

perhaps the most important is the regulation of the St. Lawrence River, in the immediate vicinity, with the consequent increase of available power and the lessening of the floods and ice shoves which make the construction of terminal facilities in the harbor so costly an undertaking. This problem was studied exhaustively in 1889 by the Montreal Flood Commission, of which Mr. T. C. Keefer was chairman, and a report was submitted. It was pointed out that the local difficulties arose almost entirely from enormous accumulations of "frazil" or "slush" ice, which was formed throughout the winter in the open waters of the Lachine Rapids. The remedy recommended was the creation, in so far as possible, of an ice cap over the water surface. If the construction of the Georgian Bay Ship Canal is undertaken by the Canadian Government it is hardly likely that so great an opportunity to carry out the ideas of the Flood Commission will be allowed to pass. If the regulation of the St. Lawrence River between Montreal Harbour and Lake St. Louis be successfully accomplished no canal construction near Montreal will be necessary and the available harbour frontage will be very greatly increased. This matter is not dealt with in the interim report, probably because the cost is not fairly chargeable to the canal scheme, but rather to the general development of Montreal as a commercial centre. Among the many problems suggested by or involved in the canal scheme there is probably not another equal in engineering interest or economic importance to this question of flooding out the Lachine Rapids, where the total fall of the river is about 50 feet, and the minimum flow nearly 250,000 cubic feet per second.

It should be noted that although this canal scheme calls for an expenditure (according to the latest estimates) of \$100,000,000, it is to be regarded as a fairly simple piece of construction and as one that presents few problems that are not familiar to the profession. The works will be on a great scale, but there is no uncertainty about any of major considerations connected with the execution of the work; and the estimates should be very close and accurate, for the surveys have been very carefully made and the unit cost of the various classes of work proposed is well-known. Compared to such problems as the enlargement of the Erie Canal or the building of the Panama, it is a model of simplicity and certainty. The lessons learned in the Detroit and St. Mary's Rivers make the adjustment of the design to the needs of the proposed traffic almost a piece of routine work.

The real problem of the Georgian Bay Ship Canal is indeed not one of engineering, but of economics and finance. Will the improvement justify the outlay? This has been the question for fifty years past and it remains the question to-day.

In 1865, shortly after the publication of the Shanly & Clarke reports, Mr. William Kingsford, the Canadian historian, himself an engineer by training and occupation, wrote in his monograph on the Canadian Canals as follows: "The geographical situation of this navigation can only have in view the trade of Lake Michigan, for from the lakes east of those waters the nearest route is by the St. Lawrence;" and "for purposes of Canadian navigation the canal is utterly unnecessary."

No one will now question the thoroughness of Mr. Kingsford's grasp of the situation of the soundness of his conclusion at the time of writing. The canal would then have served American traffic only.

In 1891, Mr. A. M. Wellington, in his comments in *Engineering News*, practically endorsed Kingsford's opinion in the following words:—"Had the route lain in American territory it would have been built long ago, and probably at Government expense as a free highway of commerce, so great is the opportunity. Were the route to-day under American control it would not be two years before work on it would be under way, but with one country to reap the chief gain and another country to pay the chief price for it, the prospect for any immediate action is poor." It may be said again that at the time of writing this conclusion was true.

The time has now come, however, when the Canadian

publicist has ceased to look to the United States as the source of the traffic which his works are to handle. The growth of the settlement along the north shores of the Great Lakes, the rapidly increasing output of the prairie Provinces, and the diminishing importance of the United States as an exporter of heavy food stuffs, have combined to create conditions in his present which his predecessors could only predict for the far future. He realizes that England is still the great purchasing market and that the returns to the Canadian farmer and shipper are determined by the prices ruling in Liverpool and London. Every reduction in the cost of transportation—and it should be remembered that it is a case of the transport of heavy material of low unit value over great distances—means therefore an increased price at the farm, and pending the growth of a local market, the Canadian West eagerly advocates every proposition that promises to reduce the cost of its export shipments. The West, however, has not been a very vehement advocate of the Georgian Bay Canal because the disability that is closest to it, and consequently most felt, has been the inability of the railroads to deliver its crops of the Great Lakes steamers at Fort William and Port Arthur before the close of navigation.

In my opinion there is little reason to-day why the West should advocate the construction of this waterway, for it is by no means clear that it would materially aid in the solution of the West's particular problem. The engineers in their report cannot find that the Georgian Bay Canal offers any advantages for grain shipments that cannot be obtained at a lesser cost by improving the St. Lawrence canals between Lake Erie and Montreal, and the climatic advantage of the St. Lawrence route has already been mentioned. Moreover, there are two great schemes, now more or less under way, to which the West looks with much interest and which affect it directly. The first of these is the National Transcontinental Railway, now building from Winnipeg to Quebec, with an east-bound grade of 0.4 per 100, and a very direct route; and the second is the Hudson's Bay Railway, from Saskatoon to Fort Churchill, which is to tap each of the great grain-gathering railway systems and to deliver its traffic to the problematical navigation of the Hudson Bay and Hudson's Straits. This railway is now under survey. It may be reasonably predicted that the next few years will see the St. Lawrence route much improved, the National Transcontinental Railway in operation and the Hudson Bay Railway also. Each of these will take some share of the grain traffic, which in itself will not for many years to come be sufficiently great to justify the investment called for in the Georgian Bay scheme, even if all the export grain were carried by that route.

The engineers have based their design upon a probable traffic of 20,000,000 tons per annum, and when we bear in mind the history of the traffic passing Sault Ste. Marie there is little reason to question the estimate. Conditions are changing and settlement is advancing so rapidly towards the north that estimates based on the facts of to-day are a little less valuable than guesses of the traffic that will exist twenty years from now. I am a profound believer in the wisdom of constructing a Georgian Bay Canal, although not necessarily of the dimensions now planned, and this even though I do not think that the grain traffic from Western Canada will be a predominating item in the traffic returns of the canal. The work is necessary to the development of the region through which the canal is projected, and of the wealth and possibilities of that region we have abundant evidence. The Sault Ste. Marie traffic has grown on the coal and iron south of the Great Lakes at a rate beyond all prediction; but who knows what wealth lies to the north of those waters? Sudbury is not much over twenty years old, and its nickel-copper industry, now not half developed, is the result of an accident of railway location, and was not in the minds of the men who built the Canadian Pacific Railway. Cobalt is not ten years old and might have lain unknown and undisturbed had not the Province of Ontario run a haphazard railway into the unopened north. Moose Mountain has not yet commenced to send out its iron, and no engineer will question the value