by Mr. Brunton and Captain Thomson, but stopping short at a point 450 feet westward of the outer end of the present wharf. Northward of this embankment, and parallel thereto, a half-tide bank, also of rubble stone, would be deposited from barges, so as to form with the southern embankment a channel or waterway having an uniform width of 250 feet at low-water mark. The half-tide bank would be provided with four beacons, fixed in the positions shown, and the southern embankment would be furnished with "turn-outs" for the wagons to pass, and thus facilitate tipping operations. The ebb and flood currents, when trained between the artificial works described, and caused to pass permanently over a fixed and definite track, may be relied on for the preservation of a depth of at least 22 feet at low water in the centre of the fair-way, and to create and preserve a corresponding deep-water approach across the toe of the spit or shoal at the east end of the proposed channel.

In connection with the southern embankment I would recommend the construction of a wharf of 1,000 feet in length, extending westwards from the eastern end of the bank, and parallel thereto throughout its entire length. This new wharf may be formed either with a facing of open piling, properly braced, and supporting a timber deck, in the manner shown on Figures 6 and 7, Drawing No. 4; or it may be a permanent wall of Portland-cement concrete, the under-water portions of which would consist of cylinders or rings of concrete placed one over the other, and sunk to an adequate depth below the bed of the channel. The cylinders when sunk would be filled up solid with cement concrete, and capped with a wall of concrete-in-mass, in the manner shown on Figure 11, Drawing No. 4. The concrete face would be permanent, whereas the timber would require renewal and repairs. The cost of the former is, however, considerably in excess of the latter, and in framing my estimate I have considered it desirable to give the price of each system, so that the decision as to which, under the circumstances, will be the preferable section to adopt, may be arrived at in the colony, seeing that the question for consideration resolves itself into one of first cost as compared with future expenditure on renewals and repairs. Should it appear desirable to adopt the timber wharf in the first instance, there is no reason why the permanent facing of cylinders could not be added at any time thereafter, when the piling may require renewal; indeed, I have assumed this mode of procedure on the section Figure 11, whereon the timber wharf to be constructed forthwith is indicated by dotted lines, whilst the permanent face of concrete is shown by full lines and colour. A convenient approach to the proposed wharf would be formed in the manner shown on the plan, viz., by embankment roots connected with an open timber viaduct of sufficient length to admit of the filling and emptying of the inner enclosure during each tide. Full details of this viaduct are given on Figures 4 and 5, Drawing No. 4.

As will be seen from the plan, the new wharf would be in direct communication with the existing system of railways, the curves adopted being sufficient for the passage of the rolling-stock without entailing the use of turntables or traverses.

At the western end of the training embankment, and in connection with the new channel, I have shown a patent slip of sufficient length for dealing with vessels of a very large class. The estimate provides for a slip adapted for taking up ships of 2,000 tons weight, and for machinery of the best type. It also includes the reclamation of a sufficient area to form a work-yard in connection with the slip.

Proposed Leading Lights.

Drawing No. 5 shows the system of leading lights which I have to recommend for adoption. It contemplates the provision of three lighthouse buildings, each fitted with an apparatus of the character described. The principle upon which the system is based is the exhibition throughout the fairway of the channel, and following its main curves, of a bright white light extending over an arc of 2 degrees, flanked on either side by a green and red arc respectively of about $7\frac{1}{2}$ degrees. In conformity with this arrangement the officers in charge of a vessel entering or leaving the harbour after nightfall would endeavour, as far as practicable, to keep a course on the white light, the fact of the red or green being visible, and not the white, serving as an indication whether the ship was on the port or starboard side of the white beam intended to indicate the centre of the fairway. For facilitating the identification of the main leading light, and to prevent its being mistaken by the mariner for that on Te Waewae Point, I propose that the apparatus should in this case be fitted with occulting gear, so as to show eclipses of the light, say, at every ten seconds, thereby rendering it easily discernible from the other and adjoining station light, and also from side-lights of vessels. The brilliancy of the two inner lights would prevent them being mistaken for the side-lights of ships after reaching the point where it becomes necessary to rely upon them for navigation purposes. For use in the daytime a beacon in line with the tower containing the main light would indicate the centre of the fairway southward of Starling Point.

It is not practicable, without considerable extra cost, to provide for lighting the east passage; but, when erecting the principal building to contain the occulting apparatus, arrangements would be made for the addition, when required hereafter, of a special light to be visible along this channel, and thus to enable mariners to approach within a safe distance of Te Waewae Rock.

Prospective Works.

Acting upon the principle to which I have already referred, I have laid down upon Drawings Nos. 1 and 3 a complete design for harbour improvements at the Bluff, of which the works I have recommended are intended to form the first instalment only. Any subsequent additions to the accommodation required from time to time should form portions of this complete scheme, so that modifications or the removal of executed works may not be required hereafter as the necessity arises for increased quayage and wharfage space. The design shown embraces two floating basins of $23\frac{1}{2}$ and 13 acres respectively, with centre wharf, swing-bridge spanning the opening between the two basins, sheds, bonded and other warehouses, a graving dock, and a complete system of railways. In view of the prospective character of these comprehensive works, I have not considered it necessary to enter upon their cost, although I am decidedly of opinion that at a future date the great facilities for trade which would be afforded by this design, when fully carried out, will not be more than will be required to meet the wants of the port.