

before long, and from time to time: and, until the line of the shingle has advanced so far seaward as to allow it to pass the end of the breakwater, the denudation of the coast to the north must go on, and protective works and more expenditure will be required as a necessity.

The close connection of these changes with the building of the breakwater is so apparent that the responsibility for the expenditure described above clearly rests with the builders of it; and a demand can therefore be fairly made on them to contribute a very large proportion, if not the whole, of the expense now devolving on the Government in protecting the railway works.

JOHN BLACKETT,
Marine Engineer.

The Hon. the Minister having Charge of the
Marine Department.

P.S.—Attached to this are the following papers, namely;—

No. 2.—10th August, 1880: Mr. Lowe's report in reply to letter from Chairman of Timaru Harbour Board; with plan.

No. 3.—10th June, 1880: Letter from Chairman of Timaru Harbour Board to Hon. Minister of Marine, remarking on my report of 2nd February, 1880, and enclosing copies of evidence taken by the Board, copies of letters to the Harbour Board from John McGregor, Esq., C.E., and the Clerk to the Levels Road Board, also copy of a report by the Timaru Chamber of Commerce.

No. 4.—Letter from Chairman of Harbour Board enclosing copy of evidence given by G. Stumbles, Esq., contractor; also,

No. 5.—Copy of a report from the engineer to the Harbour Board.

J. B.

No. 2.

MEMORANDUM from Mr. J. H. LOWE for the MARINE ENGINEER, Wellington.

Report No. 4, Timaru Harbour Works.

Dunedin, 10th August, 1880.

I HAVE perused the reply of the Timaru Harbour Board to your report on the above, together with the notes of evidence given before the committee of the Harbour Board by various witnesses, and also the report by Mr. John Goodall, engineer to the Board, on the same subject. The statements advanced by Mr. Goodall and the witnesses examined are very comprehensively summed up in the Board's letter to the Hon. the Minister of Marine, dated 10th June, 1880. The bearing of all the facts elicited is therein shown in the strongest light favourable to the views of the Board.

The main fact relied upon is that the denudation of the coast by encroachment of the sea has taken place from time to time as long as the earliest settlers can remember, and in extent reaching from the Waitaki River northward to the Dashing Rocks; and the deduction is that therefore the recurrence of such encroachments within the space indicated should not be attributable to the breakwater works. That such encroachments have occurred formerly, and in other places besides the northern vicinity of the breakwater, as described, is not denied. In my report to you of the 4th October last I remarked upon your own observations in this respect. The statements of Captain Woolcombe on the subject are of great value in enabling a just apprehension of the real position of the case to be arrived at. Captain Woolcombe gives a definite idea of the rate of encroachment upon the cliff between the present sites of the two railway viaducts in the earlier period of the settlement. A pole placed 10 feet from the edge of the cliff in 1858 was washed away three or four years afterwards, giving a rate of encroachment of 10 feet in about four years. A pole erected in another place, 4 or 5 feet from the edge of the cliff, in 1858, was carried away shortly after 1869, and so determined the rate of encroachment at that place as about 5 feet in those eleven years. This gives a definite idea of the extent of encroachment in earlier times. Then, as to the more recent encroachments, you will see by a reference to my report of measurements recorded between July and December, 1879, on the same part of the coast where Mr. Woolcombe's first-mentioned pole was placed—namely, between the two railway viaducts—shows the actual encroachment in those five months to be 24 feet. This rapid encroachment was only stopped by the laying down of the breastwork of rubble stone.

Again, the denudation of the cliff further northward is now progressing at a rate exceeding all previous observations. I have had pegs driven along this part of the coast, and measurements taken from them at various times between the 16th April last and 4th August current, the results of which are shown on the cross-sections on tracing attached hereto. It will be seen that a breadth varying from 12 feet to 27 feet of cliff, of a height varying from 14 feet to 22 feet, has been carried away in little more than three months.

So greatly has the process of denudation increased, that during the fortnight between the more recent measurements there has been a loss of ground from 4 feet in some places to 10 feet in others. This is an extent of encroachment in two weeks but just past, greater than that recorded by Captain Woolcombe as taking place in eleven years between 1858 and 1869 in the immediate neighbourhood.

I notice that the Harbour Board admit that some acceleration in the denudation has been caused by the breakwater. The above comparison of actual measurements taken in former and recent times shows the rate of this acceleration.

The fact is not disputed that the supply of shingle is intermittent. I have observed parts of the shore some miles to the southward of the breakwater occasionally bare of shingle, or alternated with sand. This has been referred to in previous reports. I have no doubt that, if southerly winds prevail for long periods, without floods in the large shingle-carrying rivers, the supply of shingle along the coast diminishes until patches become bare; and, again, after heavy floods the beach is replenished. This, however, does not controvert the fact that there is a general supply of shingle and sand sufficient to protect the clay bluffs in a great measure; and the abrasion of the cliffs where so protected is only occasional, limited in extent, and at isolated points. But the abrasion where the shingle has been entirely cut off, as it is to the north of the Timaru Breakwater, is continuous, rapid, and of so serious an extent as to be beyond all comparison with the former.