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The Canadian Society of Civil Engineers.

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THE LITTLE SALMON RIVER VIADUCT. NATIONAL TRANSCONTINENTAL RAILWAY.

By R. F. Uniacke, M. Can. Soc. C.E.

The Act of Parliament, authorizing the construction by Commission, of the Eastern Division of the National Transcontinental Railway, provides for a location from its eastern terminus (Moncton) through the central part of the Province of New Brunswick, and through the Province of Quebec by the shortest available route to the city of Quebec. At the time of the inception of the Intercolonial Railway the Province of New Brunswick had been thoroughly explored before the final location was adopted, and the controversy of the routes has been fought out over both these great public undertakings. Three routes were located for the Intercolonial Railway, known at that time as the Frontier, the Central, and the Baie des Chaleurs routes, and of these, on the recommendation of the Chief Engineer, and owing to Imperial considerations, since a subsidy aid had been granted by the Home Government, the Baie des Chaleurs route was adopted.

The Engineers of the Transcontinental Railway had located two lines, one known as the River route, following the St. John River, north from Fredericton, and the other the Central route; the latter was adopted as fulfilling more closely the provisions of the Act. That a line of railway has now been constructed along this route having a ruling point four compensated grade, with a maximum curvature of six degrees, is owing in a large measure to the advance in modern bridge and high viaduct construction. The valley of the Little Salmon River, 185 miles from Moncton, presented one of the obstacles to be overcome, as the grade development showed a crossing over 4,000 feet long, with a height of 200 feet above the water line. The description of the design and construction of this viaduct the writer has undertaken to present in this paper.

The line approaches the west end of the structure with a six degree curve through a rock cutting and crosses on a tangent bearing N. 10°—27′ W., the grade rising 0.40 ft. per hundred. The layout consists of twenty-four towers 58′ 9″ centers and twenty-five intermediate spans 100′ 3″ c. to c., the end spans being 100′ 10½″ center of bent to outer end of steel; all the tower spans are alike and also the intermediate spans, except that the masonry ends are extended to give the required bearing. The towers and bracing are made alike as much as possible, necessitating one set of templates only for the spans and parts of towers which duplicate each other. A Through girder system of construction was adopted, the girders being spaced 17′ 6″ c. to c., while the floor beams with gussets were spaced 14 ft. c. to c., along the plate girders. The east end span is on a spiral to a 6 degree curve and in consequence the girders are deflected at this abutment 1′ 3″ off the tangent to the structure produced. There were several reasons which led to the adoption of a Through girder system. In high trestle construction where the use of falsework is out of the question, the most economical layout is that of an intermediate span as long as could be handled with a well designed traveller working from grade, so as to reduce the number of high towers, their pedestals and foundations. Spans of 60 ft. with 40 ft. towers are generally employed where deck girders are used, spaced 9 ft. c. to c., and bridge ties resting on the top flanges. Owing to the Through girder system having a spacing of girders 17′ 6″ c. to c., spans of 100 ft. are handled, since the bearings of the traveller rest on the flanges, thus giving that much more base to brace the traveller in handling loads. The stability of the erection outfit is amply provided for so that in this case girders weighing 30 tons were placed in position. It certainly gives a feeling of safety to see from the car window the flanges of a heavy steel girder, and that this is not altogether sentiment is shown by the fact that instances of derailment are recorded, in which the car held to the roadway by the lateral resisting power of these girders.

Substructure.—The approach at the east end being through a rock cutting, in order to avoid building the steel work on a curve, and also to utilize the material in the cutting without waste, an abutment of reinforced concrete placed on top of the rock fill was decided on. A buried pier built from the original surface at this point would have been over 100 ft. high, difficult to design and build, and very costly. This was avoided by the use of a bank abutment. The concrete was reinforced to prevent danger of cracks from settlement in the bank, and in order to give time for the bank to settle, the ends of the girders were temporarily supported by a

Fig. 1.

General View.

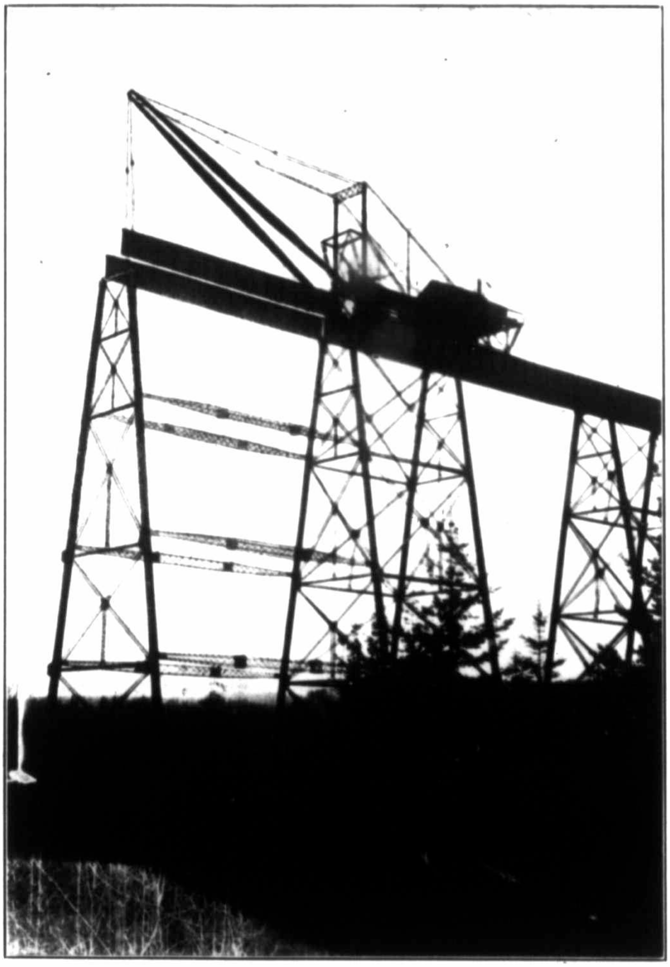


Fig. 3.

100 ft. girder ready to place.
Erection struts in position.

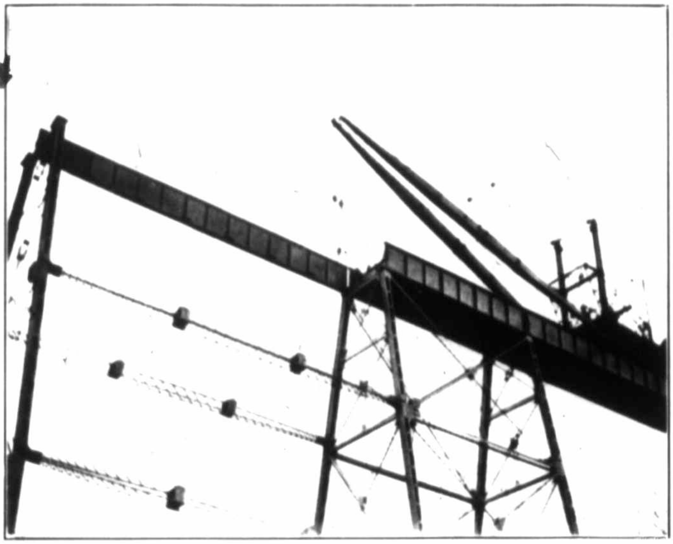


Fig. 4.

100 ft. girder in place.

crib-work of square timber, before building the permanent abutment.

In the design of the pedestals and west abutment, borings and test pits were first made to determine the character of the soil. This proved to be of compact sand, gravel and hard pan, so that no piling was required, the footings being designed to distribute the load at a pressure of from 2.5 to 4 tons per square foot. The four pedestals near the water line at the banks of the river were built with curved cutwaters, the axis of piers being parallel to the direction of the current, forming suitable icebreakers. The anchor bolts for pedestals consisted of two rods, two inches in diameter, the lengths varying according to the up-lift to be resisted. These rods were anchored at the bottom by spacers of 10" channels and washers, the concrete being built around them. In order to give room for a little variation in their position, conical forms were set around each bolt, a lip being left at the top extending beyond the base plate of column through which these voids were filled with grout after the steel was erected. The west abutment or buried pier was about 40 ft. in height above the footing course, and in order to reduce the pressure on the soil and allow the embankment to run through and surround it, an arched void was left in a longitudinal direction. No difficulty was experienced in building to this design. Details of pedestals and abutments are shown on Plate No. 2.

In laying out the work no triangulation was required and an ordinary steel tape was used, the writer's experience being that, as provision is made in the girders for expansion, a slight variation in the position of the anchor bolts is permissible, providing the expansion slots are made longer than the theoretical length requires. The chief difficulty consists in maintaining the anchors in a vertical position and protecting them from rough usage from swinging buckets of concrete and other causes.

Concrete.—The materials used in the concrete were International Portland Cement, manufactured in Hull, Que., at present by the Canada Cement Company. The sand and gravel were obtained on the bank of the river near the bridge site. In this locality good sand is very difficult to obtain and, after a test of sand from several pits, the local material was selected, the sieve test showing after the gravel was screened out:

Retained	on	20	mesh	sieve	64	per cent.
"	"	30	"	"	17	" "
"	"	50	"	"	15	" "
"	"	74	"	"	2	" "
"	"	100	"	"	2	" "
					100%	

After treating the finer residue with a 20% solution of sulphuric acid, it was found to contain 6% of soluble matter, which was eliminated by thorough washing, and a mixture of one part cement, two parts sand, and four parts of gravel, varying from the size of a pea to 3 inches was obtained. As the sand was not of the best quality, the use of 1-2-4 mixture was ordered in shafts of pedestals, since they have to sustain a high concentrated load on a comparatively small volume of concrete. The concrete used in the buried pier and foundations was a 1-3-5 mixture. In obtaining a proper facing mixture the coarser material was kept away from the forms by the use of perforated spades, pushed down and drawn back while the mixture was still plastic. This method was found more satisfactory than that of attempting to bond a facing mixture into the body as required in some specifications.

Cement.—The following description of the method adopted for sampling and testing the cement used on all structures under construction on the Transcontinental Railway may be of interest.

The cement specifications are standard and the governing tests are for fineness, specific gravity, soundness, time of setting, and tensile strength. The cement shall not acquire its initial set in less than 45 minutes and must have acquired its final set within 10 hours, the briquettes being kept in a damp closet for 24 hours and afterwards immersed in water until time of breaking.

Sampling.—It is the writer's practice on receiving notice that a consignment of cement is to be shipped to a contractor to send an inspector to the mills to draw samples from the bags as they are being loaded into the cars; one bag in forty is sampled, both doors of the car sealed with the N.T.R. lead seal and the sample cases forwarded to the cement testing laboratory in Ottawa, in charge of a Chief Cement Inspector attached to the Bridge Engineer's Office The seal being intact on arriving at the bridge site is a notice to the field inspector that the car has been sampled by the Bridge Department. The preliminary tests for soundness are made at once, the mills are notified to hold the cars if these results appear doubtful, and the final record covering the full 28 days tests is generally completed and the contractor advised of the acceptance soon after the cars are on the work. In mills where the records have been continuously good, the contractor has been permitted to use the cement on completion of the seven days test, in some cases where work would be held up for want of cars, but always at the contractor's risk and subject to the twenty-eight days tests; in no case where this has been allowed has the result proved a mistake in judgment. A cement sampling record slip is enclosed in the sealed sample case giving all information as to shipment. Copies of the final test record are furnished to the District Engineer as well as to the mills for comparison with the manufacturer's tests, and the records are compiled in loose leaf books for future reference. By means of these records and a system of reports from the field inspectors of the arrival of cars, it is an easy matter to trace any car and identify its contents after being piled in the cement storage house at the bridge site.

Design.—The Dominion Government specifications were strictly adhered to in the proportioning of the members. The compression members were figured for the pin ended formula of these specifications. In the tension members of the towers a limiting length of $200 \frac{l}{r}$ was used to avoid sagging of members, to make them capable of resisting compression and to give initial stiffness. Attention is called to the use of bulb angles in the sway bracing of towers, (Plate No. 4), which make a very stiff and economical section and avoid breakages in shipment, the great fault in box laced section of light angles. Traction and wind were figures as called for in the specifications.

The posts viewed from the stress sheets do not appear to be economical because of their relatively small radius of gyration when compared with a built up channel section; but the saving in weight of details and simplicity in shop work fully compensates for the extra main material. In the light of column tests it is reasonable to expect that the reduction in unit stresses for the increase of radii length would not be justified by practical tests. The metal is used mostly in directly resisting the primary stresses, as very little is required for secondary purposes (viz., lattice tie plates, etc.), and in this way a stronger column is obtained. The section used has also the advantage of continuous webs in each direction, which are greatly superior to the easily bent lattice bars, and moreover the interior of the column is much more accessible to the paint brush for shop and field coats. The section is symmetrical on both axes, having therefore its center of gravity in the center of the section, and no eccentric loading is induced from the girders. The small amount of redundant metal means uniformity of stress in the columns, and simplicity in the make up will decrease the cost of maintenance.

Tenders.—In calling for tenders for the steel work our usual practice was followed of furnishing bridge companies with a general design and details of girders and towers, together with a printed form of tender in which was filled in the estimated weights of steel, and number of feet B. M. of timber in the floor. With this system all bridge companies bid on the same basis, and are not required to make a single drawing to submit with tenders, but merely to fill in the unit prices for steel and timber erected in place, and to carry out the amounts on the estimated quantities furnished, viz., steel 14,000,000 lbs. timber 520,300 ft. B. M. After the tender is awarded the bridge company submit stress sheets and details for approval before ordering the material from the mills.

Floor. The rails were directly supported by 8" x 12" x 14' bridge ties resting on the steel stringers, every fourth tie being 16 ft. long to support the plank footway placed outside the guard timber for the convenience and safety of the section men. An outside guard timber 8" x 9" dapped 1" over the ties, which were spaced four inches apart in the clear, the ties were secured to the stringers by ¾" hook bolts, and the guard timbers bolted through the tie with one ¾" bolt in every fourth tie. A steel guard rail 60 lbs to the yard will be placed inside the gauge line, and eight inches therefrom in the clear, these guard rails coming together at the center of the track one rail length beyond the end of the bridge and being protected by a cast steel point fitting the rail section and spiked to the road-bed ties.

Erection. Actual erection began July 27th, 1910; the steel was all assembled and last span swung February 8th, 1911, and all riveting and painting fully completed by August 19th, 1911. Material was unloaded at a siding at the west end and handled by a two boom derrick car in the storing yard. A light locomotive standard gauge with lorry cars handled the material from the storage yard to end of steel. The main feature of the erection outfit was the 30 ton two boom erection derrick, travelling on the top flanges of the girders, the trucks of the traveller running on 115 lb. crane rail, the base of which rested on timber temporarily secured to the girder flanges. This derrick was self-propelling by means of a chain and sprocket connecting the trucks with the erecting engine, which consisted of two 10" x 12" cylinders two drum 4 spool hoist. The 115' 0" booms were box section composed of 4 36" x ¼" web plates at center section and tapering at the end, connected with four 3½ x 3½ x ⅜ angles. This section was found to weigh actually less than a latticed section and the combined unit stresses from compression and bending were very much reduced. The writer was told that the men working on the traveller, and assembling, were very enthusiastic over the ease with which the big machine handled its work. The wind at the deck of the trestle was very strong, and was generally blowing at right angles to the bridge, but the work was practically never held up on account of too much wind. The use of the erection struts is shown in the drawing, (Plate 10), and photograph, (Fig. 2); after a tower and its girders were assembled the erection struts were removed and used again to stiffen the first bent of the next tower until it too was connected and self sustaining. The hook bolts temporarily connecting the ends of three struts with the columns proved very efficient.

Another important feature was the use of riveting bridges for convenience and safety of the men in assembling, riveting, and painting. From a general drawing of these bridges, (Plate No. 6), and from the photographs, (Figs. 6, 7, and 8), the method of hand-

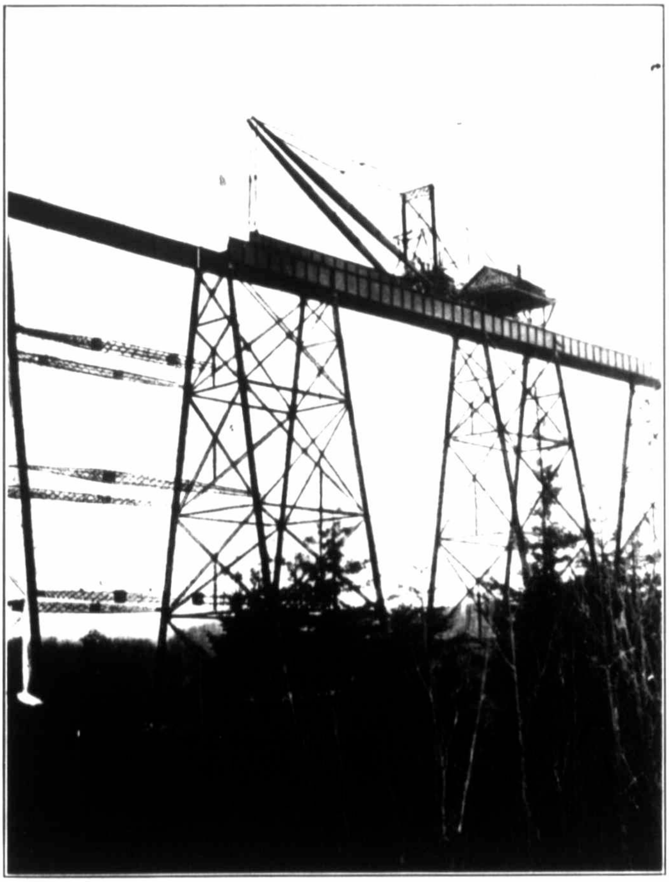


Fig. 2.

100 ft. girder raised.

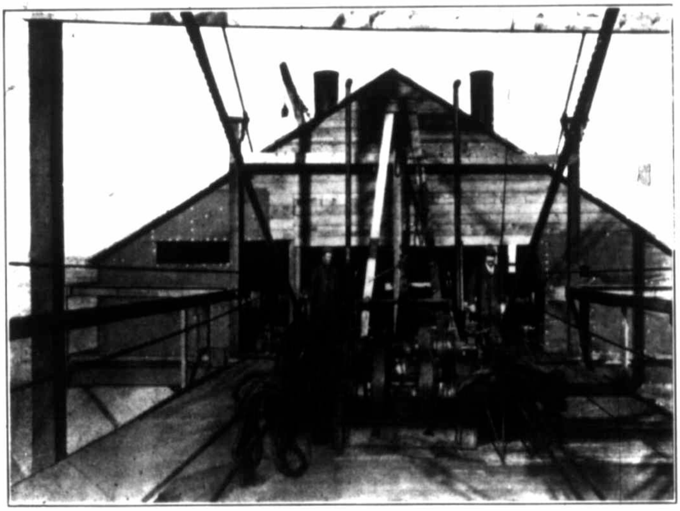


Fig. 5.

Working platform of traveller.

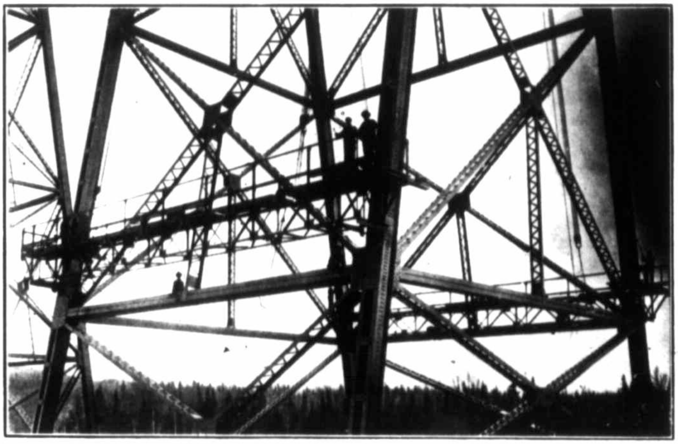


Fig. 6.

View of riveting galleries.

Fig. 7.

Method of raising and moving riveting galleries.

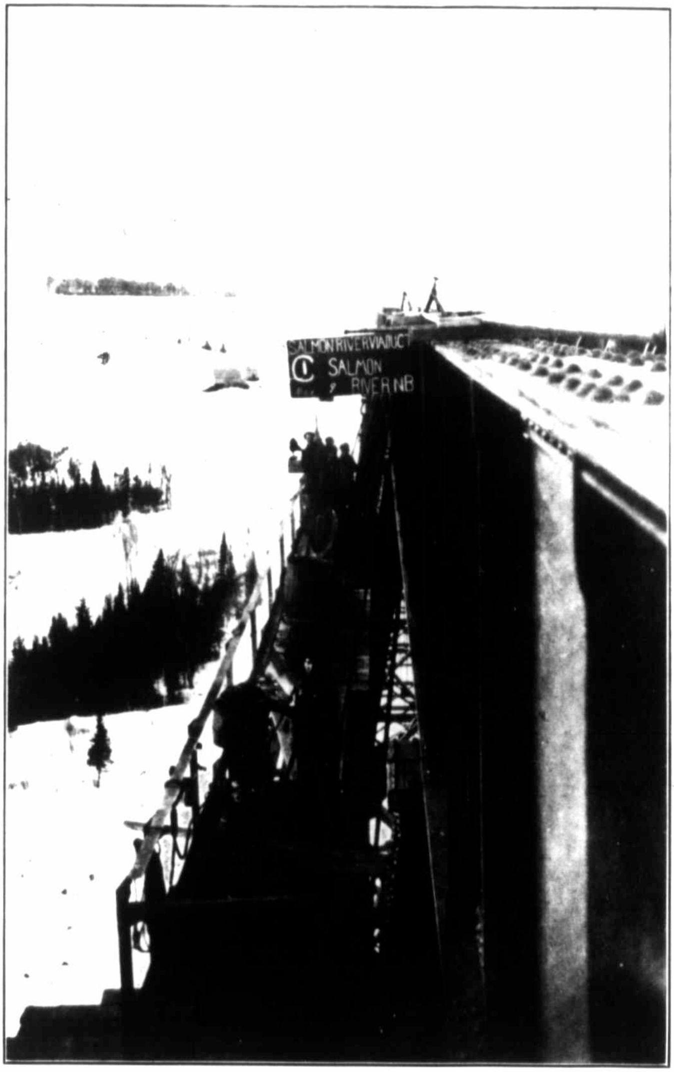


Fig. 8.

Riveting gallery in position at top of tower.

Little Salmon River Viaduct
Showing Progress of Erection

Date 1910	No. of Days	Erected to Bent No.	Tons	Aver Per Day	Remarks
to July 30		48	112¼		
July 30 to Aug 6	6	47	87¼	13½ Tons	
Aug 6 – Aug 12	5	44	355	71	
Aug 12 – Aug 18	5	43	60½	12.1	
Aug 18 – Aug 19	1	42	128¾	128¾	
Aug 19 – Aug 23	3	41	101¾	32	
Aug 23 – Aug 24	1	40	129¾	129¾	
Aug 24 – Aug 26	2	39	102¼	51.1	
Aug 26 – Aug 29	2	38	132¼	66.1	
Aug 29 – Sept 16	5	35	436	87.2	Held up 11 days by broken gear in traveller
Sept 16 – Sept 24	7	33	298½	42.6	
Sept 24 – Oct 4	8	30	441¾	55.2	
Oct 4 – Oct 11	6	28	351¼	58.5	
Oct 11 – Oct 17	5	27	172¾	34.5	
Oct 17 – Oct 22	5	25	328	65.6	
Oct 27 – Oct 28	5	23	324½	64.9	
Oct 28 – Nov 2	4	22	162	40.5	
Nov 2 – Nov 5	3	21	152½	51	
Nov 5 – Nov 12	7	19	320¾	45.9	
Nov 12 – Nov 16	3	18	308¼	103	
Nov 16 – Nov 18	1	17	152	152	
Nov 18 – Nov 20	2	16	159	79.5	
Nov 20 – Nov 23	3	15	152	50.3	
Nov 23 – Nov 28	4	14	156¾	39.2	
Nov 28 – Dec 2	4	13	150	37.5	
Dec 2 – Dec 7	4	12	165	39	
Dec 7 – Dec 12	4	11	148	37	
Dec 12 – Dec 16	4	9	311½	78	
Dec 16 – Dec 21	4	8	154	38.5	Shut down for holidays
Jan 5 1911 to Jan 11	6	7	147	26½	
Jan 11 – Jan 16	4	6	153	38¼	
Jan 16 – Jan 22	5	5	146	29.2	
Jan 22 – Jan 25	3	4	146	48.6	
Jan 25 – Jan 28	3	3	118½	39.5	
Jan 28 – Feb 2	4	2	132¼	33	
Feb 2 – Feb 7	5	1	98	20	
Feb 7 – Feb 8	1	End	93¼	93¼	
	144		7042.5	48.9	– Total Average Per Day.

Fig. 11.

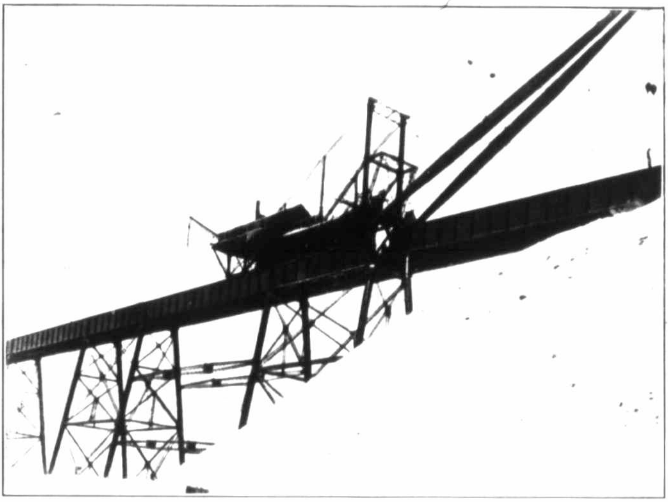


Fig. 10.

Placing last girder span.

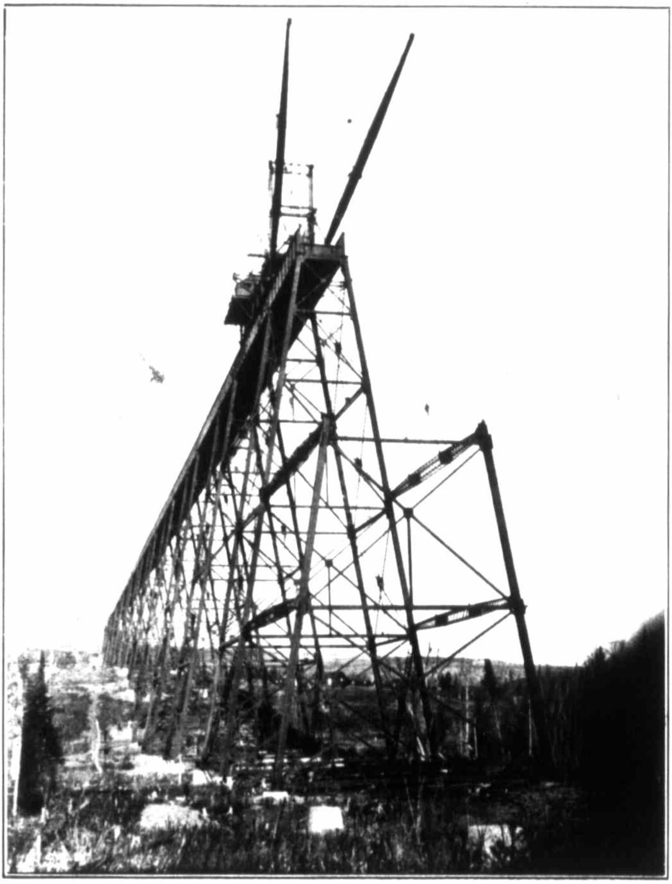


Fig. 9.

View of erection.

ling them will be plainly seen. They were carried along the top of the trestle by the two boom yard derrick car, and after being secured to the top flanges of girders by hooks, the cages were lowered or raised by hand, as required, the free end of the tackles being on the platform, so that the riveters could slack away themselves.

The erection staff varied from 60 to 80 men, of which but 6 were employed on the big traveller, 1 sub-foreman and 14 men were used to assemble the steel work, and the rest formed from two to six gangs of riveters, also crew for derrick car used for unloading material in yard, and delivering same to traveller, and driver for light locomotive. The riveting gangs averaged 302 rivets per day of 10 hours per gang, a rate which would probably have been reduced by 50% if ordinary staging had been used, instead of the riveting cages.

The table showing progress of erection, (Fig. 11), indicates rather remarkable time, considering the force employed. A pair of 100 ft. girders have been swung and bolted in their final position in 37 minutes, and floor beams and stringers assembled in half a day.

Painting. One coat of Sherwin-Williams Black Metalastic paint was used in the shop, with a coat on each contact surface before assembling. Two field coats were applied, the first Metalastic brown, and the final coat Acheson Graphite. Rivet heads and shop marks were touched up before applying the field coats. The use of a different shade for the first field coat was a great help to the inspector, to enable him to see that the several coverings were properly applied.

Inspection. The inspection of this work covers mill, shop, and erection inspection, all in accordance with the Dominion Government specifications of 1908. The bridge company, on being advised of the name of the inspection company, who are to do the inspection, are required to furnish them in triplicate with copies of all mill orders; one copy is furnished the bridge engineer, and one copy is sent to the inspection company's representative at the mills where the material is to be rolled.

The inspector then makes arrangements to be present at the rolling of the material which is being furnished on these orders, making complete surface inspection of every piece, measuring it for width and for length, and gauging the thickness. Specimens are then selected from the material so inspected by the representative of the inspection company, taken from each heat of steel which has been rolled into the material furnished on his particular order. These test pieces so selected are then forwarded to the machine shop to be properly prepared, that is to say, machined on both edges and straightened true. The test pieces so prepared are then sent to the testing laboratory at the mills, where the same are measured and broken in the testing machine, in the presence of the inspector. The results of this test piece have to conform with the requirements of the specifications, that is to say, the tensile strength has to be within the limits, also the elongation and reduction of area of the steel. The inspection company, in addition to witnessing the pulling of these test pieces previously selected by their representative, also secures from the rolling mills a certificate of the chemical analysis which may be found in the steel so tested. Frequently the inspector requires drillings to be taken from the test pieces at the mills, so as to check up the accuracy of the reports presented to him by the rolling mill company. Test pieces and material which they represent are identified by melt numbers.

As soon as surface inspection of the material has been made, and the tests have proved satisfactory, the inspector then undertakes to see that the material is properly loaded in the cars ready for shipment to the bridge works. Full descriptive reports are then made out by the inspection company, showing the number of pieces and the size and length of each piece so shipped from the steel works, together with the results of tests. These reports are then sent forward to the bridge engineer.

Shop Inspection.—As soon as the material has been received at the bridge works, the same is then unloaded, and when work is ready to commence, the various pieces of material which go to make up a full sized member are brought into the shop. The representative of the inspection company is present to see the laying off of the material, the first step in the preparation for punching. The punching is then witnessed by the inspector to see that punches and dies of the correct size are used, as required by the Dominion Government specifications. The inspector then further sees that the material, as soon as it is punched, is properly assembled, and that a sufficient number of bolts are used, so as to insure perfect fit and matching of all holes, prior to the same being riveted. The process of riveting is also supervised; and, lastly, the finished member is checked over to see that the measurements and clearances are correct, and that construction is in full accordance with the shop drawings submitted by the bridge company and approved by the bridge engineer.

The painting, which is also a very important part of the work, is then closely supervised, to see that the temperature in which the material is painted is suitable for such painting, also that the material so painted is stored under cover until such paint has become thoroughly dry.

After all these several stages of construction have been witnessed, and also the final checking up of material, full detail reports are then made out showing what material has been constructed during the week, also what other material is under course of construction, and what material has been shipped, also commenting on any errors that may have been discovered and how the same have been remedied, with a report in addition as to what future progress would be expected.

Inasmuch as this material has been purchased on a pound price, the inspection company has special representatives at each of the bridge plants estimating the weights of all material entering into the various bridge members, so as to check up against the actual weights furnished by the bridge company. If the actual weights are in excess of 2%, as allowed by the Dominion Government specifications, such weight is cut down to the estimated weight, made up by the inspection company, based on an allowance of 2%.

Inspection of Erection.—As soon as the bridge companies have made shipment of their first car-load of material, and the erection gang of the bridge company has arrived at the bridge site, on the order of the bridge engineer, an inspector is immediately despatched by the inspection company to such site. He supervises the erection of the entire structure from start to finish, seeing that the same is carried out in strict accordance with the requirements of the specifications. As the work progresses, the inspector takes at least three photographs each week, showing the progress that has been made, and also keeps an account of the labour expended in connection with the erection of the particular bridge on which he is engaged. To show that the photographs are taken weekly, a special sign is furnished by the inspection company, on which the name of the structure appears, together with the date on which the photograph was taken. This is embodied in the photograph. Weekly reports are furnished by the inspector, and the bridge engineer is kept advised as to all movement or delays that might occur at the erection site in connection with such structure. On completion of the bridge, the inspection company then reports that the work has been carried on to the satisfaction of their inspector, and such report is forwarded to the bridge engineer, who, himself, or his representative, then makes final inspection of such bridge structure, after which payments for the completed work are made. In all the various departments of inspection at the mills, at the bridge shops, and on erection, only men who have had long experience and training in that particular class of work are engaged.

Throughout all the various courses of construction a private stamp is used, bearing the trade-mark of the inspection company, together with a number representing the inspector who has used this particular stamp. This serves as a means of identification, so that the inspector at the shop, and also at the field may see that the material has been inspected and accepted. By this means if any faulty or defective workmanship should show itself, the inspector who passed this particular piece of work can be easily located by the number which he carried affixed to his stamp.

Cost and Estimates.—In the final estimates the actual amounts and cost under the several items are:

Substructure:

1,757	cu. yds.	1-2-4 Concrete	@	$15.00
6,524	"	1-3-5 "	@	11.00
4,597	"	Excavation	@	1.00
10,534	"	"	@	2.50

Superstructure:

Steel	13,991,310 lbs.	@ 4.68 cts.=	$654,793.31
Timber	518,041 ft. B.M.	@ 4.60 cts.=	23,829.89
			$678,623.20

Progress estimates were paid monthly on the superstructure according to the following basis:

	Unit.	Rate.
Steel	100 lbs.	$ 4.68
Timber in floor	M.B.M.	46.00

Schedule for monthly estimates.

	Unit.	Rate.
Steel provided	100 lbs.	$2.00
manufactured	"	1.00
delivered at site	"	.40
assembled	"	.98
riveted	"	.15
painted and fully completed	"	.15
		$ 4.68
Timber delivered	M.B.M.	$40.00
framed and placed	"	6.00
		$46.00

This basis of payment was considered a fair and equitable distribution of cost throughout the different stages of manufacture. It is the result of experience on many bridges previously built by this and other bridge companies on the described method of working and specifications, and the writer believes may fairly be used in other similar cases, as proportionate cost data.

The work was carried out under the general direction of the writer from the Bridge Engineer's Office in Ottawa, Mr. W. A. Duff, Assistant Bridge Engineer, having charge of the general design and details. The Dominion Bridge Co., Limited, Montreal, were the contractors for the steel, which was efficiently carried out, Mr. F. P. Shearwood, C.E., having charge of the design for the bridge company.

The design and layout for the erection and the traveller were made under the direction of Mr. James Finley, superintendent of erection, who was responsible for the successful carrying out of the erection; also Mr. E. W. Nichols, foreman on erection.

The mill, shop, and erection inspection was satisfactorily carried out by the Canadian Inspection Company, Limited, Montreal.

The sub-structure was completed by Messrs. Powers & Brewer, sub-contractors under Willard Kitchen Co. The construction and laying out of this part of the work was performed under the direction of Mr. C. O. Foss, District Engineer. Although the work was prosecuted in all seasons of the year there has been no accident or casualty of any kind.

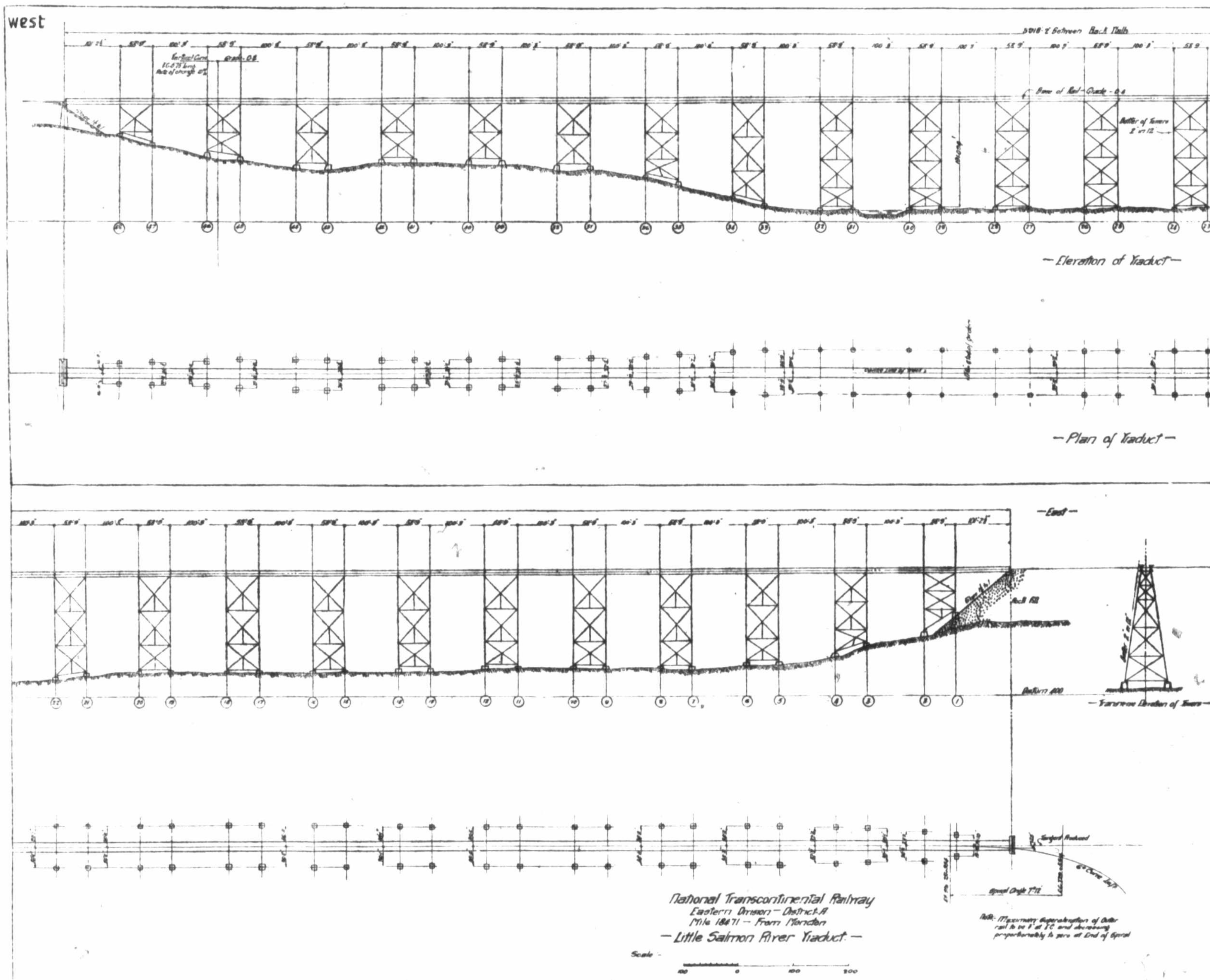
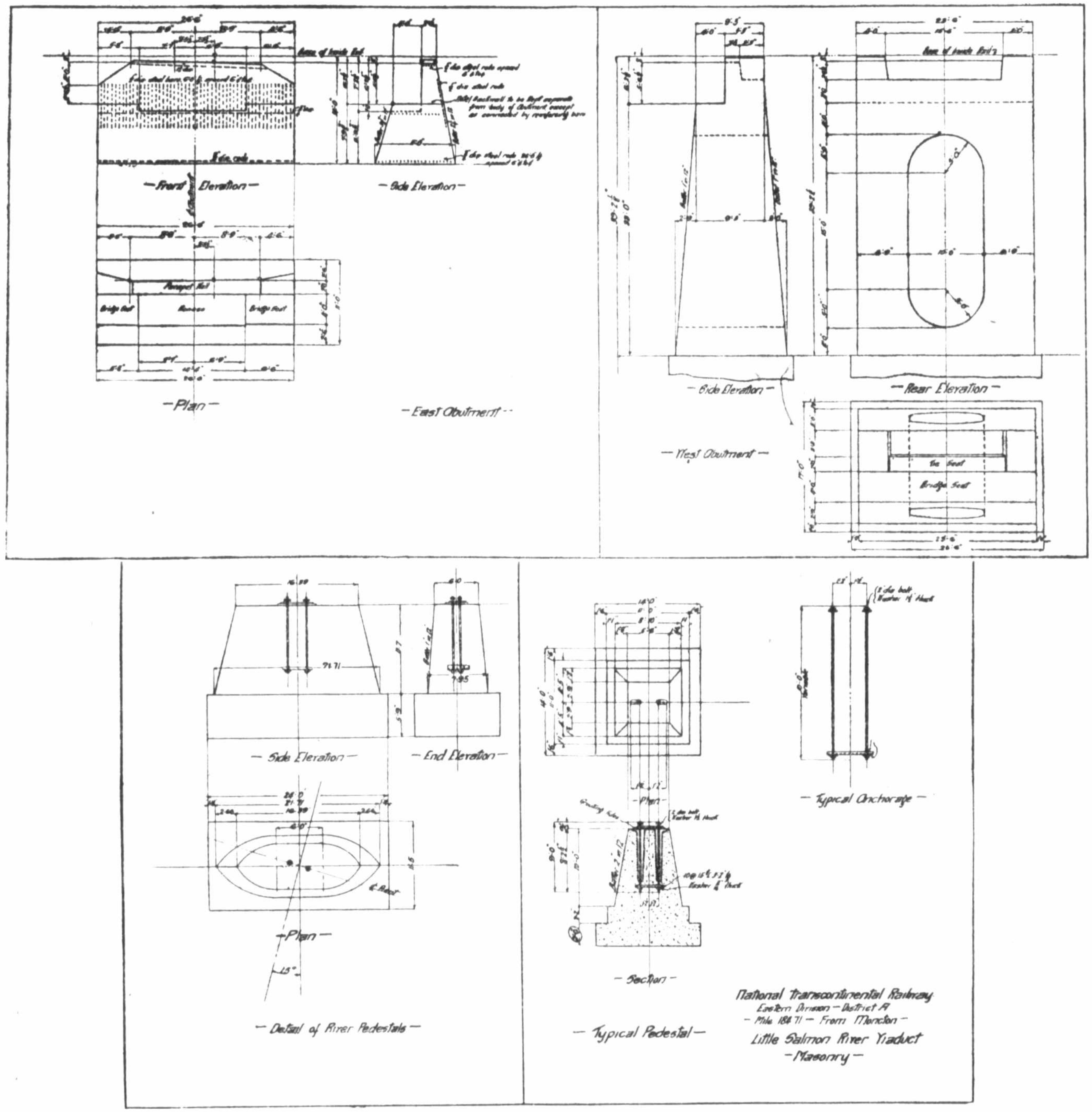

West
— Elevation of Viaduct —
— Plan of Viaduct —
— East —
— Transverse Elevation of Towers —
Spiral Angle 7°11'
6° Curve Left
National Transcontinental Railway
Eastern Division – District A
Mile 184.71 – From Moncton
— Little Salmon River Viaduct —
Scale
100
0
100
200

Plate 1.


— Front Elevation —
— Side Elevation —
— Plan —
— East Abutment —
— Side Elevation —
— Rear Elevation —
— West Abutment —
— Side Elevation —
— End Elevation —
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— Detail of River Pedestals —
— Plan —
— Section —
— Typical Pedestal —
— Typical Anchorage —
National Transcontinental Railway
Eastern Division — District A
— Mile 184.71 — From Moncton —
Little Salmon River Viaduct
— Masonry —

Plate 2.

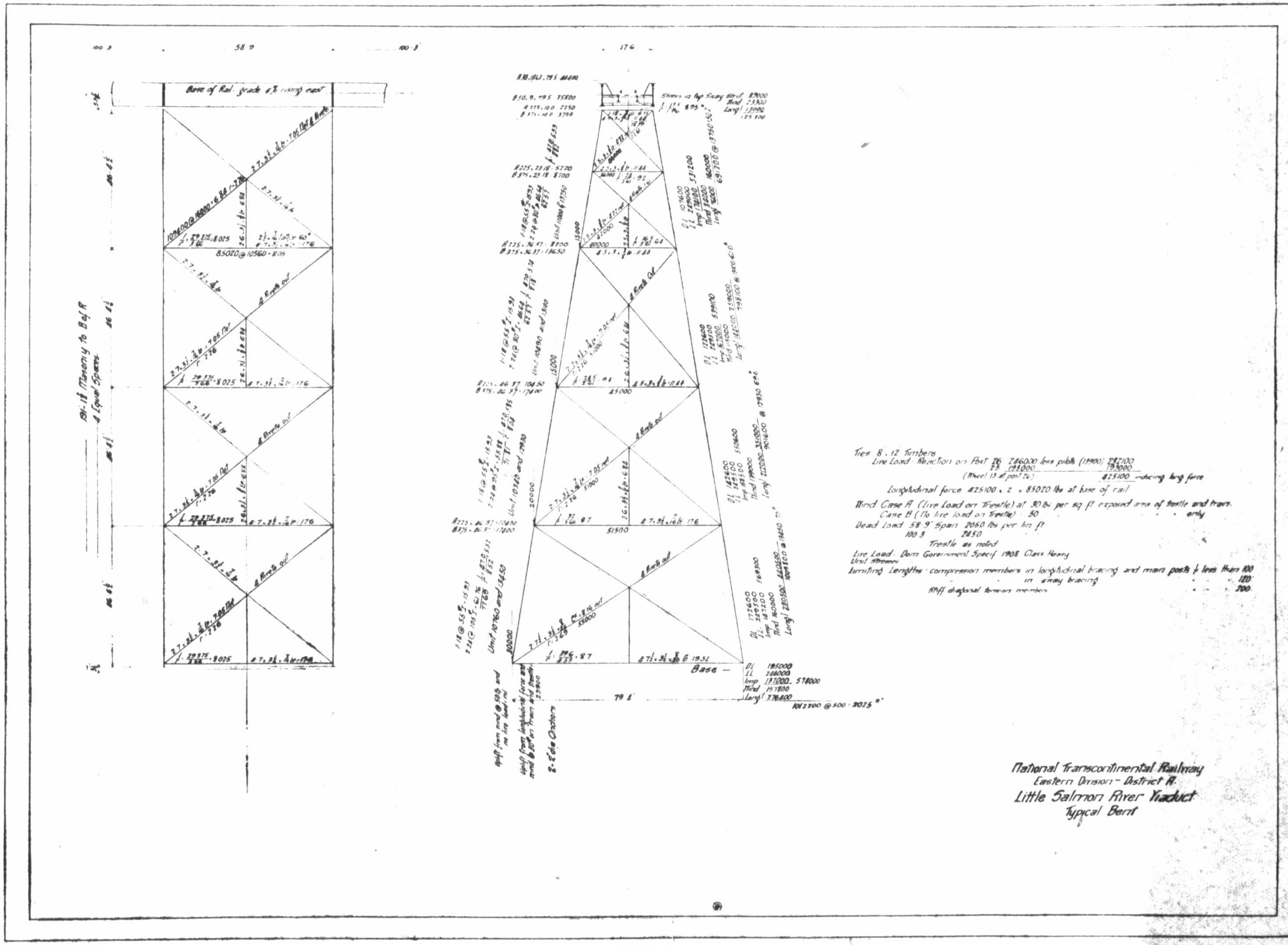

Base of Rail
Base
National Transcontinental Railway
Eastern Division - District A.
Little Salmon River Viaduct
Typical Bent

Plate 3.

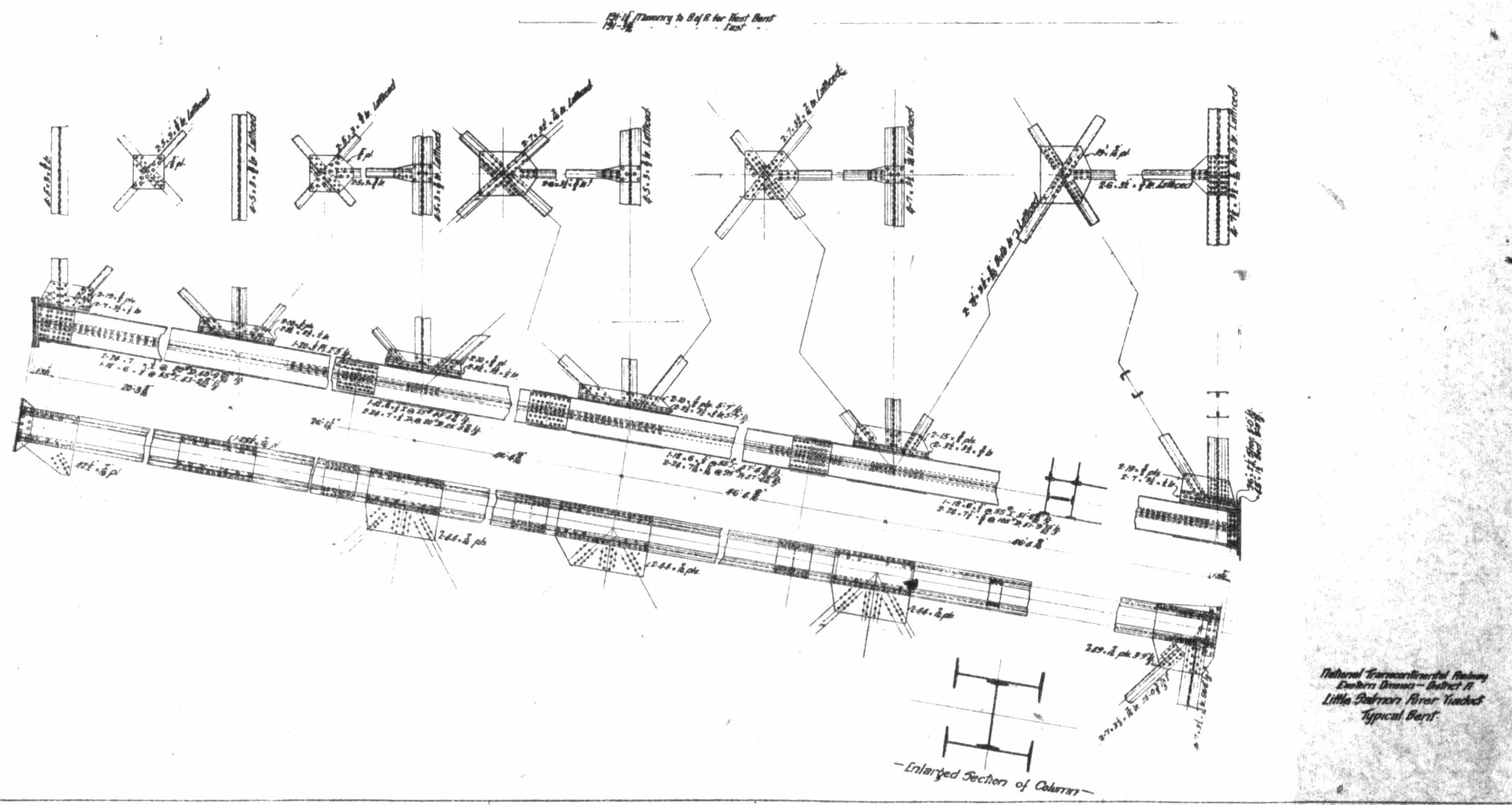
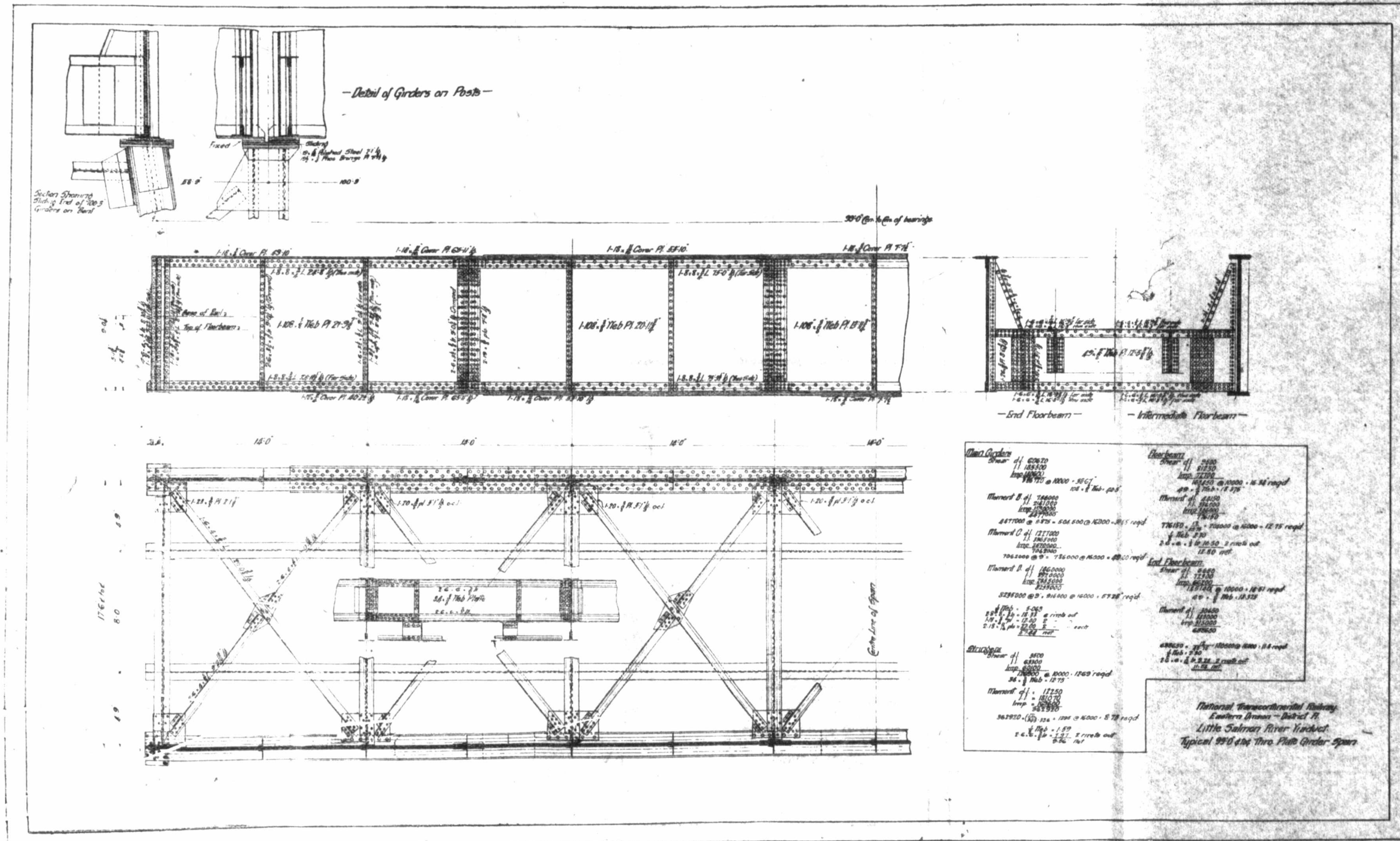

Enlarged Section of Column
National Transcontinental Railway
Eastern Division — District A
Little Salmon River Viaduct
Typical Bent

Plate 4.



-Detail of Girders on Posts-
Section Showing Sliding End of 100'-9 Girders on Bent
Fixed
Sliding
End Floorbeam
Intermediate Floorbeam
Main Girders
Floorbeam
End Floorbeam
Stringers
Centre Line of Span
National Transcontinental Railway
Eastern Division - District A
Little Salmon River Viaduct
Typical 99'0" c to c Thro. Plate Girder Span

Plate 5.

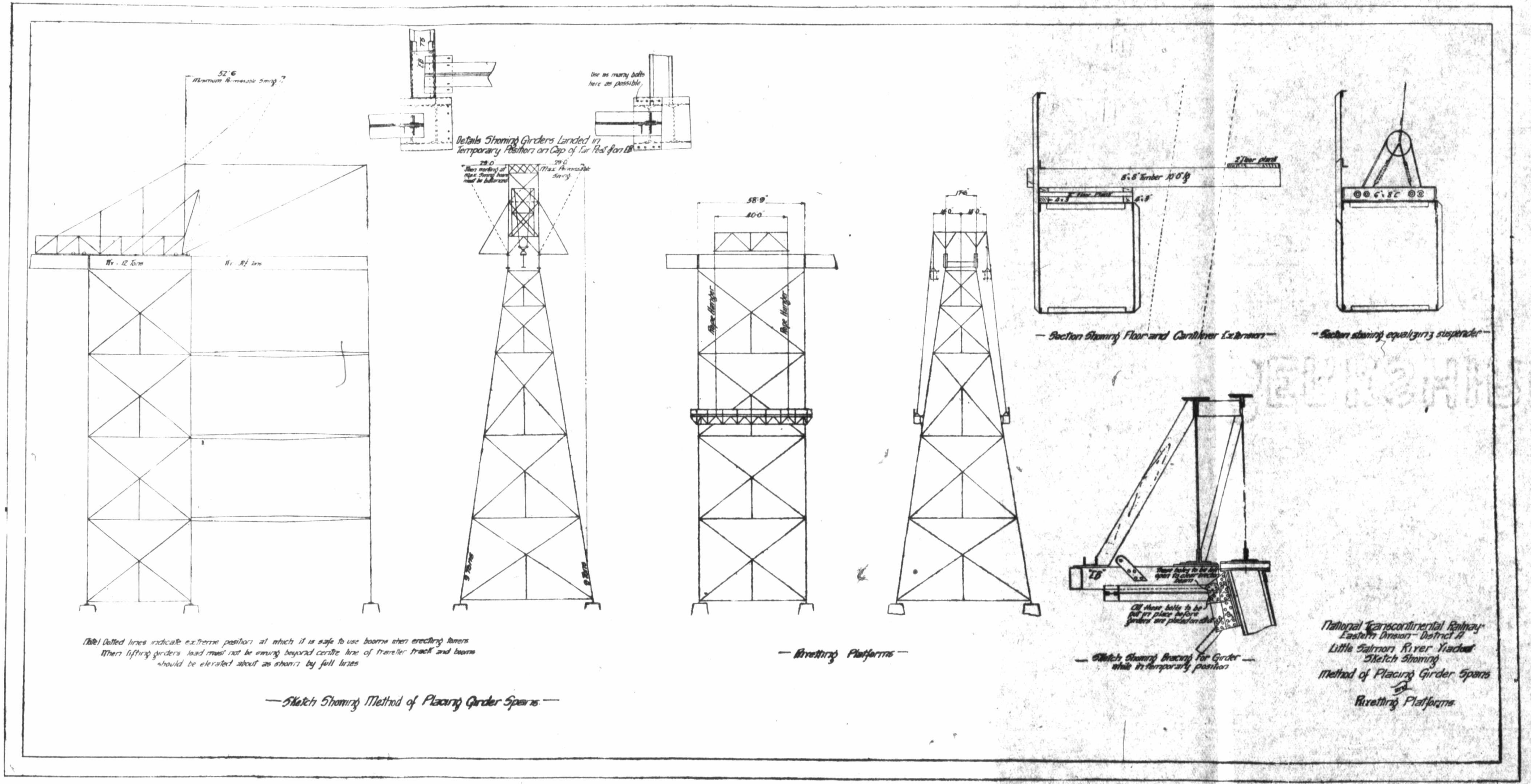

52'6
Minimum Permissable Swing
Wt. 12 Tons
Details Showing Girders Landed in Temporary Position on Cap of Far Post from EB
Use as many bolts here as possible
29.0
Max Permissable Swing
58'9"
40'0
Rope Hanger
Rope Hanger
Section Showing Floor and Cantilever Extension
Section showing equalizing suspender
Note! Dotted lines indicate extreme position at which it is safe to use booms when erecting towers
When lifting girders load must not be swung beyond centre line of traveller track and booms should be elevated about as shown by full lines
— Sketch Showing Method of Placing Girder Spans —
— Rivetting Platforms —
These holes to be left open to clear erection beams
All these bolts to be put in place before girders are placed on strut
— Sketch Showing Bracing for Girder while in temporary position —
National Transcontinental Railway
Eastern Division - District A
Little Salmon River Viaduct
Sketch Showing
Method of Placing Girder Spans
and
Rivetting Platforms

Plate 6.

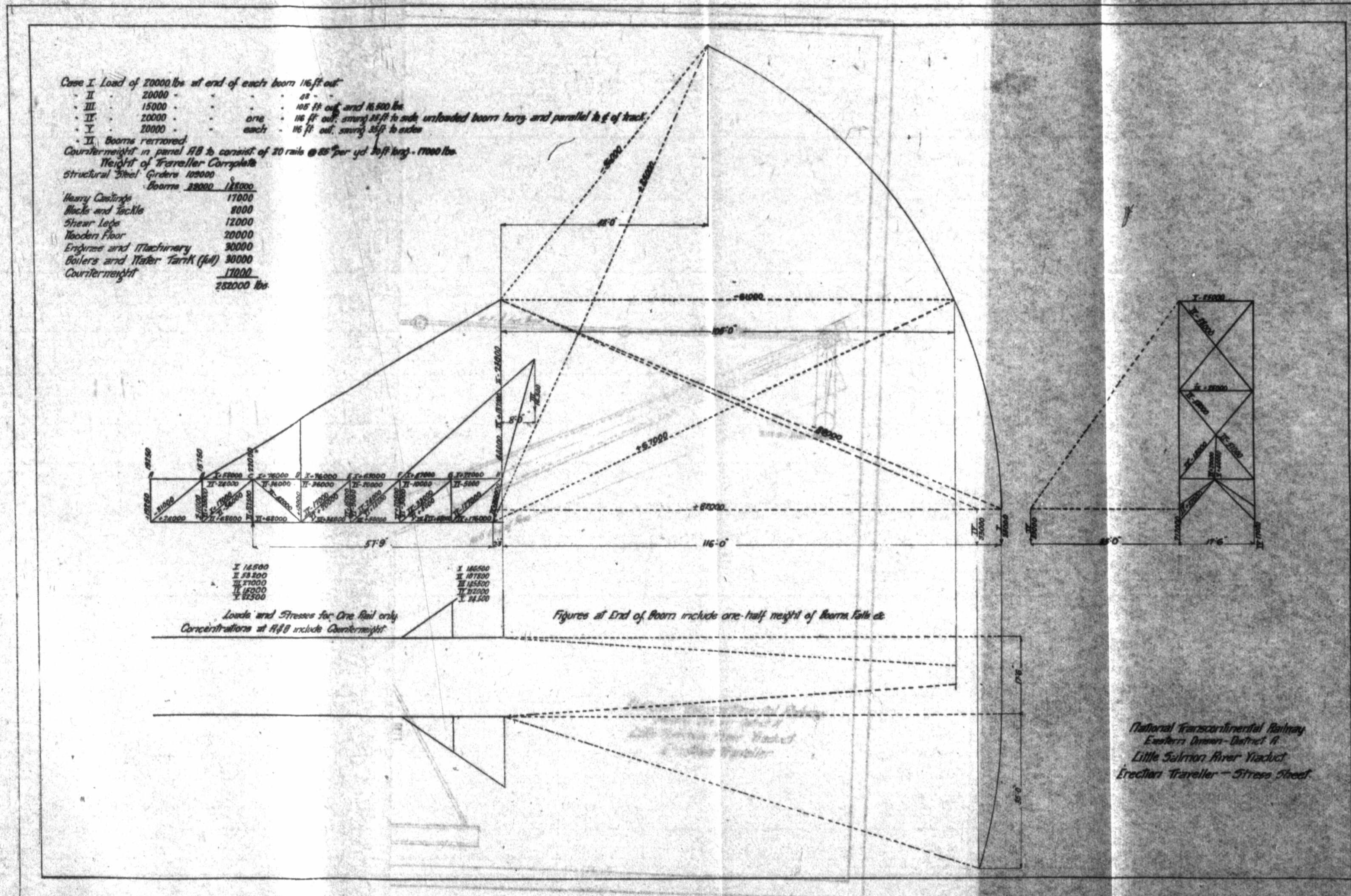

Case I. Load of 20000 lbs at end of each boom 116 ft out
" II " 20000 " " " " 48 " "
" III " 15000 " " " " 105 ft out and 16500 lbs
" IV " 20000 " " one " 116 ft out, swung 35 ft to side, unloaded boom horz. and parallel to ℄ of track
" V " 20000 " " each " 116 ft out, swung 35 ft to sides
" VI Booms removed
Counterweight in panel AB to consist of 20 rails @ 85# per yd 30 ft long = 17000 lbs.
Weight of Traveller Complete
Structural Steel Girders 109000
Booms 39000 148000
Heavy Castings 17000
Blocks and Tackle 8000
Shear Legs 12000
Wooden Floor 20000
Engines and Machinery 30000
Boilers and Water Tank (full) 30000
Counterweight 17000
282000 lbs
Loads and Stresses for One Rail only
Concentrations at A & B include Counterweight
Figures at End of Boom include one-half weight of Booms, Falls etc.
57'-9"
116'-0"
National Transcontinental Railway
Eastern Division – District A
Little Salmon River Viaduct
Erection Traveller – Stress Sheet

Plate 7.

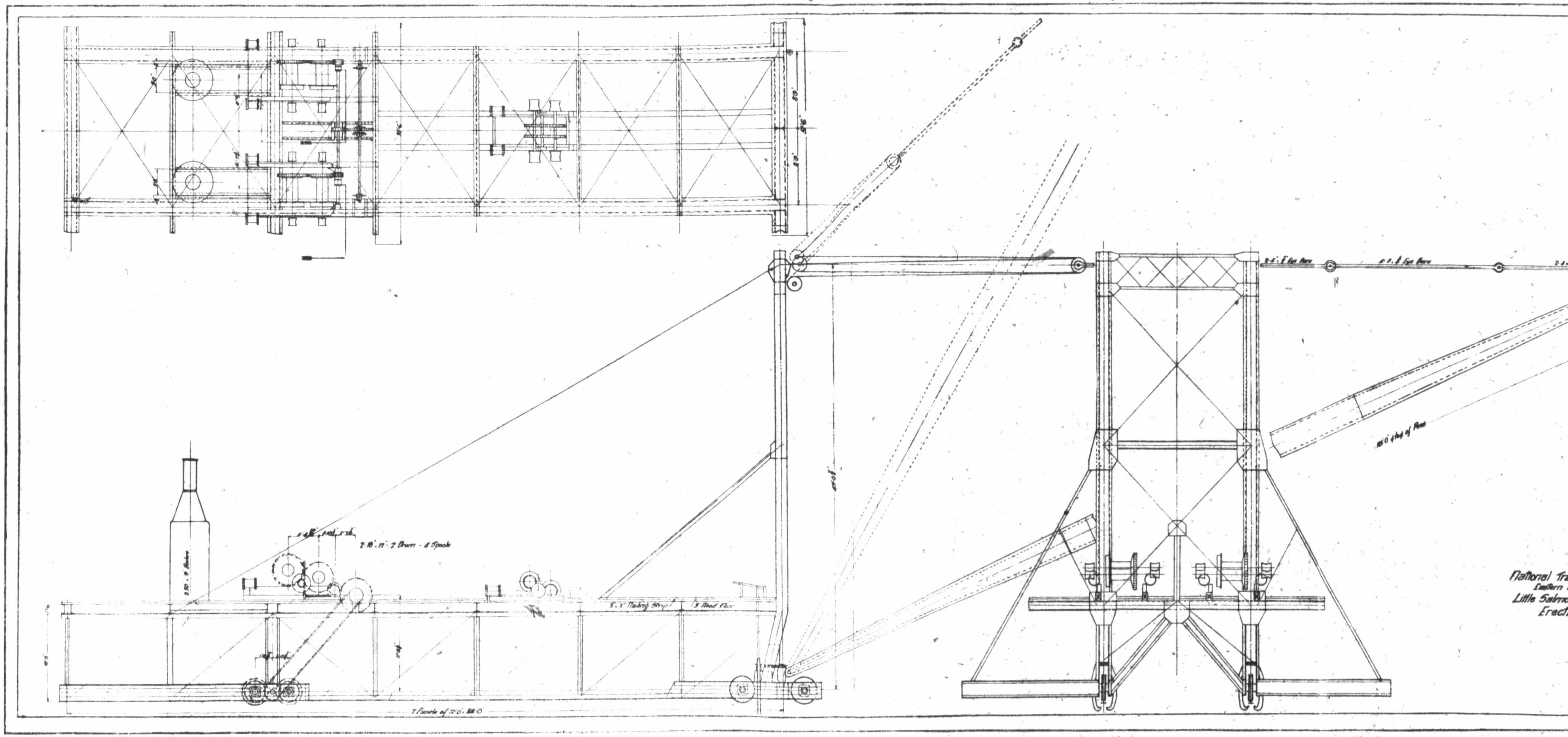
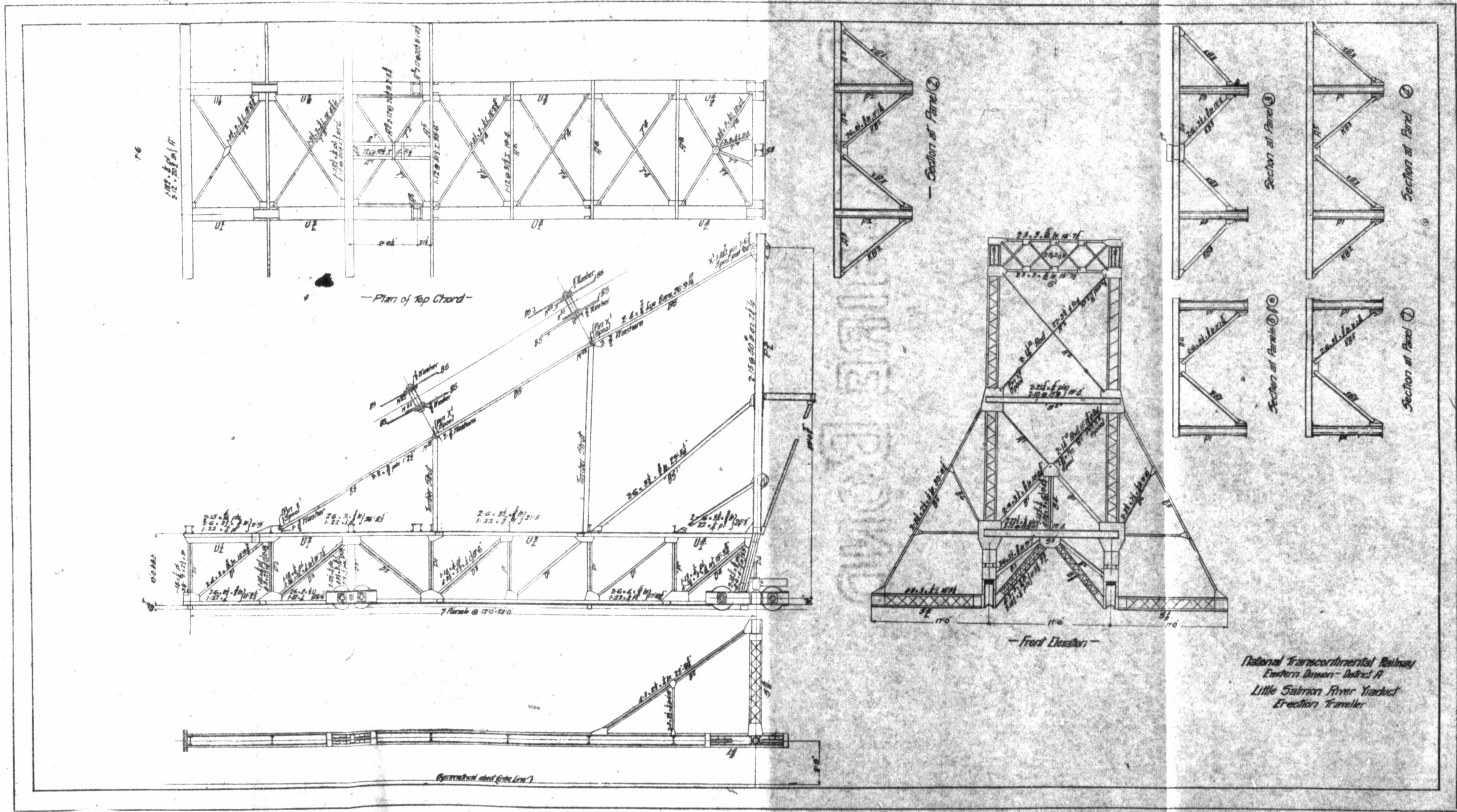

National Transcontinental Railway
Eastern Division – District A
Little Salmon River Viaduct
Erection Traveller

Plate 8.



Plan of Top Chord
Front Elevation
National Transcontinental Railway
Eastern Division - District A
Little Salmon River Viaduct
Erection Traveller

Plate 9.

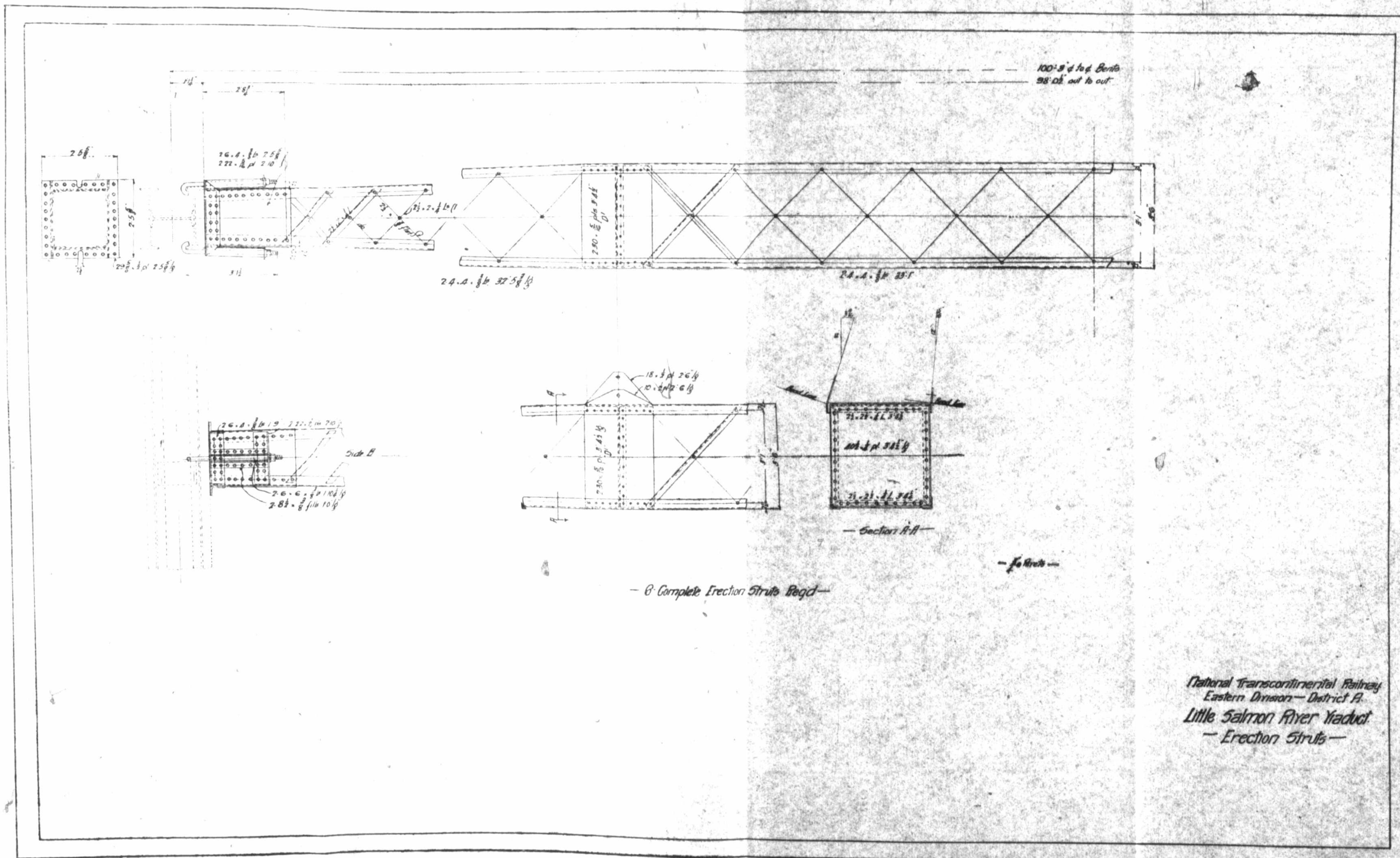
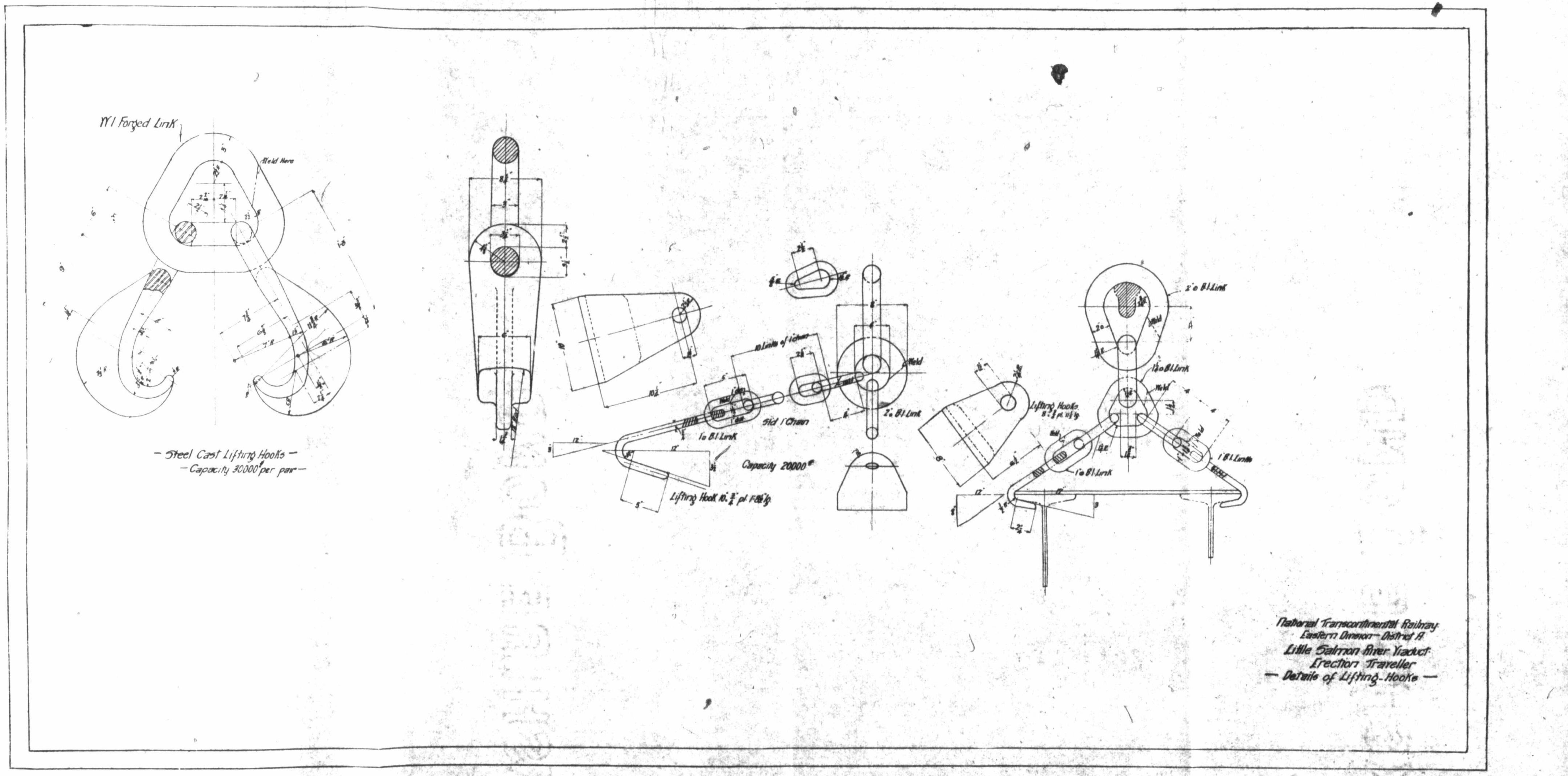

100'-8" ℄ to ℄ Bents
98'-0" out to out
Section A-A
— 6 Complete Erection Struts Reqd —
National Transcontinental Railway
Eastern Division — District A.
Little Salmon River Viaduct
— Erection Struts —

Plate 10.


W.I. Forged Link
Weld Here
- Steel Cast Lifting Hooks -
- Capacity 30000# per pair -
10 Links of Chain
Std. Chain
Weld
Capacity 20000#
Lifting Hooks
National Transcontinental Railway
Eastern Division - District A.
Little Salmon River Viaduct
Erection Traveller
- Details of Lifting Hooks -