carried out extensive works in a similar manner at Portland (England) and Table Bay (South Africa), that it would be quite practicable to form a mound of the character recommended which will prove perfectly stable when the sea slopes have assumed their normal angle. The material available from Paritutu—a hard trachyte porphyry—is admirably adapted for a work of this class, and the wave-stroke is not so great as at Table Bay; hence there can be no doubt as to the sufficiency and permanence of the proposed mound at New Plymouth. Whilst, however, expressing the fullest confidence in the permanent stability of the work after the slopes have been flattened down to the inclinations shown, I desire to point out that during execution some fears will almost inevitably be engendered as to the sufficiency and ultimate permanence of the structure, in consequence of the occasional and recurring flattening down of the slopes by heavy gales during the process of forming the mound. But it must be borne in mind that the agency by which the material is distributed and trimmed to a proper slope is one of wave-action, the operations of the workmen being confined to depositing the stone, so that it shall ultimately produce a mound when "clawed" down by the sea with the least possible waste of material—a matter requiring care and judgment where the quantities to be dealt with are so vast. However much the apparent dislocation of the mound during progress may appear from the surface, it may be taken for granted that the action of the sea will only tend to distribute the rubble over the area required for the base of the work, and that the mole when finished will, as I have explained, partake very closely, if not actually, of the profile shown on the cross-section, although the seas of several winters would be necessary for the production of the ultimate slope as shown. In the meantime the rubble would be tipped on the top of the bank for the subsequent "feeding" of the slopes by the sea.

With regard to the necessity for a temporary staging from which to deposit the materials, it seems desirable that I should explain the reasons which have led me to recommend this mode of procedure, seeing that Messrs. Carruthers and Blackett proposed to form their mole of rubble without any such provision—and I speak after thirty years' experience in works of this particular class. Notwithstanding that the adoption of the stage would necessitate the employment of a special class of skilled labour, and be more liable to damage by seas of exceptional severity, than any other portion of the work, nevertheless great ultimate economy would result from the facilities it would afford under all circumstances for depositing the rubble, layer upon layer, with a long flat slope at the outer end during progress, and for "feeding" the sea-face throughout the length of the mole as may be required from time to time. Coupled with this there must be a considerable saving of material consequent upon a smaller section of mound, which would more than compensate for the cost of the temporary staging by reducing the expenditure on the permanent work. Moreover, it should be remembered that if made as a "flying-tip"—the alternative mode of depositing the rubble as compared with dropping from a stage—the slopes of the mole when first formed from the wagons, would be, as in the case of a railway embankment, at a steep angle, and thus subject to a much greater disturbance by heavy seas than would be the case were the bank to be deposited to flatter slopes, which could be readily done from a stage. For these reasons the adoption of the stage would, as I have said, result in a smaller ultimate section for the mound, and, consequently in a saving of material, as compared with the system of direct tipping from wagons running on tramways laid on the bank itself. I may further remark, with regard to this subject, that attempts have been made to form a mound of the character proposed without a stage; but the results have finally led to the adoption of a stage, as absolutely necessary for the economical and satisfactory progress of the work.

The outer end of the mole would be protected by blocks of cement concrete, each about 80 tons weight, formed *in situ*, and allowed to settle down by the action of the sea on the rubble on which they would rest. There would be a small cast-iron lighthouse at a convenient distance back from the end slope.

It will be readily understood from the description above given, coupled with the particulars furnished in the annexed cross-section, that no quayage accommodation for vessels would be afforded by the proposed breakwater itself. Shelter would be available under the lee of the work at all times for steamers and sailing-vessels of the class engaged in local trade, the depth covered by the breakwater at low-water spring tides being 24 feet at the outer end, while a considerable proportion of the area protected would be in from 12 feet to 24 feet at low water, or 24 feet and 36 feet at high water, the rise of tide at springs being taken at 12 feet. As the most ready means of providing berthage, I have laid down on the drawing three jetties, each of 500 feet in length, extending in an E.S.E. direction from the harbour edge of the proposed roadway along the breakwater. The outer of these jetties would consist of crib-work formed of piles, braces, and a decking of totara wood, filled in with rubble-stone from the proposed quarry at Paritutu, and arranged for berthing vessels along either face in fine weather; although on some occasions, owing to "scend" or undulation, it would not be practicable to use the outer or north-east side. The further shelter which would be afforded by this crib-work structure would enable the berthage on both faces of the two other jetties (which should be of open timber-piling and framing, also of totara) to be used on all occasions.

An approach to the breakwater from Barrett's Road would be formed somewhat in the manner shown in the drawings; the precise line for this new road can best be determined on the ground, seeing that sufficient details of the configuration of the site are not at hand here. It is not improbable, therefore, that the line I have sketched may require some modification.

I am informed by the Resident Engineer, Mr. Irvine, that the quantity of stone in Paritutu available for the purpose of the works is far in excess of that required. It will be well, before commencing operations, that this point should be again looked into, and clearly established, as the section I have proposed is of greater bulk than that recommended by Messrs. Carruthers and Blackett. I may mention that the construction of the mole from *A* to *B*, on Drawing No. 2, will require about 800,000 cubic yards of rubble stone, measured in the mound. Moreover, the disposition in the hill of the stone suitable for the proposed breakwater may be such as to render it desirable to modify the level of the top of the self-acting incline, and this can only be determined with certainty by opening out the face of the rock—and the entire quantity of stone of the proper quality, above the level of the head of the incline, at least—approximately ascertained.