



FIGURE 3.—VICTORIA BRIDGE.

kelsons, were bolted in, & the top kelsons raised to position. The laying of the top plates of the tube was but a repetition of the mode adopted for the bottom ones. Particular care, however, had to be taken in watching the camber of the tube as its weight increased, & wedges were provided under the blocking to raise it up if required.

The tubes of the Britannia Bridge, over the Menai Straits, after being placed in position, were connected with short tubes built in the towers so as to form one continuous length from shore to shore. In the Victoria Bridge a different arrangement was necessary on account of its grade, & the greater expansion & contraction of iron during the sudden extremes of temperature in this variable climate. The tubes of the Victoria Bridge are only connected in pairs. They cover two openings of 516 ft. in length, including bearings, & contract & expand on iron rollers. They are 16x19 ft. at the ends of the bridge, but they increase in depth towards its centre, at which point they are 16x22 ft. The weight of two united tubes, with rails, etc., is about 54 tons, or 257 tons for each opening.

The construction of this character of work is now so well known that much allusion to it is not necessary. Moreover it is simple in the extreme, being formed of boiler plates riveted together with angle irons & lateral & transverse braces, as shown in fig. 2. The skill lies in reducing this boiler iron to such dimensions that there is no unnecessary material to add to the weight & to the expense, & yet obtaining a sufficiency of strength. Accordingly, where the sides of the tube require strength, is at the abutment. Thus it will be seen that for the top & bottom of the tube the greater strength is at the centre, whereas the sides have most material where the span starts. The immediate part of the tube resting on the pier is likewise strengthened by increased lateral bracing.

At the line of neutral axis a few circular holes are perforated in the sides of the tube to throw light into the interior. Over the top of the bridge is constructed a light roof of wood, on the ridge of which is a footwalk 26 ins. wide; & a track is also provided for the painting travellers. The roof is covered with tin & the frame & tin-work are so arranged as not to be injured by the expansion or contraction of the tubes. The sides of that portion of the top of the piers on which the tubes do not rest, are covered with iron brackets, which protect the masonry of the pier, & also prevent snow from blowing in through the space left for the expansion of the tubes.

The tubes themselves were constructed in position, & the difficult & expensive process of floating them from the shore & lifting them by hydraulic pressure was thus dispensed with. Where the coffer-dams were in use the framing was carried up from them; & in the centre a scow was anchored & piles driven in

around it, on which the scaffolding rested. It was here that the difference between the two systems of dams was apparent. In the one three scows secured with piles was necessary; in the other but one. On these supports a truss was formed on which the tube was put together.

Figure 3 shows the description of truss used for this purpose. The expansion rollers are seven in number in each set, of 6 in. diameter, in a cast iron frame, rolling on planed bed-plates. The rollers themselves being turned and the beds plated, they run as smoothly as on glass.

The rivets are an inch in diameter, & are arranged in rows. They were heated in portable furnaces, which were moved from place to place as the work proceeded. From these forges the rivets were taken up with tongs by one of the boys attending & thrown to the riveters on the stage above; & it was extraordinary to remark with what dexterity & preciseness these lads would throw the rivets & make them curve & fall over the stage to right or left on any spot they desired. The rivets were then placed in the holes punched for them, & the ends firmly clenched with heavy hammers before cooling. The rivet head thus formed is in a rough shape, & is finished by placing a steel cup-shaped tool upon it, which being struck with a heavy hammer, the head of the rivet becomes formed perfectly smooth & convex in the steel mould. The contraction of the length of the rivet in cooling draws the plates close together with considerable force.

RAILWAYS AND CANALS.

Annual Report of the Department.

Following is a summary of the report of the Deputy Minister & Chief Engineer for the year ended June 30, 1900, the report of the Chief Engineer also dealing with works of construction up to Dec. 1, 1900.

The number of railways in actual operation, including the two Government roads, the I.C.R. & the P.E.I.R. was 154; some of these, however, are amalgamated or leased, making the total number of controlling companies 86, not including the Government railways. The number of companies absorbed by amalgamation is 36, and the number of leased lines is 33.

On June 30, 1900, the number of miles of completed railway was 17,824; an increase of 466, besides 2,558 miles of sidings. The number of miles laid with steel rails was 17,694, of which 591 was double track. The number of miles in operation was 17,657.

The paid-up capital amounted to \$998,268,404, an increase of \$33,568,620. The gross earnings amounted to \$70,740,270, an increase of \$8,496,486, and the working expenses aggregated \$47,699,798, an increase of \$6,993,581 compared with those of the previous year, leaving the net earnings \$23,040,472, an increase of \$1,502,805. The number of passengers carried was 21,500,175, an increase of 2,366,810, & the freight traffic amounted to 35,946,183 tons, an increase of 4,734,430. The total number of miles run by trains was 55,177,871, an increase of 2,962,664. The accident returns show 7 passengers killed.

The above figures indicate a year of great activity in railway operations, the large increase in working expenses due to the demands of a much increased traffic and the maintenance of a high standard of equipment & service, being more than offset by the additional earnings obtained. Out of the total increase in expenses, four roads, the C.P.R., the G.T.R., the Canada Southern & the I.C.R. are responsible for over \$5,700,000, while

at the same time they gained over \$6,700,000 out of the total increase in earnings.

The Federal Government expenditure on railways prior to & since Confederation (July 1, 1867) amounts, on capital account, to \$127,636,988.07 (including \$25,000,000 granted to the C.P.R. Co.) which together with \$296,872.90 expended on the Nova Scotia Ry. & the European & North American Ry., & transferred to the Consolidated Fund, & for railway subsidies charged against the Consolidated Fund, the further sum of \$23,227,562.51, makes a total expenditure of \$151,161,423.48. In addition, there has been an expenditure since Confederation for working expenses of \$81,391,472.11, covering the maintenance & operation of the Government roads, or a grand total of \$232,552,895.59, all of which, with the exception of 13,881,460.65, paid out before Confederation, has been expended on railways during the past 33 years. This includes the annual subsidy of \$186,600 to the Atlantic & Northwest Ry. Co. for 20 years from July 1, 1889, amounting for the past 11 years to \$2,054,600, which is paid through the Finance Department, & now, for the first time, noted here. It does not include the annual payment of \$119,700 as interest at 5% on \$2,394,000, payable to the Province of Quebec for the line from Quebec to Ottawa, which has been transferred to the Public Debt. The revenue derived from the Government roads during the same period amounts to \$73,225,382.16.

Government Railways.—The railways maintained by the Government are: The I.C.R., the Windsor branch (maintained only), & the P.E.I.R. The gross earnings of all the Government roads for the fiscal year, 1899-1900, were \$4,774,161.87, an increase of \$828,344.47 over the preceding year. The gross working expenses were \$4,665,228.06, an increase of \$758,615.75. The net profit on the operations of the year was \$108,933.81. The I.C.R. gave a profit of \$120,667.02; the Windsor Branch ($\frac{1}{3}$ of total earnings) gave a profit of \$34,459.87, & the P.E.I.R. a loss of \$46,193.08. The above figures include the rental of leased lines for the extension of the I.C.R. into Montreal.

Intercolonial Ry.—On Mar. 1, 1898, the operations of the I.C.R. were extended to Montreal by means of leases obtained from the G.T. & Drummond County Ry. Companies, making an addition of 169.81 miles to the operation of the Government line, its length being 1,314.67 miles, instead of 1,145. The leasing agreement with the G.T.R. Co., dated Feb. 1, 1898, granted to Her Majesty for 99 years from Mar. 1, 1898, an undivided half share or leasehold interest in the Co.'s railway & property between Ste. Rosalie & Bonaventure Station, Montreal, together with an equal right of user with the Co. of its bridge across the River Chaudière; the annual rental being fixed at \$140,000. With regard to the Drummond County Ry., the act of 1899 authorized the acquisition by the Dominion of the Co.'s entire railway, for \$1,600,000, less subsidy paid under the subsidy Act of 1897, for 42 miles thereof between Moose Park & the River Chaudière. The amount of this subsidy was \$136,000, making the amount payable to the Co. \$1,464,000. On Nov. 7, 1899, a deed was executed by the Co. conveying to Her Majesty the whole of this railway from Ste. Rosalie to Chaudière & also the branch line from St. Leonard to Nicolet, for the consideration mentioned, less \$5,000 held pending settlement of certain details. The accountant of the railway has dealt with the rental paid under these leases as an addition to the ordinary working expenses, & in his comparative statement of averages gives such averages for each year, both with the rental included, & also with rental omitted. The figures in the report of the Deputy Minister & Chief Engineer are based on his statements with the rentals included. The statements of