of which is *across* the general direction of the stream, and strikes toward the quays at Montreal.

Considering the "channel" as that portion of the stream having a greater depth than *nine* feet at extreme low water, the width of it on the bridge line as stated is about 360 feet, or about 300 feet between the lines of ten feet water. If the centre span be executed in wood, the piers would encroach upon the "channel" as above defined. It would be better to have the centre span upon any location 400 feet wide, which will involve a tubular beam of iron, at an additional expense of about £43,000. This additional expenditure I would recommend, as this arch will be exposed to the chimneys of passing steamers; moreover, by making it of iron it cuts off the communication in the event of fire—exposing only half the structure.

While the selection of the site has been governed by the accidental conditions of the river, it possesses a variety of advantages, which under such circumstances could hardly have been anticipated.

1st. The location is on the most direct line of connection for the Grand Trunk Railway. This road, without reference to the bridge, would on approaching the city cross the canal at the only convenient point (which is near Gregory's and above all the basins) and proceeded down to Point St. Charles for its freight terminus and for a connection with the harbour independent of the canal. The bridge line is a continuation of the main track coming down to Point St. Charles.

2nd. The line in the river runs upon a rock bottom and in more shallow water than can be found upon any other direct line crossing the St. Lawrence. It is a remarkable fact that the shoalest water to be found in the St. Lawrence below Lake Ontario is on the *last* rapid —the Sault Normand opposite Montreal.

The width of the river and consequent length of the bridge is not only counteracted by this shoal water (fully half of the whole distance being less than five feet deep,) but this width involves little disadvantage, because the distance between the only navigable channel and the shores admits of a gradient, which passing *over* the limits required for the navig tion, yet descends at once so as to strike the business level at both of these shores.

3rd. The ice seldom lodges *above* the line of the bridge, although it always does to a greater or less degree immediately below it. Nun's Island gives a direction to the current, which throws the ice against Moffatt's Island where it piles with great force. The shoal, which is suspended from the lower end of Nuns' Island to the centre channel will act as a breakwater to the western half of the bridge against the effect of "bergs" of ice. The average depth of water on this shoal not exceeding seven feet, detached ice-breakers can be constructed upon it at a moderate cost, which will break the momentum of large descending fields,—while accumulations of ice having too great a draught of water to pass under the arches will be "picked up" by this shoal before reaching the piers of the bridge. On the eastern half of the bridge, the greater portion of the work will derive much protection against the effects of descending ice, by the works of the Champlain and St. Lawrence Railway, and by the natural breastwork of Moffat's Island.

4th. The site, while it possesses all the advantages of a line in the rapids where there is but one navigable channel, not only has that channel narrower than any available one in the rapids above, but the rapid is so moderate as not to offer any great impediment to the work of erection, and construction, and for three months in the year is frozen over and accessible at every point upon strong ice.

5th. Terminating at Point Charles in immediate contiguity with the canal basins, the water level of which aided if necessary by an additional supply from the head of the Lachine rapids can be conducted over hundreds of acres both on land and in the river,—the bridge will lead all the railroads from the southern shore to the only point where they can be placed in immediate connection with the navigation and receive supplies "ex-warehouse," or direct from inland or sea craft for distribution to every part of New England or the Lower Provinces. In connection with this subject I have projected a scheme of docks around Point St. Charles, which shews the capabilities of the place in point of extent to be at least equal to that of Liverpool, Glasgow, or London, and which may be taken up in sections and extended as required for the increasing wants of commerce.

The importance of this point, its fitness for a general railway terminus in connection with the sea and inland navigation, is explained at large in the appendix in an extract from my unpublished Report on the Montreal and Kingston Railway, and also an extract from a lecture before the Mechanics Institute of this city.

It will be at once seen on reference to a map, that *the whole* of the channel between Nuns' and Montreal Islands may be filled with water and made available for the navigation. Also by obtaining (upon top of the embankment) permanent access to Nuns' Island, the outer coast of that island presents an extensive frontage and deep water where barges and lake and river craft not drawing over nine feet water may load for ports below.

It is only by an artificial harbor accommodation like this that Montreal can ever hope to share with Quebec any portion of the export trade in deals. Bright deals brought by railway to Point St. Charles and Nuns' Island, could afford this transportation on account of the higher price these command over those which have been floated. This trade by attracting a larger marine to this port could not fail to give an important impulse to our commerce,

Lastly. The excellence of this site,—opposing only a single navigable channel which is trumpet-mouthed and therefore affords safe and easy access to the passage of the bridge,—is strikingly shown in the features of practicability, of economical arrangement. and the minimum of gradient which are here attainable.

If the navigable channel were a quarter of a mile or more in width, as it is both above and below the proposed line of the bridge, it would be necessary to elevate *all* that portion of the bridge which spanned this channel. one hundred feet. This would shorten the distance in which the ascent from the shore to the highest point of the bridge must be made, so as either to increase the gradient to an impracticable figure or augment the cost and length of the bridge. The increased cost might make it commercially impracticable, and the increased length might throw the terminus on shore at a point which would greatly damage if not destroy its commercial usefulness. Again, if there were *several* navigable bays under the bridge these would be separated by piers splitting the current, so as to make the navigation dangerous.

The economical arrangement consists in the fact that it will only be necessary to elevate the two piers embracing the channel to the height of one hundred feet above the water; over these a rectangular tubular beam (30 feet deep, and assisted by arches, if of wood, but without arches and of less depth if of iron) will be laid—*through* which the trains will run The piers immediately on either side of these central ones will only be raised seventy feet above the water, and from these toward either shore the height of the piers will gradually diminish, in proportion to the gradient of the bridge. The trains will run *upon the top* of the bridge in ascending from either shore to the centre arch, and the depth of the tubes (thirty feet) will, *without additional cost*, make up so much of the required elevation of the track, and thus be a substitute for a corresponding amount of masonry in the piers. This dropping of the bridge immediately on either side of the centre span is here admissable—because no masted craft will pass under the side arches—but would obviously be inadmissable if the navigable channel extended over a greater portion of the river.

The comparative lightness of the gradient is due to the existence of of the single narrow channel and its position nearly in the centre of the bridge line, from the combined effects of which the greatest possible distance is obtained for surmounting the level between the shores and summit of the bridge.

PRINCIPLES OF CONSTRUCTION.

In the foregoing part of this report, the plan of the proposed bridge has been partly developed, but in consequence of its relation to the action of the ice, its peculiar position and arrangement, it will be necessary to allude to it more fully.

The importance of retaining the "bordage" ice *in situ* has been explained, and for this purpose, that part of the bridge extending from the shores over the shoals, to the depth of five feet water, being a distance of 450 yards on one side, and 570 on the other, is designed to be a solid causeway or embankment carried above the level of the highest winter flood; from which point to the level of the rails it may be carried up by a viaduct of arches—an embankment or trestle work for the present. If the scheme of docks which I have proposed at Point St. Charles, be carried out. this causeway would become one of the dock walls, and the arches erected on it to give the proposed ascent to the bridge might be converted into warehouses. If the channel between Nun's Island and Point St. Charles be dammed, an immense amount of ice which now goes down to aid in flooding the water back on Montreal, would be retained harmless until it melted in the spring

On the south-eastern shore the great width and dead shoal water around the Laprairie basin, form square miles of ice, which, so soon as freed from its attachment to the shore, is carried by the throw of the current directly down through the *now* important channel between Moffatt's Island and the St. Lembert side. The works of the Champlain and St. Lawrence Railroad Company, although incomplete and not high enough, retained this bordage *in situ* during last winter, (1851—1852) and this in connection with the fact that the winter set in