The G.T.R.'s Victoria Bridge.

T. F. Savage, Travelling Freight Agent of the C.P.R., with headquarters at Toronto, who is an enthusiastic collector of old books, has lent us a copy of Hunter's Hand Book of the Victoria Bridge, by F. N. Boxer, architect & civil engineer, published in Montreal in 1860, by Hunter & Pickup, & printed by Jno. Lovell. The book, which is illustrated with wood cuts, gives a brief history of the work, from the time that the first practical idea for its construction was submitted to the public in 1846, up to its completion in 1859. Believing that a description of the original bridge would now be of historic interest, we reproduce that portion of the book as follows:—

The Victoria Bridge is that known as the tubular or beam bridge, & consists of a series of iron tubes resting on 24 stone piers, with a distance between each pier of 242 ft., except the centre opening, which is 330 ft. in length. Its total length between the abutments is 6,600 ft. The bridge is approached by two massive embankments, the one on the Montreal side being 1,200 ft., & that on the south shore 800 ft. in length, which together, including the abutments, make the total length of the bridge 9,084 ft., or nearly 1¾ miles.

The first step taken after the surveys were fully completed, & the line over which the bridge was to pass decided upon, was to lay off the line of the abutments & piers. This work the engineers were able to do whilst the ice was on the river, with the most minute correctness. Then the centre of the foundation of each pier was marked, which was thus performed. "Guides" were framed, so that long iron rods could be lifted & let fall on one spot, technically called by masons "jumped," until a hole was drilled into the rock, in the bed of the river, into which a bolt was driven & a float attached. By these means the precise centre of each pier was established to within a few inches.

The first step to be taken before the foundations of the piers or abutments could be laid, was the formation of coffer-dams which, for such a structure & in such a river as the St. Lawrence, required to be of no ordinary magnitude & cost. Two kinds of dams are said to have been used, each possessing over the other certain advantages. Those called floating dams were framed & consisted of two parts. One part had three sides of a rectangular form, the sides being longer than the ends, but the upper end was formed of two pieces meeting in an angle up stream, in order to turn off the current. They were carefully & strongly built, & caulked, & were then towed into position by a powerful steamboat, & their places determined by a transit from the shore. On a given signal the sluice-gate was opened & the dam sunk into its required place. The area within the dam was of course still water, & within its sides was constructed another dam, on completion of which the water was pumped out.

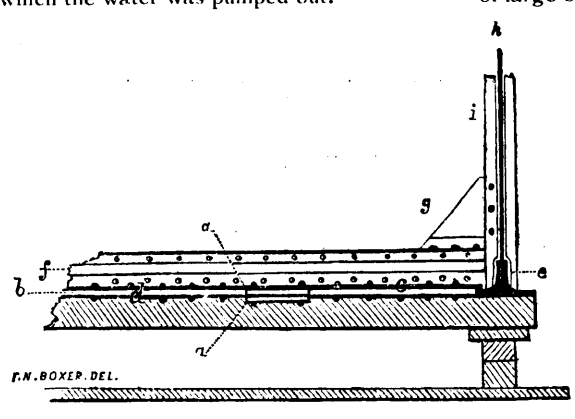

FIGURE 2.—VICTORIA BRIDGE.

The other form of dam was of the ordinary cribbing of the country, & owing to the rapidity of the stream, unusual care had to be observed in its construction. A dam of this form consisted of a double row of cribbing, each 14 ft. wide, & with 7 to 8 ft. of puddle, & between them & the part turned up stream was a regularly built ice-breaker to withstand the ice of the winters if necessary.

The comparison between the respective merits of these two classes of dams may thus be made. The floating dam could be used several times, & was found to answer best in deep water; but its great disadvantage was, that the masonry of the pier had to be completed within the working season, as it could not be made sufficiently strong to resist the pressure of the ice in winter, hence it had to be removed; also when the period arrived to construct the tube, the side of the pier was naked, & there was no point whence to start the scaffolding to support the tube-truss. With the coffer-dam this foundation for the scaffolding existed, & hence it was only necessary to frame one centre-scaffold; whereas with the floating dams three such constructions were necessary, viz., the centre, the frame, & the scaffold foundation at the side of each pier. Nor was this consideration an unimportant one, for such foundation had to be obtained by sinking scows & driving piles around them to keep them in position.

From either dam the framing was carried up above the height of the pier, & on the capping piece or sill was run a railway to admit of the passage of a travelling machine which, mounted with a crab, admitted a contrary passage on itself. Hence stones of 17 tons were moved into position with the greatest facility. On the platform of the dam were erected sheds to cover the steam engine, the blacksmiths' & carpenters' shops & store-room. The foundation of the piers seldom exceeded 22x90 ft., whereas the area required for the dams was 120x210 ft. to allow a large margin in case of their not sinking in the exact spot.

Nothing could be better than the pumps used by Mr. Chaffey, the contractor for masonry on the south side of the river. They worked centrifugally, & threw 800 gallons a minute. It was calculated that his pumps lowered the area of the water in the dam at the rate of 2 ft. per hour, & emptied a dam in 8 or 10 hours. When the dams were perfected & emptied of water, the staging constructed, & the travelling machine in operation, stone delivered & cut ready to be laid on its bed, the next process was that of cleaning out the bed of the river for the foundation.

It was the general impression that the bed of the river was trap rock, but in the progress of the work it was found that it was formed of large boulders headed together in masses, the interstices being filled up with gravel, sand, & mud, in many instances forming a hard concrete mass, & in others the reverse, beds of quicksand & mud being as frequent as any other. Three thousand tons of such material had to be cleared out of the foundation of no. 5 pier. One of the boulders taken out weighed 30 tons, & masses of 3 & 4 tons were strewed thickly over the surface. The depth, therefore, to be excavated before reaching rock greatly increased the cost to the contractors of the masonry in the piers.

In the southern half of the bridge (for it was commenced at both ends at once) the scaffolding was not used, but a compound derrick,

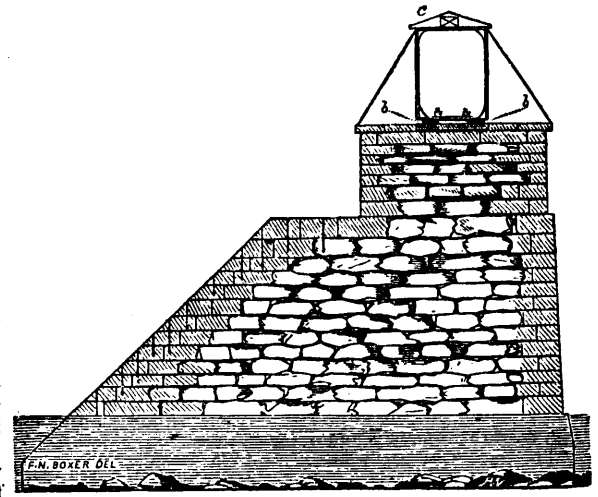

FIGURE 1.—VICTORIA BRIDGE.

worked by a high pressure engine, supplied its place. Much ingenuity was shown in obtaining this motion, as the stone could be placed by it in any position, for the derrick had a motion which admitted of precisely placing the stone in position. It was capable of handling stones 11 tons in weight.

The bridge is approached from the north shore by an embankment 1,200 ft., & another from the south shore 800 ft. in length, & the waters thus embayed, now find their way through the piers of the bridge, by which the velocity of the current has been much increased.

The abutments are each at the base 278 ft. long, & are built hollow, having 8 openings or cells 48 ft. in length & 24 ft. in width, separated by cross-walls 5 ft. in thickness. The flank-wall on the down-stream side rises nearly perpendicular, & is 7 ft. in thickness; that on the up-stream has a slope from its foundations upwards, the thickness of the walls is 12 ft., & they present a smooth surface to facilitate the operation of the ice, on which account its form had been thus determined. To insure greater resistance to the pressure of the ice, the cells are filled up with earth, stone & gravel, so that one solid mass was thus obtained.

The embankments are solid, composed of stone 36 ft. above the summer water level, & of the width of 30 ft. on the upper surface, formed with a slope of 1 to 1 on the down side of the stream, & a hollow shelving slope of about 2½ to 1 on the upper side. The slopes are faced with stones set on edge at an average angle of 45°.

The piers are solid, & constructed, as well as the abutments, of the finest description of ashlar masonry, laid in horizontal courses, measuring from 7 to 12 ft. on the bed, & from 3 ft. 10 ins. to 2 ft. 6 ins. thick above the water level, & thence varying into a course of 18 ins. under the plates. The stones were cut with the greatest exactness, seldom requiring to be redressed after being laid. They weigh from 7 to 17 tons, the average weight of each stone is 10½ tons. All the beds & vertical joints are square, dressed in the most efficient & workmanlike manner, the external face rough, & without any pick or tool marks, but with the natural quarry face preserved. The string courses & copings are fair picked, dressed throughout, & neatly pointed & weathered, & a tool-draft, 8 ins. wide, on each quoin. Each course of the ice breaker is secured with fox-wedged bolts of 1½ in. iron, which pass through into the second & third courses under it, & the horizontal joints are cramped together with iron cramps 12x5 in., through which the bolts pass.

The stone used is Chazy, a limestone of the lower Silurian order. The average height of the piers above the summer water level is