

a 1° curve, at a point 15 miles from the city of Quebec. After passing westwards through two miles of farming country, the Jacques Cartier river is crossed at a point three quarters of a mile below the old bridge. The main channel of the river at this point is about 300 ft. wide, being separated by an island 30 ft. from its eastern shore and extending about 90 ft. towards midstream. To the west of the river is a low swamp about 1,300 ft. long, requiring a bank 30 ft. high at its eastern end. Westwards to the end the land is covered with bush, principally spruce, and is more or less swampy, except for about 700 ft. of sandy soil and 900 ft. of rock at the western end. The total length is 3.77 miles.

The grading was for the most part carried on simultaneously with the clearing and grubbing, as also temporary trestle and masonry. To the east of the river the heaviest work was in the cuts at the second and fourth half miles, where 34,800 and 30,500 cubic yards respectively of material, principally gravel, was excavated. This work was done by making a gullet 13 ft. wide excavated to grade the full lengths of the cuts, and widened at the ends to admit a steam shovel. The track was then laid in readiness for a train of flat cars, to be hauled to the swamp with material and deposited by plow, as soon as the temporary trestle, extending 1,700 ft. across the river, was built. On the western side of the river the grading was principally in fill taken from the sides, except for a cut 700 ft. long which was taken to make the bank immediately adjoining its eastern end. At the western extremity of the line a rock cut completes the grading.

A temporary trestle 1,708 ft. long across the river and swamp was necessary to make the bank. The figure shows the river bents, while those in the swamps were built on sills in the ordinary way. Most of the timber for sills and caps was hewn from trees taken from the right of way, while the bracing and wallings were principally round stuff. The bents in the river were necessarily of more substantial construction, and more troublesome of erection, particularly where the current was strong and none the less easy on account of the inequality in the river bottom, necessitating the removal of heavy boulders. The bents in the river were built in pieces. The posts, being feeted with two horizontal pieces 6 ft. long, and braced to the post, were placed and loaded with the heaviest boulders, then braced across as well as to the preceding bent, and finally cut off and capped. In order that there would be no interference with the building of the piers, the bents at these points were omitted and three sets of two inclined struts, 12 x 16 in., meeting at the centre and springing from the lower deck at the bents on either side of the pier location, and capped across these apices, sufficed to convey the stringers, making a span of 26 ft.

The substructure for the bridge consisted of four piers and two abutments of first class, rock-faced ashler masonry. The figure shows the details of piers 1, 2 and 3, while 4 was on the side hill, and required no cut water. The stone was of a mixed granite formation, and was brought from a quarry opened at about a mile from the work. The courses were 18 in. in thickness, and the cut water stones on top were cut in five pieces to form part of the upper part of the pier and make a perfect bond. Portland cement mortar was used throughout. The west abutment and first three piers were grounded on cemented gravel composed of pebbles and argillaceous or silicious materials, while the fourth pier and east abutment were founded on piles. The foundations of the piers 1 and 2 were built inside coffer dams made of two rows of sheet piling 4 ft. apart, and filled in with clay. The first gave considerable trouble owing to the sudden rise of the river, which rose 6 ft. in a few hours. Pier 2 was perhaps the least trouble-

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