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The Construction of the Great Northern Railway of Canada.

By J. M. Shanly, M.Can.Soc.C.E.

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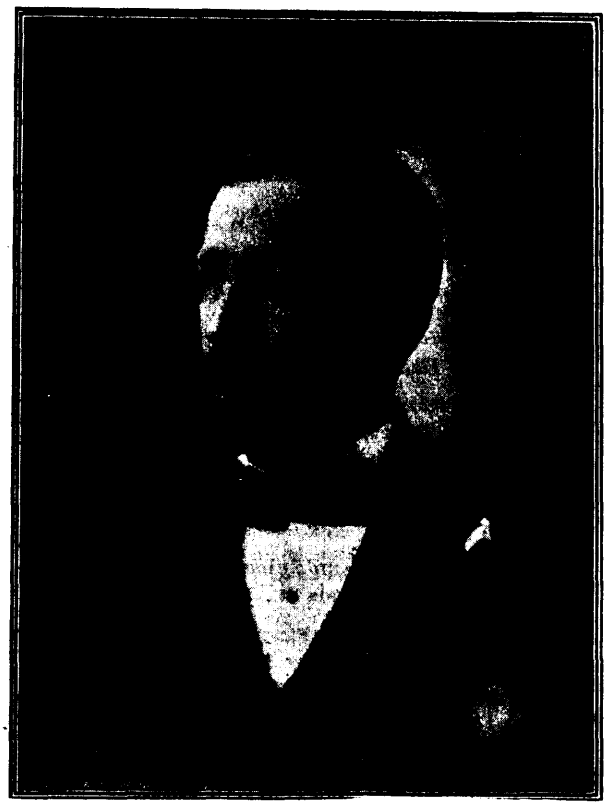
Eleven miles west of the Maskinonge is the Chicot—a small stream flowing through a deep valley. It is crossed by a steel viaduct of two 40 ft. towers and three 60 ft. intermediate spans resting on eight pedestals and two abutments. The total length is 260 ft., and the extreme height from cap to base of rail 57 ft. The pedestals were founded on rock, and the abutments on hard gray clay. Owing to the great height of these trestles it was impracticable to so design them that the windward legs would never be in tension, therefore resistance to overturning had to be provided by anchoring them securely to the masonry and making the pedestals sufficiently large and heavy to withstand the lifting force due to the extreme wind pressure. In order to ensure the necessary holding power the anchor bolts required to be very long, and it was therefore necessary to build them into the masonry. This was a very difficult matter to do, and at the same time keep the heads in exactly the proper position to receive the shoes, as a very slight displacement would cause a misfit between them and the iron work of the towers. To overcome this, the following method was adopted: The position of the bolts was first fixed accurately on the foundations, and a round stick 6 to 8 ins. in diameter, and long enough to project above the level of the coping, slightly tapering downwards, was set up perpendicularly over the point and firmly fixed in position; the masonry was then built up around the stick as high as the under side of the cap; the sticks were then withdrawn and the cap placed in position. The position of the anchor bolts was then again located and marked on the caps, and holes of proper size drilled through them into the space below to admit the anchor bolts. When the time came to set the anchorages, these holes and the space below were filled with grout and the bolts dropped into place. This method worked very well, although in a few cases the holes in the shoe plates had to be slightly enlarged, and in one or two cases the bolts had to be withdrawn and reset. When the iron was put on, a few bolts were found to be loose, owing probably to some inferiority in the grouting; it was deemed prudent, therefore, to test them all, and any that were found loose were withdrawn and reset. It seems to the writer that this method of anchorage, which depends entirely on the holding power of a threaded rod set in cement, might be improved upon. If the cement is good, and the work well done, it is no doubt absolutely safe, but such work is always liable to careless handling, and where so much depends on the anchorages, no chances should be taken. The next river is the Bayonne, about 7 miles further west. It is crossed by a through lattice span of 100 ft. on masonry abutments. The foundations were carried down through stiff clay to the rock, which



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was found at about 7 ft. below low water. About seven miles further west is the L'Assomption river, at Joliette. This is crossed by a single span of 176 ft. through pin connected truss on masonry abutments founded on piles and timber grillage. This is the last bridge on the eastern division. On the western division there are only two iron bridges, apart from that at Hawkesbury, and five small timber trestles. These bridges are both at Lachute—the first one across the North river is a single through pin connected span of 204 ft., and the other across the West river, a single through lattice truss of 103 ft. span. They are both on masonry abutments founded on piles and timber grillage.

The Hawkesbury bridge is made up as follows:—Commencing at the east end there is a through lattice pony truss of 114 ft. span across the Grenville canal, with flanking spans of 55 ft. deck plate girders at either end; these spans rest on an abutment, and three piers of masonry founded on solid rock, which is here close to the surface of the ground. There is a clearance of 42 ft. between the lowest member of this bridge and the water surface of the canal. Next comes 315 ft. of wooden trestle, and then the main bridge, which consists of seven spans pin connected deck trusses of 206½ ft. each, on stone piers. The floor being placed between the upper chords and the base of rail, 3 ft. 3 ins. below their top. Piers 1 and 8 are built with square ends, and the rest with cutwaters. The shore piers are founded on the rock, which is here almost bare at low water. The depth of water at the other piers varied from 6 to 16 ft. at extreme low water. Pier 2, counting from the Hawkesbury side, was the only one that gave any serious trouble in getting in the foundation. When the original soundings were made, the bottom at this pier was found to be covered with boulders, but what appeared to be solid rock was found to be only a foot or two lower down, and the coffer dam was put in on the supposition that this was correct. However, when the excavation was under way, it turned out that the supposed rock was only boulders, and a new coffer dam had to be built outside the first one. The excavation was carried down 9 ft. before a suitable foundation was found, through a mass of boulders and stones mixed with sawdust, slabs, etc., which had been no doubt accumulating for years. At the other piers there was comparatively little excavation, but some large boulders had to be removed from most of them before the caissons could be finally placed. The method of putting in the foundations was by means of a coffer dam for piers 2, 3 and 4, and for piers 5, 6 and 7 by bottomless caissons fitted to the rock, which had been previously cleared of boulders and loose material. The excavated space, inside the coffer dams, and the caissons were then partly filled with concrete mixed in the proportions of 1 cement, 2 sand and 5 broken stone. This was deposited under water by means of a box holding about 1 cubic yard, and after the concrete was set the water was pumped out, and the masonry commenced. Masonry was started in each pier at 3 ft. below low water. Portland cement was used