of necessity into one or other of them. When the barges arrived at the point where they were to be discharged, the skips were lifted by steam-cranes, and, by means of a hook or other appliance at the bottom of the skip connected with a discharging-chain or rope, their contents were tipped into the railway trucks, and thereby conveyed to the point of deposit. If I remember rightly, the contractor at Dunedin was using an arrangement of this kind at the time of my visit.

I have much pleasure in acknowledging the courteous attention received during my inspection from the Hon. Mr. Reynolds, Chairman of the Board, and from Mr. Tewsley, Chairman of the Works Committee; also the aid rendered by the Board's officers, Mr. Simpson, the Engineer, Captain Thomson, the Harbourmaster, and Mr. Gillies, the Secretary, each and all of whom afforded me every possible assistance and facility for examining the works in progress and the port generally.

I have, &c.,

The Secretary, Marine Department, Wellington. JOHN COODE.

OTAGO BAR.

SIR,— 5, Westminister Chambers, London, S.W., 31st March, 1880.

In accordance with the Board's request, I have duly considered the question of the improvement of the bar at the entrance of Otago Harbour, and have now the honor to submit my views on the points upon which I understand the Board desire to be furnished with my opinion—that is to say, as to whether the measures to be adopted for the treatment of the bar should partake of a tentative or of a permanent character.

From the memorandum of your Engineer, Mr. Simpson, transmitted to me with the Board's instructions, I gather that the tentative measure referred to consists of the dredging of a channel in the line of the leading lights, and maintaining it to the required depth by periodical dredging.

Drawings.

I should premise that in studying this important subject I have been greatly aided by the very complete plan prepared by your Engineer, Mr. Simpson, showing soundings in great detail, not only over and seaward of the bar itself, but also within the estuary for a distance of more than two miles from Tairoa Head. This plan forms the ground-work of Drawing No. 2, which accompanies this report, No. 1 being the published Admiralty chart of the harbour. On both of these drawings the works which I shall hereinafter describe are shown by red colour.

Tentative Proposal.

First. With respect to the proposal to dredge a channel across the bar in the line of the leading lights, and to maintain it at the required depth by dredging operations:—

Bearing in mind the fact that the bar is the resultant, so to speak, of the power of the waves which heap up the sand, &c., and cause it to accumulate on the one hand, and, on the other, of the tidal scour which tends to keep down this accumulation, it follows that the benefit to be derived from any such operations as those directed to the creation and maintenance of deep water in the sailing track by means of dredging must of necessity, in the absence of permanent works, be very uncertain; and, to be of any real value, must be frequently repeated, if, indeed, as is by no means improbable, they were not required to be constant and continuous, in so far as the state of the sea on the bar might permit, seeing that much of the work of a dredger in the formation or clearance of a channel extending over some weeks, or perhaps months, would occasionally be undone in the course of a few hours.

There can be no doubt that if dredging on the bar is to be resorted to, a dredge-vessel of the hopper type is the proper kind of craft to employ. After making due allowance for the time necessary for such a vessel to go sufficiently far out to sea to dispose of the dredged material, without risk of any portion being carried back towards the entrance, and to return and take up her moorings, and allowing also for such occasional stoppages as will unavoidably take place, I do not think an average of more than 1,500 tons per day, for the days on which it may be practicable for the vessel to work on the bar, should be calculated upon, even with a dredger having a hopper capacity of 1,000 tons.

With regard to the quantity of materials to be removed in order to form a channel through the bar on the line of the leading lights, with a depth at low water of spring tides of 24 feet, and a bottom width of 200 feet, I find that such a channel or cut would necessitate the removal of somewhere about 120,000 tons of material.

Assuming, in the absence of borings or probings, that the whole of this quantity of dredging would be in sand, or other free material, the time that would be required to cut a channel of the dimensions above stated, taken at the rate of 1,500 tons per day—the rate before intimated—would be eighty days, or, say, three months of continuous working. It should not be overlooked, however, that so long a period as three months of continuous smooth water on the bar would not of course occur, and therefore the time over which the dredging operations would extend, although amounting to only eighty working days in the aggregate, would necessarily be prolonged to an extent dependent upon the prevalence and amount of sea disturbance on the bar. It is, further, important to remember that the wave-action, during so long a period as that of three months, could not be expected to do otherwise than to cause such frequent disturbances in the sand on either side of the dredged channel as would diminish both the width and depth of that portion of the new cut which might have been previously executed.

The frequency and extent of this prejudicial action would depend, as I have before stated, and necessarily so, upon the frequency and character of the changes of the sea disturbance, and therefore could not be predicted with any degree of confidence. The one point which is alone reasonably certain is, that the intervals of quiescence would be so short as to render the necessity for dredging operations so frequent as to be almost continuous during all but the finest seasons. It is only right to say, however, that experience extending over a series of years could alone determine, with any approach to