trains passing through it, and made of sufficient strength to carry six times the heaviest load hitherto known to travel on railways in this or any other country."

In the accompanying plate of the Victoria Bridge, the centre arch is indicated by the steamer passing through it; the width between the towers is here 330 feet, or 110 yards, and the enormous tube which spans the gulf must be constructed so as "to sustain six times the heaviest load hitherto known to travel upon any railway in the world." Of course this is to be understood as applying to a train or part of a train 110 yards long—nevertheless involving a degree of strength and durability of which it is extremely difficult to form a just and accurate conception.

We hope to be able to furnish diagrams and descriptions of the details of this great Canadian work in future numbers of the *Journal*.

It will not be inappropriate, perhaps, to announce here the intention of the Council of the Institute to publish, from time to time, plans and views of the leading structures on the Grand Trunk, the Great Western, and other railways of Canada. Nor do we think that the time is far distant when—in continuing our illustrations of the great public works of this country—we may be enabled to delineate the details of the unrivalled Welland and St. Lawrence Canals, the Slides of the Ottawa, the Suspension Bridge and Rideau Locks at Bytown and other magnificent structures, which are scarcely known except by a misty reputation beyond the counties in which they are situated.

Subjoined is Mr. Stephenson's report on the Victoria Bridge to the Directors of the Grand Trunk Railway:—

21, Great George Street, Westminster,
2nd May, 1854.

Gentlemen,—Absence from England, and other unexpected circumstances, have prevented my sooner laying before you the results of my visit to Canada last autumn, for the purpose of conferring with your Engineer-in-Chief, Mr. Alexander Ross, respecting the Victoria Bridge across the River St. Lawrence, in the vicinity of Montreal.

The subject will naturally render itself into three parts, viz.:—

First,—The description of Bridge best adapted for the situation.

Second,—The selection of a proper site.

Third,—The necessity for such a structure.

Regarding the first point, I do not feel called upon to enter upon a discussion of the different opinions which have been expressed by engineers, both in England and America, as to the comparative merits of different classes of bridges, and more especially as between the suspension and tubular principles, when large spans become a matter of necessity. It is known to me that in one case in the United States a common suspension bridge has been applied to railway purposes, but from the information in my possession from a high engineering authority in that Country, the work alluded to can scarcely be looked upon as a permanent, substantial, and safe structure. Its flexibility, I was informed, was truly alarming, and although another structure of this kind is in process of construction near Niagara, in which great skill has been shewn in designing means for neutralising this tendency to flexibility, I am of opinion that no system of trussing applicable to a platform suspended from chains will prove either durable or efficient, unless it be carried to such an extent as to approach in dimensions a tube fit itself for the passage of railway trains through it. Such bridge may doubtless be successfully, and perhaps with propriety, adopted in some situations, but I am convinced that even in such situations, while they will in the first cost fall little short of wrought iron tubes, they will be more expensive to maintain, and far inferior in efficiency and safety.

I cannot hesitate, therefore, to recommend the adoption of a Tubular Bridge, similar in all essential particulars to that of the Britannia over the Menai Straits in this Country; and it must be observed, that, the essential features being the same, although the length much exceeds that of the work alluded to, none of the formidable difficulties which surrounds its erection will be involved in the present instance. In the Britannia, the two larger openings were each 460 feet, whereas in the proposed Victoria there is only one large opening of 330 feet, all the rest being 240 feet. In the construction of the latter, there is also every facility for the erection of scaffolding which will admit of the tubes being constructed in their permanent position, thus avoiding both the precarious and expensive process of floating, and afterwards lifting the tubes to the final level by hydraulic pressure.

In speaking of the facilities, it is a most agreeable and satisfactory duty to put on record that the Government Engineering Department has, throughout the consideration of this important question, exhibited the most friendly spirit, and done everything in its power to remove several onerous conditions which were at one time spoken of as necessary, before official sanction would be given for the construction of the Work.

On my arrival in Canada, I found that Mr. A. M. Ross had collected so much information bearing on the subject of the site of the Bridge, that my task was comparatively an easy one.

Amongst the inhabitants of Montreal, I found two opinions existing on this point—somewhat conflicting: the one side maintaining that the River should be crossed immediately on the lower side of the city, where the principal channel is much narrower than elsewhere, and where also the Island of St. Helens would shorten the length of the Bridge; the other seeming to be in favour of crossing a little below Nun's Island.

Sections of the bed of the River at both points had been prepared, and a careful study of these left no doubt on my mind that the latter was decidedly the one to be adopted.

In addition, however, to the simple question of the best site for the construction of a bridge across the St. Lawrence, my attention was specially called to the feasibility of erecting and maintaining such a structure during the breaking up of the ice in spring, when results take place which appear to every observer indicative of forces almost irresistible, and, therefore, such as would be likely to destroy any piers built for the support of a bridge. I have not myself had the advantage of witnessing these remarkable phenomena, but have endeavoured to realise them in my mind as far as practicable by conversation with those to whom they are familiar, and, in addition to this, I have read and studied with great pleasure an admirable and most graphic description by Mr. Logan of the whole of the varied conditions of the river, from the commencement of the formation of ice to its breaking up and clearing away in spring. To this memoir I am much indebted for a clear comprehension of the formidable tumult that takes place at different times amongst the huge masses of ice on the surface of the river, and which must strike the eye as if irresistible forces were in operation, or such as, at all events, would put all calculations at defiance.

This is no doubt the first impression on the mind of the observer; but more mature reflection on the subject soon points out the source from which all the forces displayed must originate.

The origin of these powers is simply the gravity of the mass occupying the surface of the water with a given declivity up to a point where the river is again clear of ice, which in this case, is at the Lachine Falls. This is unquestionably the maximum amount of force that can come into play; but its effect is evidently greatly reduced—partly by the ice attaching itself to the shores, and partly by its grounding upon the bed of the river. Such modifications of the forces are clearly beyond the reach of calculation, as no correct data can be obtained for their estimation; but if we proceed by omitting all consideration of those circumstances which tend to reduce the greatest force that can be exerted, a sufficiently safe result is arrived at.

In thus treating the subject of the forces that may be occasionally applied to the piers of the proposed bridge, I am fully alive to many other circumstances which may occasionally combine in such a manner as apparently to produce severe and extraordinary pressure at points on the mass of ice or upon the shore, and, consequently, upon the individual piers of a bridge. Many inquiries were made respecting this particular view, but no facts were elicited indicative of forces existing at all approaching to that which I have regarded as the source and the maximum of the pressure that can at any time come into operation affecting the bridge.

I do not think it necessary to go into detail respecting the precise form and construction of the piers, and shall merely state, that in forming the design, care has been taken to bear in mind the expedients which have hitherto been used and found successful in protecting bridges exposed to the severe tests of a Canadian winter, and the breaking of the ice of frozen rivers.

I now come to the last point, viz., the necessity of this large and costly bridge.

Before entering on the expenditure of £1,400,000 upon one work in any system of Railways, it is of course necessary to consider the bearing which it has upon the entire undertaking if carried out, and also the effect which its postponement is likely to produce.