

1,000ft. from the bend, and that 1,000ft. gives more shelter than if it were straight out. That was the argument originally advanced for putting the curve in the breakwater. In 1881 he (Mr. O'Connor) advocated just what Mr. Stumbles was advocating now, carrying the breakwater straight out, for the reason that it would lengthen the time during which the harbour would be free of shingle; but the Board at that time did not adopt the suggestion, and the newspapers laughed at the reasons given for it. To do it now would cost £50,000 more than if done originally.

Mr. Stumbles believed, if the work was extended the back-wash would be restored.

Mr. O'Connor doubted it. The back-wash appeared to be connected with the shore or shoal water. There was less and less of it out to sea.

Mr. Stumbles concurred in this.

Mr. O'Connor said that it might not be necessary to go out 125ft. per annum with a wall, to keep ahead of the shingle, but it might be necessary to go a great deal more. He would not be surprised to see the shingle form itself into a narrow spit and run along the mole very rapidly. That was what he was afraid of at present.

To Mr. Wilson: The class of rubble required for an exposed structure would not be much, if any, cheaper than concrete, at the price of stone here.

To Captain Woolcombe: The reflected wave scarcely exists now, the shingle has gone so far out.

Mr. Stumbles pointed out that the shingle was a great protection to the work on the inner part of the wharf. It would be a good thing for the working if the breakwater were backed up all the way along.

The Chairman said the shingle was of value in that way, and they would like to be able to say "Thus far and no further."

Mr. Hill said he believed the shingle began to make up at the breakwater through the putting-down of random blocks breaking the run of the sea, and the taking-off the parapet blocks allowing the waves to run over into the harbour. Had the Commissioners any data placed before them to show how the bottom was making up in Caroline Bay?

Mr. O'Connor: Yes, we went there and saw it.

Mr. Hill: Will it take long to accumulate so as to bring it round into the harbour?

Mr. O'Connor could not say how long, but thought it would take a very long time.

Mr. Hill thought it would not take so very long. He believed the shingle would be brought back from Dashing Rocks.

Mr. O'Connor: We assume that the deposit in Caroline Bay has gone round the harbour.

Mr. Goodall said that heavy seas running past the end of the mole would always keep the bottom disturbed, and at a uniform depth. The Caroline Bay deposit might come further out than it is yet, but when it came under the influence of the southerly seas the silt could settle no further. A limit would be reached where no further settlement could take place, and that limit, he believed, was far to the north of the harbour. Perhaps the shingle in Caroline Bay came from Waimataitai Lagoon, where the beach was now protected from the southerly seas but exposed to the north-easters. It could not be from Dashing Rocks, as there the beach was under the influence of the southerly seas.

Mr. O'Connor said if the shingle was shifted, by barges or otherwise, it would of course be discharged at some point where there would be no doubt it would travel north—not south.

Mr. Flatman: If the amount stated is removed, will that prevent the spit travelling along the work?

Mr. O'Connor took it that the dredging would take place principally alongside the breakwater, and would of course prevent such a spit being formed. The essential difference between himself and Mr. Goodall was that Mr. Goodall assumed that the dredging machinery could be worked with moderate uniformity on a great many days in the year. He (Mr. O'Connor) did not think it safe to reckon on that. There would be many interruptions, many occasions when they could not work, just when they wanted to work. Mr. Goodall also assumed that the dredge would usually lift to its maximum capacity. Dredges never did that. If a dredge averaged 50 per cent. of its capacity throughout the day it did very well. Even at Lyttelton one often saw the dredge-buckets running empty, or nearly empty, and with the particular form of dredge they proposed to adopt at Timaru, it was more difficult to insure working to full capacity. This was the only practicable form of dredge for the purpose. The maker in his circulars gave an example of a machine "capable" of lifting 400 tons per hour, but he gave as its average work 200 tons per hour. As to the difference between his (Mr. O'Connor's) estimate of cost and Mr. Goodall's, he did not know the maker's price for a 300-ton machine, but he saw that a 50-ton dredge cost £1,000, and a 100-ton one £2,000, and he thought it fair to assume that other prices would be similarly proportionate to the power, so that a 300-ton dredge would cost £6,000, and the cost of the barge would be additional to that. Mr. Goodall estimated only £4,000, for barge and all. As to the barge, they could not reasonably expect to get the hull of a 300-ton hopper-barge for less than £2,000, and with the driving machinery (additional to machinery for pumping) it would cost probably £3,000. He had other data on the subject in the report by Sir John Coode and Mr. Blackett to the New Plymouth Board in 1889, in which they recommended a pump hopper-dredge, and the description given of that dredge showed that it was only expected to work up to half its maximum power of lifting. The cost of the dredge was put down at £11,000 delivered, and the cost of working at £4,500 a year, or (including interest and depreciation) 7d. a ton on the material to be shifted. Shingle would be more difficult to shift, and therefore a larger margin should be allowed. At New Plymouth there was 200,000 tons to shift annually, and Sir John Coode recommended a dredge of 400 tons hopper-capacity. Here there was not quite three-quarters of that quantity; but he (Mr. O'Connor) proposed a machine of three-quarters of that capacity, because the material to be shifted was not sand, but shingle. His figures were about three-fourths of Sir John Coode's.

Mr. Teschemaker: Then you say that the harbour can be kept going for £3,400 a year?