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BRIDGE LAUNCHING.

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Read before the General Section, 22nd December, 1904.

The writer's object in presenting this short paper to the notice of the Society, is to call attention to a method of erection of steel bridges, which, though it has been for many years in vogue in England and the Continent generally, has not hitherto been much adopted in Canada.

The construction of a bridge may be simple, but the erection of the same is governed entirely by local circumstances, and in countries where lumber for falsework is scarce, and the cost of skilled labour is high, it is necessary to seek such means of handling the work in the field as will entail as small an outlay as possible for these items.

The particular work to which attention is called, is the erection of several steel bridges for the Central Bahia Railway, South America. The design for these bridges was prepared by the writer, who also had personal charge of the erection, and the bridge selected for description is one of 203 feet length spanning a deep gorge, the base of rail being about 180 feet above water level, and the sides of the gorge being very precipitous.

The difficulty of successfully designing the bridge was enhanced by the fact that this portion of the country is liable to severe shocks of earthquake, and suitable provision was made for the supports of the trusses, as will be described later.

Owing to the cheapness and facility of procuring cement and stone, the abutments and wing walls were built of concrete, the concrete being braced and tied together with old rails and tie bolts as indicated on drawing, since it was found that the adjacent rock was cracked and fissured for a consderable depth. The general lines of cleavage of strata ran north and south, and the direction of oscillations east and west.

The method of erection of the bridge was as follows: Steel suspension ropes 1-5 8″ diameter were carried across the gorge, resting on wooden roller bents at each abutment and connected to a winch at each end. Each half span was assembled, one on each side of the opening, and hauled to the beginning of opening, then the second panel of each from the centre was securely bolted to the hinged top of a temporary wooden braced boom 80 feet long, which was pivoted on the rock face of the gorge as shown on plan. Near The centre panels of the bridge were placed rolled bearing shoes. which rsted on the 1-5 8″ suspension ropes. The suspension ropes were stiffened by the use of 5-8″ steel wire rope guys, these were used for alignment, and in assisting the hauling ropes in starting, stopping, balancing and controling ths travel of trusses. The shore ends of the trusses while being launched rested on skids, the ends being counter balanced as much as possible during the launching. These skids rested on rails, and are shown in the illustration, Powerful screw jacks were used when these skids jammed.

Hauling ropes of ¾″ steel were attached to the trusses, the hauling being accomplished by the aid of a locomotive.

When the ends of the half spans met at the centre of the opening, the closing up and adjustment was done by means of jacks and four powerful cam jaw levers bolted to upper and lower chords of trusses, thus holding them in position while the joints were being riveted up. When this was done the centre and end cross girders and gusset plates and spandrels of upper and lower chords were placed in position, and after these the wind bracing, laterals, floor beams and joists.

The greater weight of the truss was carried on the 80 foot boom, and the trusses were assembled at such a height that when the two halves met together, the lowering of the top end of booms would bring the trusses to the necessary height to suit the finished rail level.

The time occupied in launching and closing up the trusses was thirty-six hours, and for fixing platform, raising, clearing and closing tracks about one day. Freight traffic was suspended for three days, tracks and approaches raised, and abutments altered to suit the new bridge during this time. Passengers and baggage were conveyed across by means of a small, low level trestle bridge,

while portions of bridge material and urgent freight were carried over on the suspension ropes.

The material of the existing bridge, which the new one was to replace on account of increased rolling loads, was removed by means of same booms, gear and tackle as were afterwards employed in launching the new span.

As before mentioned, special end bearings had to be designed to allow provision for displacement by earthquakes. As will be seen in plate, the shoes were of disc form, resting on a number of balls, these in turn resting on bed plates of suitable dished form. This form of bearing was found to work in a very satisfactory manner during earthquake shocks, which gave oscillatory motion at centre of span of about three inches, with no signs of cracks or settlements of abutments or wing walls.

The total weight of the bridge as launched, was about one hundred and twenty tons, thus giving a load on each launching boom of about thirty tons.

Provision was also made for adjusting the rail approaches by the use of four moveable track entrance trussed beams 12″ x 18″ fixed at each end of bridge, one end being strapped and bolted to side of end floor beam, the other end resting on cross beam bearers, skids and wedges for facilitating alignment and levelling up of track entrances into bridge after earthquake shocks or settlement of ground.

The cost of erection and launching, including labour, material and transportation of same, was about $500.00.

The material used in construction of the bridge was steel, the unit stress allowed being about 13,000 pounds per square inch for both tension and compression.

Maximum deflection at centre estimated at 2½ inches.

The main joints of trusses at the centre, as also the gusset plates were rivetted, all other connections being bolted, chiefly on account of lack of skilled labour and with a view to facilitate speedy erection.

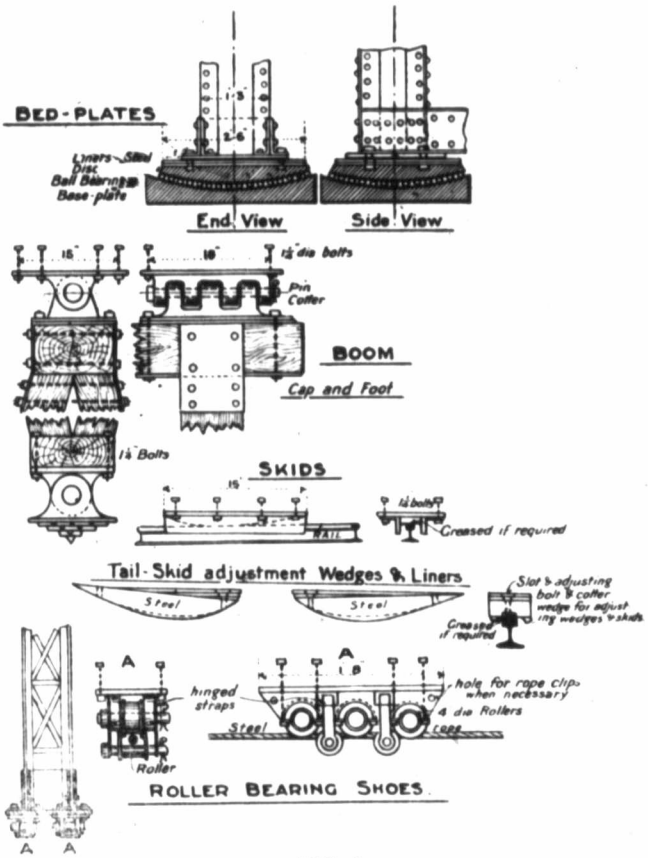
BED-PLATES
Liners
Disc
Ball Bearings
Base-plate
End View
Side View
BOOM
Pin
Cotter
Cap and Foot
SKIDS
Tail-Skid adjustment Wedges & Liners
Steel
Steel
Slot & adjusting bolt & cotter wedge for adjusting wedges & skids
Greased if required
hinged straps
Roller
hole for rope clip when necessary
4 dia Rollers
Steel
ROLLER BEARING SHOES

FIG. 1.

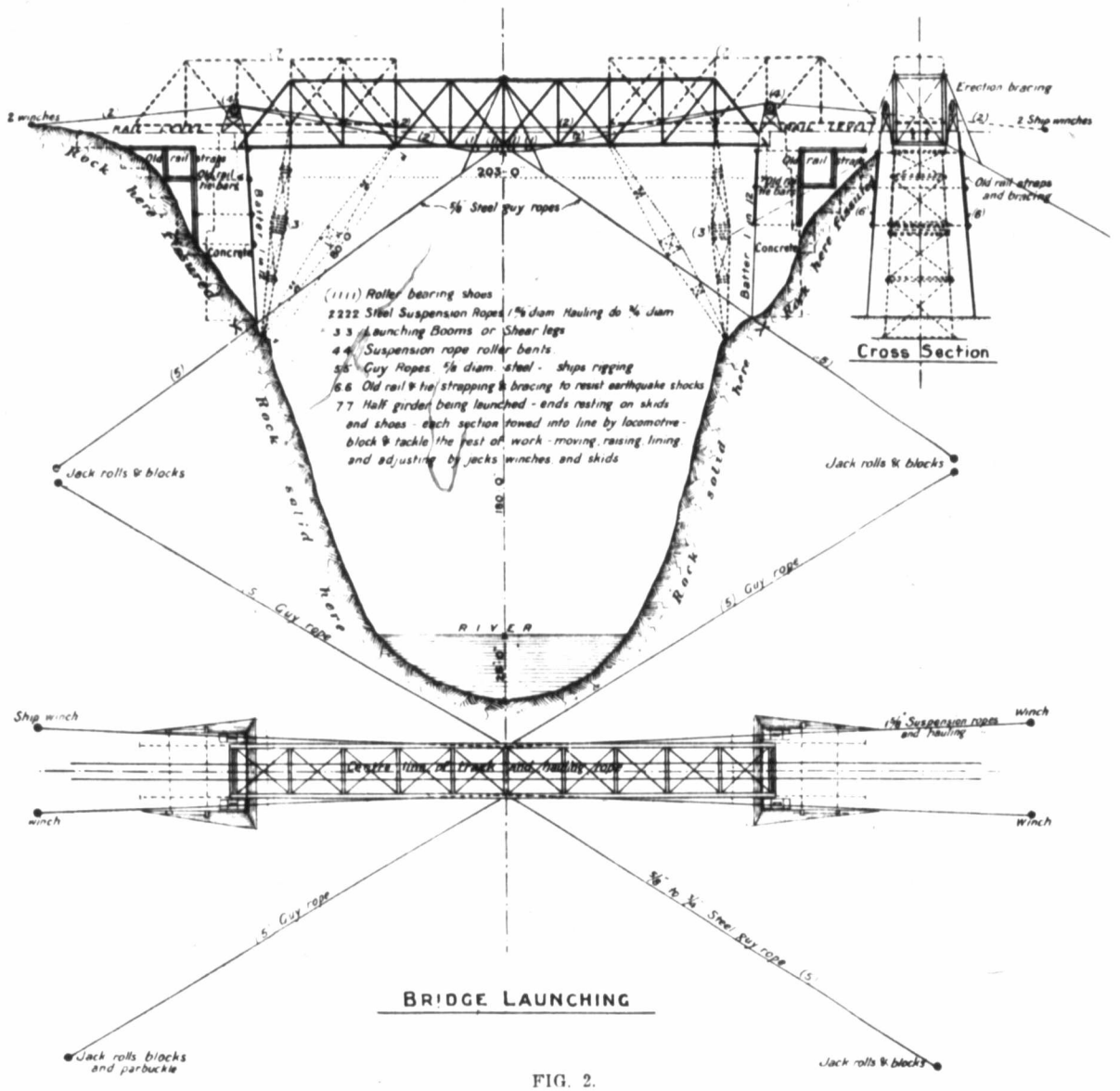
Erection bracing
2 Ship winches
Old rail straps and bracing
Cross Section
(1111) Roller bearing shoes
2222 Steel Suspension Ropes 1⅝ diam Hauling do ⅝ diam
3 3 Launching Booms or Shear legs
4 4 Suspension rope roller bents
5 5 Guy Ropes ⅝ diam steel - ships rigging
6 6 Old rail & tie strapping & bracing to resist earthquake shocks
7 7 Half girder being launched - ends resting on skids and shoes - each section towed into line by locomotive - block & tackle the rest of work - moving, raising, lining and adjusting by jacks winches and skids
203-0
⅝ Steel guy ropes
Rock
Jack rolls & blocks
5 Guy rope
RIVER
Ship winch
winch
1¼ Suspension ropes and hauling
Centre line of track and hauling rope
⅝ to ¾ Steel guy ropes (5)
Jack rolls blocks and parbuckle
BRIDGE LAUNCHING

FIG. 2.