

tra cost of \$250,000 or \$1,200,000 above the lowest tender.

(e) even if such tender were based upon the specifications of the board, there are no plans before the board to show how this would be done. Plan 'C' shows only two preliminary strain sheets. Neither the connections of ebebars in the top chords or web members, their layout, nor any other information are given. The bottom chords of plan 'A' which might be used for plans 'C' or 'B' are not acceptable in view of the results of tests T7A and T7B. A note on one of the plans says that if tests are not satisfactory they would be replaced by something else.

The word 'satisfactory' in this case has no meaning since no guarantee of tests was given beyond the vague sentence in letter No. 1, accompanying the tenders:

'The specifications should, of course require only such values as can reasonably be expected from carbon steel in the light of compression tests already made upon it.'

Such results would give a bridge much inferior in strength to the board's design.

The board could not, therefore, give an opinion on plans which do not exist.

Referring to the comparative strength of the board's plan and of 'A,' 'B' and 'C' designs, I enclose calculations showing the superiority of the board's design (appendix 'D').

The calculations for elastic limit are to a certain extent based on assumptions, and, besides, elastic limit and yield point cannot be absolutely compared. I have made the comparison as conservatively as I could, owing to the lack of knowledge on the limit of elasticity of built compression members, in regard to which no investigation has ever been attempted, at least to my knowledge, previous to the experiments made by the board at Phoenixville.

The calculations for ultimate strength are correct and based on the minimum results obtained or specified by the board and on the minimum results guaranteed by the St. Lawrence Bridge Company.

Of course, in a work of this magnitude, where such guarantees are asked from the contractors and where a comparatively new kind of metal is used, I understand that the specifications of the board may have to be altered on such points that could not be ascertained before calling for tenders, such as extreme length of materials procurable, and the physical and chemical tests of materials that mills are ready to manufacture irrespective of cost. I was astonished to find out how little change was really insisted upon by the contractors and steel makers and, of course, such changes, as agreed to by the board, ought to be allowed to all contractors alike. The case is different when the conditions of the contract have not been fulfilled, when vital clauses are concerned and where the changes asked for are absolutely contrary to the requirements of the board and department or diminish the strength of the bridge.

To conclude. As implicitly stated in the report of October 26, 1910, the plans, details and materials of designs 'A,' 'B' and 'C' of the St. Lawrence Bridge Company are not made according to specifications. They provide for

a bridge weaker than the board's design, as shown in Appendix 'D.'

Even if they could be made as strong as required by the specifications, there is no plan before the board to show how this result would be attained.

The tenders of the St. Lawrence Bridge Company on their own designs 'A,' 'B' and 'C' do not, therefore, comply with the requirements of the board, as expressed in the specifications, nor of the department, as expressed in the public notices and form of contract issued.

They cannot, therefore, be considered by the board.

The board's design, for the many reasons given on page 4, 5 and 6, complies with all the requirements of the board and the department. It is satisfactory to all engineers and contractors concerned, and I do not know of any technical reason why either of the four tenders on this design should not be accepted.

Yours respectfully,

(Sgd.) H. E. VAUTELET,

Chairman and Chief Engineer.

Hon. Geo. P. Graham,

Minister of Railways and Canals,

Ottawa, Ont.

Montreal, January 20, 1911.

Sir,—I beg to supplement my letter addressed to you on December 10, 1910, by adding to page 6, the following remarks in regard to design V of the board.

(k) A report of Sir Douglas Fox on the board's design was transmitted to me by a representative of the British Empire Bridge Company, and reads as follows:—

'Have made careful examination of board's specifications, general designs and details. Specification is clear and concise and prepared with great care and judgment. It will ensure structure built combining stability and permanence with reasonable economy. Design admirably suited for its purpose. It is perfectly sound alike as to construction and erection and in detail is worked out with skill and judgment. Experiments on large models of compression members have enabled the design of vital parts to be prepared with certainty. Think no hesitation in proceeding with works on lines laid down.'

(l) Letters number two, dated September 30, 1910, attached to the tenders of the St. Lawrence Bridge Company stated:

'Had it not been for the many difficulties that came up on considering the erection of the board's design we would have been content to have tendered on this design only, believing the bridge in other respects to be all that can be desired.'

As mentioned in my letter of December 10 (page 9), the difficulties of erection had become much less serious by October 15, 1910, when the St. Lawrence Bridge Company wrote:

'In a general way we may say that for each design we have worked up in detail a scheme we are satisfied will do the work safely, and on this we have based our estimates.'

And later, speaking of the board's design: 'With the inside traveller the risks above mentioned can, we think, be practically eliminated.'