will provide more room than required if the main portion of the lightering is eliminated by the completion of the breakwater, I do not make any provision for them in my estimate for Breakwater Harbour extension.

It will be noticed that a large discrepancy in the estimates submitted is occasioned by Mr. J. D. Holmes having thought fit to make provision in his estimates for raising the whole of the breakwater a further 10 ft. above H.W., or 16 ft. in all. The following is a short summary upon this subject of the opinion of the designer of the breakwater, John Goodall, M.Inst.C.E., and other eminent civil engineers, who have undoubtedly had years of experience in the design, construction, and maintenance of harbour-works:—

J. Goodall (1884), says: "In this section is shown in plain lines the superstructure of the breakwater, &c., surmounted by a parapet wall of concrete, &c. The cost of the latter is not included in the estimate, as it will not be advisable for years, until the work has thoroughly subsided, to attempt to build the parapet wall." (See Extract 1, page 16.)

Messrs. Bell and Scott in their report of May, 1884, state: "We consider the height of the breakwater—namely, 6 ft. above H.W.—is not sufficient for the safety of ships inside, &c., and that it will be found necessary sooner or later to raise a parapet to keep heavy seas from sweeping over the works." (See Extract 1, page 18.)

J. Goodall in his report of May, 1884, in reference to Messrs. Bell and Scott's suggestion that the breakwater must be raised sooner or later, points out that the 6 ft. height was designed for economy, and that a low breakwater without a parapet did not require so wide a base. (See Extract 1, page 20.)

Messrs. C. Napier Bell and J. P. Maxwell reported in 1894 upon the damage to the breakwater in the severe storm which took place in February, 1894, and were particularly asked to advise means to prevent further damage and to advise as to future construction. They considered that the width of the concrete was ample, and to protect same from further damage recommended piling heavy masses of rubble blocks up to high water. This was done. They go on to state, "Although we think it necessary to thus strengthen the exposed part of the structure, we do not look upon the damage sustained as a serious failure, &c. There is no alternative, now that a great extent of the structure is built, but to continue the design as we find it, &c. We consider that the best method of expending the money in hand, so as to make the works as complete as possible, is to finish the breakwater to the Auckland Rock (see Exhibit 1, page 26). The recommendation for these repairs and the extension of the breakwater as designed—*i.e.*, 6 ft. above high water—have been carried out, but the breakwater is still some 1,200 ft. from the Auckland Rock."

Mr. F. W. Marchant in his report of 1906 recommends the completion of the breakwater, and says, "There is no doubt whatever about the complete stability of the work as it is now being constructed, &c. No suggestion can be offered for improvement of either design or detail or in the manner of working-operations." (See Exhibit 6, page 2.) He, however, goes on to state, "In order to render the water in the enclosed areas as calm as possible a parapet along the first cant of the breakwater and the piling-up of more blocks on the wave-breaker on the second cant would almost entirely stop any water breaking over into the harbour." (See Exhibit 6, page 3.)

Messrs. Maxwell, Williams, and Mason in their report dated July, 1909, recommended the completion of the breakwater upon the lines upon which it was then constructed, which they point out had proved quite adequate for the purpose. (See Exhibit 9, page 6.)

Messrs. Cullen and Keele in their 1912 report recommended that the breakwater should be raised 10 ft. (See Exhibit 14, page 9.) In their 1925 report they evidently reconsidered this matter, as in Exhibit 21, pages 6 and 7, they state, "We recommend that the type of section for the extension should be the same as that of the existing breakwater. The latter appears to have stood the exposure well without any serious injury from wave-stroke, &c. It consists of a rubble foundation brought up to a level of about 19 ft. below low water, on which concrete blocks are built up in a rectangular section 25 ft. wide* to a height of 30 ft.—*i.e.*, to 6 ft. above high water, spring tide, with a wave-breaking apron of large stones and concrete blocks on its seaward side."

Mr. Furkert in his evidence on page 325(?) points out that Messrs Cullen and Keele modified their 1912 recommendation, and in their 1925 report adopted 6 ft. as the height of the breakwater above high water; also, on page 526, in referring to his own estimate he states, "I worked approximately to Cullen and Keele's latest plan in taking out the quantities in regard to the breakwater and mole. I did not think it necessary to take the moles 6 ft. above high-water mark, and made reductions in quantities accordingly, &c. I think I allowed 2ft. 6 in. above high water for the moles."

From the foregoing it will be seen that Mr. Goodall, the designer of the breakwater, had most excellent reasons for not including the provision of a parapet—at least, for many years. Therefore, prior to the laying of the foundation stone in 1887, the only engineers of standing who thought a parapet should be provided were Messrs. Bell and Scott, which, in their opinion, was required for the safety of ships. Up to 1894 the Gladstone Wharf had been constructed and the second cant of the breakwater was in progress. In February, 1894, a storm damaged the breakwater, and Messrs. Bell and Maxwell, who were commissioned to report (1) on the present condition of the works, (2) to devise means to prevent further damage, (3) to advise as to future construction, do not recommend the addition of a parapet. In 1906 Mr. Marchant recommended a parapet to render the water in the enclosed area as calm as possible and to stop any waves breaking over into the harbour. Messrs. Maxwell, Williams, and Mason in their report of 1909 do not recommend a parapet; and finally Mr. Furkert in his 1924 report and Messrs. Cullen and Keele in their 1925 report do not recommend the construction of a parapet. Since the breakwater was used by shipping we have only Mr. Marchant and

* NOTE.—This should be 36 ft. wide.—A.C.M.