

& at all events certainly better attained by a bridge at Chaudiere than by no bridge at all. It is obvious that when the railways on the south shore can come to Quebec they will not lose the opportunity, & that the centre of gravity of such a well-situated seaport as ours cannot be displaced. Since 1891, the estimated cost of the bridge has been very materially reduced in consequence of the reduction in price of all kinds of bridge material.

Accompanying the report were the following professional reports.

OPINION OF WALTER SHANLEY, C.E.

In 1889 the Co. had a report made by W. Shanley on the three routes as designated below. Here are the comparative figures given by Mr. Shanley :

WIDTH OF RIVER HIGH WATER.	
The Citadel.....	4,281 ft.
Pointe a Piseau.....	5,468 "
Chaudiere.....	2,590 "
EXTREME DEPTH OF WATER ON PIER SITES.	
The Citadel.....	132 ft.
Pointe a Piseau.....	125 "
Chaudiere.....	43 "
EXTREME HEIGHT OF PIERS FROM BOTTOM OF RIVER TO UNDER SIDE OF BRIDGE.	
The Citadel.....	282 ft.
Pointe a Piseau.....	275 "
Chaudiere.....	193 "
STEEL BRIDGING, RIVER SPANS AND SHORE VIADUCTS.	
The Citadel.....	5,291 ft.
Pointe a Piseau.....	6,850 "
Chaudiere.....	3,100 "

Mr. Shanley continues as follows :—" The figures set out above make it plain to be understood that in respect of all natural difficulties the 2 lower sites, the Citadel & Pointe a Piseau, stand at an immense disadvantage when compared with the upper, or Chaudiere crossing. Construction plans applicable to each place have been sufficiently far advanced to allow of fairly correct comparative estimates of costs being made and the result leaves no room to doubt that the river could be bridged on the Chaudiere line for several millions less than at either of the two lower points. The difference between the cost of the Chaudiere project, carried out in its entirety, and that of either of the other proposed bridges is so immense that to speak of the two latter as rivals of the former would be a misnomer. . . . Except at Chaudiere, any attempt to bridge the river must be attended with risks ; notably the risk of under estimating cost because of the great height (upwards of 130 ft. in clear water) of the under surface portions of the structure which would have to carry the vast piers, or towers, rising to a height of 150 ft. above high tide level. In view, then, of the many millions certain expenditure that a bridge anywhere below the Chaudiere would involve in excess of a bridge at that point and in view of the risks and uncertainty of cost sure to attend the attempt to bridge the river anywhere else, and, finally in view of the commercial aspects of the project, I feel compelled to record my belief that the construction of a bridge either on the Citadel line or on the Pointe Piseau line is practically impracticable. In these days of great bridge spans by means of the Cantilever system, or principle, there are, so to speak, no engineering obstacles to prevent the bridging of the St. Lawrence on the Chaudiere site. The one main Cantilever span would have a stretch of 1,400 ft. The great bridge over the Firth of Forth, now nearing completion, has two openings of 1,700 ft. each."

OPINION OF COLLINGWOOD SCHRIEBER.

Following is an extract from a report prepared by the Chief Engineer of the Department of Railways & Canals, Feb. 18, 1891, after a special visit to Quebec. Speaking of E. A. Hoare's estimates on the cost of a bridge at the Chaudiere, the Chief Engineer says in substance :—" This site is really, it appears to me, unobjectionable. * * *

At the Pointe Piseau & Point Diamond sites 2 piers will stand in the channel, which may be objected to by the shipping interests. That at Point Diamond strikes me as very objectionable. The proposed site at the Island of Orleans may, I think, fairly be ruled out, as it would undoubtedly be very costly to construct. That it is feasible to construct a bridge over the river near Quebec, there is no manner of doubt."

The comparative figures given by Mr. Schrieber were as follows :—

	Chaudiere.	Pte. Piseau.	Pt. Diamond.
Extreme length of bridge....	3,420 ft.	6,754 ft.	5,866 ft.
Width of river (water edge to water edge) high tide....	2,300 "	5,600 "	4,200 "
Width of river (water edge to water edge) low tide....	1,800 "	4,000 "	3,900 "
Deepest water in channel at low tide....	143 "	122 "	123 "
Height above high water....	150 "	170 "	170 "

ISLAND OF ORLEANS SITE.

	High Tide.	Low Tide.
Width of south channel....	5,000 ft.	4,000 ft.
" " north "....	8,000 "	2,000 "
Deepest water in south channel at low tide....	13,000 "	6,000 "
" " north "....	170 "	92 ft.

OPINION OF C. E. GAUVIN, C. E.

In his annual departmental report, dated Nov. 2, 1896, Hon. E. J. Flynn, then Premier of the Province & Commissioner of Public Works, made a very favorable mention of a report prepared under his instructions by Mr. Gauvin, Superintendent of Surveys in the Crown Lands Department, which was a very complete review of the different sites proposed for the Quebec Bridge. After summing up the different bridge plans then submitted, Mr. Gauvin concluded as follows :—" To simplify this examination I will, first of all, eliminate two sites which can have no chance of success in the selection which will eventually be made : 1st, That of the Island of Orleans, owing to the great length of the two bridges, that over the north & that over the south channel ; to the consequent very heavy cost of maintenance of these two works, whose total length would be 15,075 ft., nearly 3 miles, that is to say about 5-2-3 times the length of the Chaudiere Bridge ; to the serious obstacle to the navigation of large vessels which would be presented by the bridge over the south channel, with its 16 piers in the river, which would, moreover, greatly impede the movement of the ice ; finally to the drawback which would result, especially for a line of such importance as that of the Quebec Bridge, of having to cross the River St. Charles over a drawbridge to enter the city, a drawbridge being the only means of crossing that river ; 2nd, That at Pointe a Piseau (Sillery), because if an expenditure of \$12,500,000 is to be incurred, it would be as well for a few hundred thousands of dollars more to build the bridge at Quebec itself. The choice, therefore, remains between the site at Cape Diamond & that at the Chaudiere. From a technical point of view, the Chaudiere site is far superior to its Quebec rival ; the length of the bridge there would be only half that of the bridge before the city, and the foundations of the piers of the first would reach only a depth of 40 ft. below the highest waters, while the supports of the 2nd would have to go down to 135 ft. below the same level. As a result, it is also the Chaudiere site which offers the most advantages as regards expense. According to E. A. Hoare, the cost of the bridge there would be only about 4-10 of that of the bridge before Quebec."

Further on the same engineer says :—" A bridge thrown over the river at Cape Diamond would undoubtedly present a magnificent appearance, and would, beyond contestation, possess advantages, as regards communication between Quebec & Levis, which a bridge at the Chaudiere, for instance, could never have. In the case of a construction of such importance, I would not have the aesthetic

question entirely put aside ; but as the bridge would not be thrown over the St. Lawrence merely to produce an artistic effect, or for the purpose of establishing a constant means of communication (not by railway) between the population of Quebec & Levis, I doubt very much whether consent would be obtained to spend from \$5,000,000 to \$6,000,000 for those two considerations, which, after all, are but secondary. What is the chief, I may say the only, object of a bridge over the river St. Lawrence at Quebec ? Is it to have direct & uninterrupted communication between the populations of Quebec & Levis ? No. The chief object of the bridge at Quebec, or in its vicinity, is to connect the networks of railways on the north & south shores, & also to provide for the three great lines, the Grand Trunk, the Intercolonial & the Quebec Central, a means of reaching the port of Quebec itself, that is to say, those vast docks which have been built at such great expense in the estuary of the river St. Charles, & which possess so many advantages for loading & unloading cargoes, & which are so admirably situated with a view to future enlargement. This is the main object of the bridge. Now, the Chaudiere site is, beyond doubt, that which will enable us to attain that end at the lowest cost. The importance now possessed by the steam ferry between Quebec & Levis is chiefly due to the fact that there is no junction at Quebec between the railways of the north & those of the south shore. When this junction will be affected—whether at Quebec or at the Chaudiere matters little—when freight & passengers for Quebec by the Grand Trunk, Intercolonial & Quebec Central can reach their destination without transshipment, & likewise when freight & passengers from Quebec destined for points on those lines can take the railway at Quebec itself & avoid the transshipment to which they are now exposed, it will be seen that what will remain of the traffic between Quebec & Levis will be inconsiderable ; too inconsiderable, in fact, to justify an additional expenditure of from \$5,000,000 to \$6,000,000. It is quite probable, moreover, that a bridge at Cape Diamond would only very imperfectly accommodate the purely local relations between Quebec & Levis ; for to reach by the bridge from the commercial part of Quebec, the lower town, to that of Levis, the portion situated at the foot of the cliff & vice versa, it would be necessary to make a long detour, to ascend a height of 170 ft. above the level of the river on one shore & descend the same height on the opposite one. We may thus believe that, in most instances, it would be much quicker & consequently more economical to cross the river in a steamboat, as is now done, than to make use of the bridge. It is therefore certain that, in the question of the selection of a site for the bridge, the consideration of purely local communications between Quebec & Levis can have but a slight influence."

Mr. Gauvin then answers certain objections brought up against the Chaudiere site in the report of Mr. Bonin in 1890, in which it was contended that during the construction of the bridge a new centre of population would form at a certain distance from Quebec which would become a connecting point of railways. Mr. Gauvin refutes that statement as follows :—" If the bridge be built before Quebec, during its construction a new centre will be formed in the vicinity of the work on the heights of Levis, which are admirably adapted for the purpose—the fact must not be overlooked that, on the Quebec side, a tunnel will immediately follow the bridge—when the work is ended this centre will remain & become the terminus of the line ; there will be the real junction of the C.P.R. & the other lines on the north shore with the railways of the south shore. Quebec will then, as it were, be served only by a secondary line ending in a cul-de-sac