence. Subsequently, the Proprietors of Sewall's Falls Bridge (corporation) was dissolved and roughly $19 per share returned to the stockholders, that result considered a total loss for the original investors.[27]

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[21] Kimball, 1875, p. 70.
[22] *The Caledonian.* (St. Johnsbury, Vermont), February 5. 1839.
[23] *New Hampshire Statesman and State Journal* (Concord, New Hampshire), July 13, 1839.
[24] Kimball, 1875, p. 70.
[25] See "Sewall's Falls Bridge v. Fisk & Norcross" cited below.
[26] "Sewall's Falls Bridge v. Fisk & Norcross," in Foster, William L., *Reports of Cases Argues and Determined in the Superior Court of Judicature of New Hampshire.* v. 3. Concord, NH: B.W. Sanborn, 1854, pp. 171-182.
[27] Kimball, 1875, p. 70.

Free Bridge, 1839

In the wake of the gale of 1839 that destroyed or damaged all of Concord's bridges over the Merrimack, a group of nearly 400 subscribers from the towns of Concord, Loudon, Pembroke, Chichester and Epsom raised roughly $3,400 and erected a bridge in that year over the Merrimack "at a point where Bridge street now meets Main street"[28] The town of Concord then paid the subscribers one-half of the subscription amount on the condition the bridge be free of tolls. It thus became the first free bridge across the Merrimack and one of the earliest free bridges the state crossing a major waterway.

Unfortunately the first Free Bridge had a short life, swept away by the ice freshet of January 8, 1841. It was replaced by a more substantial structure that lasted until 1849. In 1850 the bridge was replaced again with a covered bridge, built by Peter Paddleford, at the large cost of $16,221.38.[29] The Paddleford bridge was replaced in 1894 by an iron truss bridge built by Berlin Bridge Company at a total cost of $19,115.73.[30]

Free Sewall's Falls Bridge, 1853

Following the dissolution of the Sewall's Falls Bridge corporation, the Merrimack County Road Commissioners laid out a highway "4 rods in width" across the Merrimack River "in the place where said Sewall's Falls Bridge formerly stood."[31] The road was approved on April 17, 1852 along with the authorization pay the Proprietors of Sewall's Falls Bridge damages in the amount of one dollar.

With the highway over the river approved, Concord voters were asked to authorize the Selectmen "to take immediate measures for building a bridge across the Merrimack at Sewall's Falls." Voters approved the measure on August 14th 1852. A contract for the stonework of the pier and abutments was awarded to Simson, Balch & Company and work began in 1852. Simson and Balch were paid $1,735 for work done in 1852 and $2,386.25 in 1853 when the stone work was complete. The contract for the bridge superstructure was awarded to Peter H. Paddleford who was paid $3,557.95 "for lumber and materials, and labor constructing said bridge per contract with Selectmen."[32] Another roughly $400 was paid to others for additional stonework and filling and grading the abutments, for a total cost of about $8,075.

Peter H. Paddleford was a noted covered wood-truss bridge builder at the time who had just completed the building of two other Merrimack Rivers bridges for Concord, Free Bridge, completed in 1850 and Federal Bridge completed in 1851.[33]

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[28] Lyford, 1903, p. 41. Writing in 1903, Lyford is referring to the Bridge Street Bridge, also known as the Loudon Bridge. Today the crossing is spanned by the NH Route 9, Loudon Road bridge, built 1966, since named the World War II Veterans Memorial Bridge.

[29] Concord. *Proceedings of the Annual Town Meeting in Concord, March 11th to the 17th, 1851.* Concord: Tripp & Osgood, 1851, p. 30.

[30] See Concord Annual Reports for 1893, p. 102, 164; 1894, p. 115.

[31] NHHD ROW Source Record 39-112: Merrimack County, Book 2, page 217, April 17, 1852.

[32] Concord Annual Report, 1854, p. 59-60.

[33] "Peter Paddleford (1785-1859) of Littleton, New Hampshire, was one of New England's most significant nineteenth-century covered bridge builders. He built several major covered bridges, including two across the

The map of the city of Concord prepared by J. C. Badger in 1855 shows the location of the Sewall's Falls Bridge, the city's other major bridges and the roads and turnpikes connecting with them (Figures 25, 26).

With the exception of the need to place rubble stone around the piers and abutments to prevent scour, in 1854 and 1859, Sewall's Falls Bridge served well until January 1, 1862 when it was lifted off its foundations and demolished by a gale. The bridge was rebuilt by John C. Briggs using wood arches of his own design that spanned 170 feet between the abutments and the pier.[34] An open deck roadway was carried on top of the arches. The bridge was completed for $1,758.92, roughly half the cost of Paddleford's covered truss bridge, although three years later an additional $1,000 was spent to add reinforcing trusses underneath.[35]

Briggs' arched truss bridge lasted until October 6, 1869 when a severe rain and the resulting freshets in many streams and rivers caused widespread damage across the state. The *Daily Mirror* reported that

> among the bridges carried away are all those on the Suncook river, the bridge at Loudon Mills, as well as at Holt's dam at that place, three bridges in Dunbarton, several at Henniker, sixteen in Weare, five in Gilmanton, and one over the Merrimack in Concord, at Sewell's Falls.[36]

City expenditures for 1869 indicate that a total of $4,036 was spent on materials and labor for "repairs of damage to roads and bridges by the freshet of October 1869," but mention of the work done on specific bridges was not made.[37] It is assumed that repairs were made to Sewall's Falls Bridge out of the city's general highway and bridge budget since no mention of a specific contract for a new bridge appears in the records.

Sewall's Falls Bridge, 1873

In early 1872 Sewall's Falls Bridge survived an ice freshet that destroyed the Federal Bridge downstream from it, only to be destroyed a few months later during the spring log drive. A log jam developed against the pier that grew until it reached the reinforcing truss under the west span and ripped it down. The bridge remain closed the remainder of the year. In January 1873 the east span

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Connecticut River between Vermont and New Hampshire, as well as numerous lesser-known spans in the upper reaches of Vermont and New Hampshire. Initially, Paddleford used the Long truss for his bridges, but as early as 1834 he had developed his own design, using a multiple kingpost truss with long counterbraces extended over more than one panel, which helped distribute loads and increased the truss's rigidity. Although never patented, the Paddleford truss dominated covered bridge construction throughout northern New England for over half a century. This was due, in part, to the work of Peter's son, Philip H. Paddleford (1815-1876), who went into partnership with his father in 1835 and continued building bridges throughout his life. There are 20 extant historic (pre-1955) Paddleford truss covered bridges in New England, although none built by the designer himself." In, Bennett, Lola, "Covered Bridges NHL Context Study," Draft National Register of Historic Places Multiple Property Documentation Form, 2012.

[34] Briggs built the Hooksett Village Bridge over the Merrimack River in 1859 for $5,200. It was a 3-span triple lattice truss of his own design for which he was granted Patent No. 38,653 on May 26, 1863. The Hooksett Village Bridge was replaced with a steel truss in 1909, also designed by John W. Storrs.

[35] Kimball, 1875, p. 71.

[36] "The Great Rain and Freshet. Loss of Life and Great Destruction of Property." *Daily Mirror*, October 6, 1869.

[37] Concord Annual Report, 1870, pp. 18-19, 59-60.

collapsed under the immense weight of snow and ice that had accumulate on the closed span. In the spring, John Kimball was appointed Building Agent for the City to supervise rebuilding of the entire structure and paid $300 for his services. Kimball was also serving as Mayor of Concord at the time; he served four terms from 1872 thru 1876. The contract for the stonework was given to Lyman R. Fellows who rebuilt the entire substructure with cut granite laid in cement at a cost of $6,348.69. The center pier was massively built, measuring "38 feet long, 24 feet high, 10 feet thick at bottom and 6 feet at top."[38] The contract for the superstructure was awarded to Dutton Woods in the amount of $7,750 for construction of a covered wood double-lattice truss with reinforcing arch (Figure 27). The complete expenditures for the bridge were published in the city's Annual Report for 1874 (Figure 28). Dutton Woods was a prolific builder of wood bridges in New Hampshire, see note.[39]

According to the City reports, the 1873 Fellows and Woods bridge did not require any repairs or maintenance until 1886 when the Commissioner of Highways, Edgar H. Woodman, reported the following:[40]

> The total expense for Bridges and Culverts during the year amounts to $1,348.91, the largest outlay in any single item being the new roofing of Sewall's Falls bridge. This expenditure was made imperative because of the destruction of the former roof during a violent gale, though fortunately the bridge itself was not otherwise injured. The new roof was constructed in a substantial manner, and connected with the superstructure by a system of rods and bolts which it is believed will render it permanently secure. The work was completed in a most satisfactory manner by Mr. S. F. Patterson at the contract price of $400.

The City reports show expenditures on Sewall's Falls Bridge of $162.70 in 1901 for "repairing" and $325.58 in 1903 for "replanking." In 1908 the bridge was "reshingled" at a cost of $800. Conditions in the vicinity of Sewall's Falls Bridge at the end of the nineteenth century are shown on the Hurd map of 1892 (Figure 29).

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[38] Kimball, 1875, p. 71. This pier subsequently carried the subject 1915 steel truss bridge; it was demolished in 2016 and the stone salvaged for use in the park at the south end of the new (2016) bridge.

[39] Dutton Woods was "widely known as a very successful and skillful bridge builder." He was born in Henniker, NH October 19, 1809 and died on May 2, 1884. He began bridge building in 1837 and was employed doing so on numerous railroads including the Hartford and New Haven, the Connecticut, the White River, the Northern, the Concord and the Contoocook Valley Railroad. He moved to Concord in 1852 where he served as Bridge Agent of the Concord Railroad from 1855 until his death. "Among his best works was the construction of the large double tracked bridge a Goff's Falls [Manchester, NH], on the Concord Railroad, where, from the beginning to the completion, not a single train was interrupted." Obituary from: *Engineering News and American Contract Journal*, May 10, 1884, p. 232.

[40] Concord Annual Report, 1886, p. 113.

Concord's Great Bridge Building Program of 1914-1915

In 1913 the New Hampshire Legislature passed "An Act in Amendment of Chapter 76 of the Public Statures Relating to Damages Happening in the Use of Highways" that shielded towns and other corporations from liability resulting from damages incurred by operators of "carriages" weighing in excess of 6 tons.[41] The law was primarily the result of increasingly heavy motor trucks breaking-through bridge decks and in some cases, collapsing an entire bridge or span. The law included a provision to increase the allowable vehicle weight from 6 tons to 10 tons, beginning April 15, 1915.[42] The purpose of the law was to motivate owners to insure that their bridges were capable of at least 6 ton loading and to be prepared to insure they were capable of 10 ton loading within two years. The law sowed considerable confusion and anger among towns and cities as to how they should respond, resulting in widespread calls for its repeal. Regardless, the immediate reaction to the law was a flurry of work for structural engineers to inspect bridges, to determine their safe carrying capacity, and to provide estimates to strengthen or replace them in order to meet the 6-ton or 10-ton requirement. Many short-span wood beam bridges that could be economically replaced with steel beam or concrete structures, were replaced. Owners of longer span bridges, such as covered wood trusses, began studying their options.

In April 1914, after trucks broke through several city bridges, the Concord Board of Public Works voted to have all the City's bridges spanning the Merrimack and Contoocook Rivers inspected by Will B. Howe, City Engineer and John W. Storrs of Storrs & Storrs Engineers and a report prepared on their serviceability (Figure 30). The resulting report identified five bridges to be repaired or replaced: Pembroke Bridge over the Merrimack (previously known as Concord Bridge), Federal Bridge over the Merrimack, Main Street Bridge (Penacook) over the Contoocook (previously known as Penacook Bridge), Borough Bridge over the Contoocook (canal branch) in Penacook, and Sewall's Falls Bridge.

Storrs submitted his reports to Howe in May 1914, who in turn submitted them to the Board of Public Works (Board) in June. In November 1914, the Board authorized Storrs & Storrs to prepare plans for a new steel bridge to replace the Pembroke bridge and obtain bids for its construction. Berlin Construction Company of Berlin, Connecticut won the contract with the low bid of $23,993.00, a sum about twenty-percent less than anticipated. A glut in steel production that began in Europe in the early part of 1914 had extended to the American market. The price of plate and sheet steel, used in large quantities by bridge fabricators to make rolled structural shapes which were in-turn cut and riveted into built-up truss and girder members, dropped sharply. *Iron Age* reported in July that "it is clear the position is bad. Plates and sheets are weaker too and all works want orders and specifications."[43] This translated into a highly competitive market for work among

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[41] New Hampshire. Laws of the State of New Hampshire, Chapter 19, Laws of 1913.

[42] In the January Session of 1915, the Legislature further amended the law to read: " Towns and other municipal corporations shall not be liable for such damages to a person traveling upon a bridge, culvert, or sluiceway when the weight of the load, inclusive of the carriage, or of the carriage alone, exceeds six tons; provided, however, that all new bridges upon main trunk lines and cross-state highways shall be constructed to bear not less than ten tons, but towns and municipal corporations shall not be liable where the total weight of the load and carriage exceeds six tons." (Chapter 173, Laws of 1915).

[43] "Finished Steel at Lowest Price of the Year." *Iron Age,* July 23, 1914, p. 227.

steel bridge builders and a timely opportunity for Concord to save many more thousands of dollars on the cost of the other four bridges providing they moved quickly.

Storrs was asked to quickly prepare proposals and cost estimates to replace the Federal, Main Street, Sewall's Falls and Borough bridges for presentation to the Board in December. All his recommendations were accepted and by a unanimous vote of the Board. Storrs was instructed to prepare the plans and specifications necessary to put all four bridges out to bid as soon as possible.

Ten companies submitted bids for the bridges which were opened on January 23, 1915:[44]

NAME OF BIDDER.	AMOUNT OF BID.				
	Borough.	Federal.	Main Street.	Sewall's.	All Four Combined.
Berlin Construction Co.....	$4,075.00	$20,625.00	$15,965.00	$14,318.00	$53,985.00
The Boston Bridge Works.....	5,094.00	24,213.00	15,938.00	15,897.00	59,125.00
The Jobson-Gifford Co	5,470.00	27,060.00	15,410.00	17,580.00	65,520.00
King Bridge Co.....	5,700.00	26,200.00	17,100.00	16,800.00	65,000.00
Lackawanna Bridge Co.....	5,391.00	26,425.00	14,640.00	17,942.00	61,792.00
McClintic-Marshall Co.....	5,098.00	25,644.00	15,036.00	17,841.00	62,460.00
Penn Bridge Co	5,380.00	22,800.00	12,900.00	15,400.00	54,200.00
The Pennsylvania Steel Co ...	5,600.00	27,090.00	13,700.00	18,400.00	63,390.00
Phœnix Bridge Co	6,350.00	27,120.00	15,300.00	19,360.00	66,130.00
The United Construction Co..	5,488.00	28,750.00	16,918.00	18,970.00	66,940.00

Berlin Construction Company was low bidder for the Borough, Federal and Sewall's Falls bridges. Penn Bridge Company of Beaver Falls, Pennsylvania was low bidder on the Main Street Bridge. The total cost for all four bridges as bid was $53,497. Berlin Construction Company was an offshoot of the Berlin Bridge Company which had built many bridges in the state, including Concord's so-called Loudon Bridge, built 1893, that carried Bridge Street over the Merrimack River (previously known as the Free Bridge). Penn was one of the oldest bridge companies in continuous operation, having been established in 1868 as T.B. White & Sons. The firm incorporated as Penn Bridge Co. in 1887 and grew quickly, employing over 500 by 1908.

At the January 27, 1915 meeting of the Board of Mayor and Alderman a resolution to appropriate $60,000 and to award the contracts to the low bidders was passed by a majority but vetoed by Mayor Charles French. The mayor objected on two counts: that Boscawen should share in the cost of the Main Street bridge in Penacook which was of great benefit to that town, and that the City should not feel compelled to upgrade the capacity all of its bridges at once in order to comply with the recent act of the Legislature.

City Engineer Howe argued that the bridges could be built cheaper now than the next year, that the bids for the four bridges was $20,000 lower than expected, and that Berlin Construction

[44] Concord Annual Report, 1915, p. 348.

Company, the low bidder on three of the bridges, "desired the award before February 1, as an advance in the price of steel would go in effect that day which would materially affect their bid."[45] The resolution was put up again and with a unanimous vote of the fourteen alderman present was reenacted over the mayor's veto. The following week the contracts for the four bridges were awarded to the respective low bidders.[46]

Pembroke Bridge, 1915

Meanwhile, the contract for the Pembroke Bridge, bid separately from the others and awarded to Berlin Construction Company in December 1914, was officially signed in January. On May 12, 1915 it became the first of the five bridges to start construction and the first completed three months later on August 25. The four span bridge had a total length of 470 feet, consisting of two central Pratt through-truss spans with a shorter Warren pony-truss span at each end (Figure 32). In the course of demolishing the old bridge a large number of stringers were found broken. Howe reported that "no mistake was made in replacing this menace to public safety. The city was truly fortunate in not having had an accident of a serious nature occur on this old bridge."[47]

The Pembroke Bridge opened 28 days behind schedule due to severe rains during the month of July that totaled 10.25 inches for the month, "a record for July unparalleled in the history of the local weather service."[48] The rains of July 1915 wreaked havoc on the City's other ongoing bridge projects as well. Heavy rain the first week of July raised the level of the Merrimack River to near flood elevation. By Sunday morning July 12 the situation at the Federal Bridge (often referred to in the newspaper as the East Concord bridge) had become critical and workers rushed to reinforce the temporary heavy timber bents known as falsework, built in the river to support the steelwork of the new bridge spans during erection. A raft was quickly constructed and launched to serve as a platform to carry workers and reinforcing timbers alongside the falsework. After the noon break for dinner, the raft carrying tools, materials, workers and William E. Nash, the city's resident engineer of construction, was moved into position and moored to the falsework. It was quickly realized that the force of the current against the raft was buckling the falsework and everyone began scrambling up the falsework in a desperate attempt to reach the steelwork above and the catwalk to shore.

> The pull of the river against the raft proved too strong for the structure and while the men were crawling up through the supporting beams to reach the deck of the bridge and get back to shore the whole thing collapsed and went into the river carrying the steel girders, false work, men and all with it. Nash, who was making his way through the structure of timbers instead of trying to reach the bridge deck, had warning and was able to jump clear of the falling structure and make his way to shore. One of the boats owned by the contractors was smashed by the one of the heavy girders but Nash quickly made the other and rowing out took the injured men and those who had escaped to shore. He then made a search for the missing man among the debris as it floated down stream but was unable to find him and the body is supposed to be pinned down by the heavy steel beams. That there was not a larger loss of life is considered very fortunate as the mass when it caved into the

[45] "New Bridges." *Concord Monitor*, February 1, 1915, p. 6.
[46] "New Bridges." *Concord (Evening) Monitor*, January 28, 1915, p. 6.
[47] "Report of the City Engineer." Concord Annual Report, 1915, p. 347.
[48] *Concord (Evening) Monitor*, "Brief Local Mention." July 29, 1915.

> water was a jumble of timbers and steel in which the men appeared to be inextricably mixed.[49]

Within two weeks the collapse had been cleared, new falsework erected and one span completed despite continuing rain and high water that hampered progress and threatened all the false work placed in the river.

On July 24th the Concord Monitor reported that

> Work on the lower bridge [Pembroke Bridge] is now being rushed and good progress is now being made. The short span and one of the long spans on the east end have been riveted and the other long span is partially completed with the roadway being laid as fast as the riveters advanced. The Borough Bridge has been completed and the condition of the roadway will permit the opening of the structure in about two weeks.[50]

The final cost of the Pembroke Bridge with changes made to the masonry and the approaches was as follows:[51]

Labor and materials for masonry changes		$286.94
Superstructure complete		23,993.00
Storrs & Storrs, plans, etc.		1,199.65
Work by highway department		28.43
	Total	$25,508.02

Borough Bridge, 1915

The Borough Bridge was completed by Berlin Construction Company and opened for traffic on August 16, 1915. It replaced a covered lattice bridge of unknown original date that was substantially rebuilt in 1892 (Figure 34). The 1915 bridge was a single-span Warren pony truss with an overall length of 100 feet (Figure 35). The bridge was equipped with an 18-foot concrete roadway and a 5-foot sidewalk. The final cost of the Borough Bridge was as follows:[52]

Labor and materials for foundation changes		$247.46
Superstructure complete		4,075.00
Storrs & Storrs, plans, etc.		203.75
	Total	$4,526.41

Federal Bridge, 1915

The Federal Bridge finally opened on September 30, 1915 roughly a month behind schedule due to the July washout of the falsework and partially completed steelwork. The finished bridge consisted of three Pratt through truss spans with a total length of 450 feet. The South and middle spans were each 154 feet long; the north span was 132 feet long (Figures 36-40). It was decided

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[49] *Ibid*. July 12, 1915, pp. 1, 2.
[50] *Concord (Evening) Monitor*, "Brief Local Mention." July 24, 1915, p. 6.
[51] Concord Annual Report, 1915, p. 348.
[52] *Ibid*, p. 349.

to add a 5'-wide sidewalk to the bridge after the contract was let and this work was also done by Berlin Construction Company.

The final cost of the 1915 Federal Bridge was as follows:[53]

Daniel Marr & Son Co., masonry change, [on] account of sidewalk		$25.00
Superstructure and original masonry changes		$20,625.00
Sidewalk		2,635.00
Storrs & Storrs, plans, etc.		1,163.00
Trucking		2.50
	Total	$24,450.50

The wrought iron truss Federal Bridge that was replaced in 1915 was built in 1873 at a cost of $27,024.35, a sum $2500 greater than the much heavier bridge built 42 years later. It was one of the earliest iron truss highway bridges in the state as well as one of the few built by the Wrought Iron Bridge Company of Canton, Ohio utilizing the patented Phoenix segmental wrought-iron column. The bridge had three spans and was described at the time as "a wrought iron column and arched channel bridge." This "Phoenix column" bridge was built to replace the Paddleford truss covered bridge built in 1851 that was taken down by the ice freshet of 1872. Immediately adjacent to the Paddleford bridge was the Boston, Concord & Montreal Railroad Bridge that was also carried away at the time.

> The power of the Merrimack in times of flood, long ignored, was recognized at length, and the conviction became general that it was unwise to longer waste money upon structures unable to withstand it.[54]

It was decided by the City and the railroad to share in the cost of building single massive abutments of sufficient width to seat both bridges and of sufficient mass and quality to resist whatever the Merrimack might cast against them. The piers and abutments were built of first-class cut granite masonry laid in mortar. The abutments were set further into the banks to increase the width of the channel and better avoid snags and ice jams. This change increased the overall length of the bridge by forty feet.

Concord engineer Charles C. Lund designed the 1873 Federal Bridge for the City.[55] The patented Phoenix-column bridge was the state of the art and the large cost of the bridge, roughly $27,000, reflected its importance to the community.

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[53] *Ibid*, p. 350.
[54] Lyford, 1903, p. 40
[55] Lund was both a lawyer and civil engineer and by 1868 was regularly employed by the city for the surveying of roads and lots. He was appointed engineer in charge of the design of the City's first sewer system in 1870. In 1874 he was serving as both an Officer and Consulting Engineer for the City Board of Water Commissioners and in that capacity was responsible for the design of the city's water supply system. In the ensuing decades he provided the city with engineering services of all manner and form. In about 1888, shortly after he completed high school, John W. Storrs obtained training as an engineer from Charles Lund (see section on Storrs below). Information on Lund was obtained from Concord Annual Reports.

The cost of the 1873 Federal Bridge was as follows:[56]

Paid as follows:		
Boston, Concord & Montreal Railroad Co., for one-half of the expense of stone work furnished by it in excess of the amount furnished by the city		$7,546.88
Samuel J. Shaw, for stone		863.56
Jeremiah Brown, rubbling east abutment		47.46
M. H. Johnson		46.00
H. E. Perkins, 127 loads of stone		12.70
C. C. Lund, engineering		45.25
Wrought Iron bridge Company		18,462.50
	Total	$27,024.35

Main Street Bridge, Penacook, 1915

The contract for the superstructure of Main Street Bridge in Penacook was awarded to Penn Bridge Company of Beaver Falls, Pennsylvania. The bridge being replaced was a Pratt truss built in 1898 by the Wrought Iron Bridge Company, Canton, Ohio (Figures 41, 42). A separate contract for new concrete piers and modifications to the abutments was put to bid and won by the New Hampshire Cement Construction Company of Manchester for $4,370.00. Work on the substructure was started on May 19, 1915 and finished in just four weeks. The superstructure consisted of three plate girder deck spans each approximately 63 feet in length for an overall length of 190 feet. The bridge was equipped with a 25-foot wide roadway with 5-foot sidewalks on each side and an extra heavy floor system to accommodate a street car line down the center. The floor system was of the transverse jack-arch type, consisting of a solid arched concrete deck poured between 12" steel I-beams beams, in-turn carried by four plate girders, each 72" deep (Figures 43-47). The bridge was opened to traffic on October 27, 1915.

The final cost of the Main Street Bridge was as follows:[57]

Piers (New Hampshire Cement Construction Co.)		$4,370.00
Abutment changes		268.25
Superstructure (Penn Bridge Co.)		12,875.00
Storrs & Storrs, plans, etc.		645.00
Foot-walk		300.00
	Total	$18,458.25

Sewall's Falls Bridge, 1915

As previously mentioned above, in early 1914 John Storrs was asked to inspect and report on the condition of five bridges for the City of Concord. Storrs' findings were submitted to the Board of Public Works in June. The report entitled "Sewall's Falls Bridge," reads as follows [58]

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[56] Concord Annual Report, 1874, p. 49-50.
[57] Concord Annual Report, 1915, p. 351.
[58] Original typed letter in Storrs' Correspondence File "No. 86," located at the New Hampshire Department of Transportation Bureau of Environment.

> The bridge here is a wood lattice bridge with wood arches, consisting of two spans of about 163' each. This bridge does not come anywhere near up to the requirements of the statute going into effect April 15th, 1915. It would be possible probably to repair this bridge, but the expense would be about $4500, still leaving an old wooden bridge.
>
> This bridge is stated to have been built in 1873. At present the trusses are out of line and out of plumb; in some instances as much as 11" in the height of the truss. The spliced joints in the arches are short and inefficient. The arches, in instances, are buckled and crippled sideways. The arches and the trusses are supposed to act together but the whole organization is very unsatisfactory. The floor system here is way too light for the loading, the floor beams being the same size as those at the old Pembroke bridge.
>
> A new steel structure with an 18' roadway, four lines of pipe railing on two sides, with a capacity for 10-ton loads or road roller with a plank floor suitable for a coal tar wearing surface would cost about $18,000.

Sewall's Falls Bridge was the last of the group of five bridges to be built. On 9 August 1915 the *Concord Monitor* reported that the steel for Sewall's Falls Bridge was being unloaded at the Garrison Station. No other mention of the construction process was found in the newspaper until December 23, 1915 when the *Monitor* reported that "the new steel bridge over Sewall's Falls was completed today." The following day the Monitor announced that the five bridges were "All Done" after the Board of Public Works visited the Sewall's Falls Bridge and officially opened it that morning.[59] Although opened to traffic, painting and paving of the bridge was postponed until spring. The City held back $1,000 of the contract funds until the work was completed. In his 1916 annual report, City engineer Howe reported the following:

> Late in December, 1915, work was suspended on this structure, leaving the coal-tar wearing surface to be laid on the floor and the painting of the metal above the floor level to complete it. In June the floor was cleared, the coal-tar wearing surface laid and the painting of the bridge completed in accordance with the terms of the contract. A final certificate of completion was issued by your engineer on June 20, 1916. The completion of this structure gives safe bridges across the Merrimack River, for all traffic permissable upon the public highway, by whatever route one approaches the city.

The final cost of the Sewall's Falls Bridge was as follows:[60]

Labor and material for foundation changes		$193.18
On account of superstructure		13,318.00
Storrs & Storrs, plans, etc.		715.90
Balance on superstructure (painting and paving)		1,000.00
	Total	$15,227.08

Between 1916 and 1936 there were no entries for repairs or expenditures in the Concord Annual Reports for Sewall's Falls Bridge.

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[59] *Concord Monitor*, "All Done. Concord's Five Bridges are Completed." December 24, 1915, p. 5.
[60] Concord Annual Report, 1915, p. 351.

Sewall's Falls Bridge & the 1936 Flood

Sewall's Falls Bridge played a crucial role in the emergency needs of the City of Concord during the Great Flood of March 1936. The flood was unprecedented and caused widespread damage and loss of life across a wide swath of the northeastern United States. The region was emerging from one of the severest winters on record when hard rains began falling from the Ohio Valley to Maine around the 15th of March. The hillsides were laden with snow, rivers were packed with ice and the underlying earth was still frozen solid. By Thursday, the 19th, a massive low-pressure center formed in Texas and heavy with moisture from the Gulf of Mexico, pushed into the region dumping torrents of rain on the sodden snow pack and already flooded rivers. New Hampshire was especially hard hit and lost the greatest number of bridges although monetary losses were greater in Maine and Massachusetts due to destruction of several large and recently constructed bridges.[61]

The Flood peaked in Concord on the night of Thursday March 19th as measured by the height of the Merrimack River passing over Sewall's Falls Dam. At its crest, over 16 feet of water passed over the flash boards of the dam, compared to a peak of 12 feet during the 1927 flood, the previous record holder. Over 200 WPA workers and 100 National guardsmen battled for 24 hours filling and piling sandbags to save the dam. On Friday as the water slowly began to recede the extent of the devastation to the City became apparent. Between the flooding of the Merrimack, Contoocook and Turkey Rivers and low lying areas, all roads and bridges in and out of the city were unreachable, impassable, or missing. Over 300 homes were under six to twenty feet of water. Electricity and gas was cut and would be out for days. The rail yards were under eight or more feet of water.

By Friday midnight the waters inundating Sewall's Falls Road began to recede, revealing major washouts leading to the bridge. Saturday's *Concord Monitor* "Flood Special" reported that a "score of trucks of all descriptions commenced rushing sand into that area at one o'clock this morning and dumped two thousand tons of sand into washout, city officials reported." Three washouts near Beaver Meadow Brook and the "golf links" had to be filled to allow the trucks to reach two larger washouts 20 and 30 feet wide and 12 feet deep in the approach to the bridge. By Saturday morning the bridge was reached, inspected, determined safe and opened to emergency traffic, giving the city access to the outside world for the first time in two days.

> Milk trucks from East Concord were the first to get through, then bread trucks were permitted to go through by police who directed traffic on a limited basis. From then on one way traffic was allowed to go over the only one of the dozen main arteries of of the city not still under water.[62]

On Tuesday the 24th Mayor John W. Storrs announced that the city was making a survey of the flood damage and that every department was joining in the effort as fast as the receding waters would allow. "At present the city highway department is using 21 trucks and two steam shovels to make temporary repairs to the roads and streets as they are freed of water. The task, however, is a colossal one and nothing of a permanent nature can be done at this time, the mayor said."[63]

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[61] Bowman, "Bridge Building Follows Flood," 1937, pp. 54-58.
[62] *Concord Daily Monitor*, March 21, 1936. Flood Special, p. 1.
[63] "City to Make Survey to Note Flood Damage." *Concord Daily Monitor*, March 24, 1936.

Following the 1936 flood, the south approach to the Sewall's Falls Bridge was modified to provide a less restricted flood plain to avoid channeling and washouts. The south abutment was converted into a pier and the solid fill approach behind the abutment was removed and the natural contours restored. In 1937 an elevated approach trestle over 700 feet long consisting of ten spans carried on steel bents was constructed in place of the solid approach that enabled flood waters to flow underneath, largely unobstructed.. The trestle approach was constructed using WPA funding for flood relief projects and was built by the New Hampshire Highway Department using Simpson Brothers Corporation as the Contractor and Bethlehem Steel Company as the fabricator. In 1964 the south abutment of the trestle, the two southernmost approach spans and the timber deck were removed and a new concrete abutment and concrete deck were installed.

In the 1990s plans for the replacement of the Sewall's Falls Bridge were developed by the NHDOT. The project was put off several times and in 2004 four options for complete replacement of the bridge were presented to the public. Replacement met with resistance from the historic preservation community and led to the development in 2004 of a plan to rehabilitate the historic steel truss bridge for one lane of travel and build a new span alongside it to carry the second lane of travel. This plan was adopted by the Concord City Council in 2010, but a 2015 inspection of the bridge found the condition of the bridge to be more extensive than previous rehabilitation plans had considered. Additional studies and public hearings led the City City Council to conclude in 2013 that complete replacement of the bridge was the most prudent alternative. In September 2014 final design of the new bridge began. Construction began in August 2015 and on November 10, 2016 the new bridge was open to traffic.

Further in-depth information and documents pertaining to the entire design and permitting process that led to the replacement of the Sewall's Falls Bridge can be found at: ***http://www.sewallsfallsbridge.com.***

ENGINEERING CONTEXT

Design Rationale

Will B. Howe and John W. Storrs chose a Pratt truss as the most cost effective bridge type for the site. The relatively light weight of the trusses enabled reuse of the existing stone pier and abutments, which had proven their durability over forty-one years of service facing up to the Merrimack River.

The Pratt truss 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 to be built largely of wood, but the design was suited to all-metal construction and was soon widely built by the railroads using cast iron posts and wrought iron ties. The increasing use of Bessemer steel for bridge building in the United States in the 1890s further increased the use of the Pratt truss.

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. The Pratt design was readily adaptable to all-riveted construction. 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.

Storrs' prior experience as a bridge engineer with the Boston & Maine Railroad would have exposed him to the benefits of an all-riveted bridge. By 1900 riveted highway bridges were being built with the same design and construction practices that Storrs would specify for the Sewall's Falls bridge fifteen years later.

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 for various New England railroad companies.[64] 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.[65]

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.[66]

Will B. Howe, City Engineer. Concord NH.

Howe, as chief of the City of Concord Engineering Department, was responsible for management of all bridge construction projects undertaken by the city, including the five-major bridges built in 1915. He approved the design of the bridges done by consulting engineer John Storrs and inspected the construction of the bridges utilizing city-employed resident engineers.

Will Bernard Howe was born in Concord, NH July 3, 1859. He graduated from Concord High School and began his long engineering career in 1878 working as a rodman for Charles C. Lund,

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[64] American Society of Civil Engineers (ASCE), "Memoir of Thomas Willis Pratt." *Proceedings of the American Society of Civil Engineers* 1 (1876): 332-335; Carl W. Condit, *American Building Art, The Nineteenth Century*. (New York: Oxford University Press, 1960): 108.

[65] Condit 1960, p. 109.

[66] ASCE 1876; 334-335; Condit 1960:111, 112, 302; Theodore M. Cooper, "American Railroad Bridges." *Transactions of the American Society of Civil Engineers* 21 (July 1889): 11.

a civil engineer with offices in Concord. He was involved principally with railroad work, including the location and construction of the Profile and Franconia Notch Railroad. Upon his death in 1880, Lund's practice, then operating as Lund and Foss, was assumed by his partner Charles Orrin Foss who then partnered with Frank A. Merrill to form Foss & Merrill, Engineers. Howe continued with Foss & Merrill, working on projects for Boston, Concord & Montreal Railroad and the Concord Railroad as well as the Sewall's Falls dam and power development. Between 1883 and 1888 Howe served as Assistant and then Chief Engineer of the Central Railway in Nova Scotia. He returned to Concord in 1888 to assume management of Foss & Merrill until 1893 when he became Concord's first City Engineer. Howe served as City Engineer until his death April 1, 1922.[67]

John W. Storrs, Storrs & Storrs Consulting Engineers, Concord, NH.

Storrs was responsible for preparing the inspection reports, cost estimates, plans, specifications, and bid documents for the five-major bridges built by the City of Concord in 1915.

John Williams Storrs was born in Montpelier, Vermont November 24, 1858. His family moved to Concord, New Hampshire in the early 1870s. He suffered a loss of hearing from scarlet fever at age ten and by some accounts was privately tutored and by other accounts "was educated in the public schools of the city."[68] Following high school Storrs was trained in engineering in the office of Charles C. Lund, a prominent civil engineer in Concord responsible for the design of the city's first sewer and water supply systems, among many other projects. When Lund died in 1890 and his practice was assumed by Foss & Merrill, Storrs obtained employment with the Concord & Montreal Railroad as an assistant engineer and bridge inspector. He retained that position when the C&M was bought by the Boston and Maine Railroad in 1895.

In 1903 he began simultaneously to serve as the state engineer for Carroll, Coos, and Grafton counties, New Hampshire. Storrs left state employment in 1905 to establish a private engineering consulting practice in Concord. His business letterhead dated from May 1906 reads "Office of John W. Storrs, Bridge and Consulting Engineer;" a smaller notation to the side reads "With the B. & M. R. R. Fifteen Years as Assistant Engineer and Bridge Inspector."[69] Sources state that he was "employed by the Boston & Maine Railroad as an engineer from 1890 to 1911."[70] It was typical at the time for consulting engineers to be on a retainer by railroads to provide engineering services.

In 1909 Storrs' son Edward joined him and the firm of Storrs and Storrs was established with offices at 59 North Main Street (Figure 30). Edward was born in Concord in 1886. Following graduation from Concord High School in 1904 he worked for two years with the Boston & Maine Railroad followed by a year with Empire Bridge Company of Elmira, New York[71] (a subsidiary of United State Steel Corporation created in 1901 along with the American Bridge Company consolidation).

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[67] Journal of the Boston Society of Civil Engineers, v. 9, 1922, p. 309.
[68] *New Hampshire Highways.* "State Highway History from 1899 to 1905." December, 1928.
[69] Direct marketing letter of introduction mailed by Storrs to "Honorable Board of Selectmen" offering engineering services to "inspect and make full reports on old wooden bridges." Letter dated May 15, 1906. Located in Storrs Files, NHDOT.
[70] *New Hampshire Highways*, December 1928.
[71] "Concord's New Bridges." *Granite Monthly,* May-June, 1915, pp. 291-93.

John Storrs was appointed Chief Engineer of the Public Service Commission of New Hampshire in 1911, made a commissioner in 1918 and Chairman in 1928. In 1930 Governor Charles W. Tobey refused to re-appoint the 71-year-old Storrs, insisting that the veteran public servant was "too old" to provide the necessary energy, consideration, and steady guidance. Still active, Storrs hung out his shingle for "Storrs, Engineers" at a new office at 27 North Main Street, Concord.[72]

In 1933 Storrs gave up his private engineering practice, credited with having carried out or overseen the design and construction of more bridges in New Hampshire than any other individual. He did not retire from engineering due to personal decline, however, but rather to lead his fellow citizens of Concord in confronting the ongoing challenge of the Great Depression. Beginning in 1933, Storrs served five consecutive two-year terms as mayor of the city until he was forced from the office not by voters, but by death on September 19, 1942.[73]

Storrs is known to have designed at least one hundred bridges in New Hampshire. The development of the low cost lightweight pre-fabricated riveted steel truss for highway bridges at the beginning of the 20th century offered engineers like Storrs a simple, fast and cost-effective solution to the exploding demand for new bridges that followed the advent of the automobile. The development of increasingly heavy motor trucks during the second decade of the century brought state laws requiring bridges be upgraded to carry them, a demand that continued in one form or another, through most of the 20th century.

The following information on Storrs is an excerpt from *Builders of Bridges in New Hampshire* by James 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. Many of Storrs' office records survive and show that his practice included the structural evaluation of innumerable wooden bridges throughout the state.[74] Storrs found many of these to have been neglected and overstressed by excessive loading.
>
> 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." 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

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[72] *Concord Daily Monitor*, September 21, 1942; Concord city directory 1919; US Population Census 1920.
[73] *Concord Daily Monitor*, November 8, 1933 and November 6, 1935.
[74] Garvin, 1999.

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.

Berlin Construction Company, Berlin, CT.

Berlin Construction Company was responsible for the fabrication and erection of the superstructures of four of the the five-major bridges built by the City of Concord in 1915, including the Sewall's Falls, Federal, Pembroke and Borough bridges.

The Berlin Construction Company can trace its origins to the establishment of the The Corrugated Metal Company in East Berlin, CT in 1868. The firm initially produced rolled sheet-iron products including roofing and fire-proof doors and shutters but soon expanded into producing and fabricating rolled structural shapes into roof trusses and other assemblies. In 1878, recognizing the growing market for iron highway bridges, the company acquired the rights to a parabolic truss design for bridges that had just been patented.[75] The inventor, William Douglas joined the company as treasurer and executive manager and by 1885 the company was operating as the Berlin Iron Bridge Company.[76]

The company grew rapidly into perhaps the largest fabricator of structural iron and steel members and assemblies in New England, employing up to 400 workers in the plant and scores more on construction crews that erected the product.

> There is no definitive count of the company's bridges, though at least 600 are known to have been completed during its first ten years, and the company itself claimed at least 1,000. Most were in the Northeast, though even today Berlin trusses survive as far away as Texas. A few multiple-span bridges were of tremendous size, but most were a single span in length, with through-trusses used in crossings over 100 feet and pony trusses for shorter spans. The lenticular design accounted for the bulk of the company's output, although it also produced other bridge types, specialized industrial structures such as dock cranes, and ironwork for roofs and buildings.[77]

In 1900 the Berlin Iron Bridge Company became one of twenty-eight bridge companies acquired by J.P. Morgan to form the American Bridge Company, a goliath consolidation 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 (US Steel) in the form of a subsidiary. American Bridge continues to be one of the world's foremost builders of large and complex steel structures.

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[75] See Patent 202,526, April 16, 1878.
[76] History of the Berlin Iron Bridge Company. Online at [http://www.past-inc.org/bibco/history.html].
[77] Ibid.

Following the acquisition, three executives of Berlin Iron Bridge, Daniel E. Bradley, George H. Sage and Seymour N. Robinson quit and formed The Berlin Construction Company, with Bradley serving as its first president. In 1902 the company opened a fabrication facility and offices in Berlin, CT. The company specialized and prospered in steel bridge fabrication and erection and proved a formidable competitor against much larger companies as demonstrated by its winning four out of the five bridge contracts issued by the City of Concord in 1915. In 1916 the company was officially incorporated in the state of Connecticut, with George H. Sage at the reins as president. The company began diversifying its products and services to include structural steel and construction services for a variety of industrial structures and buildings.[78]

In the building boom that followed WWII, Berlin Construction stay abreast of the rapidly evolving building technologies, such as switching from hot driven rivets to high strength bolts in 1955. In 1962 the company changed its name to The Berlin Steel Construction Company to better reflect its main functions of fabricating and erecting structural steel, which it continues to do today from divisions located in Connecticut, Massachusetts, Pennsylvania and Maryland.[79]

In addition to the four bridges built in Concord in 1915, the Berlin Construction Company is known to have built: a low Warren truss over Blow-Me-Down Brook between Cornish and Plainfield in 1925; a 240-foot through Parker truss over the Pemigewasset River between Bristol and New Hampton and a three-span Pratt deck truss over the Connecticut River between Dalton and Lunenburg, Vermont, both erected following the flood of 1927; a through Pratt truss over the Baker River at Plymouth in 1930; the Western Avenue bridge in Henniker, in 1933, using two spans from the 1915 Manchester Street Bridge in Concord.[80]

Bethlehem Steel Company, Bethlehem, PA.

Bethlehem Steel Company was responsible for the fabrication of the steel for the superstructure, of the Sewall's Falls Bridge South Approach Trestle built in 1937.

The Bethlehem Steel Corporation began in 1858 as the Bethlehem Rolling Mill and Iron Company in the village of South Bethlehem, Pennsylvania. Robert H. Sayre, chief engineer of the Lehigh Valley Railroad founded the company with the purpose of producing rails and in 1863, under the new name, Bethlehem Iron Company, the first rails rolled off the line.[81]

The company grew exponentially adding a Bessemer steel furnace in 1873 to produce steel rails, and a heavy forgings plant for the production of ordnance in 1887-1894. Between 1900 and 1904 the name is changed to the Bethlehem Steel Company and then to the Bethlehem Steel Corporation by Charles M. Schwab who quit as President of United States Steel to buy controlling interest of Bethlehem. Schwab purchased the patents to Henry Grey's invention of the wide-flange "H" beam and built a special continuous rolling mill to produce them. Known as the Grey-beam, H-beam,

[78] See corporate history of the Berlin Steel Construction Company online at [http://www.berlinsteel.com/history.html].
[79] Ibid.
[80] Garvin, 1999.
[81] Metz 1996:4-6.

and later the Bethlehem beam, the shape was lighter, stronger and cheaper than fabricated sections of the time. The Grey-beam revolutionized structural steel construction and ushered in the age of the skyscraper.[82]

In 1931 Bethlehem purchased the McClintic-Marshall Company for $32,000,000, along with several other large and small fabricators and created Bethlehem's Fabricated Steel Construction Division, sometimes (incorrectly) called Bethlehem Bridge Company. Bethlehem was now be able to bid on work that could previously only be handled by American Bridge or McClintic-Marshall.[83] When acquired by Bethlehem, McClintic-Marshall was successfully completing the George Washington Bridge, the largest bridge in the world by a factor of two, using Bethlehem produced steel.[84]

During World War II, Bethlehem's employment swelled to nearly 300,000. The company grew by more than a third in the decade following the war, but in 1959, for the first time, the United States imported more steel than it exported. The 1980s brought the results of the tens of millions of tons of cheap imported steel that were dumped into the United States market, much of which was subsidized in violation of trade laws. Bethlehem discontinue its steelmaking activities at the main Bethlehem plant in 1995, exited the railroad car business in 1993, ended shipbuilding activities in 1997 and filed for bankruptcy in 2001. Two years later, the company's remnants, including its six massive plants, were folded into Mittal Steel (now ArcelorMittal, Luxembourg) ending U.S. ownership.[85]

Among the many well-known world-record bridges constructed by Bethlehem Steel are the Ambassador Bridge between Detroit and Windsor, Ontario; the Golden Gate Bridge; and the Verrazano Narrows Bridge. Five bridges in the New Hampshire Historic Bridge Inventory were constructed by the Bethlehem Steel Corporation: Bartlett Bridge (No. 244/138), built in 1928, carrying New Hampshire Route 16-A over the East Branch of the Saco River; Franconia Bridge (No. 070/115), built in 1930, carrying New Hampshire Route 18 over the Gale River; Chesterfield-Brattleboro Bridge (No. 040/095), built in 1937, carrying New Hampshire Route 9 over the Connecticut River; Wentworth Bridge (No. 146/120), built in 1937, carrying New Hampshire Route 25 over the Baker River; and North Stratford-Bloomfield Bridge (No. 029/206), built in 1947, carrying Vermont Route 105 over the Connecticut River. More recently, the Route 95 bridge, a cantilever truss over the Piscataqua at Portsmouth, was completed in 1972.[86] Many smaller bridges across the state can also be attributed to Bethlehem Steel.

Simpson Brothers Corporation, Boston MA.

Simpson Brothers Corporation served as general contractor for building the Sewall's Falls Bridge South Approach Trestle in 1937 and was responsible for construction of the substructure and erection of the superstructure.

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[82] Barnette 1995:11; Metz 1996: 26-27.
[83] *Business Week* 1931:8; *New York Times* 1931: January 30, p. 29; February 5, p. 30; February 6, p. 31(a).
[84] Darnell 1984:67; *New York Times* February 6, 1931, p. 31 (b).
[85] James L. Garvin, "Builders of Bridges in New Hampshire." Uncompleted draft manuscript (1999). On file at Division of Historical Resources, Concord, NH. See https://en.wikipedia.org/wiki/Bethlehem_Steel.
[86] Garvin, (1999).

Boston city directories indicate the Simpson Brothers Corporation was formed in 1899 with offices at 77 Summer Street in Boston. C. Fred Simpson and James Simpson had operated a contracting business under the name Simpson Brothers since at least 1882, specializing in paving with asphalt and other materials for "Streets, Street Crossings, Carriage Ways, Side Walks and Private Walks, Floors in Breweries, Stables, Basements and Laundries of Private Dwellings, Warehouses, Mills, Rinks and Manufactories of every description.[87] By the early 1900s the Simpsons were building concrete structures "of all kinds" including fire proof buildings, reservoirs, standpipes, oil and water tanks, retaining walls and coal pockets.

Sometime between 1915 and 1925 the company came under the direction of Charles F. Knowlton. The firm advertised in directories as "general contractors and builders," specializing in reinforced concrete construction during the 1930s and road construction during the 1940s and 1950s. Directory listings continued through 1959, the last date for which information was obtained.[88]

In New Hampshire the Simpson Brothers Corporation are known to have completed at least two bridge projects, both related to the 1936 flood: the three-span Lebanon NH-Hartford VT- Bridge carrying US 4 over the Connecticut River, built in 1936; and the [subject] new approach to the Sewall's Falls Bridge consisting of ten I-beam stringer spans, completed in 1937.

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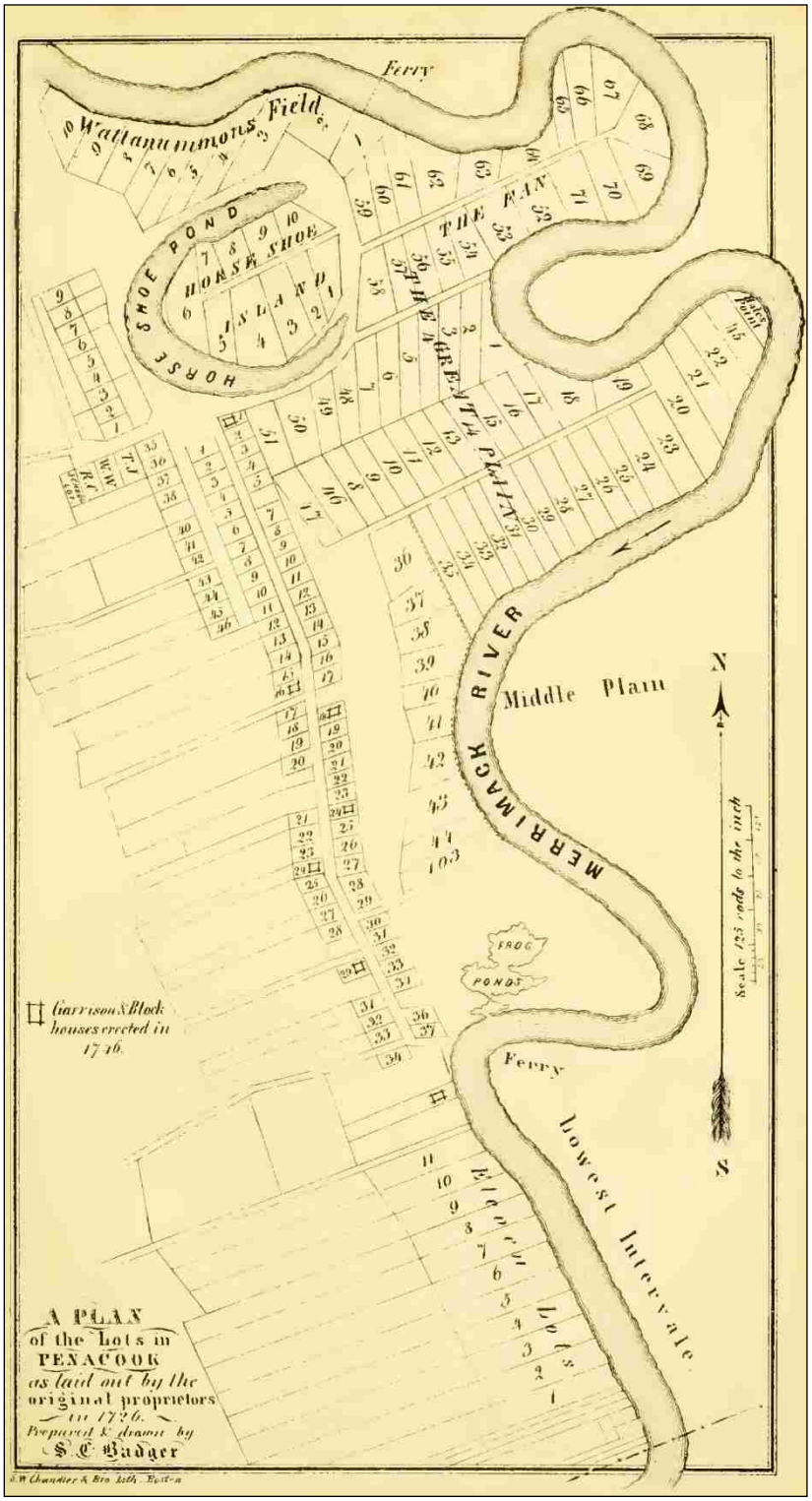
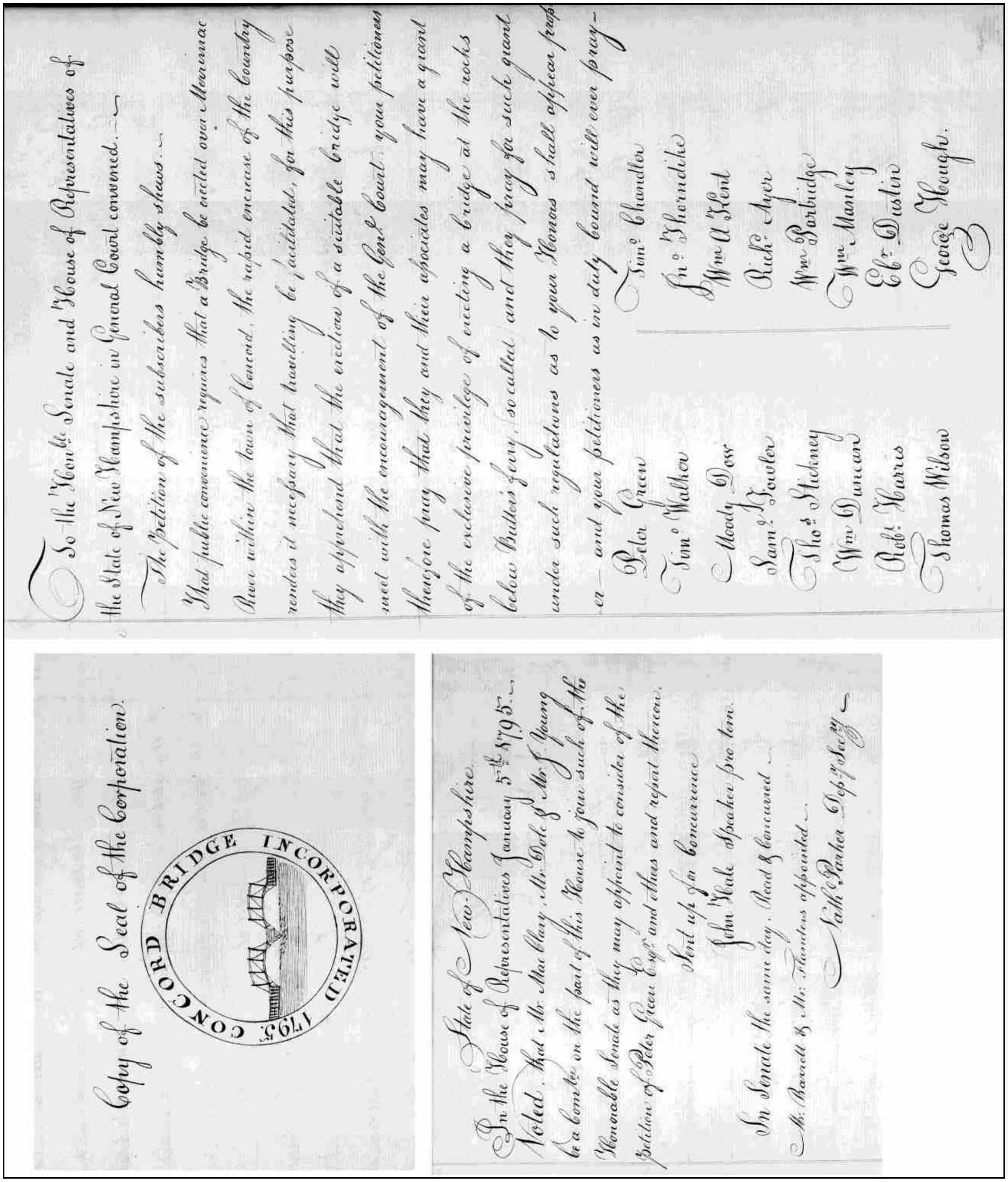


FIGURE 18: Map of Penacook (later Concord) in 1726, showing the location of ferries established across the Merrimack at the south end of the village below the Frog Ponds where Concord Bridge would be built in 1795, and at the north end near Wattanummons Field where Federal Bridge would be built in 1798 (Bouton 1856, p. 125).



Copy of the Seal of the Corporation.

State of New Hampshire

In the House of Representatives January 5th 1795.

Voted. That Mr. MacClary, Mr. Dole & Mr. Young be a Comtee on the part of this House to join such of the Honorable Senate as they may appoint to consider of the Petition of Peter Green Esqr and others and report thereon.

Sent up for Concurrence

John Steele Speaker pro tem.

In Senate the same day. Read & Concurred

Mr. Barrett & Mr. Flanders appointed

Nath Parker Dep Secy

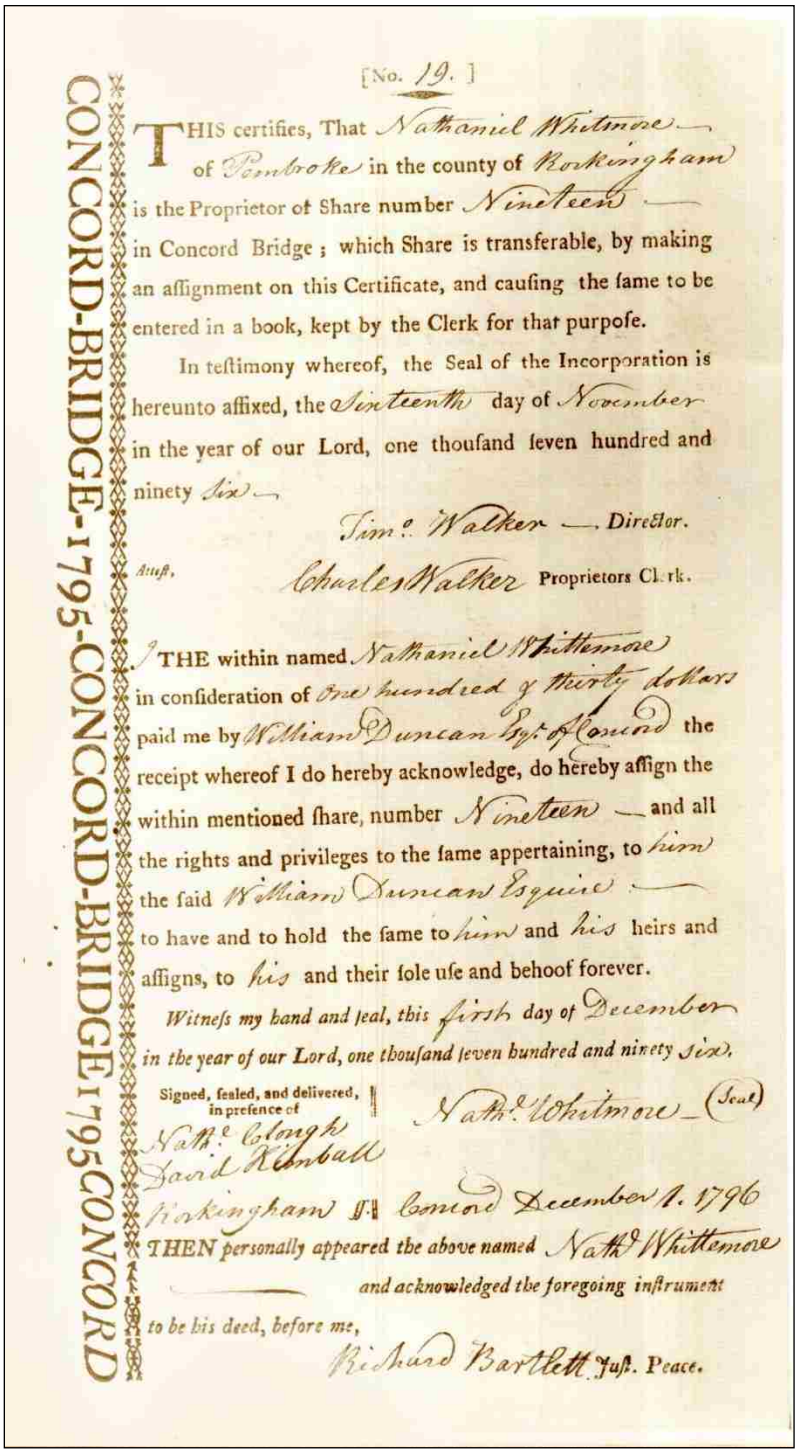
To the Honble Senate and House of Representatives of the State of New Hampshire in General Court convened. —

The Petition of the subscribers humbly shews —

That public convenience requires that a Bridge be erected over Merrimac River within the town of Concord, the rapid encrease of the Country renders it necessary that travelling be facilitated, for this purpose they apprehend that the erection of a suitable bridge will meet with the encouragement of the Genl Court: your petitioners therefore pray that they and their associates may have a grant of the exclusive privilege of erecting a bridge at the rocks below Butters ferry, so called, and they pray for such grant under such regulations as to your Honors shall appear proper — and your petitioners as in duty bound will ever pray —

Peter Green
Timo Walker
Moody Dow
Saml Fowler
Thos Stickney
Wm Duncan
Robt Harris
Thomas Wilson
Timo Chandler
Jno Thorndike
Wm A Kent
Richd Ayer
Wm Partridge
Wm Manley
Ebr Dustin
George Hough.

FIGURE 19: Original charter document of Concord Bridge Corporation dated January 5, 1795. Located in the collection of New Hampshire State Archives (Concord Bridge Corporation 1795).



CONCORD-BRIDGE-1795-CONCORD-BRIDGE-1795-CONCORD

[No. 19.]

THIS certifies, That Nathaniel Whitmore of Pembroke in the county of Rockingham is the Proprietor of Share number Nineteen in Concord Bridge; which Share is transferable, by making an assignment on this Certificate, and causing the same to be entered in a book, kept by the Clerk for that purpose.

In testimony whereof, the Seal of the Incorporation is hereunto affixed, the Sixteenth day of November in the year of our Lord, one thousand seven hundred and ninety Six.

Jam.s Walker — Director.

Attest, Charles Walker Proprietors Clerk.

I THE within named Nathaniel Whittemore in consideration of One hundred & thirty dollars paid me by William Duncan Esq.r of Concord the receipt whereof I do hereby acknowledge, do hereby assign the within mentioned share, number Nineteen — and all the rights and privileges to the same appertaining, to him the said William Duncan Esquire — to have and to hold the same to him and his heirs and assigns, to his and their sole use and behoof forever.

Witness my hand and seal, this first day of December in the year of our Lord, one thousand seven hundred and ninety six.

Signed, sealed, and delivered, in presence of
Nath.l Clough
David Kimball

Nath.l Whitmore (Seal)

Rockingham ss. Concord December 1. 1796

THEN personally appeared the above named Nath.l Whittemore *and acknowledged the foregoing instrument to be his deed, before me,*

Richard Bartlett Just. Peace.

FIGURE 20: Original stock certificate No. 19 of the Concord Bridge Corporation dated November 16, 1796 issued to Nathaniel Whitmore for the sum of 130 dollars. Located in the collection of New Hampshire State Archives.

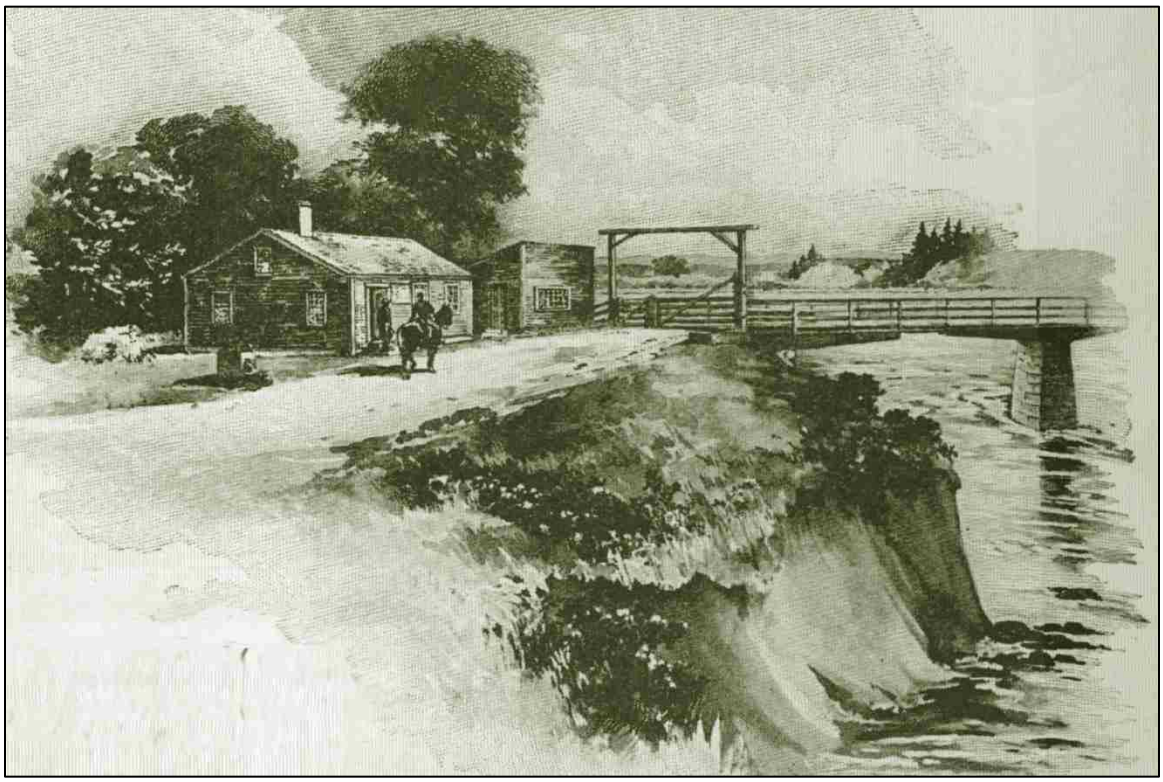


FIGURE 21: Concord Bridge, built 1795, as depicted in the *History of Concord New Hampshire* by James O. Lyford, 1903.

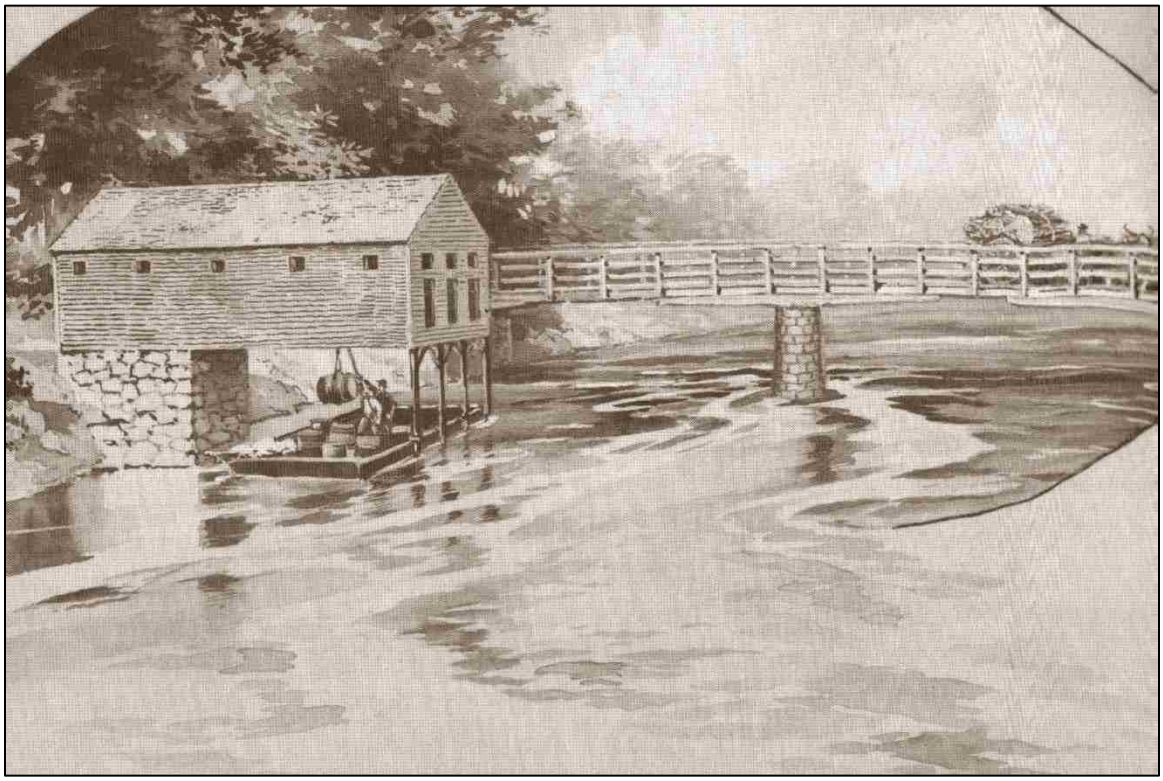


FIGURE 22: Concord Bridge, built 1795, as depicted in *At a Bend in the River*, a commemorative pamphlet published by Concord Bicentennial, Inc., 1965.

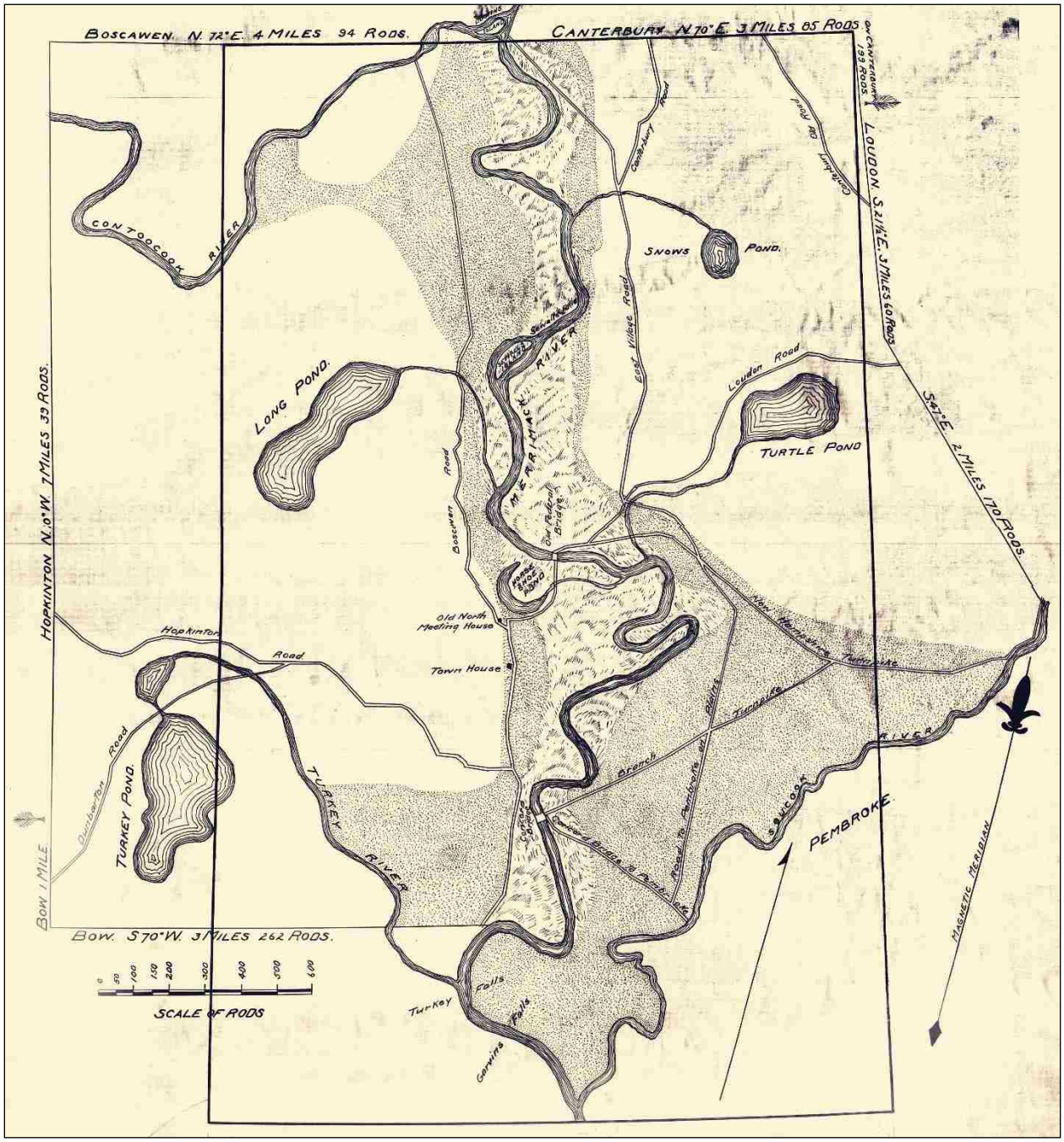


FIGURE 23: Map of Concord in 1803 showing Concord Bridge, built 1795 and Federal Bridge, built 1798, crossing the Merrimack River. Also note Dumbarton Road bridge over the Turkey River, date of construction not determined (Leavitt 1803).

[CHAPTER 36.]

State of
New Hampshire.

"AN ACT TO INCORPORATE THE PROPRIETORS OF SEWALLS FALLS BRIDGE"

[Approved January 3, 1833. Acts, vol. 29, p. 255.]

Sec. 1. Be it enacted by the Senate and House of Representatives in General Court convened, That Ebenezer Eastman, Abraham Bean, Samuel Tilton Hugh McAllaster, Daniel C. Atkinson, Orlando Brown their associates, successors and assigns, be and they hereby are incorporated and made a body politic, by the name of the Proprietors of Sewalls Falls Bridge, and by that name may sue and be sued, prosecute and defend to final judgment and execution, and shall be and hereby are vested with all the powers and privileges, which by law are incident to corporations of a similar nature.

Sec. 2. And be it further enacted, That the said Proprietors be, and they hereby are authorized and empowered to construct, build, maintain and keep in repair a Bridge over Merrimack River at any place within half a mile from the head of Sewalls Falls in the northerly part of Concord in the County of Merrimack, and the same from time to time to rebuild and keep in repair forever, and also may purchase and hold so much real estate as may be necessary and convenient for carrying into effect the purposes of this act.

Sec. 3. And be it further enacted, That the said Ebenezer Eastman, Abraham Bean and Samuel Tilton or either two of them, may call the first meeting of said Proprietors at any suitable time and place by advertizement in any one or more of the newspapers published in Concord aforesaid, expressing therein the time, place and design of such meeting, at least two weeks prior thereto. At which said first meeting, or at any adjournment thereof, the said proprietors may agree on the manner of calling their future meetings; and at the same or at any subsequent meeting duly notified and holden they may elect such officers or agents, as they may deem necessary for conducting the affairs of said corporation; may divide their joint stock into shares and agree on the manner of transferring them, may order assessments and fix the time of their payment, may pass by laws, not repugnant to the laws of the State for their regulation and government and annex penalties to the breach thereof, not exceeding ten dollars for any one offence, and do and transact any business necessary for carrying into effect the objects of their association. All questions at any meeting of said Corporation shall be determined by a majority of votes of the members present or represented, allowing one vote to each share, and authority to vote at any such meeting in behalf of an absent member, shall be proved by writing signed by the person represented and filed with the clerk.

Sec. 4. And be it further enacted, That the shares in said Corporation shall be liable and holden for the payment of all assessments duly made thereon, and upon the nonpayment thereof within the time fixed therefor, the delinquent share or shares may be advertized and sold at public auction, or so many of them as may be necessary to pay such assessments, with incidental charges, under such regulations as the Proprietors in their by laws may have prescribed.

Sec. 5. And be it further enacted, That to reimburse the Proprietors the moneys, by them expended in building and keeping said Bridge in repair, a toll be and hereby is granted and established; and any toll gatherer appointed by said Corporation, is hereby authorized to demand and receive the following rates of toll, and to stop and detain any person or persons from crossing said Bridge with their carriages, teams, horses or other creatures until the same shall be paid, that is to say,—For every foot passenger, one cent, for each horse and rider or horse led four cents; for each horse and chaise, or other carriage drawn by one horse six cents, if drawn by two horses ten cents, and three cents for each additional horse, for each cart or other carriage drawn by two oxen, six cents, and four cents for each additional yoke of oxen, for each sleigh or sled with one horse or one yoke of oxen three cents, and two cents for each additional horse or yoke of oxen, for each horse or mule in droves two cents; for each neat creature in droves, one cent, for each sheep or swine one fourth of a cent, and one driver and no more to be allowed to pass with each team free of toll. And at all times when the toll gatherer does not attend his duty, the gate or gates upon or across said Bridge shall be left open.

Sec. 6. And be it further enacted, That if within four years from the passing hereof the said Bridge shall not be built and ready for the accommodation of passengers then this act shall be void and of no effect; and in case said Corporation shall fail to have and keep in good repair a convenient and safe bridge, within the limits aforesaid, according to the true intent and meaning hereof for the space of two years at any one time thereafter, then this act shall be void.

Sec. 7. And be it further enacted, That said Corporation shall not by means of the erection of any abutments, pier, or any part of their said Bridge, obstruct the navigation of Merrimack River, but shall leave a waste way for the free passage of all rafts of lumber, boats or other craft of a width not less than eighty feet.

FIGURE 24: Charter of the first Sewall's Falls (Toll) Bridge, 1833 (Laws of New Hampshire 1833).

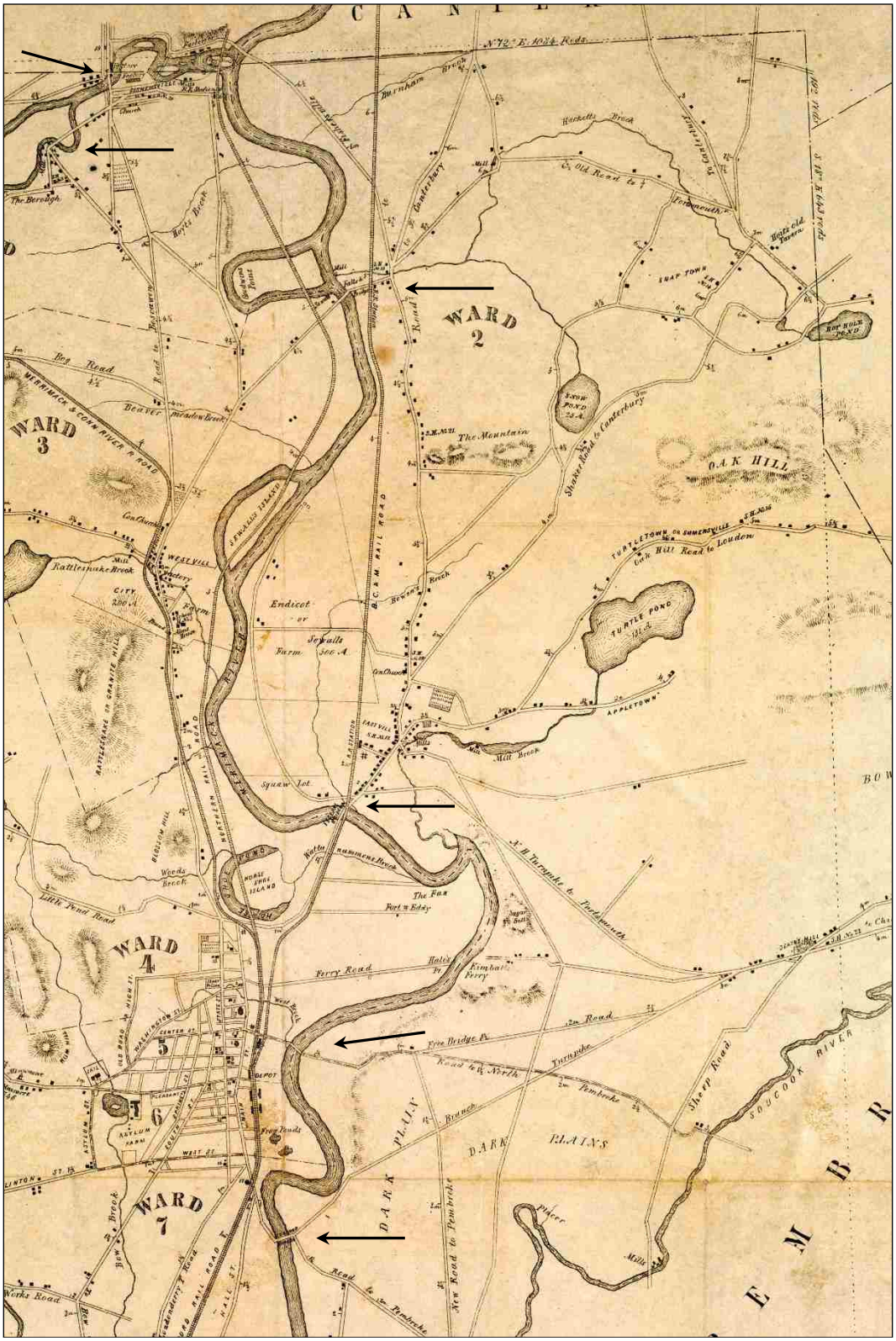


FIGURE 25: Map of the City of Concord 1855, showing south to north, Concord, Free, Federal, Sewall's Falls, Borough and Main Street (Penacook) bridges (Badger 1855).

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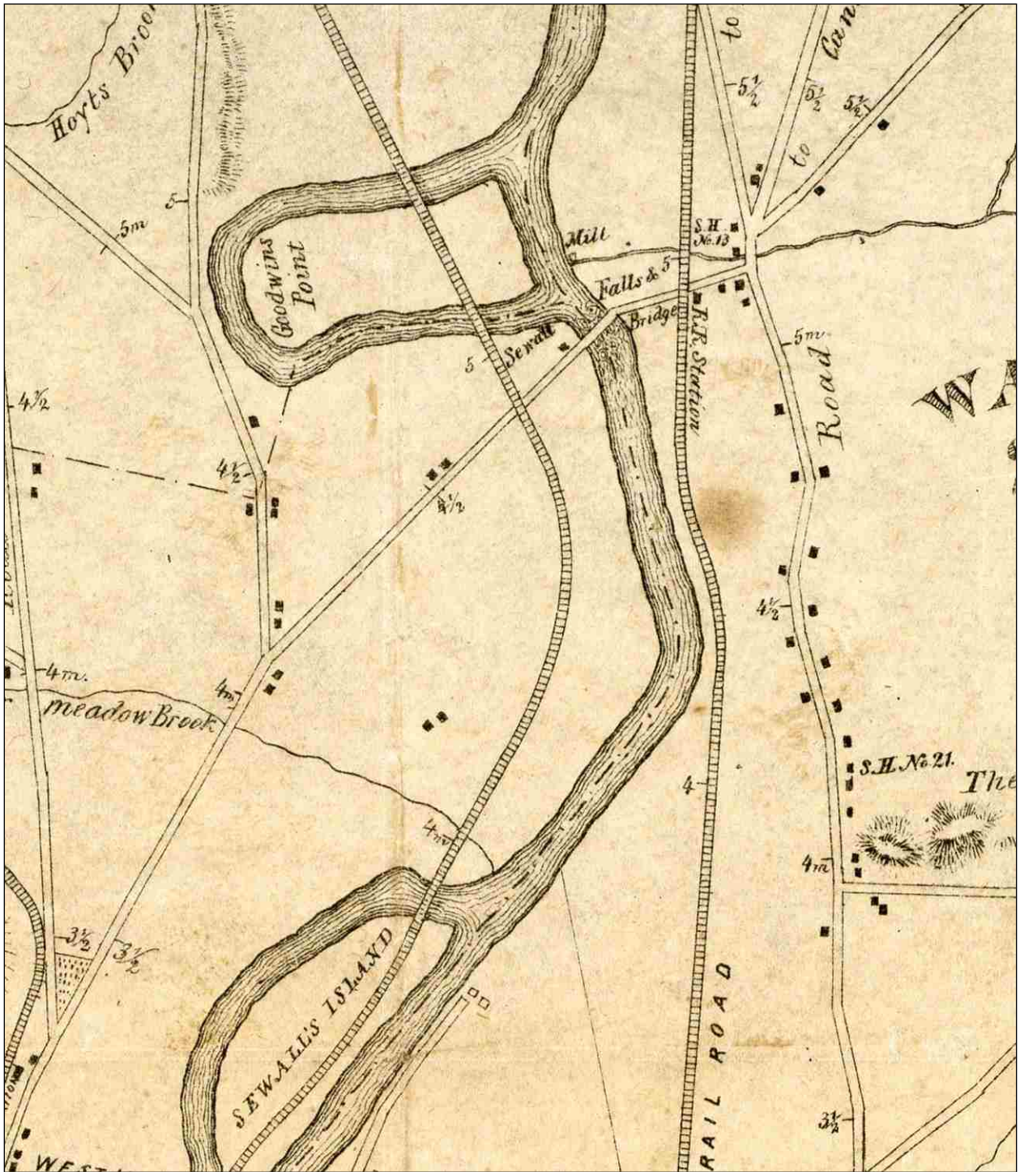

FIGURE 26: Detail of 1855 Concord map showing Sewall's Falls Bridge and development in the vicinity. The bridge at the time was a two-span covered wood truss built by Peter H. Paddleford, a noted covered wood-truss bridge builder. The stonework of the pier and abutments was built by Simson, Balch & Company. Note the Northern Railroad running along the west side of the river and the Boston, Concord & Montreal Railroad running along the east side (Badger 1855).

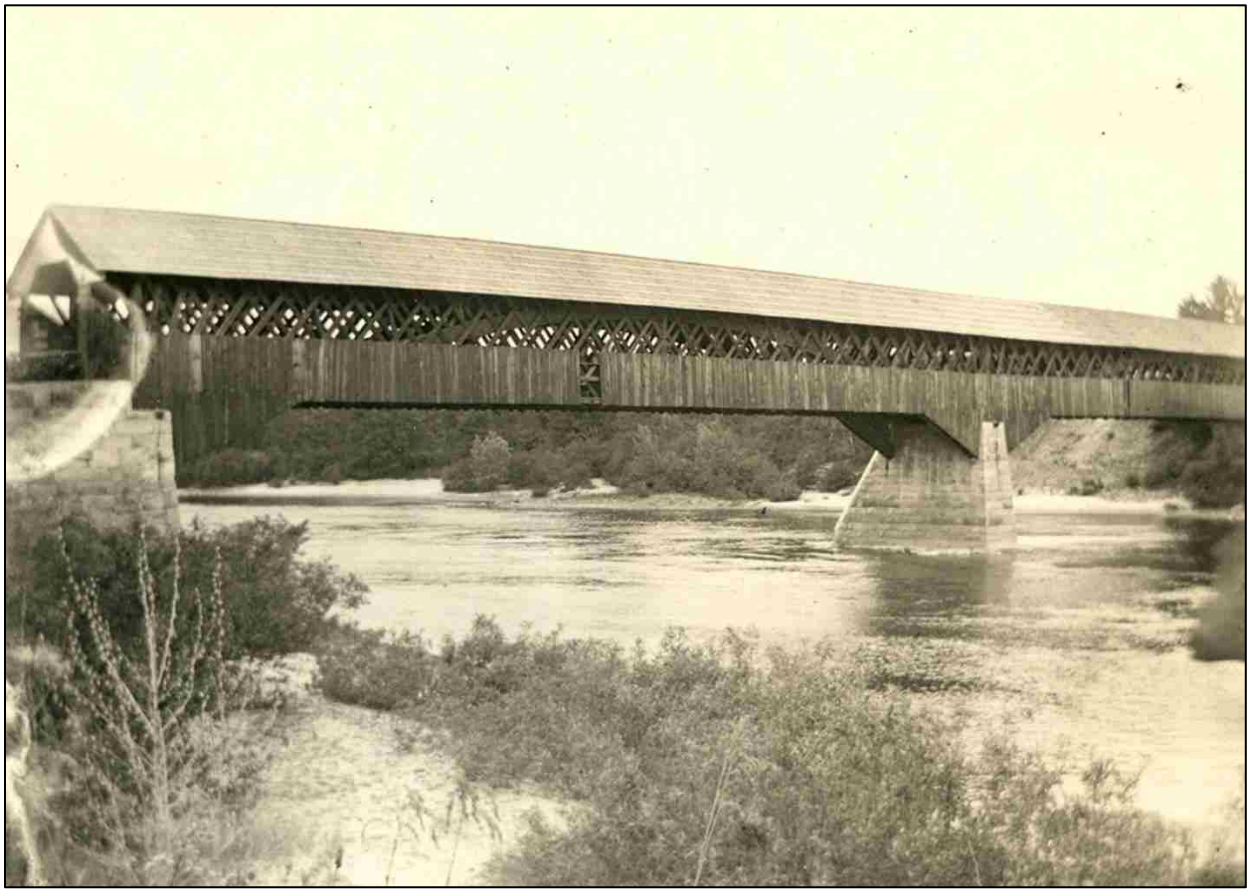

FIGURE 27: Sewall's Falls Bridge, built 1873. Substructure by Lyman R. Fellows; Superstructure by Dutton Woods (Courtesy of National Society for the Preservation of Covered Bridges).

SEWALL'S FALLS BRIDGE.

Appropriation,		$10,000
Paid as follows:		
L. R. Fellows and men, pay-roll, No. 1,	$200.00	
" " " No. 2,	426.36	
" " " No. 3,	425.95	
H. M. Fuller, stone,	769.07	
H. Partridge, drawing stone,	771.50	
L. R. Fellows and men, pay-roll, No. 4,	509.25	
Hutchins & Co., cement,	338.20	
L. R. Fellows and men, pay-roll, No. 5,	602.50	
" " " No. 6,	429.00	
" " " No. 7,	287.94	
Ira Foster, drawing stone,	$165.85	
L. R. Fellows and men, pay-roll, No. 8,	314.44	
" " " No. 9,	302.25	
" " " No. 10,	259.25	
Geo. T. Annis, stone,	170.50	
Putney & Chadwick, stone,	136.50	
C. H. Norton, use of team,	240.13	
Cost of stone work,		$6,348.69
Parker, Hoyt & Simonds, lumber,	$262.50	
Concord & Northern R. R., freight,	50.40	
D. Woods, on account of contract,	1,500.00	
		$1,812.90
Whole amount expended to Feb. 1,		$8,161.59
Unexpended balance,		$1,838.41
Dutton Woods's contract amounts to	$7,750.00	
Paid him as above,	1,500.00	
Due when bridge is completed,	$6,250.00	
Amount already expended,	8,161.59	
Estimated cost,	$14,411.59	

FIGURE 28: Itemized cost of the 1873 Sewall's Falls Bridge that served with only routine maintenance until replaced in 1915 with subject steel truss bridge. The truss spans were set on the 1873 stone pier and abutments (Concord Annual Reports 1874. pp. 29-30).

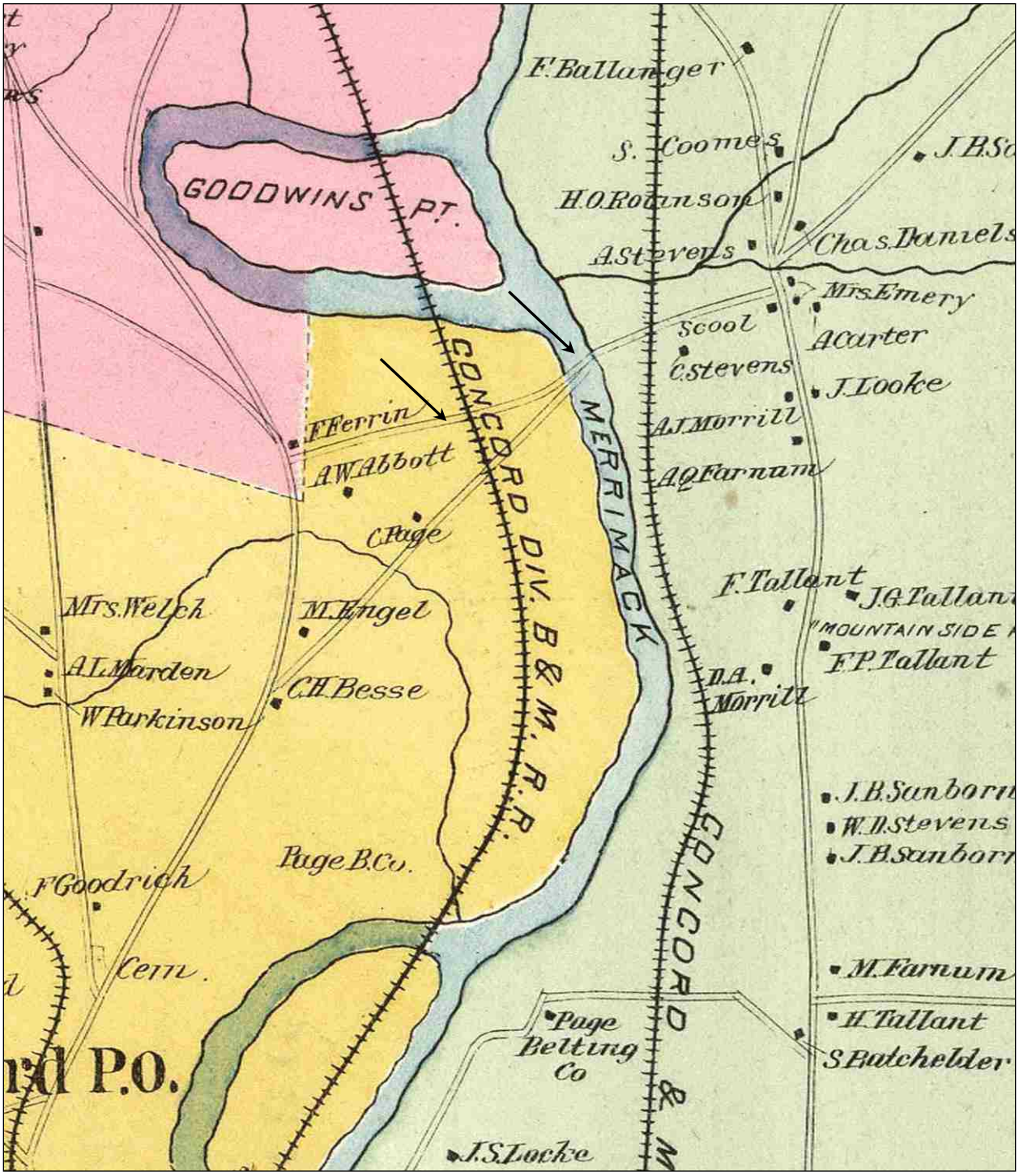

FIGURE 29: Map of Sewall's Falls Bridge and vicinity in 1892. Note the second road established since 1855 (Figure 26) leading to the bridge from Fisherville Road and running between the Ferrin and Abbott properties. This road or portions of it evidently follows Manor Road today (Hurd 1892).

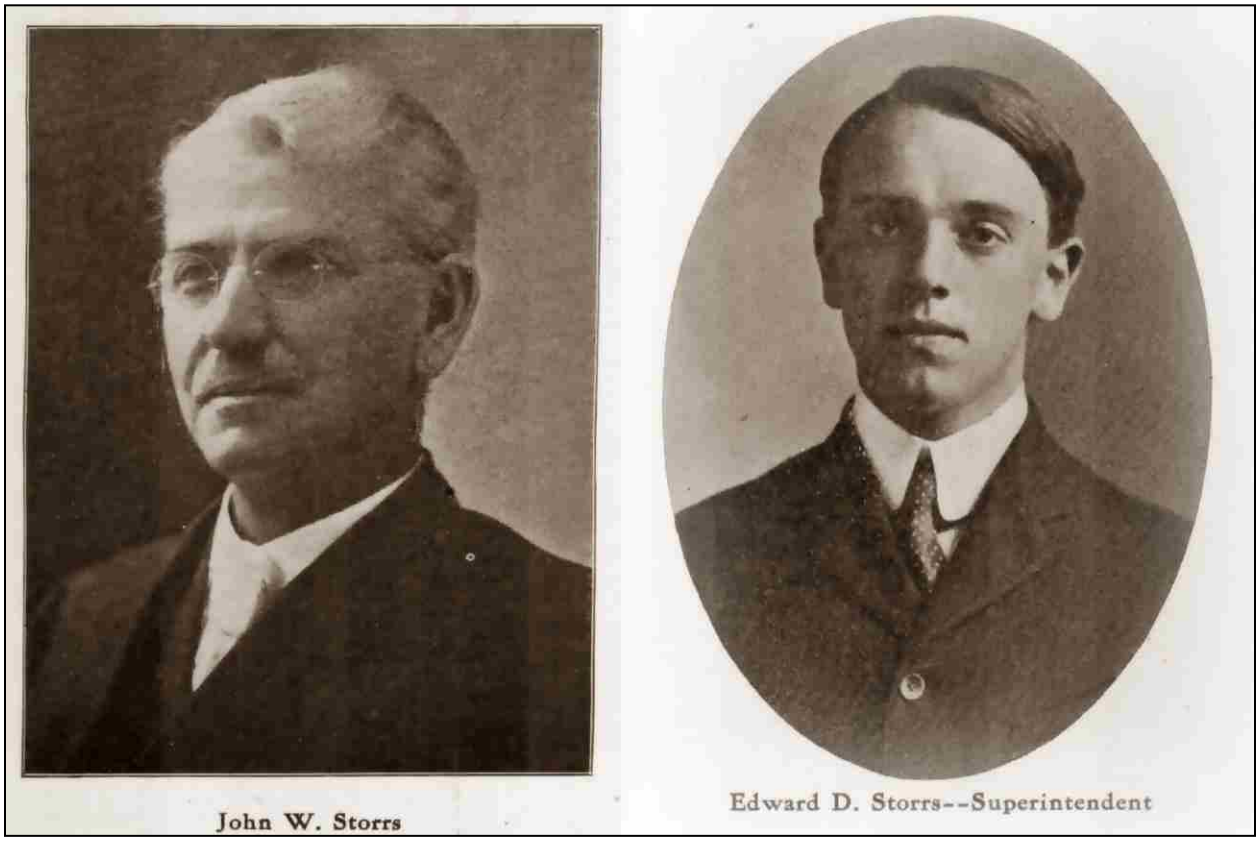

FIGURE 30: John and Edward Storrs, of Storrs & Storrs Engineers, as they appeared in 1910 for an article in *Granite Monthly Magazine* (Metcalf 1910).

FIGURE 31: Topographic map of Sewall's Falls Bridge and vicinity in 1927. Note Manor Road is established in its present configuration (USGS Penacook NH quadrangle, 1927).

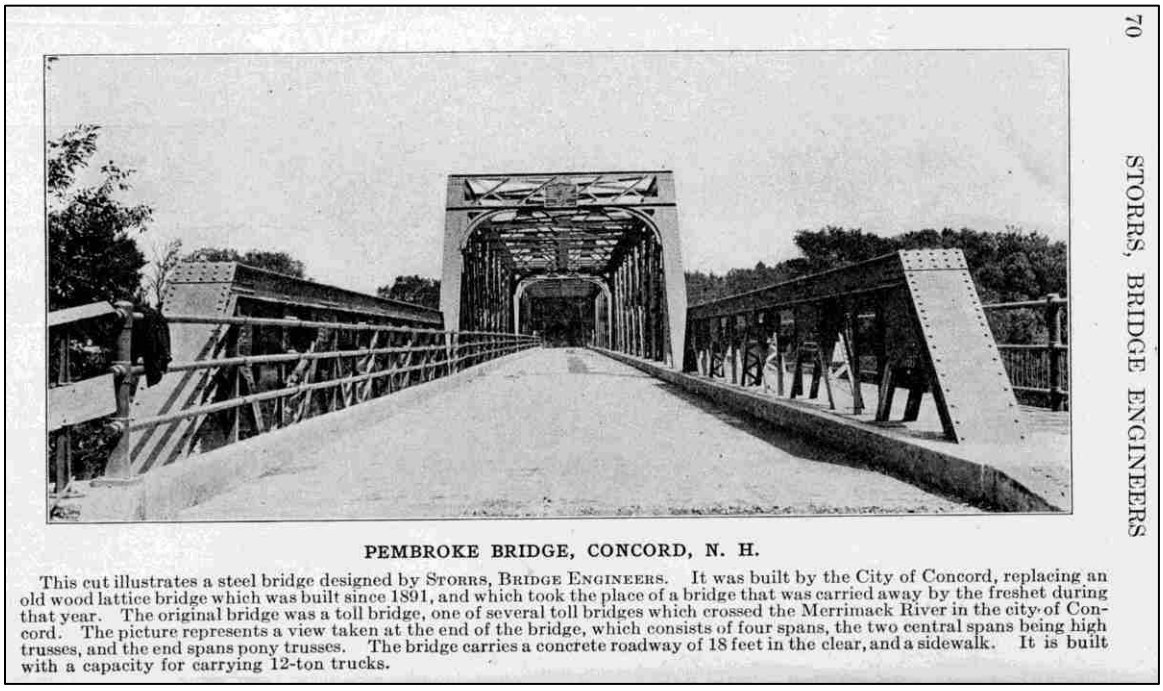

FIGURE 32: Pembroke Bridge, built in 1915, replaced the wood covered Concord Bridge rebuilt in 1891 following its destruction by the March 27, 1891 freshet (Storrs & Storrs 1918).

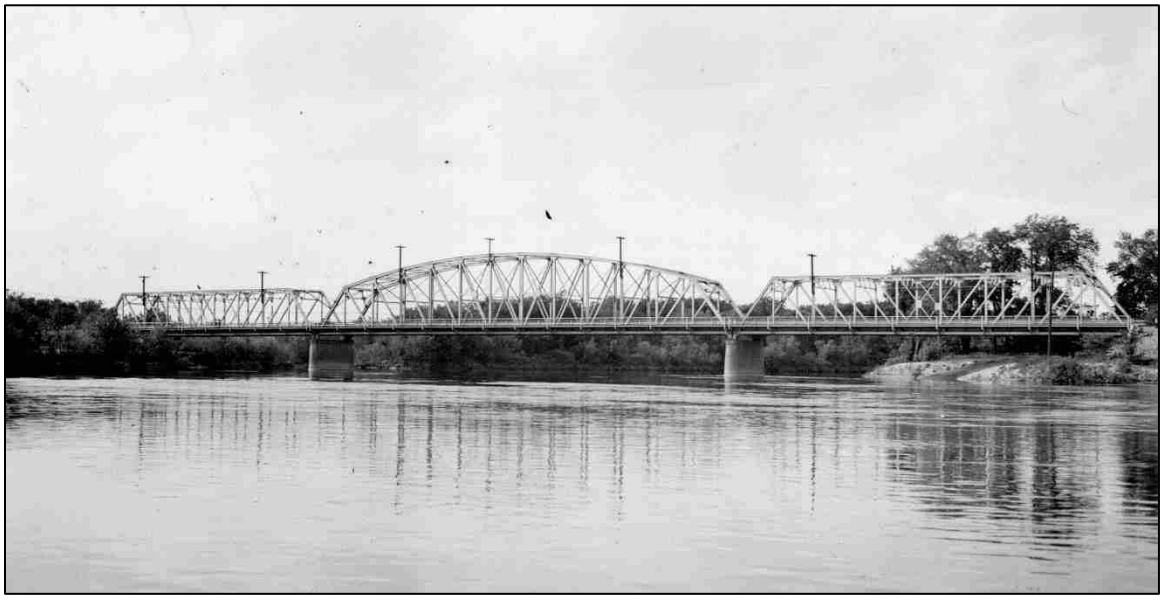

FIGURE 33: South End Bridge built 1933; photo dated 1940 replaced 1915 Pembroke Bridge. The South End Bridge (Concord 186/103) was replaced in 1998 with the present 5-span I-beam stringer bridge Concord 185/104), since named the Korean Veterans Memorial Bridge (NHDOT bridge card Concord 186/103).

FIGURE 34: Borough Bridge over Contoocook River canal near Holden's Mill, Penacook. Date of original bridge unknown; substantially rebuilt in 1892 as shown in postcard, circa 1910. Replaced by steel truss bridge in 1915 (Penacook Village Association).

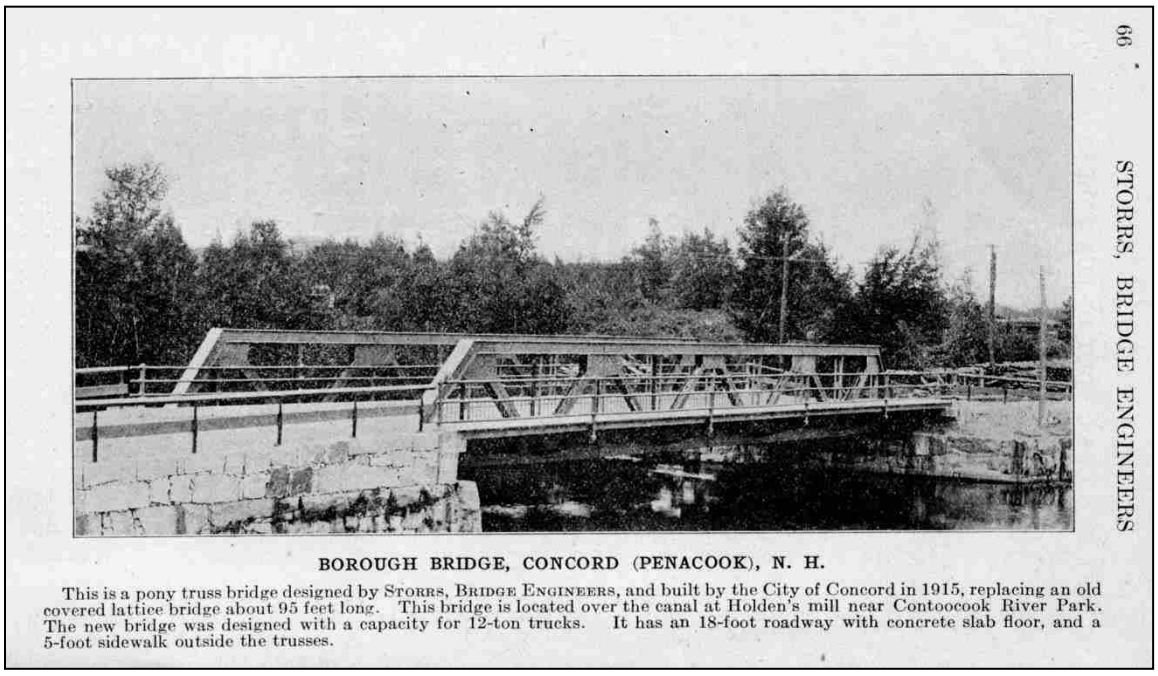

FIGURE 35: Borough Bridge, 1915 (Storrs & Storrs 1918).

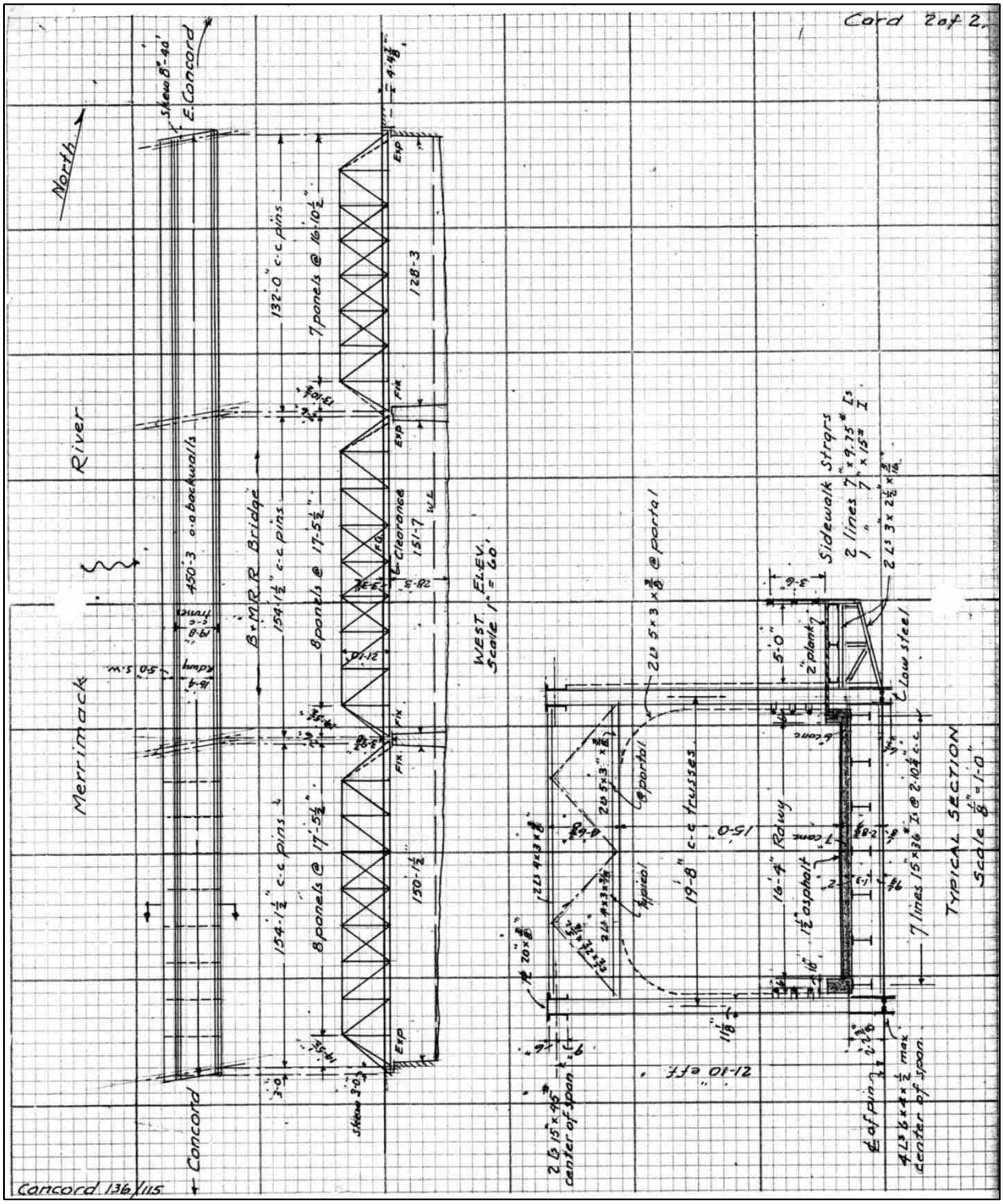

FIGURE 36: Federal Bridge 1915. Plan, elevation and section sketch made by NHHD engineer Wendell H. Piper, c.1940 (NHDOT bridge card Concord 136/115, no date on card).

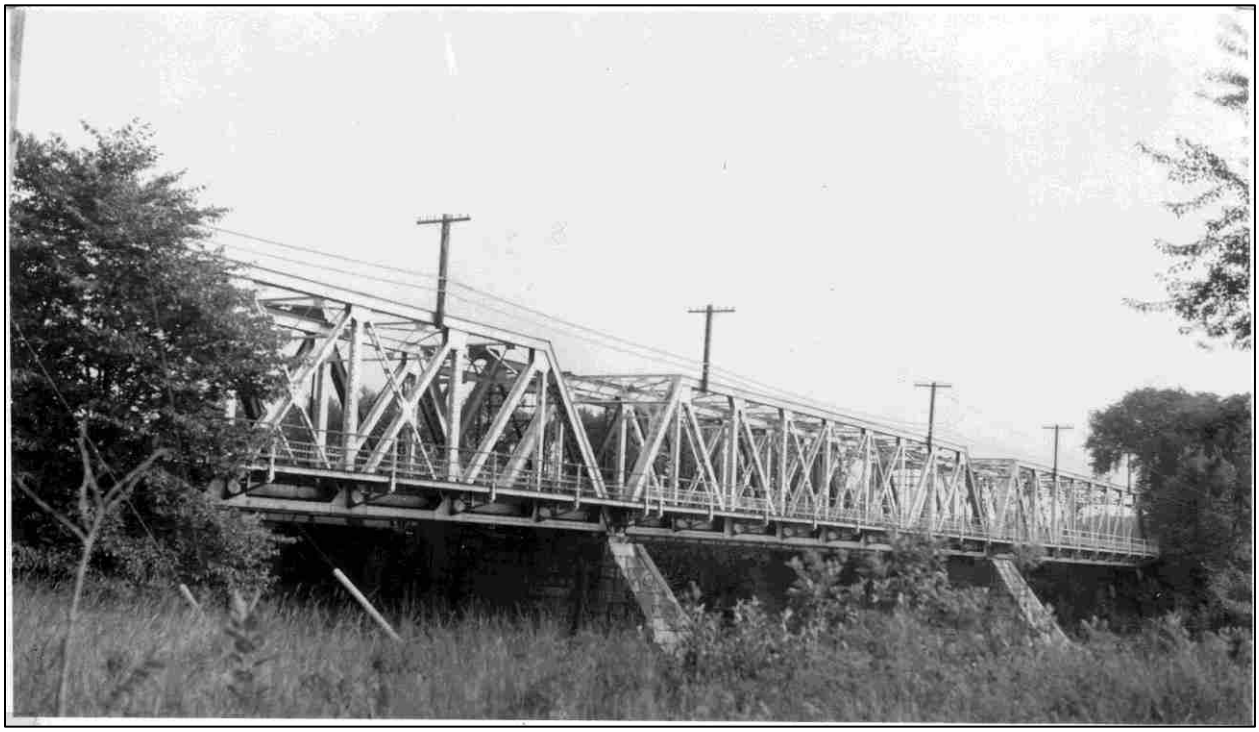

FIGURE 37: Federal Bridge, built 1915, showing upstream side. Photo c. 1940. Boston & Maine Railroad Bridge just visible behind. This bridge was replaced by the US 93 bridge in 1959 (NHDOT bridge card Concord 136/115, no date on card, c. 1940).

FIGURE 38: Federal Bridge, built 1915, showing south approach and portal. Photo c. 1940. Boston & Maine Railroad Railroad Bridge at right (NHDOT bridge card Concord 136/115, no date, c. 1940).

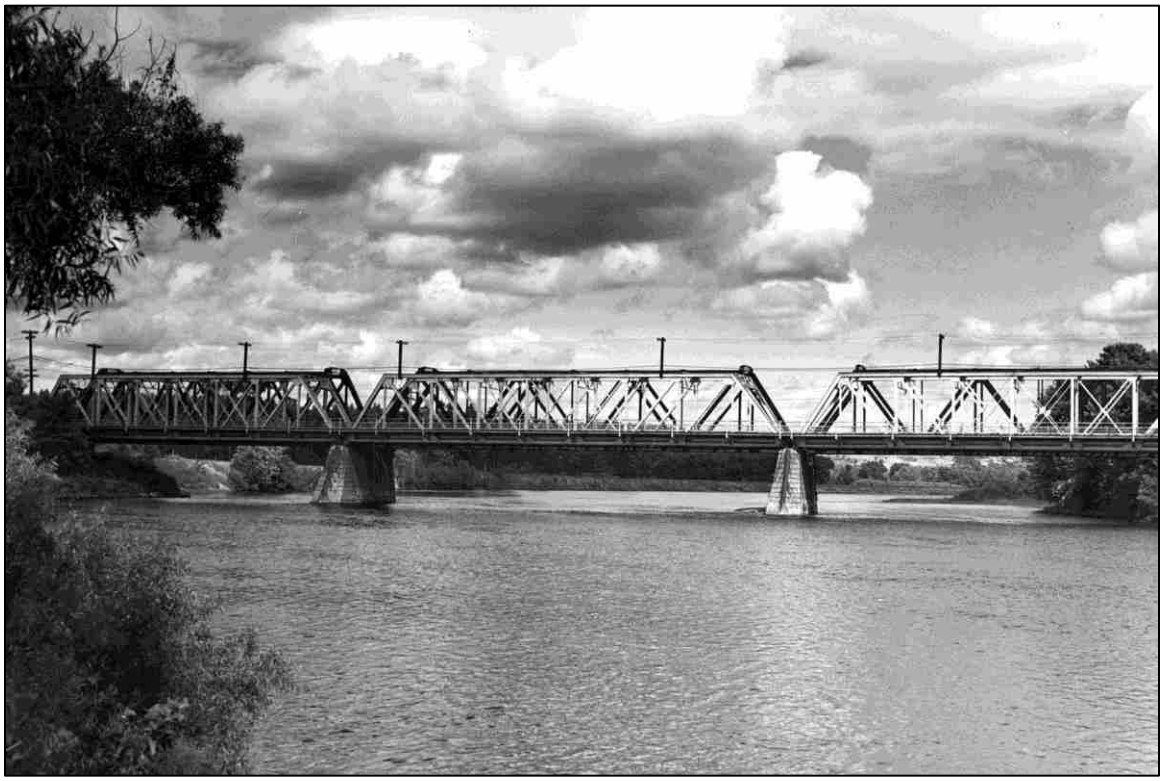

FIGURE 39: Federal Bridge, 1915 upstream side, no date. Photograph courtesy of Concord Public Library Photograph Collection.

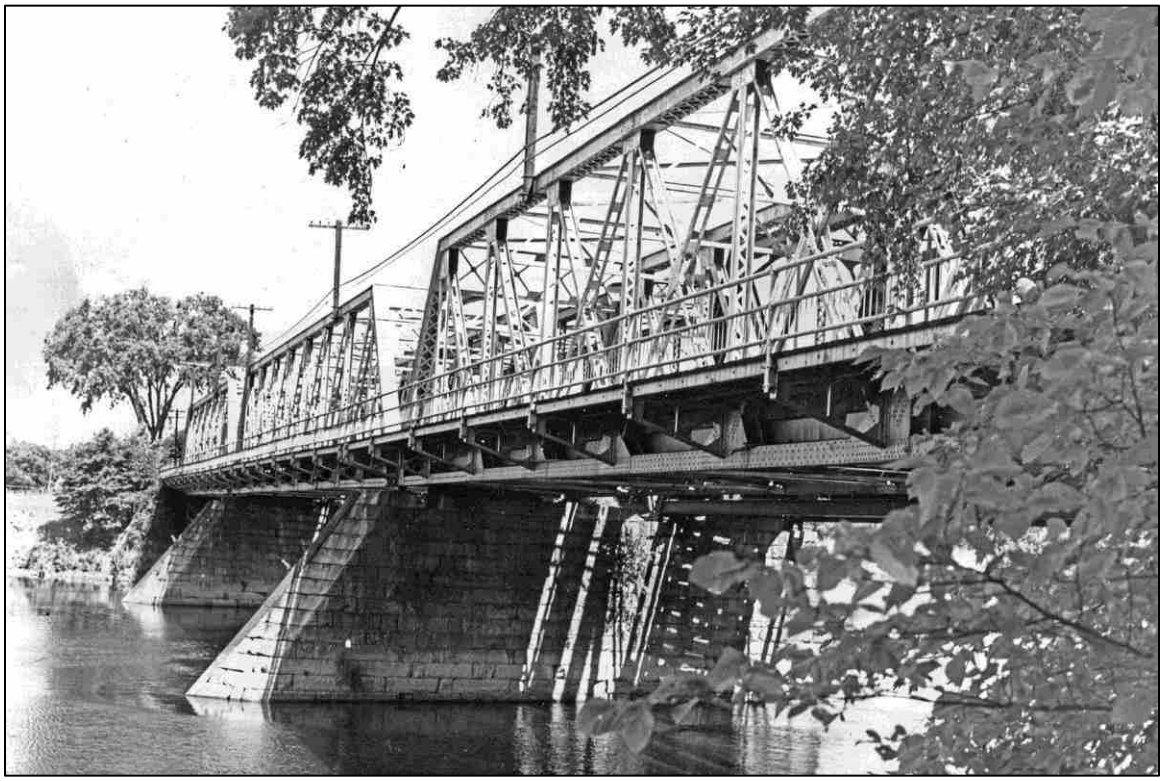

FIGURE 40: Federal Bridge, 1915 upstream side and pier detail, no date. Photograph courtesy of Concord Public Library Photograph Collection.

FIGURE 41: Main Street Bridge Penacook, north approach, looking south. Pratt truss built 1898 by Wrought Iron Bridge Company, Canton, Ohio, replaced 1915. Postcard dated 1906 (Penacook Village Association).

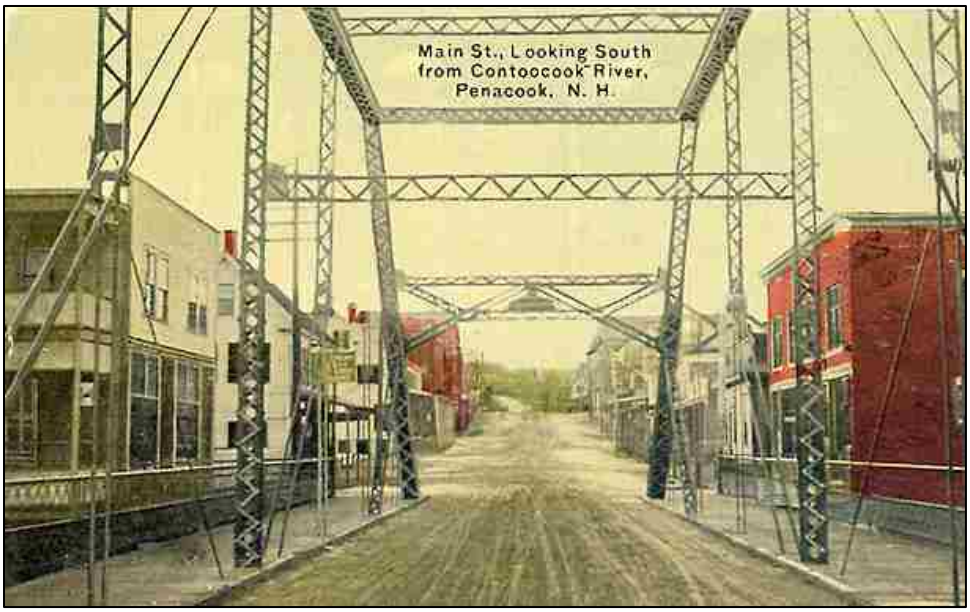

FIGURE 42: Main Street Bridge Penacook. Postcard c. 1906 (Penacook Village Association).

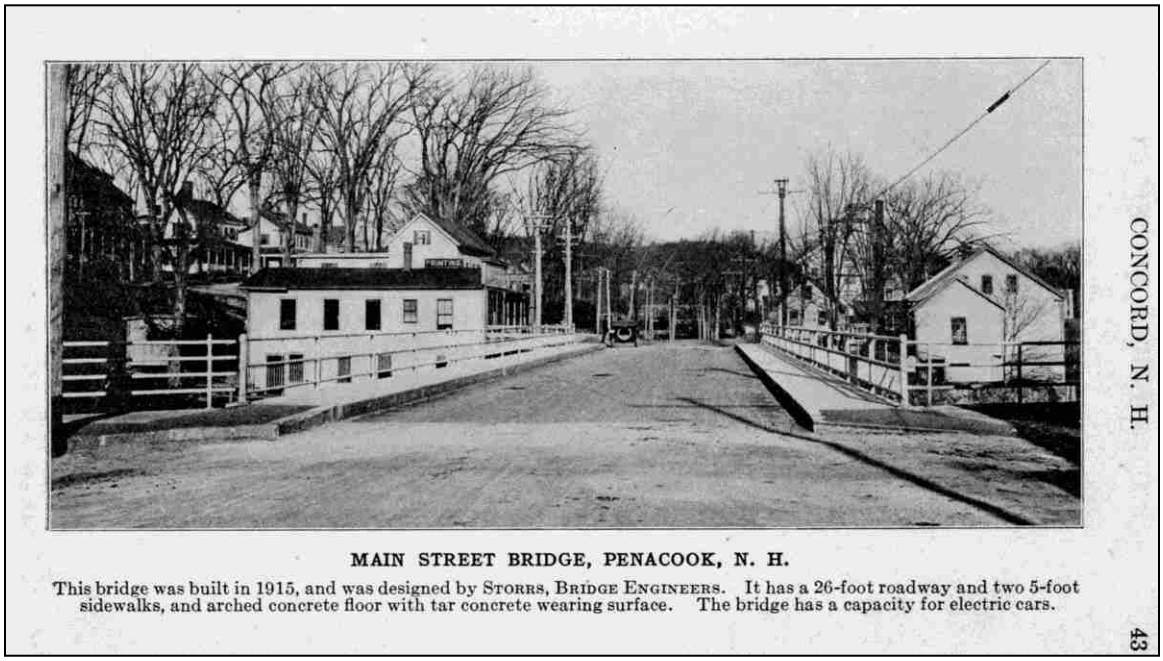

FIGURE 43: Main Street Bridge Penacook, 1915 (Storrs & Storrs 1918).

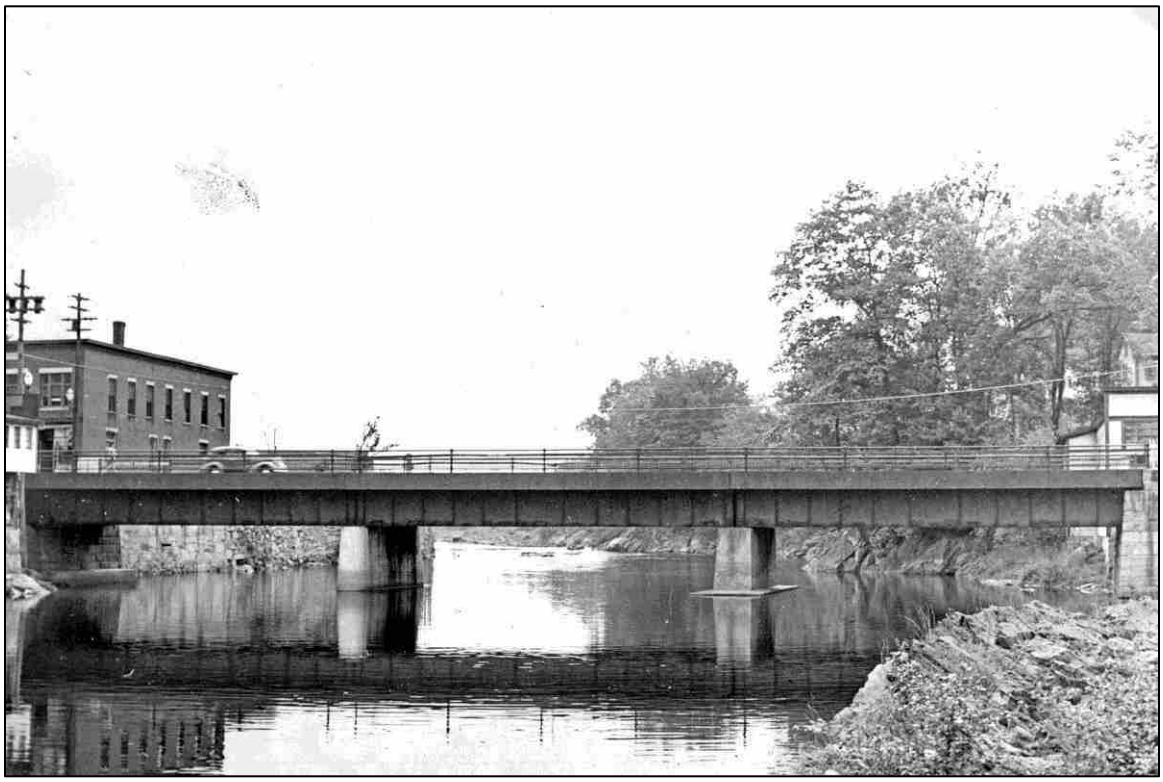
FIGURE 44: Main Street Bridge Penacook, 1915 downstream side, no date. Photograph courtesy of Concord Public Library Photograph Collection.

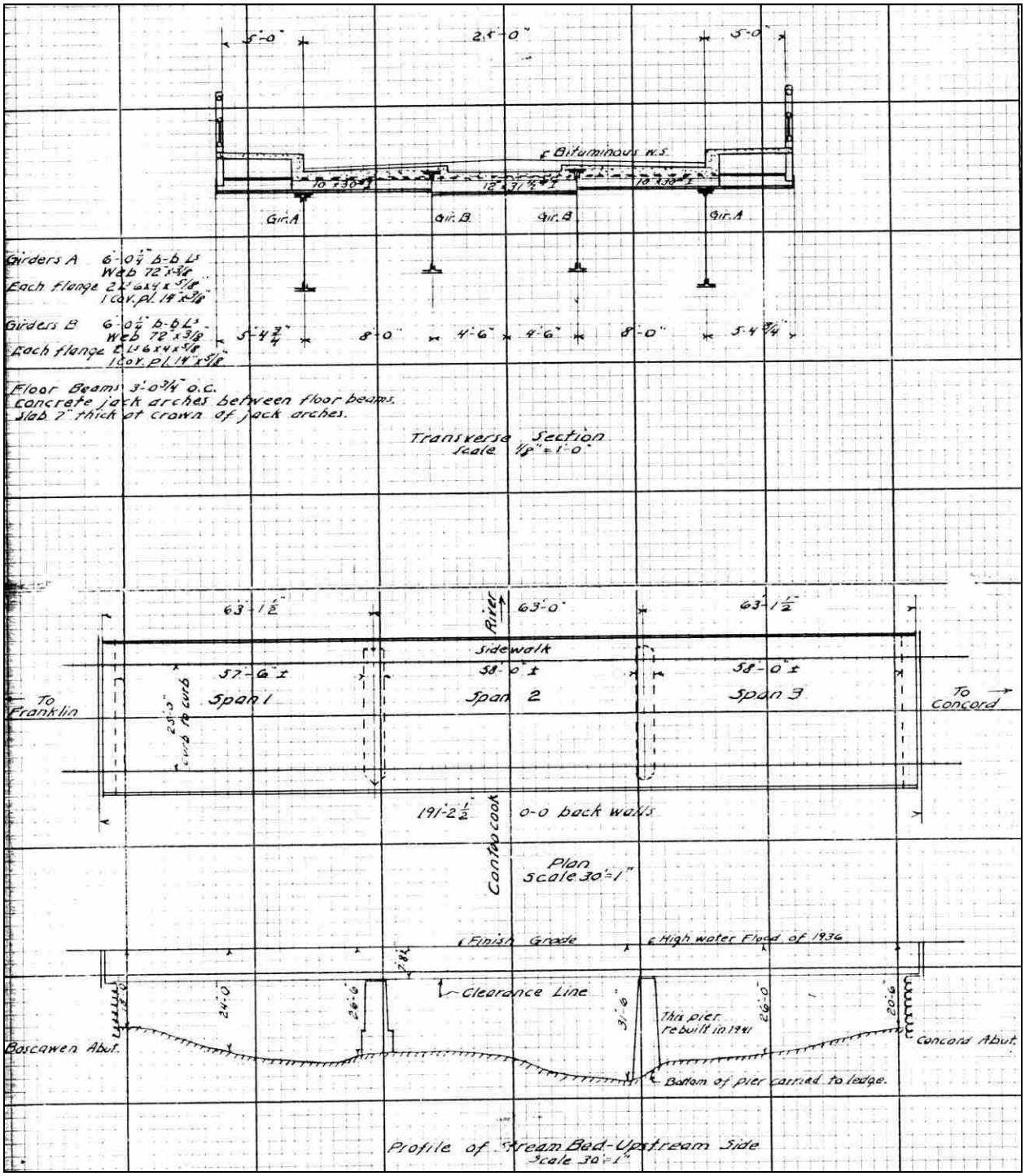

FIGURE 45: Main Street Bridge Penacook, 1915, a three span deck plate girder bridge. Plan elevation and section sketch made by NHHD engineer Wendell H. Piper, June 12, 1940 (NHDOT bridge card Concord 040/090).

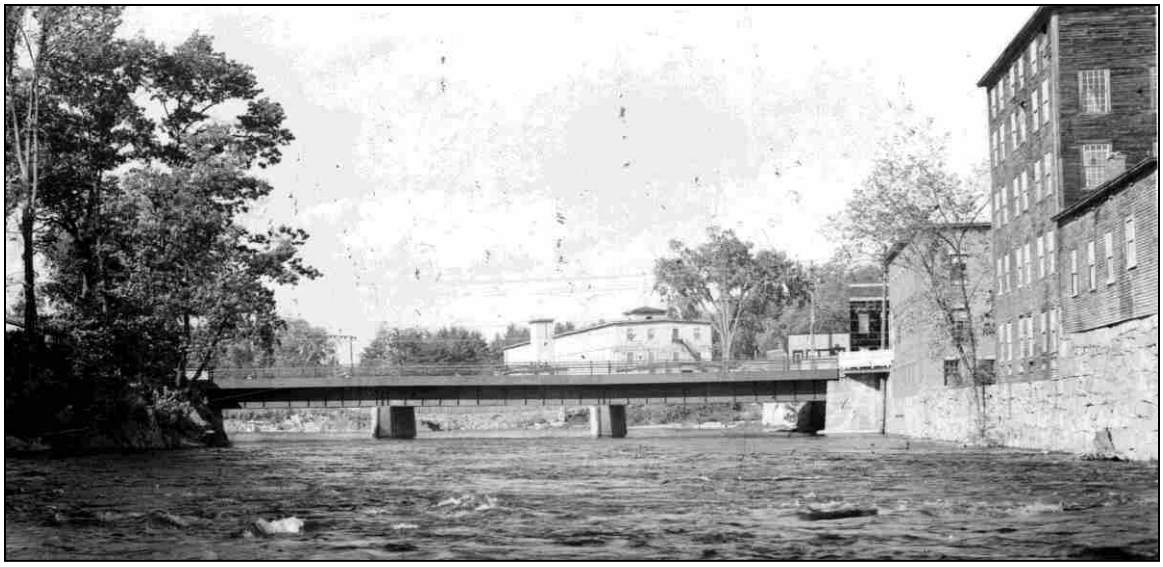

FIGURE 46: Main Street Bridge Penacook, built 1915. Upstream side, photo dated June 12, 1940 (NHDOT bridge card Concord 040/090).

FIGURE 47: Main Street Bridge Penacook, built 1915. North approach, photo dated June 12, 1940 (NHDOT bridge card Concord 040/090).

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SEWALLS FALLS BRIDGE
SEWALLS FALLS ROAD OVER MERRIMACK RIVER
CONCORD
MERRIMACK COUNTY,
NEW HAMPSHIRE.

NEW HAMPSHIRE STATE NO. 727
Photographer: Rob Tucher
April 2015; March 2016

NH-727-1 Context view from upstream of bridge. Looking southeast.

NH-727-2 Upstream side (west elevation) of north span. Looking east.

NH-727-3 Downstream (east elevation), oblique view. Looking northwest.

NH-727-4 West elevation of north span. Looking east.

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NH-727-14 North portal. Looking south.

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NH-727-23 Detail of upper chord, post, diagonal and lateral bracing connections. Looking northeast.

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NH-727-25 Detail of steel deck flooring and concrete joint over floor beam. Looking east.

NH-727-26 Detail of pipe railing, steel curbing, newel post of south truss span, and detail of structural steel guardrail and concrete curbing of approach span. Looking east.

NH-727-27 Detail of pipe railing attachment to truss posts, showing cast iron standoffs. Looking northeast.

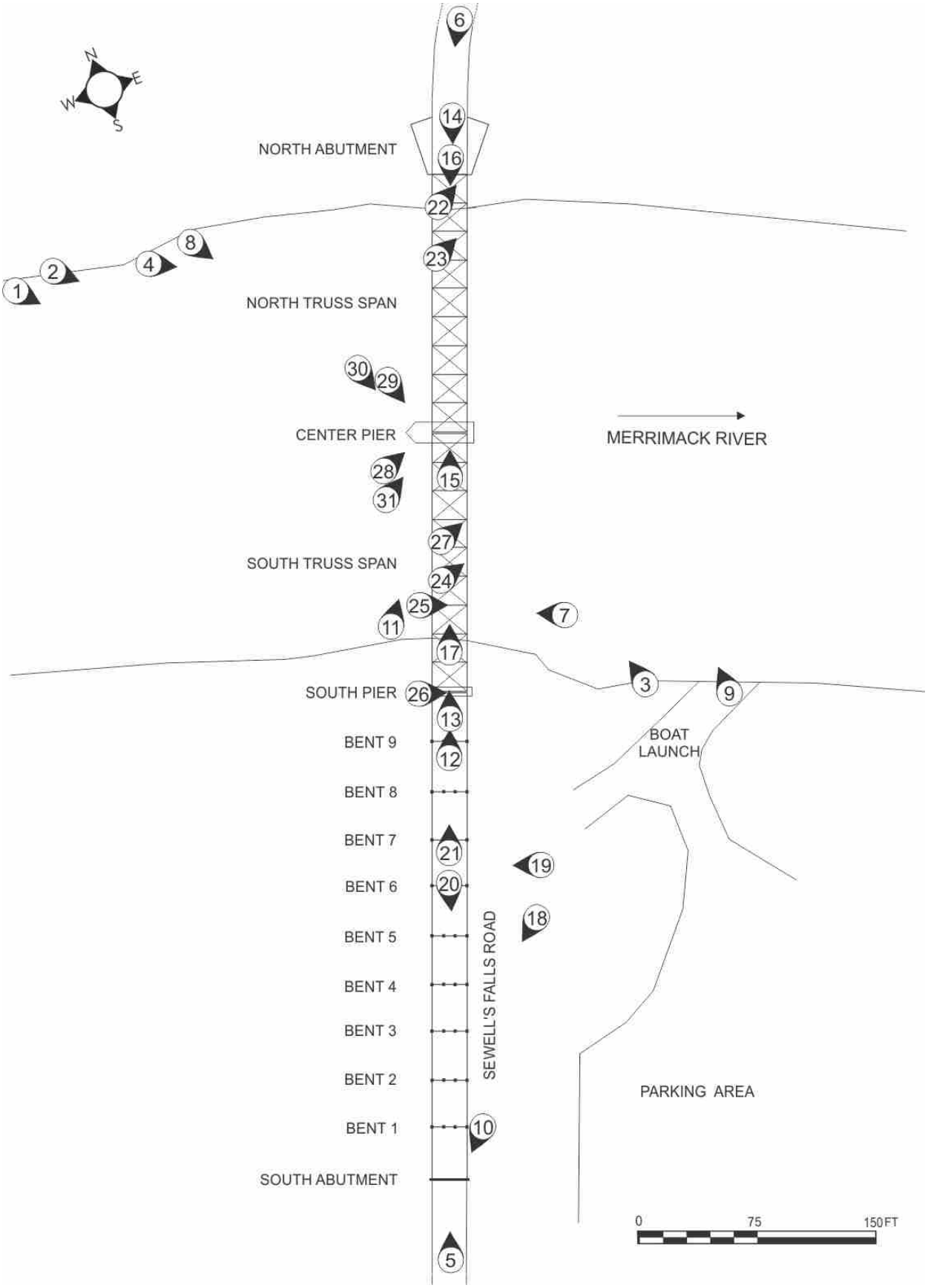
NH-727-28 Center pier, south elevation, showing superstructure removed, prior to demolition, 23 March 2016. Looking northeast.

NH-727-29 Center pier, north elevation, showing superstructure removed, prior to demolition, 23 March 2016. Looking southeast.

NH-727-30 Center pier, north elevation, showing demolition, 23 March 2016. Looking northeast.

NH-727-31 Center pier, south elevation, showing demolition of pier, 23 March 2016. Looking northeast.

SEWALLS FALLS BRIDGE
MERRIMACK RIVER, CONCORD NH
NH STATE NO. 727
KEY TO PHOTOGRAPHS



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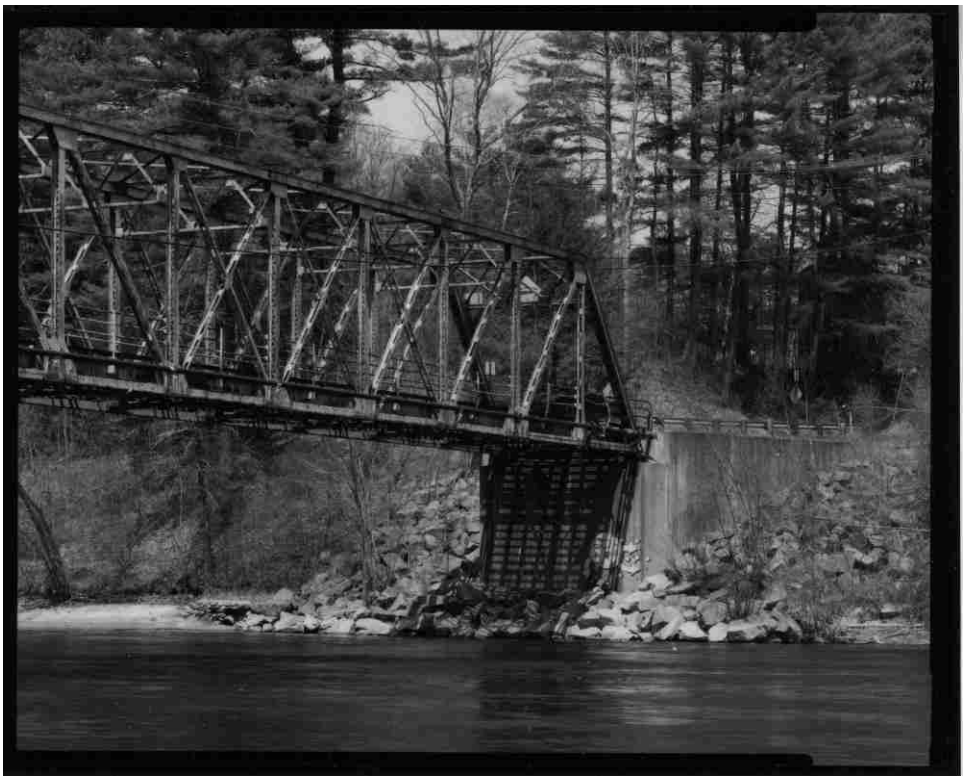

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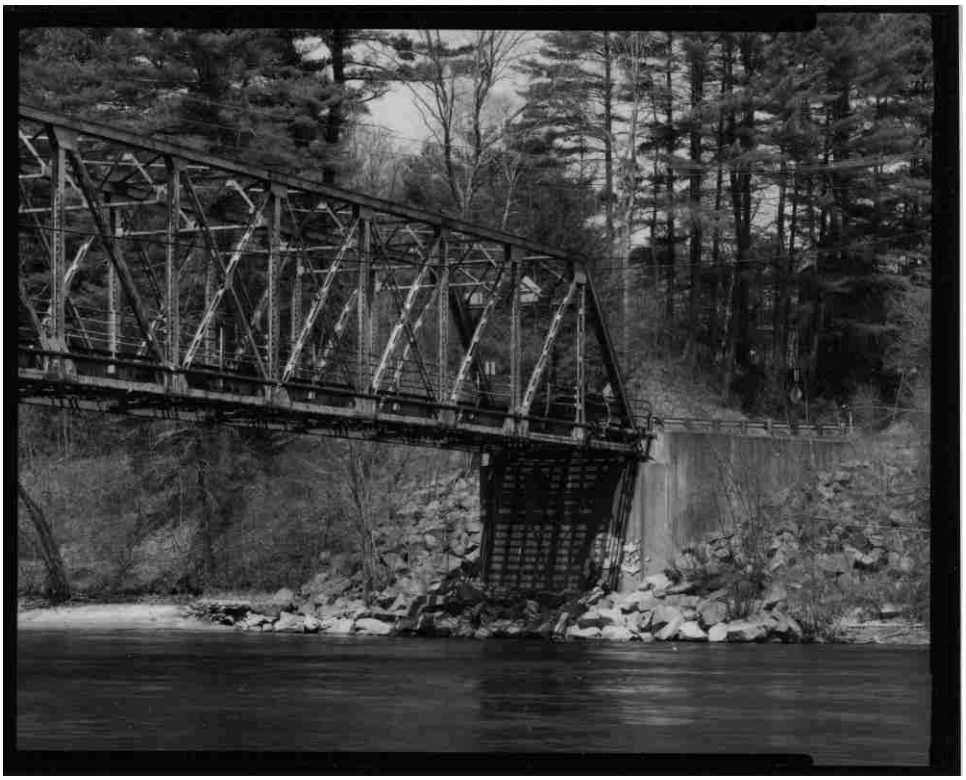

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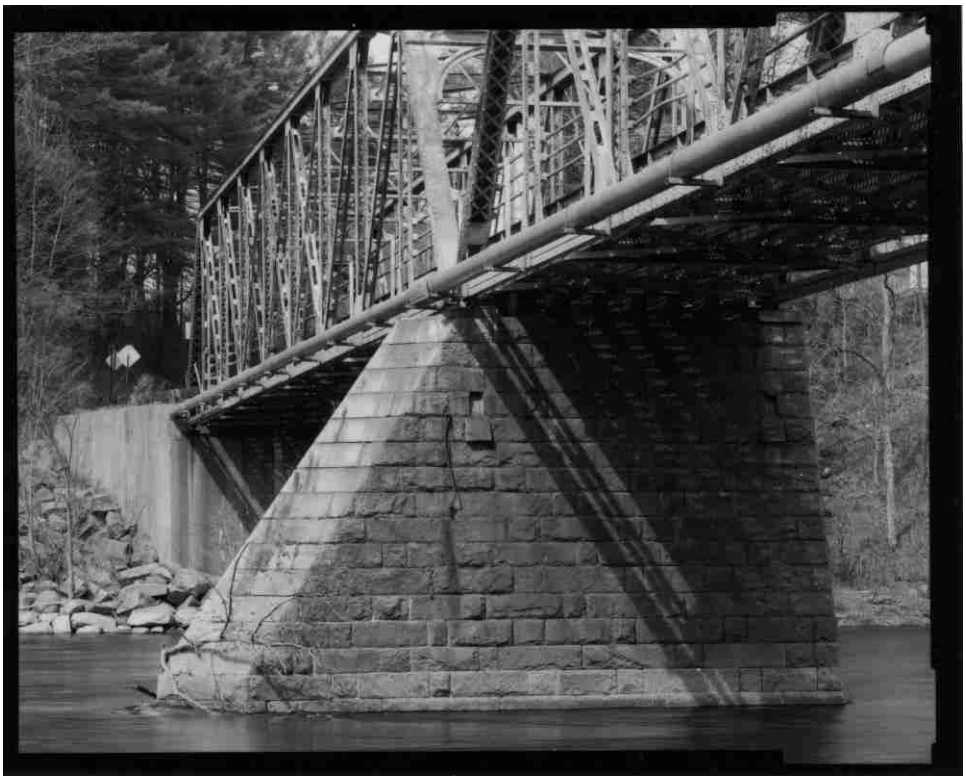

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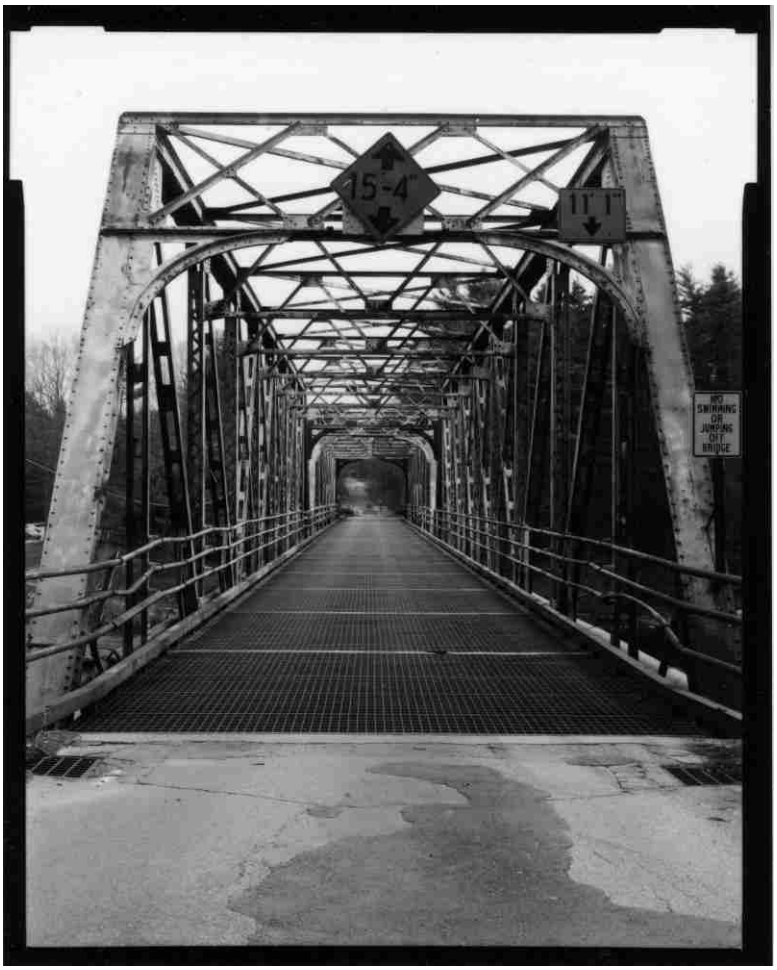
NH-727-13 South portal. Looking north.



NH-727-14 North portal. Looking south.

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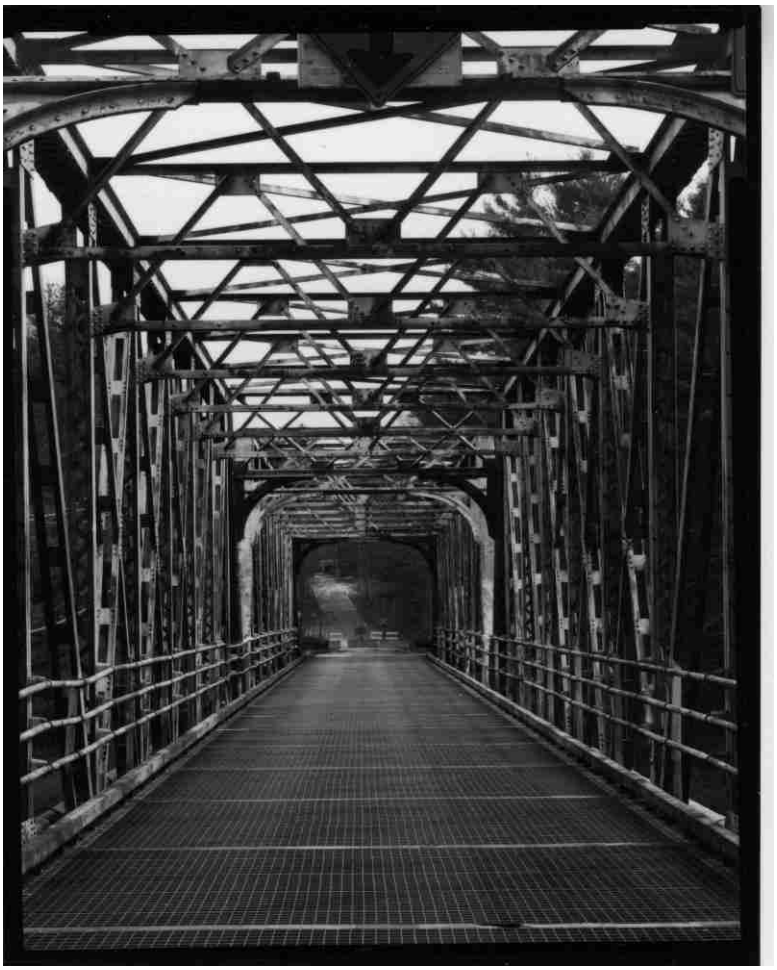

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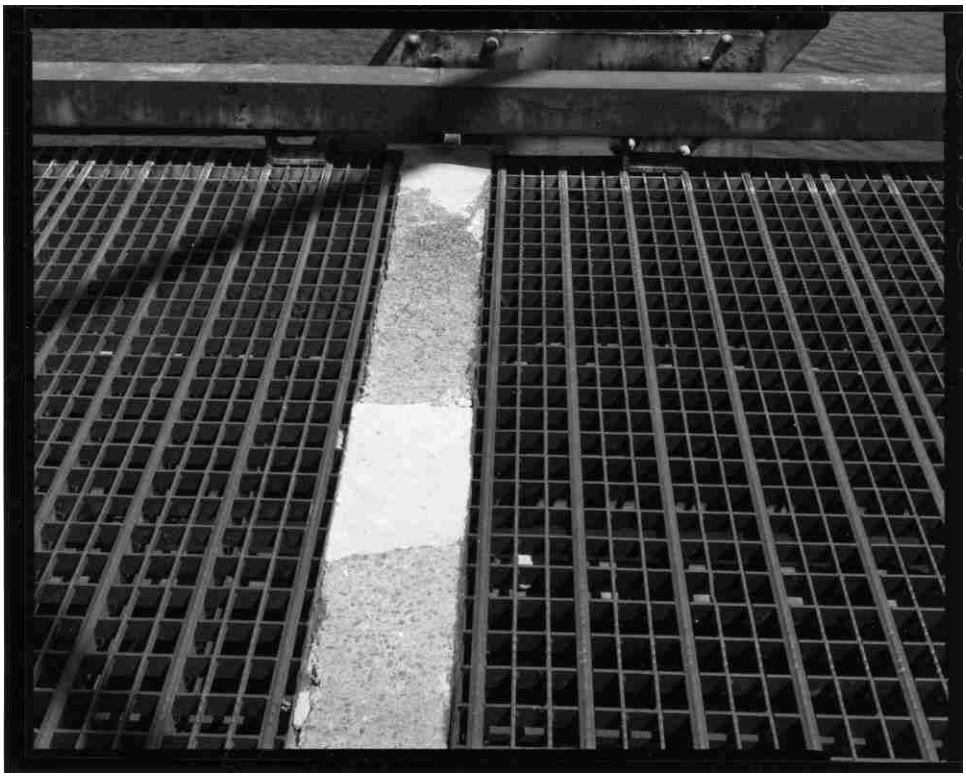

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NH-727-31 Center pier, south elevation, showing demolition of pier, 23 March 2016. Looking northeast.

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NH-727_ DRAWING-02	"City of Concord, N.H. Sewall's Falls Bridge over the Merrimack River, 1915." W.B. Howe, City Engineer, Storrs & Storrs, Bridge Engineers, Concord, N.H." Elevation, plan, section. Original drawing on file at New Hampshire Department of Transportation, Concord. Plan File 2-12-1-16.
NH-727_DRAWING-03	"Sewall's Falls Bridge over the Merrimack River, City of Concord, N.H." Shop drawing plans and specifications. Berlin Construction Company. Contract 3998. April 28, 1915. Original drawing on file at New Hampshire Department of Transportation, Concord. Plan File 2-12-1-16.
NH-727_ DRAWING-04	"City of Concord, N.H. Sewall's Falls Bridge. Miscellaneous Details." Shop drawing. Berlin Construction Company. Contract 3998. April 22, 1915. Original drawing on file at New Hampshire Department of Transportation, Concord. Plan File 2-12-1-16.
NH-727_ DRAWING-05	"Sewall's Falls Bridge over the Merrimack River, 1915. City of Concord, N.H." Shop drawing, riveting diagram. Berlin Construction Company. [Drawing and title block damaged]. Original drawing on file at New Hampshire Department of Transportation, Concord. Plan File 2-12-1-16.
NH-727_ DRAWING-06	[Sewall's Falls Bridge over the Merrimack River, City of Concord, N.H.] Shop drawing, bridge railing. Berlin Construction Company. Contract 3998. May 4, 1915. Original drawing on file at New Hampshire Department of Transportation, Concord. Plan File 2-12-1-16.
NH-727_ DRAWING-07	[Sewall's Falls Bridge over the Merrimack River, City of Concord, N.H.] Shop drawings and specifications on note paper, S-1, Floor beams, April 23, 1915; S-2, Floor beams, April 23, 1915; S-3, Name plate details, May 8, 1915. Berlin Construction Company. Contract 3998. Original drawings on file at New Hampshire Department of Transportation, Concord. Plan File 2-12-1-16.

NH-727_ DRAWING-08 [Sewall's Falls Bridge over the Merrimack River, City of Concord, N.H.] New Hampshire Highway Department. Temporary timber bent falsework to support truss following 1936 flood. Harold E. Langley, designer. November 23, 1936. Original drawing on file at New Hampshire Department of Transportation, Concord. Plan File 1-16-1-1.

NH-727_ DRAWING-09 New Hampshire Highway Department. Works Progress Administration Project. W.P.F.R. [Flood Relief] No. 245; W.P.A. 10067. Sewall's Falls Road. City of Concord. Title Sheet [1]. December 21, 1936. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 1-16-1-1.

NH-727_ DRAWING-10 New Hampshire Highway Department. Works Progress Administration Project. W.P.F.R. [Flood Relief] No. 245; W.P.A. 10067. Sewall's Falls Road. City of Concord. Typical sections of approaches. Sheet 2 of 4. December 21, 1936. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 1-16-1-1.

NH-727_ DRAWING-11 New Hampshire Highway Department. Works Progress Administration Project. W.P.F.R. [Flood Relief] No. 245; W.P.A. 10067. Sewall's Falls Road. City of Concord. South pier, plan, elevation, sections. Sheet 3 of 4. December 15, 1936. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 1-16-1-1.

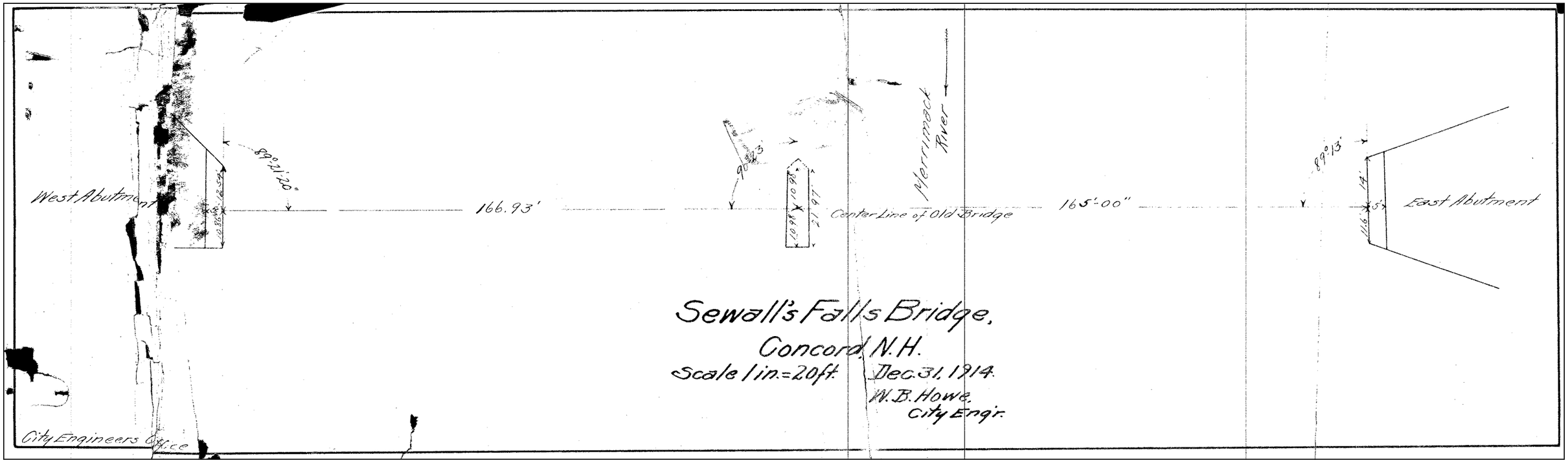
NH-727_ DRAWING-12 New Hampshire Highway Department. Works Progress Administration Project. W.P.F.R. [Flood Relief] No. 245; W.P.A. 10067. Sewall's Falls Road. City of Concord. Layouts of approach and river bank; wash boring data. Sheet 4 of 4. December 15, 1936. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 1-16-1-1.

NH-727_ DRAWING-13 New Hampshire Highway Department. Works Progress Administration Project. W.P.M.S. [Projects on State Secondary System-Modifying] No. 304. [Sewall's Falls Road. City of Concord]. Plan and elevation of new approach abutment and piers; wash boring data. Sheet 1 of 3. January 13, 1937. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 1-16-1-1.

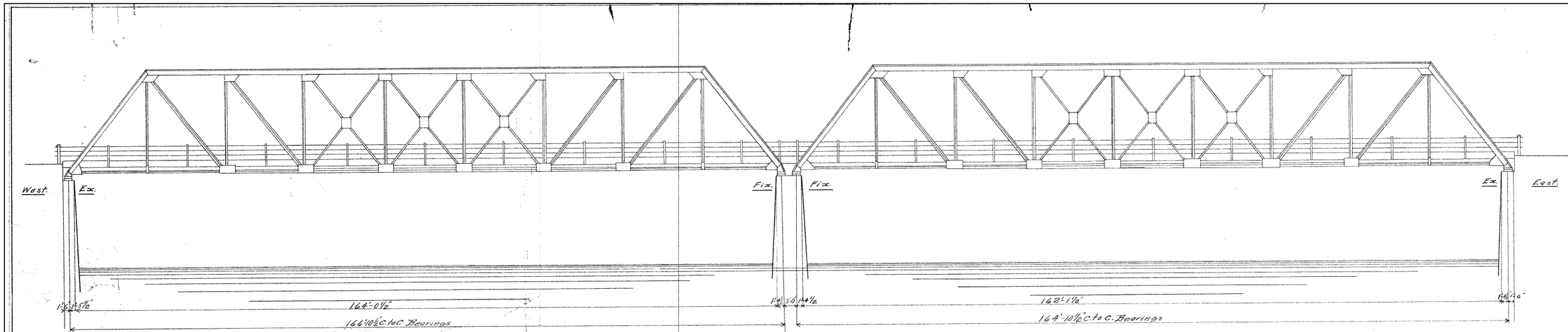
NH-727_ DRAWING-14 New Hampshire Highway Department. Works Progress Administration Project. W.P.M.S. [Projects on State Secondary System-Modifying] No. 304. [Sewall's Falls Road. City of Concord]. Plan, elevation, section, details of new approach superstructure. Sheet 2 of 3. February 12, 1937. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 1-16-1-1.

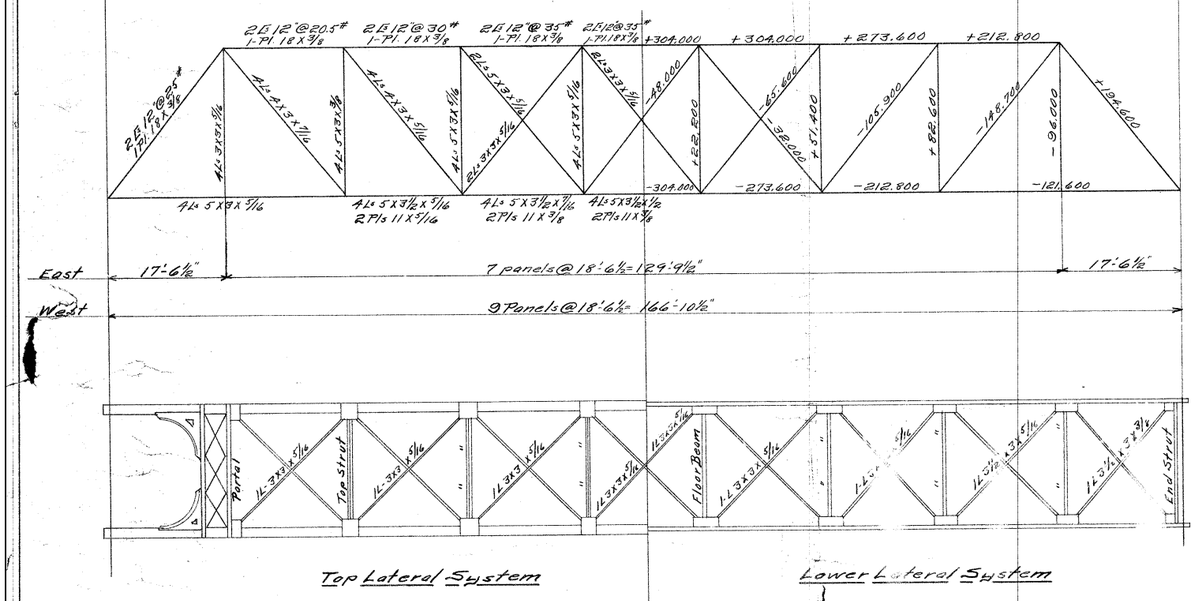
NH-727_ DRAWING-15 New Hampshire Highway Department. Works Progress Administration Project. W.P.M.S. [Projects on State Secondary System-Modifying] No. 304. [Sewall's Falls Road. City of Concord]. Railing and wheel guard details where approach meets new pier. Sheet 3 of 3. December 15, 1936. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 1-16-1-1.

NH-727_ DRAWING-16 New Hampshire Highway Department Bridge Division. Concord Sewall's Falls Bridge No. 070/117. State Project No. S-1720. Proposed New Deck. Plan, elevation, section, details. Sheet 1 of 2. October 17, 1949. Original drawing on file at New Hampshire Department of Transportation, Concord, NH. Plan File 2-12-1-16.



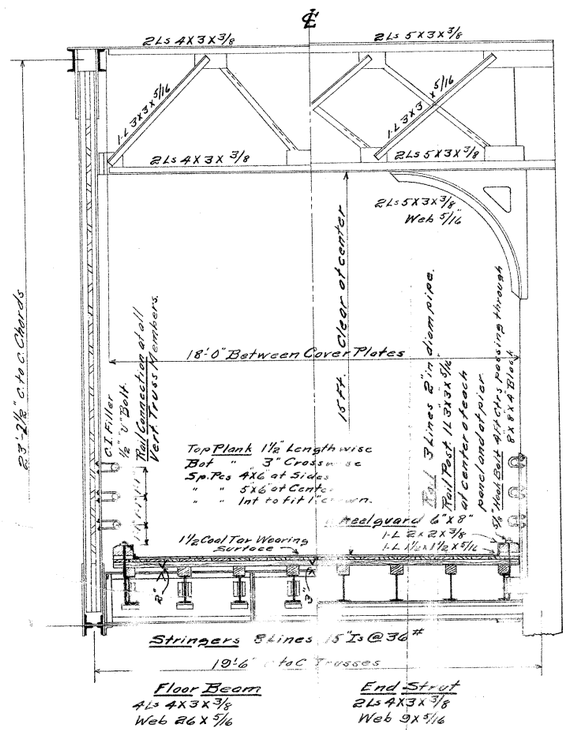
NH-727_DRAWING-01





Top Lateral System

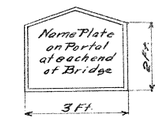
Lower Lateral System



Note:-

Bottom Chord Tie Plates	9"x1/2"	-3 Ft. Centers.
Web Tension " "	9"x3/8"	" " "
Top Chd & End Post " "	18"X3/8"x1'-6" and Double Lat	2 1/4"X3/8"
Web Comp. " "	12"x3/8" and Single Lat	2 1/4"x5/16"

No Metal Less than 5/16" Thk except as noted.



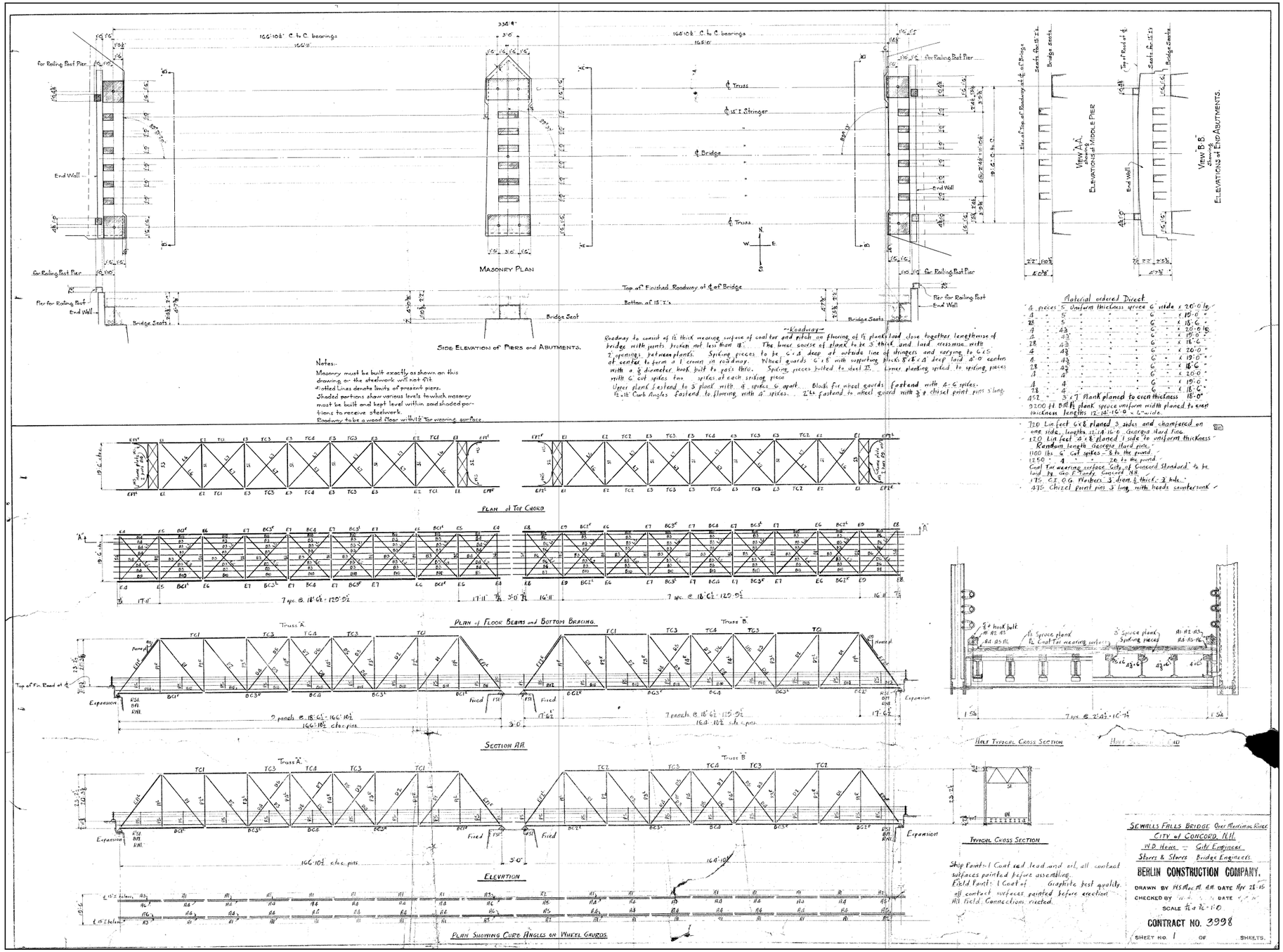
City of Concord, N.H.
Sewalls Falls Bridge
over the Merrimack River.
~1915~

W. B. Howe City Engineer.
Storrs & Storrs Bridge Engineers.
Concord, N.H.

E.D.S.

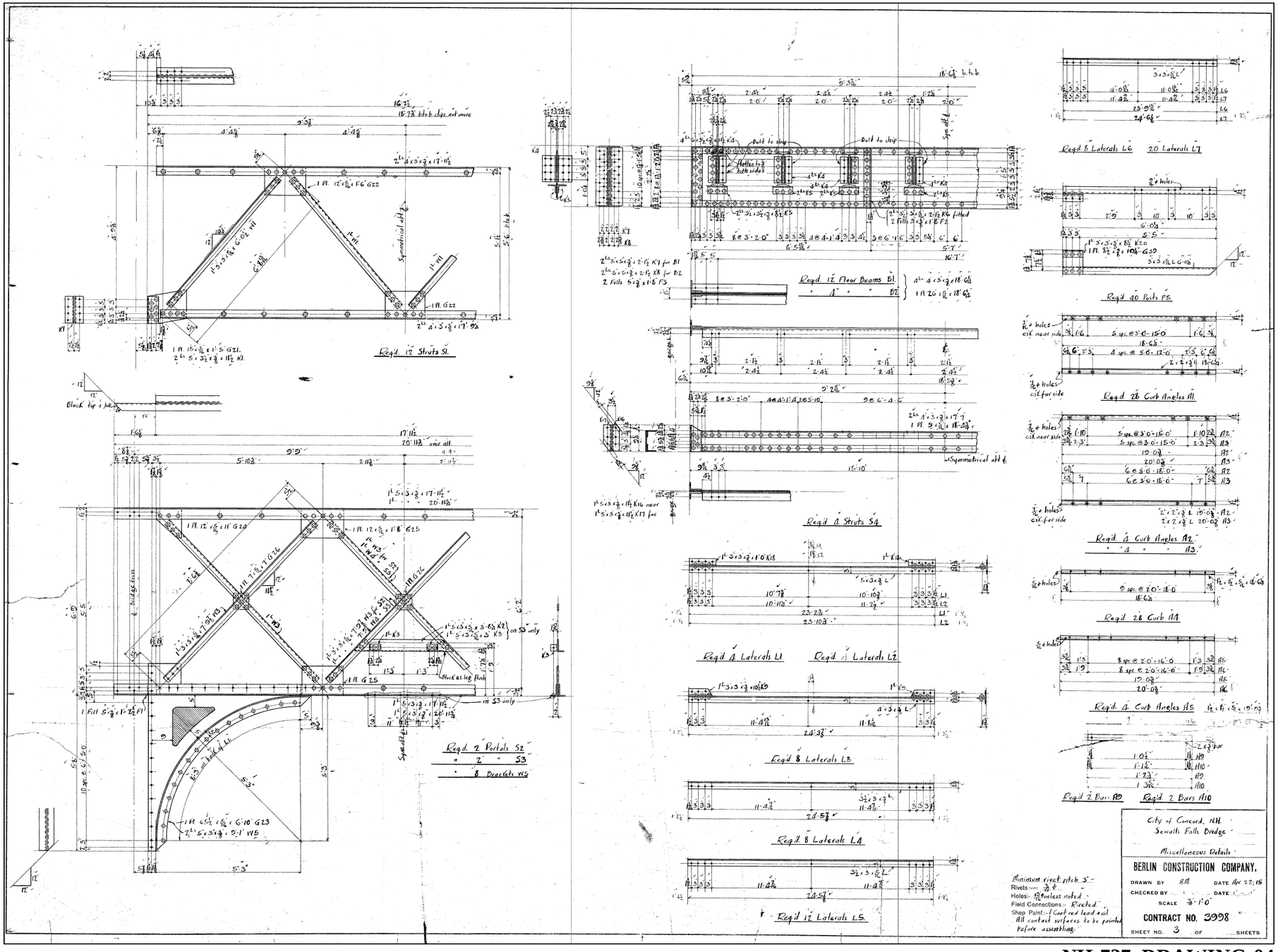
NH-727_DRAWING-02

SEWALL'S FALLS BRIDGE
NH State No. 727
DRAWINGS



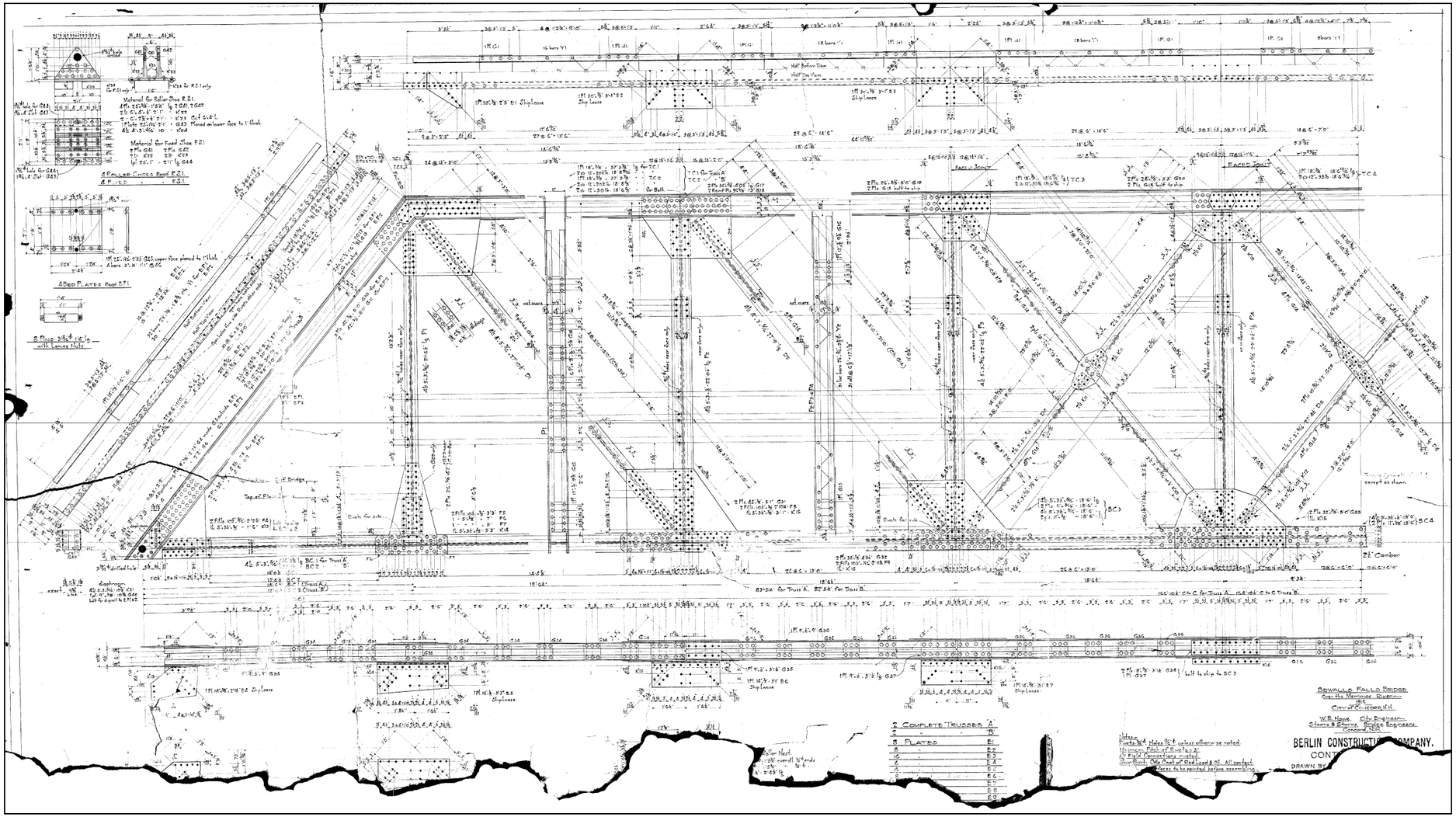
NH-727_DRAWING-03

SEWALL'S FALLS BRIDGE
NH State No. 727
DRAWINGS

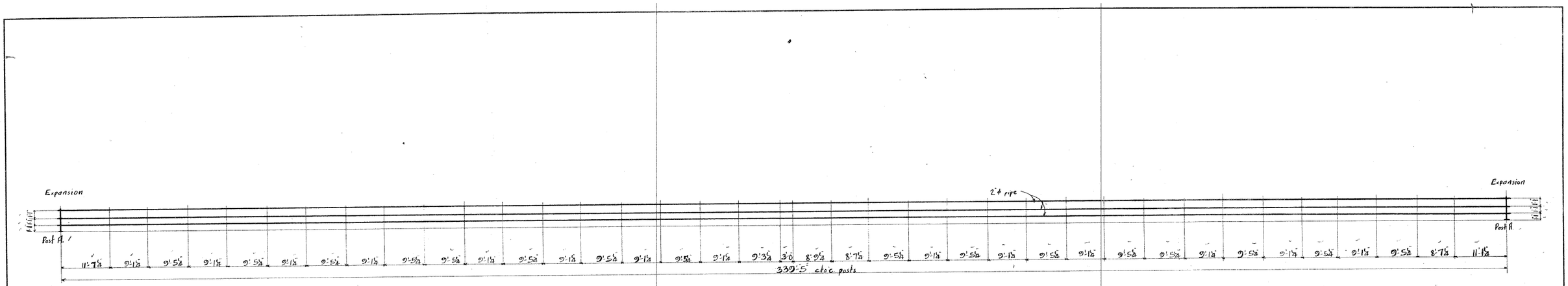


NH-727_DRAWING-04

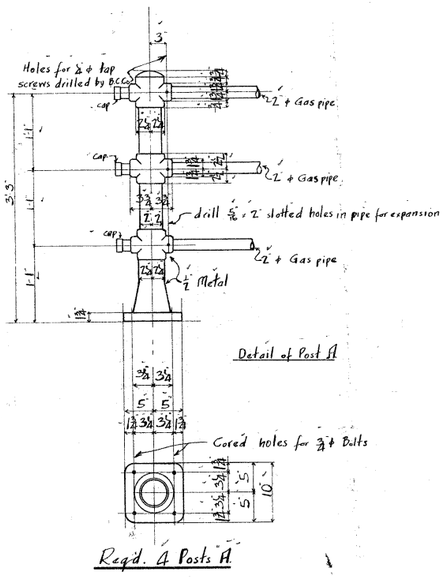
SEWALL'S FALLS BRIDGE
NH State No. 727
DRAWINGS



NH-727_DRAWING-05

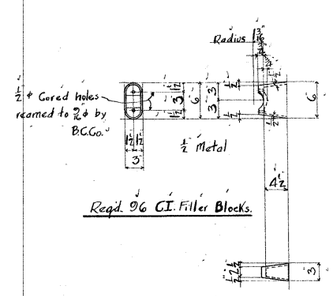


Req'd 2 Complete Railings



Detail of Post A

Req'd. 4 Posts A



Req'd. 96 CI. Filler Blocks.

Notes:-
Size of railing as noted
All pipe to slip through posts A loose and tap screwed to posts with ¼ ϕ tap screws.
Posts to be of cast iron with smooth and even finish
All couplings must be at least 8" either side of working lines as shown on plans
All tapping for ¼ ϕ tap screws done by B.C.Co.

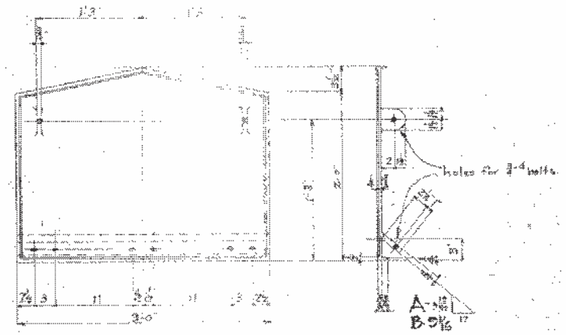
Shop Paint - 1 Coat red lead and [illegible] oil

BERLIN CONSTRUCTION COMPANY.
DRAWN BY A.M. DATE
CHECKED BY [illegible] DATE 1915
SCALE 3/32"-1'-0"
CONTRACT NO. 3998
SHEET NO 4 OF 4 SHEETS.

Form No.

BERLIN CONSTRUCTION CO SHEETS

CONTRACT No. 3998



Detail showing location of back end legs.

1912.
CHARLES J. FRENCH, MAYOR.
BOARD OF PUBLIC WORKS:
E.I. BLACKWOOD. W.A. BROWN.
E.L. DAVIS. M.J. LEE.
N.W. HOBBS. A.P. STURTEVANT.
W.B. HOWE, CITY ENGINEER.
STORES & STORES, BRIDGE ENGINEERS.
CONCORD, N.H.
BUILT BY
BERLIN CONSTRUCTION COMPANY.
BERLIN, CONN.

2 Name Plates Req'd. 1-A 1-B

NAME PLATE. MADE BY S.C.C. 3-8 1912.

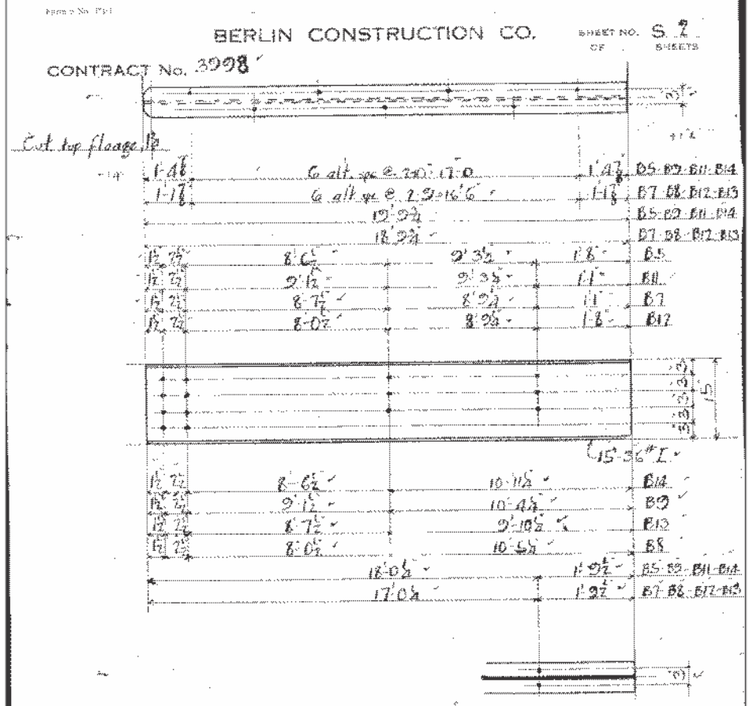
Sewall Falls Bridge, Concord, N.H. DELIVERED BY ____ 19__

3

Form No. 1751

BERLIN CONSTRUCTION CO. SHEET NO. S 2 OF SHEETS

CONTRACT No. 3998



Req'd 1 Beam B5 Req'd 1 Beam B2 Req'd 1 Beam B11 Req'd 1 Beam B14

" 1 " B7 " 1 " B8 " 1 " B12 " 1 " B13

Holes 1/2" ϕ

Shop Paint- 1 Coat red lead & ____ oil

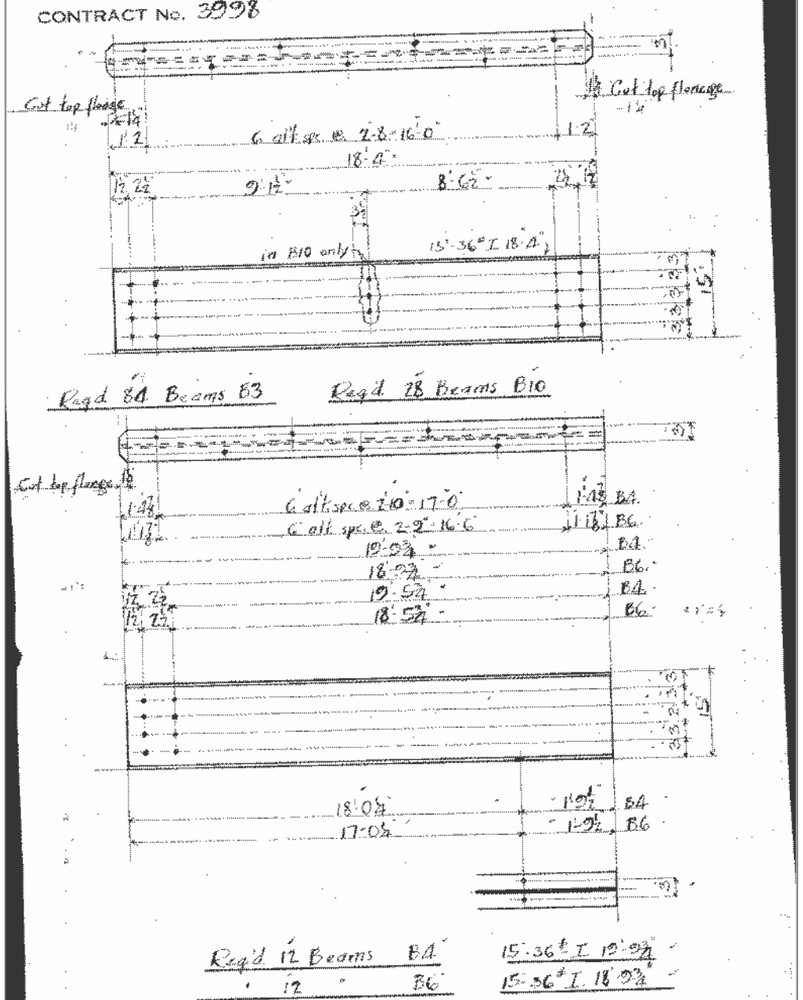
MADE BY Pitt. 4-23 1912

CHECKED BY B.C.C. 1912

Form No. 1751

BERLIN CONSTRUCTION CO. SHEET NO. S 1 OF SHEETS

CONTRACT No. 3998



Req'd 12 Beams B4 15-36# I 19'-9½"

" 12 " B6 15-36# I 18'-9½"

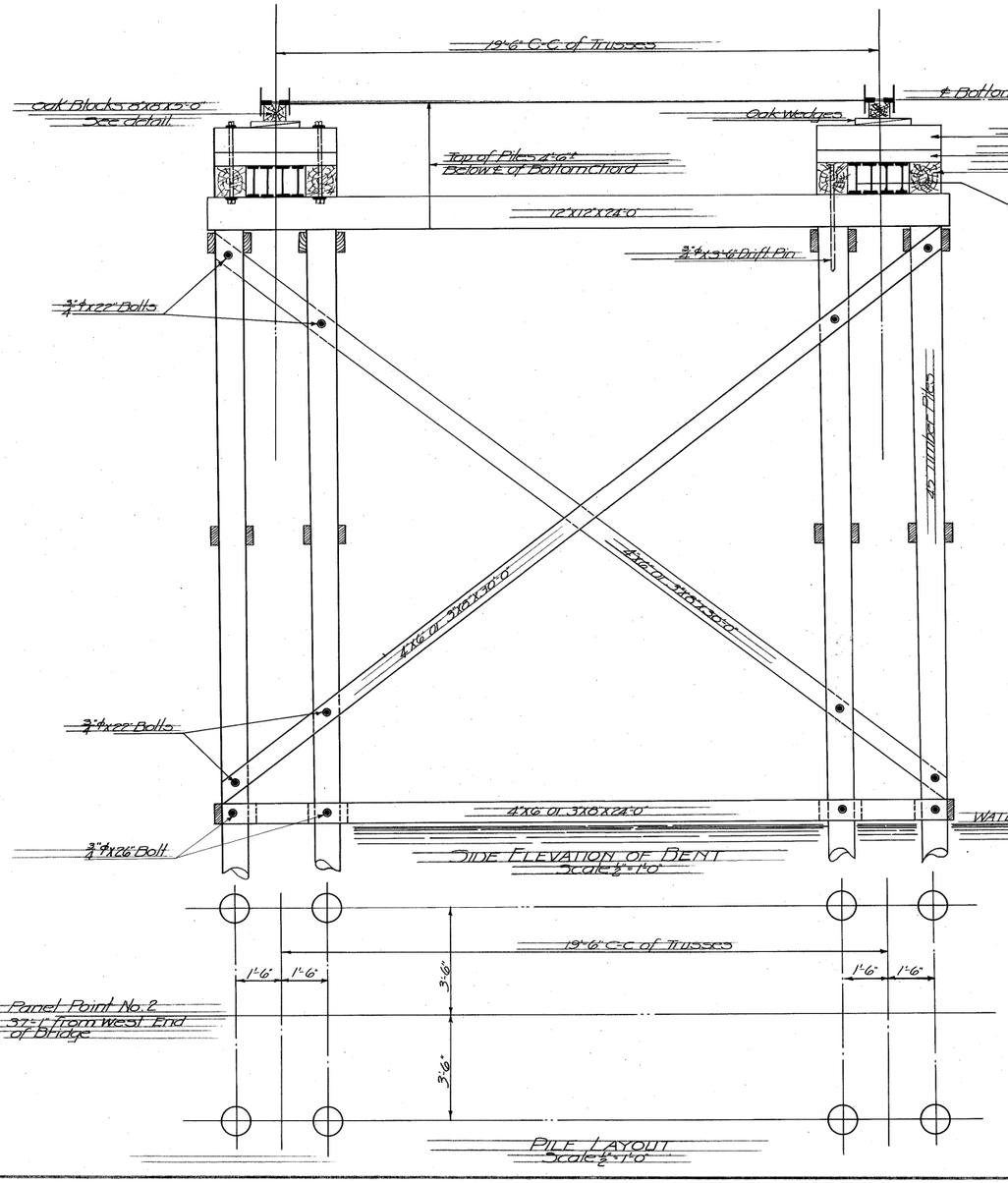
Shop Paint- 1 Coat red lead & ____ oil

Holes 1/2" ϕ

MADE BY Pitt. 4-23 1912

CHECKED BY

FED. ROAD DIST. No.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.				



STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

CITY Concord
PROJECT Sewalls Falls
LOCATION
ROAD
STREAM Merrimack River

DESIGNED BY H.E.L. DATE 11-23-36
DRAWN " H.B.P. " 11-28-36
TRACED " H.J.A. 12-21-36
CHECKED " R.R.K. 12-3-36

SHEET 1 OF 1 SHEETS

~~2-9-8~~ 1-16-1-1

FED. ROAD DIST. No.	STATE	W.P.A. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.	WPFR 24 WPA. 10067	1936	1	7

INDEX OF SHEETS

STATE OF NEW HAMPSHIRE

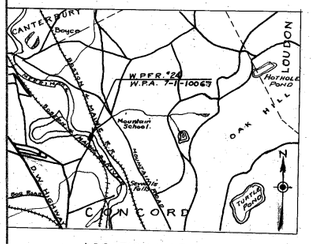
STATE HIGHWAY DEPARTMENT

PLAN AND PROFILE OF PROPOSED
WORKS PROGRESS ADMINISTRATION PROJECT
WPFR NO.24. W.P.A. 10067

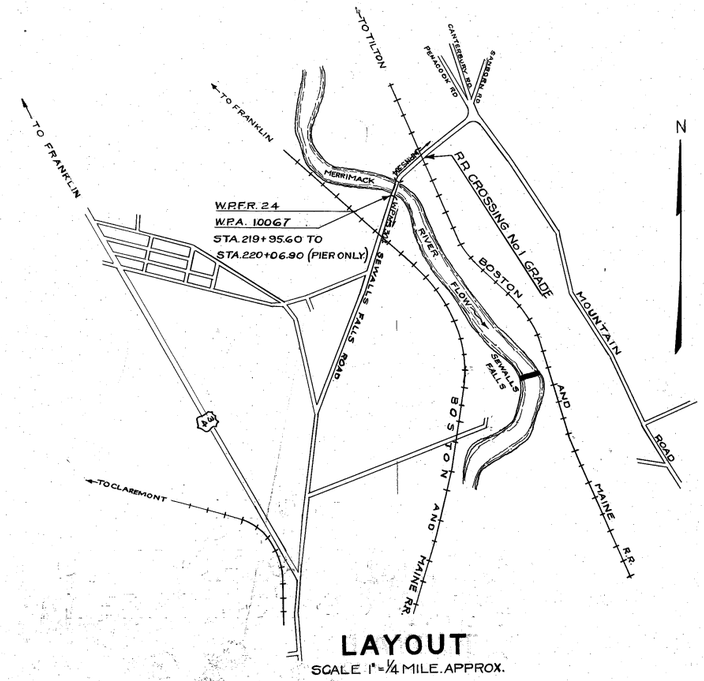
SEWALL'S FALLS ROAD.

SCALES PLAN 1" = 50'
PROFILE VERT 1" = 10'0" HORIZ. 1" = 50'

NOTE. This project to be constructed in accordance with standard specifications on file with the Bureau of Public Roads. and Special Provisions attached to Proposal.



LOCATION MAP.
Scale:- 1" = 1 MILE (APPROX.)



LAYOUT
SCALE 1" = 1/4 MILE. APPROX.

CITY OF CONCORD
MERRIMACK COUNTY

CONVENTIONAL SIGNS

TOWN LINE		SURVEY LINE	30 APPROX. +20
FENCE LINE		CULVERTS	
STONE WALL		POWER POLE	
GUARD RAIL		TELEPHONE POLE	
TRAVELED WAY		GROUND ELEVATION	DATUM LINE
RAILROADS		GRADE ELEVATION	DATUM LINE
RETAINING WALL		MAN HOLE	
DOUBLE FACED WALL		CATCH BASIN	C B
CURBS AND PAVED GUTTERS	CURB GUTTER	WATER GATE	
HEDGE		HYDRANT	HYD

Note:
This sheet revised 12-21-36.
Destroy all previous prints.

RECOMMENDED FOR APPROVAL 12-2-36
[redacted]
CHIEF ENGINEER

APPROVED: J. E. Everett
HIGHWAY COMMISSIONER

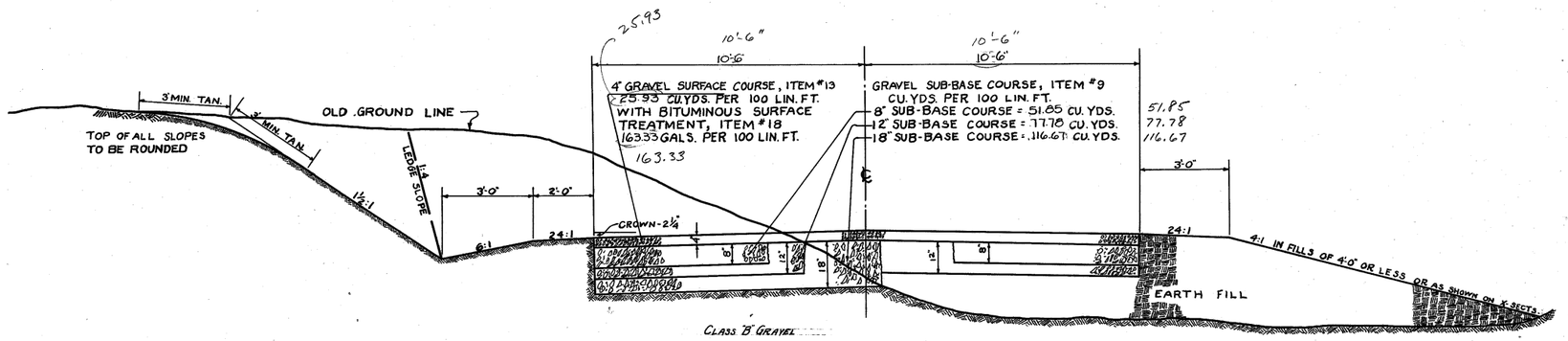
RECOMMENDED FOR APPROVAL:
[redacted]
DISTRICT ENGINEER, BUREAU OF PUBLIC ROADS.

RECOMMENDED FOR APPROVAL:
[redacted]
CHIEF ENGINEER, BUREAU OF PUBLIC ROADS.

APPROVED:
[redacted]
DIRECTOR, BUREAU OF PUBLIC ROADS.

SEWALL'S FALLS BRIDGE
NH State No. 727
DRAWINGS

FED. AID DIST. NO	STATE	STATE PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.	WPFR-24 (MERRIMACK)	1936	2	7



TYPICAL SECTION OF APPROACHES

Note:-
This sheet revised 12-21-36.
Destroy all previous prints.

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

CITY CONCORD
PROJECT WPFR #24
LOCATION NEAR SEWALL'S FALLS
ROAD SEWALL'S FALLS
STREAM MERRIMACK RIVER

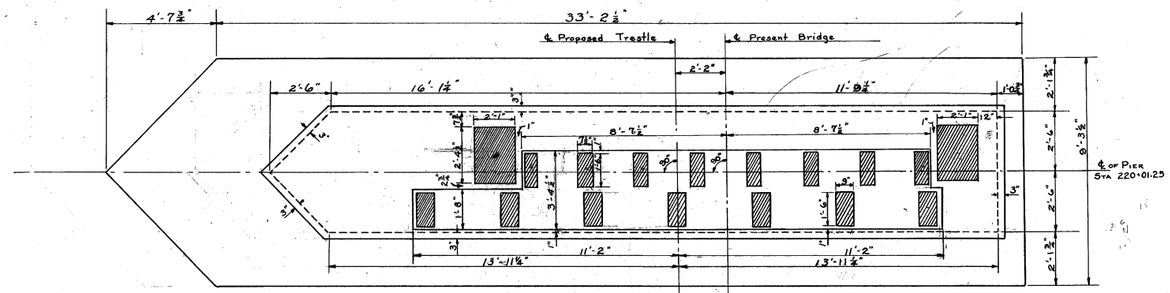
DESIGNED BY		DATE	
DRAWN	"	"	
TRACED	" MH	"	11-23-36
CHECKED	" RRR	"	12-1-36

SHEET 2 OF 4 SHEETS

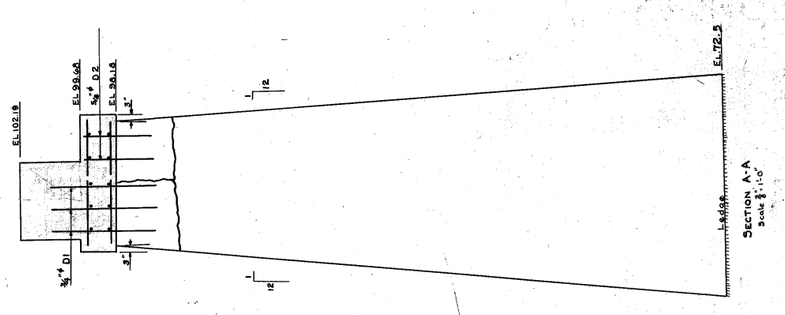
File No. ~~C-7-36~~ 1-16-1-1

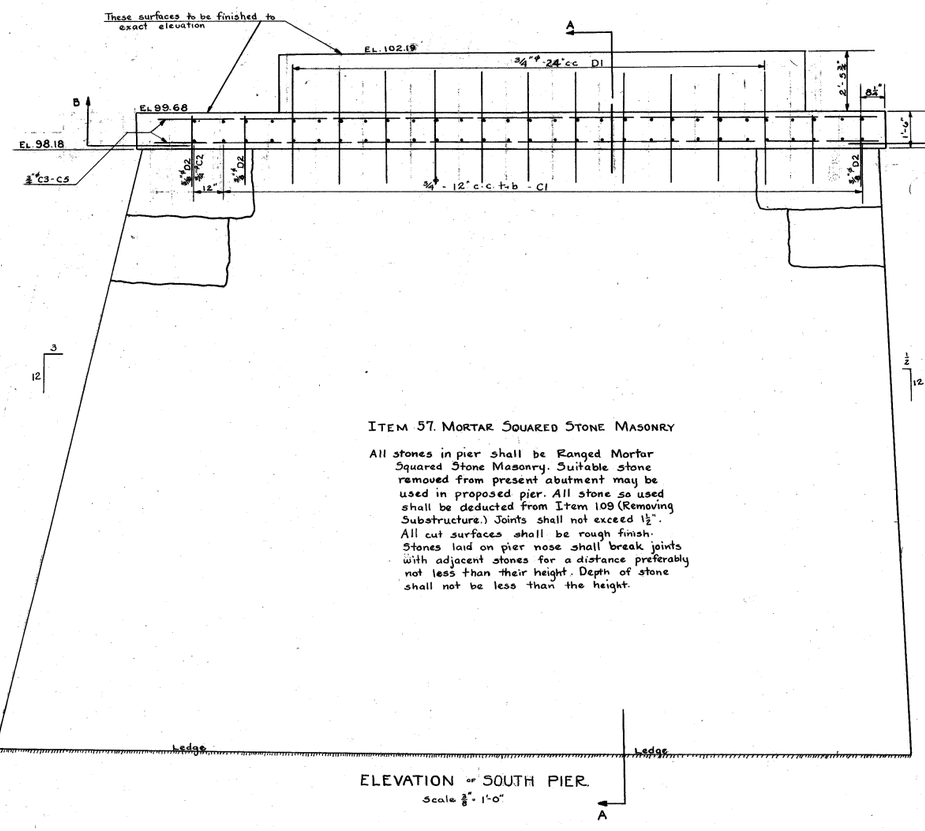
NH-727_DRAWING-10

FED. ROAD DIST. NO.	STATE	WPA PROJ. NO.	FISCAL YEAR	SHEET NO	TOTAL SHEETS
9	N.H.	WPR 24 WPA-1000	1936	3	7

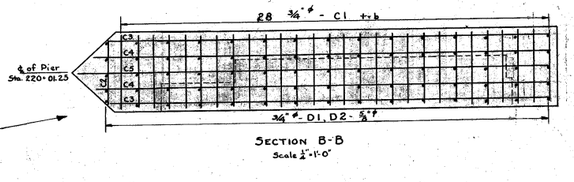


PLAN of SOUTH PIER.
Scale ⅜" = 1'-0"





ELEVATION of SOUTH PIER.
Scale ⅜" = 1'-0"



SECTION B-B
Scale ½"=1'-0"

Section B-B Note:
All vertical bars within dotted area to be ¾"ℓ D1

ITEM 57. MORTAR SQUARED STONE MASONRY

All stones in pier shall be Ranged Mortar Squared Stone Masonry. Suitable stone removed from present abutment may be used in proposed pier. All stone so used shall be deducted from Item 109 (Removing Substructure.) Joints shall not exceed ½". All cut surfaces shall be rough finish. Stones laid on pier nose shall break joints with adjacent stones for a distance preferably not less than their height. Depth of stone shall not be less than the height.

NOTES

Present Abutment to be removed as directed by the ENGINEER.
All excavation for proposed pier above EL. 78.0 shall be included under ITEM 109 (Removing Substructure). All excavation for proposed pier below EL. 78.0 shall be included under ITEM 98 (Structure Excavation Unclassified.)
Retain present two span through Pratt truss bridge. Span lengths 164'-10½" and 166'-10½" c-c bearings. Clear roadway 16'-4". Center clear height 15'-0"
Specifications A.A.S.H.O. and N.H.H.D. 1935
All steel to be 2" clear from face of concrete unless otherwise noted.
All concrete to be Class "A" (3000"). minimum cement factor = 1.60. Maximum size of aggregate = 1½"
No concrete to be poured until reinforcing steel and forms have been checked by the Engineer
All exposed corners of concrete to be cast square and trimmed to a uniform round with carborundum stone after concrete has thoroughly set.

NOTE: THIS SHEET REVISED 12-15-36. DESTROY ALL PREVIOUS PRINTS.

ESTIMATE OF QUANTITIES

No.	ITEM	QUANTITY
33	Reinforcing Steel	1196 Lbs
34	Concrete Class "A"	15 Cu. Yds.
57	Mortar Squared Stone Masonry	225 " "
98	Structure Excav. Uncl.	145 " "
109	Removing Substructure	69 " "
327	Maint & Removal of Existing Timber Horse	1 EACH

Actual Removing Substructure = 294 CU. YDS.
Mortar Squared Stone Masonry = 225 " "
For Estimate - Removing Substructure, 69 " "

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

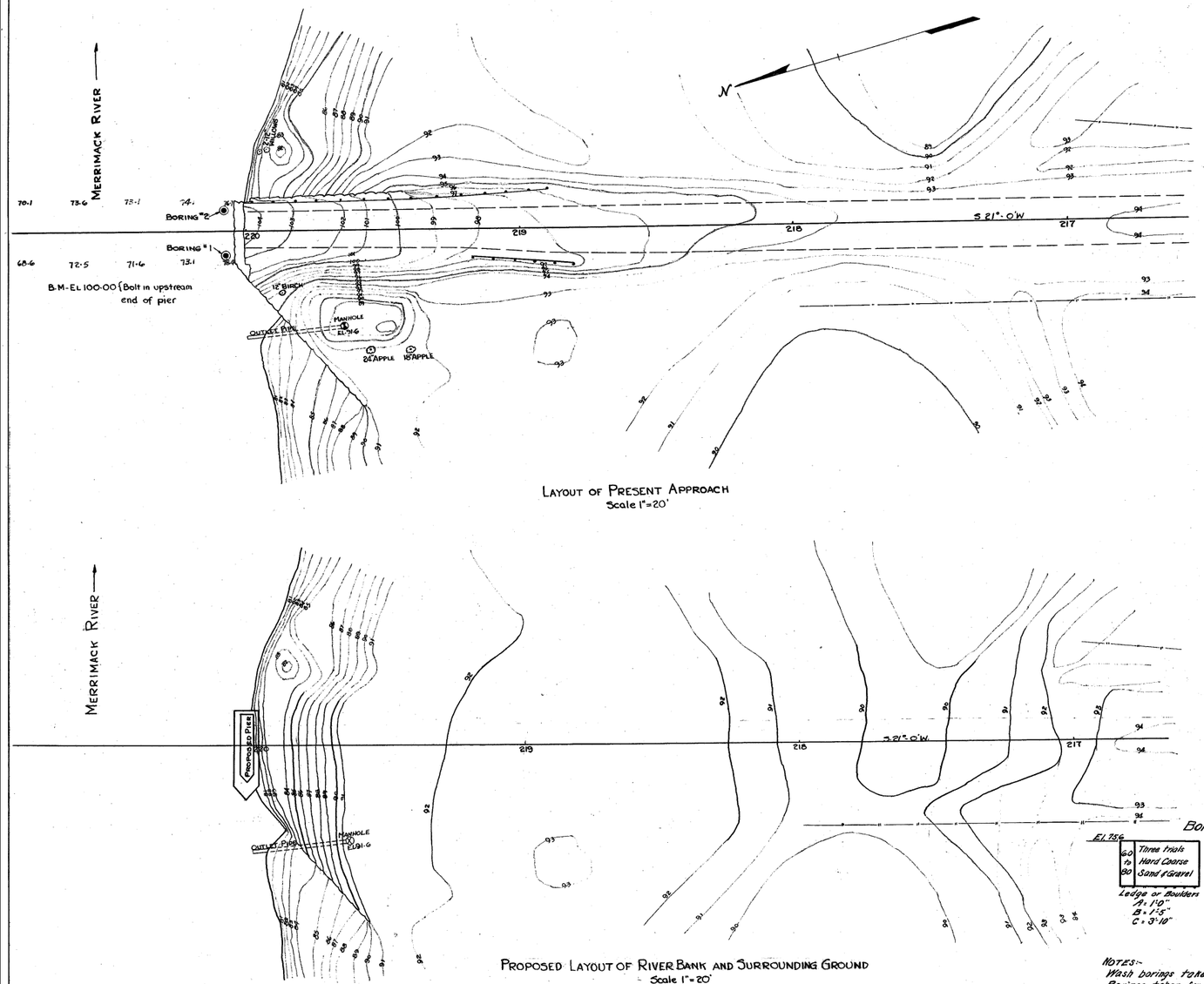
TOWN	CONCORD
PROJECT	W.P.F.R. *24
LOCATION	NEAR SEWALL'S FALLS
ROAD	SEWALL'S FALLS
STREAM	MERRIMACK RIVER
DESIGNED BY	T.H.M. DATE 10-14-36
DRAWN	" " " 10-16-36
TRACED	" G.W.H " 12-12-36
CHECKED	" RK, AG, T.G.H. " 12-15-36

SHEET 3 OF 4 SHEETS

FILE NO. [redacted]

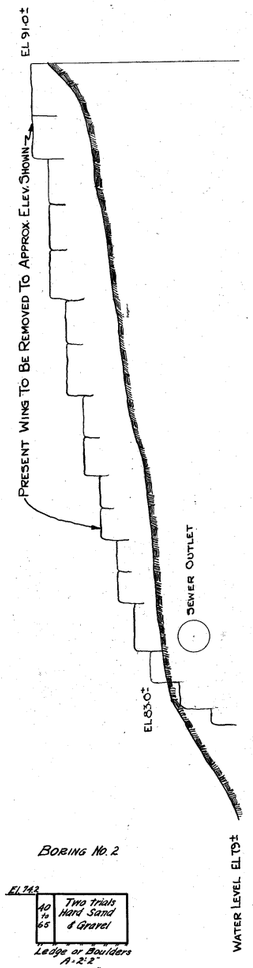
FED. ROAD PROJ. NO.	STATE	USWPH PROJ NO	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.	WPMS 304	1935	14	47

FED. ROAD DIST. NO.	STATE	WPA PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.	WPFR-24 WPA 10067	1936	4	7



LAYOUT OF PRESENT APPROACH
Scale 1"=20'

PROPOSED LAYOUT OF RIVER BANK AND SURROUNDING GROUND
Scale 1"=20'



ELEVATION OF PART OF NW WING TO BE RETAINED
Scale 1/4"=1'-0"

BORING No. 1

EL 75.6 — 60 to 90 — Three trials Hard Coarse Sand & Gravel
Ledge or Boulders A: 1'0" B: 1'5" C: 3'-10"

EL 75.1 — 40 to 60 — Two trials Hard Coarse Sand & Gravel
Ledge or Boulders D: 2'3" E: 2'6"

BORING No. 2

EL 74.2 — 40 to 65 — Two trials Hard Sand & Gravel
Ledge or Boulders A: 2'2" B: 3'0"

NOTES:-
Wash borings taken Nov. 2, 1936, by Chas. A. Leary Co., Boston, Mass.
Borings taken for purposes of design and show conditions at boring points only but do not necessarily show nature of the material to be encountered in connection with the construction of the pier.
Figures in left hand columns indicate blows per foot dropping a 135 lb hammer 2'0" to 3'0" on a 1 1/4 in. ø pipe in a casing.

NOTE: THIS SHEET REVISED 12-15-36.
DISTROY ALL PREVIOUS PRINTS.

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT.

CITY. CONCORD.
PROJECT. W.P.F.R. 24
LOCATION. NEAR SEWALL'S FALLS
ROAD. SEWALL'S FALLS
STREAM. MERRIMACK RIVER.

SURVEYED BY W.H.E. DATE 4-27-36
PLOTTED " " "
TRACED " T.H.M. " 11-30-36
CHECKED " R.R.K. " 12-1-36

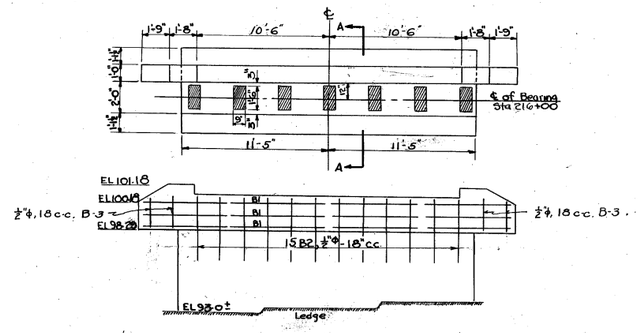
SHEET 4 OF 4 SHEETS

FED. ROAD DIST. NO.	STATE	WPA PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS	FILE NO 8-3-6	FED. ROAD DIST. NO.	STATE	USWPH PROJ. NO.	FISCAL YEAR	SHEET NO.
		WPFR-24					9	N.H.	WPMS 304	1935	14

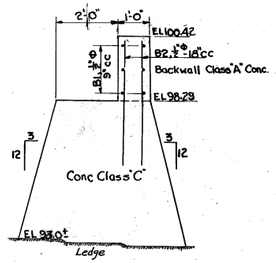
NH-727_DRAWING-12

4 48

FED. ROAD DIST. No.	STATE	U3WPH PROJ. No.	PROJECT YEAR	SHEET No.	TOTAL SHEETS
9	N. H.	WPMS 304	1935	4	47

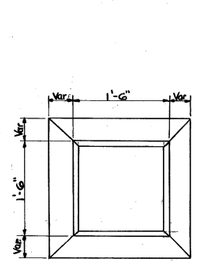


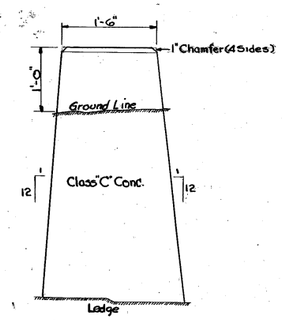
PLAN-ELEVATION OF SOUTH ABUTMENT
Scale ¼"=1'-0"



SECTION A-A
Scale ½"=1'-0"

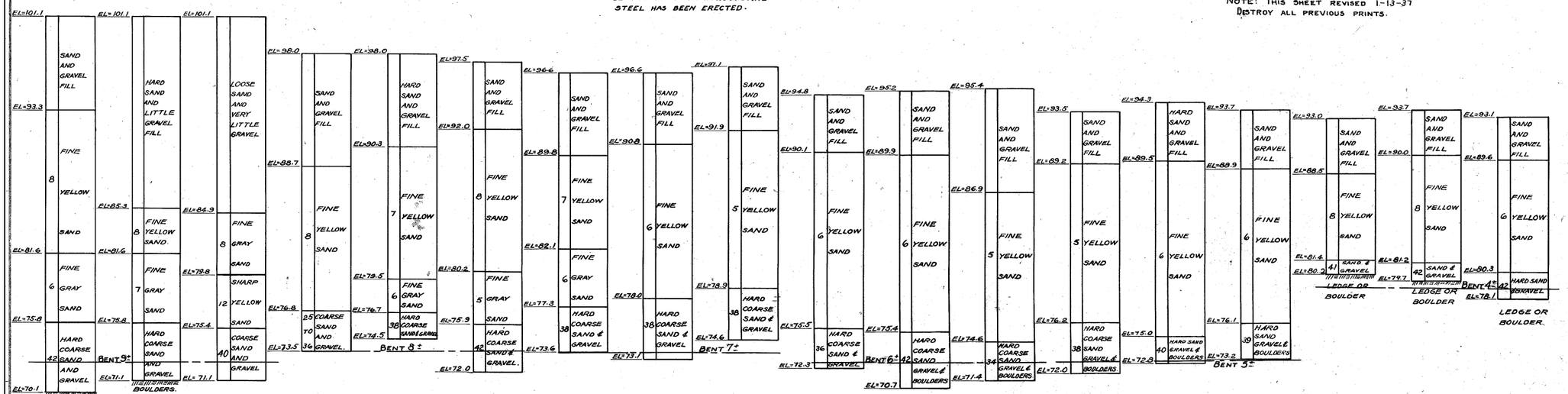
NOTE: CONCRETE IN BACKWALL NOT TO BE POURED UNTIL STRUCTURAL STEEL HAS BEEN ERECTED.

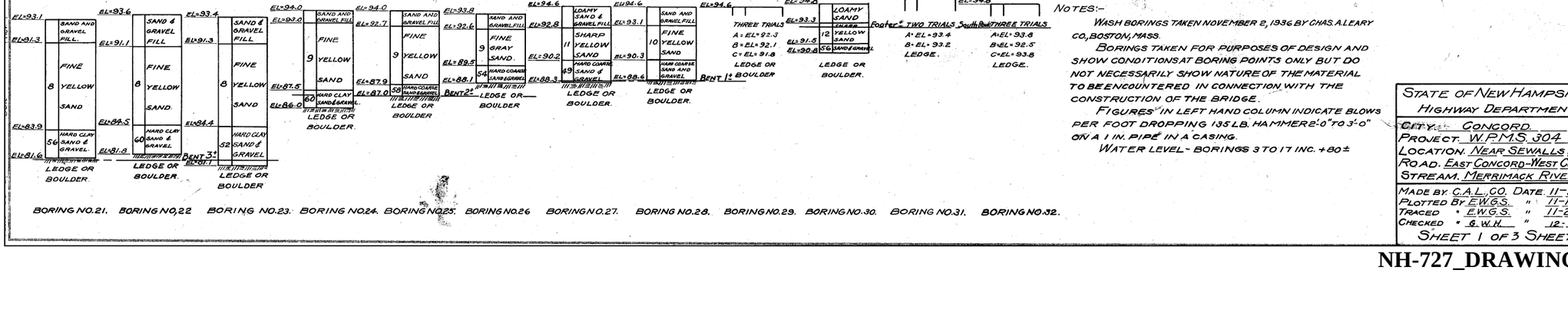




TYPICAL PEDESTAL FOR BENTS 1 AND 2
Scale 1"=1'-0"

NOTE: THIS SHEET REVISED 1-13-37
DESTROY ALL PREVIOUS PRINTS.





NOTES:-

WASH BORINGS TAKEN NOVEMBER 2, 1936 BY CHAS. A. LEARY CO, BOSTON, MASS.

BORINGS TAKEN FOR PURPOSES OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY BUT DO NOT NECESSARILY SHOW NATURE OF THE MATERIAL TO BE ENCOUNTERED IN CONNECTION WITH THE CONSTRUCTION OF THE BRIDGE.

FIGURES IN LEFT HAND COLUMN INDICATE BLOWS PER FOOT DROPPING 135 LB. HAMMER 2'-0" TO 3'-0" ON A 1 IN. PIPE IN A CASING.

WATER LEVEL - BORINGS 3 TO 17 INC. +80±

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

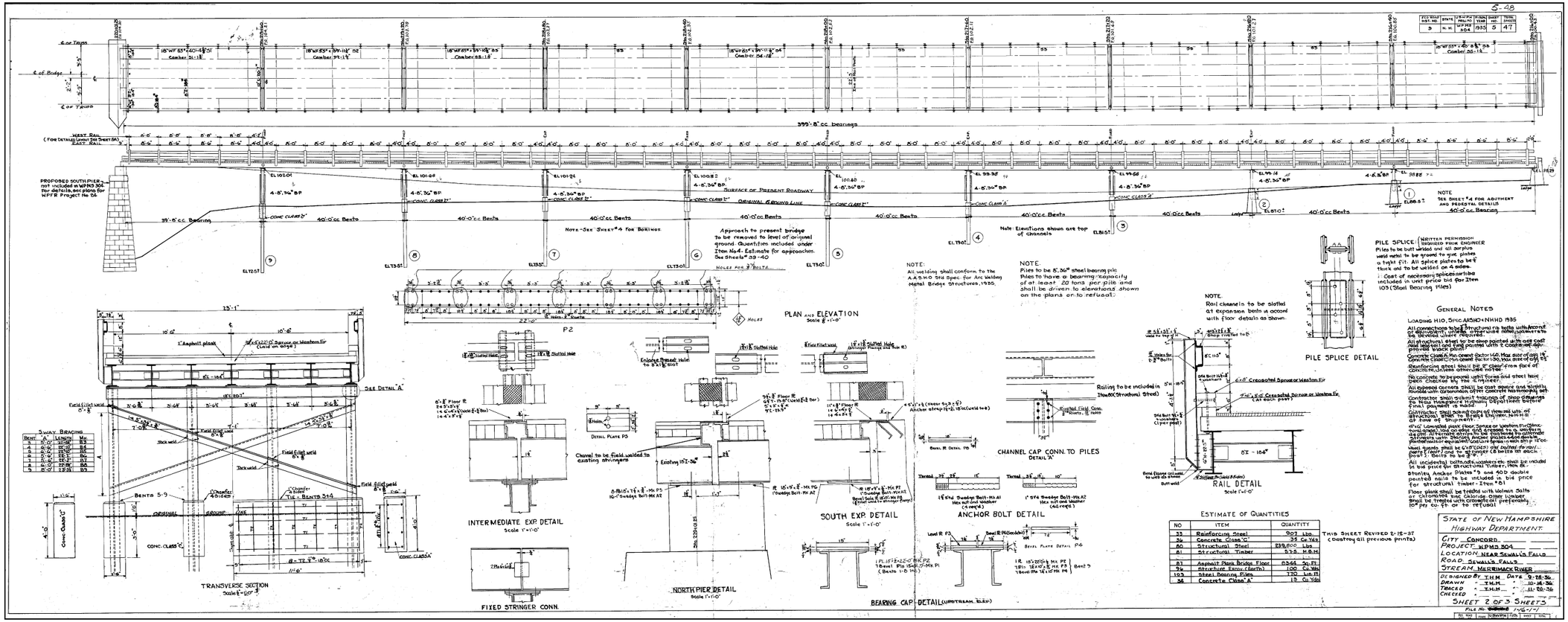
CITY. CONCORD.
PROJECT. W.P.M.S. 304
LOCATION. NEAR SEWALLS FALLS.
ROAD. EAST CONCORD-WEST CONCORD
STREAM. MERRIMACK RIVER.

MADE BY. C.A.L.CO. DATE. 11-2-36.
PLOTTED BY E.W.G.S. " 11-19-36
TRACED " E.W.G.S. " 11-20-36.
CHECKED " G.W.H. " 12-15-36

SHEET 1 OF 3 SHEETS.

NH-727_DRAWING-13

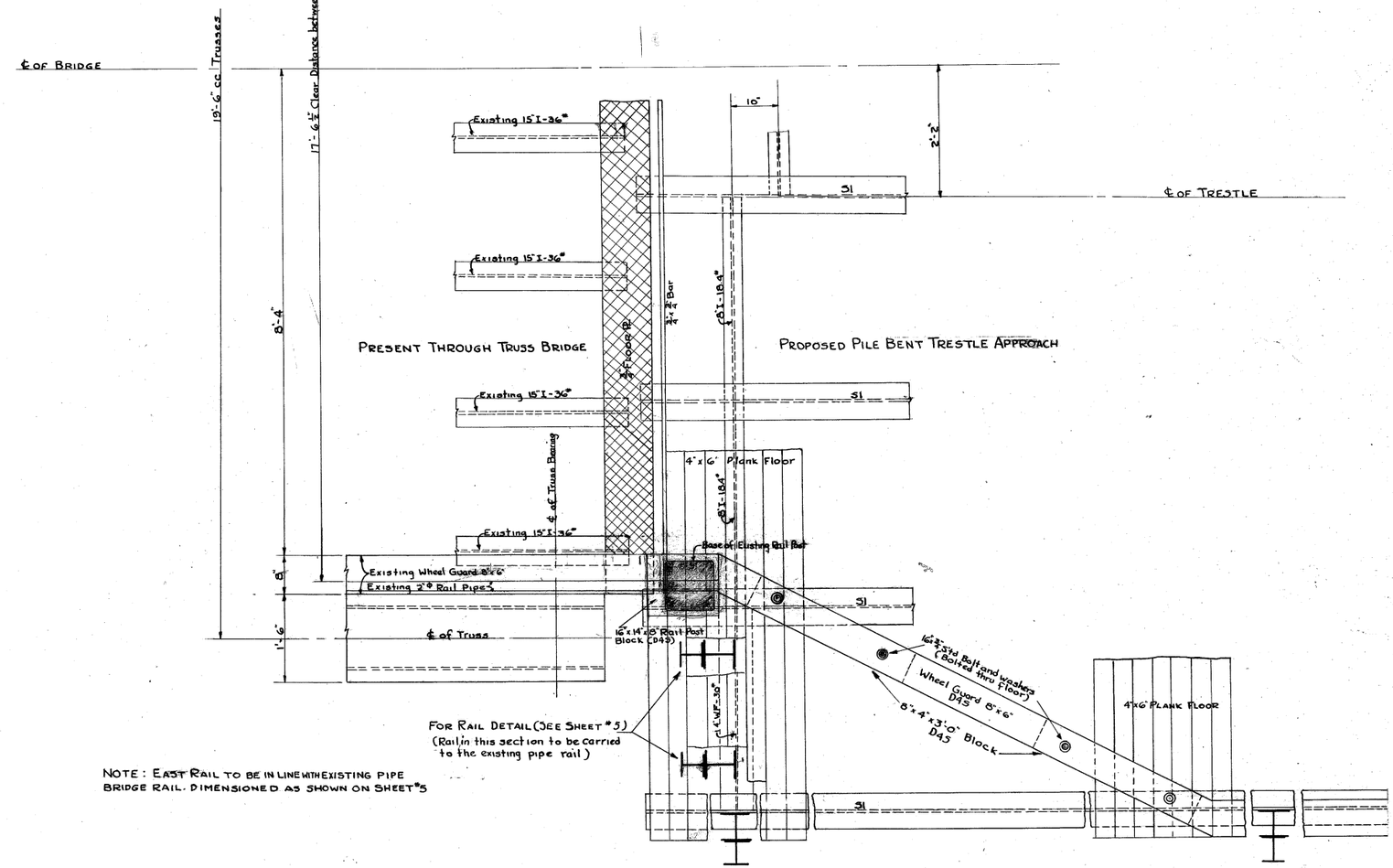
SEWALL'S FALLS BRIDGE
NH State No. 727
DRAWINGS



NO	ITEM	QUANTITY
33	Reinforcing Steel	907 Lbs.
36	Concrete Class "C"	35 Cu. Yds.
8C	Structural Steel	239,800 Lbs.
8I	Structural Timber	3.3.3 M.B.M.
8J	Asphalt Plank Bridge Floor	6344 Sq. Ft.
9A	Structure Excav. (Earth)	100 Cu. Yds.
103	Steel Bearing Piles	330 Lin. Ft.
36	Concrete Class "A"	13 Cu. Yds.

NH-727_DRAWING-14

FED. ROAD DIST. NO.	STATE	U.S.W.PH. PROJ. No.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N.H.	N.H.P.M. 304	1936	5A	47



LAYOUT OF RAIL AND WHEEL GUARD DETAILS AT WEST END OF PIER
Scale 1"=1'-0"
{FOR ALL ADDITIONAL DETAILS SEE SHEET No. 5

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT

CITY: CONCORD
PROJECT: W.P.M.S. 304
LOCATION: NEAR SEWALL'S FALLS
ROAD: SEWALL'S FALLS
STREAM: MERRIMACK RIVER

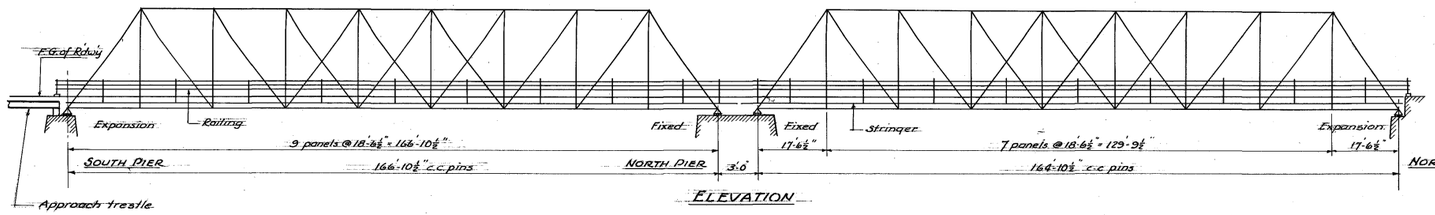
Designed by: ___ Date ___
Drawn by THM " 12-15-36
Traced by RHD
Checked by RRK 12-16-36

SHEET 3 OF 3 SHEETS

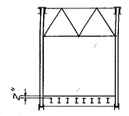
FILE No. ~~69-3-6~~

NH-727_DRAWING-15

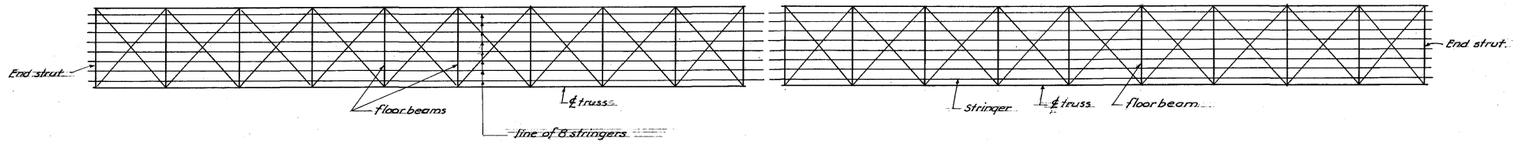
FED. ROAD DIST. NO.	STATE	PROJ.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
9	N. H.				



ELEVATION



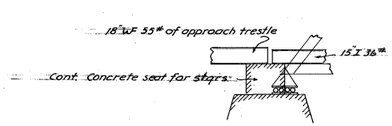
TYPICAL CROSS SECTION



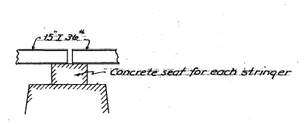
PLAN OF FLOOR BEAMS & BOTTOM BRACING

ESTIMATE OF QUANTITIES

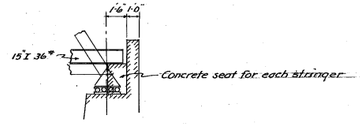
ITEM No	DESCRIPTION	UNIT	QUANTITY
36.3	Steel Grid Floor	Sq. Ft.	3,649
36.1	Structural Steel	Lb.	13,875



SOUTH PIER

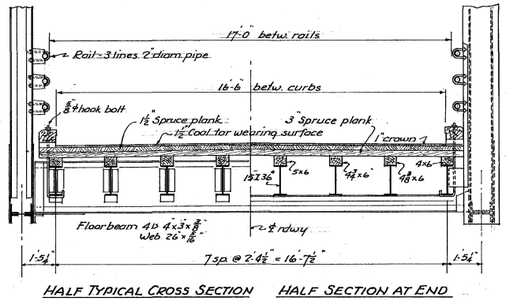


NORTH PIER (Between Truss Spans)



NORTH ABUTMENT

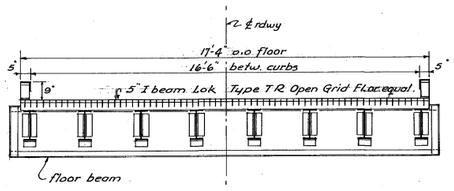
DETAIL OF EXTERIOR STRINGER BEAM SEATS



HALF TYPICAL CROSS SECTION HALF SECTION AT END

EXISTING WOOD DECK
Scale ⅜" = 1'-0"

Note: Remove existing wood deck to top of stringers and replace with Carnegie-Illinois 5" I Bm Lok Open floor T.R. Type, or equal. No material to be salvaged.
Top of stringers are 2" lower than top of Floor beam. Cost of removing existing deck to be subsidiary to Steel Grid Floor, Item 36.3



CROSS SECTION OF PROPOSED FLOOR
Scale ⅜" = 1'-0"

Note: Field welding of floor to stgs and splice angles to be as shown in Drawing F-3465 furnished by Carnegie-Illinois Steel Corporation, or as recommended by the Manufacturer.

GENERAL NOTES

Loading H-15-44 for flooring only
Specifications A.A.S.H.O. 1944 and N.H.H.D. 1948.
Concrete shall be Class A air entraining.
Maximum size of coarse aggregate 1".
All Structural Steel and Grid Floor to be given one shop coat of approved red lead and oil.
Grid Floor steel as per Spec. ASTM Designation A7-42 shall have a copper content not less than 0.20%.
For further information, see sheets titled "Addenda to Specifications".

APPROVED [signature] DATE 6/13/49
BRIDGE ENGINEER

	Notes changed	AMW	11/14/49
△	DESCRIPTION	BY	DATE
	REVISIONS		

STATE OF NEW HAMPSHIRE
HIGHWAY DEPARTMENT BRIDGE DIVISION

TOWN CONCORD - SEWALLS FALLS BRIDGE NO. 070/117
~~FEDERAL~~ PROJECT S-A-B-M STATE PROJECT S-1720
ROUTE NO. OVER MERRIMACK RIVER
LOCATION 1.61 Mi. N.E. FROM JCT. U.S. 3

PROPOSED NEW DECK

	BY	DATE		BY	DATE	
DESIGNED	E.S.	5/49	CHECKED	R.W.H.	5/49	BRIDGE SHEET NO. 1 OF 2
DRAWN	"	"	CHECKED	"	"	
TRACED	W.H.D.	5/49	CHECKED	E.S.	6/49	FILE NUMBER 2-12-1-16
QUANTITIES	E.S.	-	CHECKED	R.W.H.	5/49	

PROJ. NO.	SHEET NO.	TOTAL SHEETS
S-1720	1	2