(1) பக்கங்களின் எண்ணிக்கை 84

(2) புதுக்கித் திருப்பிய நாள் 6/88

(3) ஆதாரங்குறிப்பவர் கருக்கொப்பம்

# தமிழ்நாடு ஆவணக் காப்பகம்.

தமிழ்நாடு அரசு

பொதுப்பணி துறை

அரசாணை எண்.
மு. கோப்புத் தாள் எண். 153

அச்சகம்
பலவகை

நாள் : 16-1-1888

198-.

வோ கண்டபடி கையாளவோ கூடாது

ம-1—18,006—15-6-87.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read—the following despatch from the Right Honorable Viscount CROSS, Her Majesty's Secretary of State for India, to His Excellency the Right Honorable the Governor in Council, Fort St. George, dated India Office, London, 15th December 1887, No. 11, Public Works:—

Madras Harbour Works. Remarks by Mr. Parkes on Report of Harbour Committee.

With reference to my Public Works letter No. 10, dated 24th ultimo, which forwarded, for your Excellency's information, copies of the report which has been presented by the committee appointed to consider the best position for the entrance to Madras Harbour, I now transmit copy of a letter which has been received from Mr. Parkes, the Consulting Engineer for the Harbour, containing his remarks on the conclusions of the committee.

2. Of the four designs which were laid before the committee by the late Captain Taylor, as representative of the Harbour Trust Board, the committee, for the reasons stated in their report, have recommended the adoption of No. III. Mr. Parkes, for engineering and other reasons, strongly urges the adoption of a design similar to No. I. The comparative merits of these designs are sufficiently discussed in Mr. Parkes' letter and in the minutes of evidence taken before the committee, of which copies are now forwarded for your Excellency's information.

3. Before coming to a final decision on the course which should be adopted on the recommendations of the committee, I desire to have the benefit of your Excellency's opinion in Council after obtaining the views of the Harbour Board on the whole subject.

Enclosure.

From W. PARKES, Esq., to the Under Secretary of State for India, dated 23, Abingdon Street, 25th November 1887.

In compliance with the request contained in your letter of the 22nd instant, No. P.W. 2070, I have the honor to submit the following remarks on the report of the committee appointed to consider the above question.

2. It is desirable that I should at the outset explain my position with regard to this question. I have never taken a prominent part in its discussion. When it was originally raised in 1882, shortly after the destructive storm of November 1881, I recommended that a decision upon it should be deferred till the works of restoration had made some progress. When, in 1883, Sir John Hawkshaw's committee, in their first report, expressed an opinion unfavorable to the change of entrance, I ventured to recommend that this decision should not be accepted as final (see my report to the Government of Madras, dated 9th March 1882, paragraphs 44 and 45, and that to the India Office, dated 10th February 1883, paragraph 14).

3. The committee appointed by the Government of Madras, however, on the 30th April 1883, were not satisfied to leave the question in this state, but in their report, dated 20th June, forced an immediate decision by presenting an independent scheme of reconstruction, of which a north-east entrance was an essential feature. This scheme was referred to Sir John Hawkshaw's committee, and by them emphatically condemned. This decision was accepted as final by the Secretary of State, and I felt that the discussion of the question ought then to be considered as exhausted, and that my duty was to show how the admitted evils of the sanctioned eastern entrance could be best met by other arrangements. To this I devoted a large portion of my

report of 21st August 1884 (from paragraph 60 to the end), and to the further development of this I have since devoted much time and consideration.

4. It is right I should mention that while I disclaim any responsibility in this final decision in favor of the eastern entrance, I entirely acquiesced in it as the best under the circumstances, though had my opinion been officially asked I should have been disposed to say more about the views and arguments of the nautical men locally consulted than was said in the report of Sir John Hawkshaw's committee.

5. From the above it will be seen that there is nothing in my past attitude in regard to this question to prevent my acquiescence in the adoption of a north-east entrance, if such reason is shown for it as will place the decision on a logical basis, even though I might have to yield something of my own estimate of the balance of argument on a question on which there is admittedly much to be said on both sides; but I think it my duty, holding the position I do, to give what assistance I can to enable the Secretary of State to decide whether an order based on the recommendations of the present committee can be considered as final and unassailable.

6. With this view I have given careful and critical examination to the evidence and to the committee's report, and I am bound to say that, in my opinion, the adoption of that report as a basis for further action will not relieve the undertaking of the difficulties under which it is at present laboring, but will rather tend to introduce new ones.

7. I do not propose to criticise the report in detail, but, in justification of the opinion above expressed, I would beg to direct attention to three points suggested by a study of the report:—

*1st.* The introduction of a question of far greater importance than that of the entrance, which, if solved in the direction indicated by the committee, would render the further discussion of the entrance question quite superfluous.

*2nd.* Its incompleteness as an authoritative basis for the action of Government.

*3rd.* A recommendation in a matter which, from the committee's point of view, is one of secondary importance, but from my point of view of primary importance, and to which, in my capacity of responsible Engineer of the works, I think it is within the scope of my authority to take exception.

8. The first question of importance above alluded to is set forth in the second paragraph in page 2 of the report. It is that—

"So rapid and regular is the encroachment of the sand on the south side, that, if continued at the same rate, which we have strong reason to apprehend will be the case, within 20 years the depth of water at the south-east corner will be reduced to four fathoms."

This apprehension is used as an argument against the formation of an entrance at the south-east corner, a proposal which has never been seriously entertained on account of the fact that the sand is advancing on that side of the harbour, but it is now for the first time introduced as it is in the committee's next paragraph as an argument against the eastern opening, though no reference is made to its causing any difficulty at the site of the north-east opening.

9. Now I submit that if this apprehension of the committee is to be taken as a ground for future action, it must be taken with all its necessary consequences. Those consequences are that within 20 years, that is, within the lifetime of the majority of the persons now employed in or about the harbour, the navigable depth of the south-east corner will be lost, that "at a time not very far distant" it will be lost at the middle of the sea face of the harbour, and by an inevitable continuance of the same process the site of the proposed north-east entrance will be subject to the same destructive action. Thus the present generation will witness the gradual absorption of the harbour in a mass of sand and the reduction of the advantages of Madras as a trading port to something far inferior to what they were before the harbour works were commenced.

10. It will be easily supposed that, when such a prospect as this was suggested to me, I lost no time in looking carefully to the grounds of my own very different conclusion. I am happy to say that the result has been the confirming and strengthening of that conclusion, and I think I may confidently add the detection of the fallacy on which the anticipation of the committee is based.

11. I would beg to explain in as few words as I can what is the conclusion which has been thus questioned. When my original proposal for a harbour at Madras was first put forward, objections were made to it in several influential quarters on the ground of its interference with the movement, and the consequent accumulation, of sand. This question was specially referred to Mr. Bateman, who was consulted by the Secretary of State before the scheme was sanctioned in 1875. Mr. Bateman's opinion was that the injurious accumulation of sand would take so long that it might be disregarded.

12. The first year's work caused what appeared to be a formidable accumulation, and the question was again raised and fully discussed, with the result that the Government was reassured. A calculation was made showing that the accumulation in one south-west monsoon occupied about one-fiftieth of the space available for arresting the sand, thus giving 50 years as the minimum



153
2

life of the harbour, without making any allowance for the opposite movement in the north-east monsoon, which was known to be considerable, but which could not then be definitely determined. Fifty years, therefore, with a considerable, but not at that time accurately determinable, addition was taken as approximately the time during which no measures need be taken to protect the harbour from sand.

13. Even after this the question was from time to time raised and discussed, but one objector after another dropped off, and since 1879 the question has been absolutely at rest.

14. In the meantime the movements of sand have been carefully watched, recorded, and reported on, so that if any one were disposed to object, the data were always at hand on which to base any adverse theory. But no one has come forward, and, on the contrary, the accumulation of facts has been such as to confirm in the most complete manner the correctness of our original anticipations. Each year shows a slight advance of beach, and the advance from year to year is so regular, though proceeding at a decreasing rate, as to show that the accretion is not the result of casual and variable storms, but of some regularly recurring seasonal action. The oblique stroke of the light but continuous surf on the beach is generally acknowledged as a sufficient cause for the results seen and recorded.

15. A position thus built up by the confirmatory experience of 10 years has a strong presumption in its favor. It may be based on a fallacy, but I submit it deserves to be attacked, if it is to be attacked at all, by some well-defined alternative theory. For such I have been looking anxiously since I first heard the committee were not satisfied with my position, but all I have got as a result is the vague statement of their apprehensions quoted in paragraph 8.

16. This statement is based on certain figures from which the committee and myself draw very different conclusions. In May 1886 there was a heavy cyclone sea which produced certain exceptional results, the shore line was considerably washed back, and there was a considerable accretion of sand at two, three, and four fathoms under water.

17. The committee examining the latter alone came to the conclusion that it did not bear out my contention that the advance proceeds in a decreasing annual ratio, but the contrary, and they show that if it continues at the same rate in future as in the last four years, the four-fathom line will reach the south-east corner of the harbour in 15½ years. This period is increased in their report to 20 years, though upon what grounds does not appear.

18. My deduction from the same data, but including with them the upper parts of the slope which were washed back, is that the rate of advance is decreasing, and that the measurements as a whole show that the disturbance of the storm of May did not result in any addition to the normal year's accumulation, but simply redistributed it by drawing down sand from the shore. Thus, my original calculation of 50 years as the *minimum* estimate of the life of the harbour is in no way affected, but the measurements show that the originally indeterminable addition to the 50 years may be taken to be at least 10 years, so that there is half a century to run from the present time. I think it unnecessary at present to cite further figures, but I may say that, if a further investigation were required, these would be forthcoming, and would confirm in a remarkable way my general conclusion.

19. I should add that the difference between the committee and myself is not limited to the question of 20 or 50 years. There is another point of almost equal importance. It contend that it is now well established how the sand comes, and in what quantities it comes, and therefore how it may be intercepted when it becomes necessary, and what the cost of intercepting it will be. It may be added that that cost, which will not be required for 50 years, will not thenceforward be a serious burden on the trade. On the committee's supposition there is no such knowledge. If the sand is conveyed by currents (which, though not suggested by the committee, is the only other conceivable vehicle for its transport) it is impossible to say how or where it will be deposited, or whether it can be in any way controlled.

20. I have now shown how very different are the conclusions drawn by the committee and myself from the same data. I hope I have also shown to the satisfaction of the Government that my conclusions are not of a character to be set aside in favor of such a vague suggestion as that put forward by the committee. But if the case ended here I should hardly feel justified in asking that the committee's suggestion should be set aside in favor of my conclusion. I could only ask that a decision should be postponed pending a reference to further experience. Meanwhile a continuance of the present heavy rate of expenditure on the works would be hardly justifiable.

21. But since the committee ceased their sittings, after the members had left town, and while the report was in circulation for signature, information has reached me which I think has brought the question to a practical test. A survey was made in September 1887 which shows the exact position of the four-fathom contour at that date. It will be remembered that the committee's apprehension was that this would continue to advance at the same rate as in the four years previous to 1886. I contended that the advance in 1886 was exceptional and raised the average abnormally. I expressed my belief that future years would show, not a retreat, but a retarded rate of advance till the average normal annual rate was restored.

22. The following are the facts shown by the recent survey. On the line of section 300 feet south of the pier the average annual advance between 1882 and 1886, and which the committee expected to continue, was 120 feet. From 1886 to 1887 the actual advance was, however, 10 feet.

On the line of section 550 feet south of the pier the anticipated advance was 96 feet, the actual 35 feet.

At 950 from the pier the anticipated advance was 78 feet, the actual 30 feet.

At 1,350 from the pier the anticipated advance was 65 feet, the actual 70 feet.

The fifth section was not repeated, but this as well as the fourth, and to some extent the third, had shown in 1886 much less exceptional disturbance than those nearer the pier.

23. Now, in view of these facts, I think I may go a step further than I should have ventured to do before the receipt of this information, and ask that this suggestion of the committee should be dismissed as a groundless scare.

24. I now proceed to the second point named in paragraph 7, viz., "The incompleteness of the committee's decision as an authoritative basis for the action of Government." On this point I need hardly explain that I do not claim to have any voice except as contributing information necessary to enable the Secretary of State to form a decision.

25. I would remark that there is this peculiarity in the subject referred to the committee. An authoritative decision upon it, fully endorsed by the Secretary of State, is already in existence. Since that decision was given, 3½ years ago, there has not arisen any new evidence on matters of fact, nor has any new question been introduced except that of the advance of the sand, which has been introduced by the committee themselves, and not by any of the witnesses on one side or the other. This question, as I have shown, is of far greater importance than the question of entrance. It must be dealt with independently of the latter, and in one of the three following ways, each of which will suggest its own consequences. If the committee's view of the sand question is to be accepted as proved, I can see no other course than to at once abandon, and close the accounts of, a most unfortunate and ill-advised undertaking. If the question is to be reserved for the test of further experience, further outlay should be suspended till time has solved it. If it be at once and finally rejected, as I think I have shown may be safely done, then the effects of its removal from the committee's balance of argument must be considered.

26. Taking the last alternative, it is to be observed that the point is introduced by the committee simply as an argument in favor of the north-east entrance. But there is nothing to show what weight they give to this argument, and whether its removal will transfer the balance to the other side. If it did so, of course, the decision as now pronounced would be null and void. If it did not, then we should have two co-existent but conflicting judgments, based upon the same evidence, one pronounced by Sir John Hawkshaw, Sir John Coode, and Professor Stokes, the other by Admiral Salmon, Sir John Coode, and Sir George Nares.

27. This somewhat peculiar position derives importance from a fact which has been brought to light by this inquiry. I have said that the evidence as to matters of *fact* was identical before the two committees. In the evidence as to matters of *opinion* there is a marked contrast between the two. In the earlier case the nautical evidence was represented to be unanimous in favor of the north-east entrance. This alleged unanimity no doubt had great weight as an argument with the Harbour Trust Board, with the Government of Madras, and with the Government of India, but it is an argument which no longer exists. The unanimity has completely broken up, and it is now shown that nautical opinion is very much divided on the subject.

28. Under these circumstances, is it certain that the present strong feeling in favor of the north-east entrance will be permanent at Madras? The immediate or proximate successor of the late Captain Taylor may be an advocate of the eastern entrance. The Harbour Trust Board is a changing body. The financial view of the question, as yet hardly presented, will open a prospect of an addition of 40 or 50 per cent. to the harbour dues. May not these considerations, and I can imagine others to support them, give rise to an urgent demand for an appeal from Admiral Salmon's committee, which would be supported by the precedent of the appeal granted from Sir John Hawkshaw's committee?

29. I now pass to the third point named in paragraph 7, as to "a recommendation in a matter which from the committee's point of view is one of secondary importance, but from my point of view may be of primary importance, and to which, in my capacity of responsible Engineer of the works, I think it is within the scope of my authority to take exception." I fear it will be considered that what I have already said has rather enhanced than otherwise the difficulties of the situation. I hope that what I have now to say may do something to suggest a solution, though unfortunately I have to begin by again joining issue with the committee.

30. When I was before the committee on the 29th June, several schemes for a north-east entrance were shown to me, and my opinion upon them was asked. I was informed that the choice was virtually limited to two, which I will call A and B. Having previously seen and considered these I was able to speak definitely, and I gave the preference, for reasons adduced, very decidedly to plan A. There was much general discussion of the matter, and I left the room with the strong impression that the members of the committee were equally in favor of plan A.



153/3

31. Several weeks afterwards I was requested to furnish estimates of these two schemes, and finding that my anticipation that the cost of plan B would be considerably greater than that of plan A was fully confirmed, the difference being nearly 5 lakhs of rupees, and remembering the impression made upon me that the committee were fully alive to the other objections to plan B, which had been fully discussed, I did not think it necessary to repeat these in writing, and furnished simply the estimates in abstract.

32. It was therefore with considerable surprise that I afterwards found that the committee had adopted plan B, with all its objections, as their final recommendation, and make no allusion in their report to plan A. My objections to plan B are, of course, mainly on engineering grounds, and these might be outweighed by any considerable superiority on nautical grounds, but it is a case in which it is impossible that such considerable superiority can exist. I cannot admit that even the engineering member of the committee can be so good a judge as myself of the relative difficulties of carrying out the two schemes, and I submit that it is a matter of detail in which the committee's recommendation may be amended so as to make it conform to my views. I do not now trouble you with the details of my objections, but I shall be ready to furnish them if required.

33. What I have now to say is dependent upon the substitution of plan A for plan B. The estimated cost of plan A (in addition to the sanctioned estimate) is Rs. 18,11,411, with an overlap of 600 feet, or of Rs. 20,86,677, with an overlap of 800 feet. This is supposing that its adoption is decided on before the work proceeds any further. I find that if the work were allowed to proceed upon the sanctioned plan till each pier is built to within about 300 feet of its termination, and the formation of a north-east entrance according to plan A were then ordered, the ultimate extra cost would be something under a half a lakh of rupees, say 18½ lakhs or 21½ lakhs.

34. If this were done the harbour would be virtually restored to the state in which it was previous to the storm of November 1881, for the last 300 feet of each pier are standing in a state to give effectual shelter, and the question of a change of entrance might then be reconsidered in view of the actual effect of the piers as originally designed. The trade would then have the benefit, such as it is, of such a harbour in a virtually complete state pending the construction of the new entrance. To carry out the work to that extent would take about eighteen months, during every month of which time the shelter would be improving. To proceed on the plan recommended by the committee, the first two or three years would be spent in opening the harbour still more to the sea, and that in the most dangerous possible form, while a further three years would be occupied before anything like efficient shelter would be obtained.

35. In conclusion, I would beg to call attention to one point which has not been mentioned by the committee. The committee have stated very fairly how various admitted evils would be cured by the construction of the north-east entrance. For these evils Captain Taylor and others only allow the possibility of one remedy. It should be borne in mind, however, that many of them can be cured by other and less costly remedies, as I have previously shown. Credit should be taken for these on the side of the eastern entrance without necessarily assuming that they will place the whole balance of advantages in its favor.

---

ORDER—dated 16th January 1888, No. 153 W., Public Works.

Communicated, in continuation of G.O., No. 3484 W., dated 20th December 1887, to the Chairman for an expression of opinion by the Harbour Trust Board.

(True Extract.)

Captain, R.E.,
Under Secy. to Govt., P.W.D.

To the Chairman, Harbour Trust Board, with one plan and copy of report.
" Marine Department.

Exd. J. Moses.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

# Govt. of {1888} Madras.

PUBLIC WORKS.

*Dated January, 16th.*

*Recd.* *Encl.*

**G.O., 16th Jan. 1888, No. 153 W.**

**JANUARY.**

## Madras Harbour Entrance

Communicating to the Chairman, for an expression of opinion by the Harbour Trust Board, despatch from the Secretary of State forwarding a letter from Mr. Parkes containing his remarks on the conclusions of the London Committee on the question of the —.

53/5

9TH JUNE 1884, No. 1437 W., PUBLIC WORKS.

## PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

LETTER—from

COLONEL J. SHAW-STEWART, R.E.,

*Secretary to the Government of Madras,*

*Public Works Department,*

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,

PUBLIC WORKS DEPARTMENT.

SIR,

I am directed to acknowledge receipt of your letter, dated 17th May 1884, No. 198 M., with which is forwarded copy of a despatch and enclosures from Her Majesty's Secretary of State for India respecting the proposed scheme for the restoration of the Madras Harbour, and in which you request that the Government of India may be favored with an expression of the views of this Government in the matter.

2. The three points specially dealt with in the papers now under acknowledgment are—

(1) The position of the entrance to the harbour, together with its shape and width.
(2) The section to be given to the sea-face.
(3) The officer under whom, as chief executive authority, the restoration of the harbour is to be proceeded with.

3. With respect to the first point, I am to state that His Excellency the Governor in Council still remains strongly of opinion that the entrance should be placed at the north-east angle of the harbour, in from 7 to 7½ fathoms of water, as recommended by the Madras Committee; and that it should have a width of 500 feet.

4. As bearing on this point, it appears to this Government that sufficient weight has not been attached to the unanimous opinions of nautical experts on the spot, copies of which were forwarded to you with my letter, dated 11th October 1883, No. 2862 W. It is admitted by Sir John Hawkshaw's Committee that the question of access and egress through the proposed new entrance is "*more a nautical than an engineering question.*" That it is emphatically a nautical question scarcely admits of doubt; and on this point the nautical authorities who have been consulted are singularly unanimous. In a letter, dated 6th May, No. 4354, copy of which accompanies this, and to which special attention is solicited, the Master Attendant of Madras states: "All commanders of vessels who have been consulted, and that includes nearly all that have visited Madras since the accident, approve entirely the alteration from every point of nautical convenience." Captain Taylor adds: "I submitted some of the chief opinions, but could have collected hundreds, all giving testimony of the same nature."

5. I am directed to again solicit attention to those opinions; and, in doing so, to point to the fact that they represent the views of experienced men, commanding the largest steamers visiting the port; men who have known this coast and these seas for years, and who have watched the progress of the harbour works from the beginning. If there be any more competent nautical authority, thoroughly conversant with the somewhat complicated local conditions and with the nature of cyclonic storms, I am to state that His Excellency in Council earnestly requests that the question at issue may be referred to such authority before it is irrevocably decided.

6. In further connection with this point, I am directed to observe that Sir John Hawkshaw's Committee appear to have misapprehended the circumstances from want of the necessary local knowledge. In paragraph 11 of their last report, they state that during 1883 they considered the question of forming a new entrance at the south-east elbow, and reported against it; and in paragraph 12 they continue: "Though the Madras Committee say that the strongest winds are from the north-east, and though winds blow twice as long from that quarter as from the south-east, they now propose a new entrance fully open to those prevailing winds." The argument being apparently that, if a southern entrance cannot be entertained, *a fortiori* a northern entrance must be objected to still more strongly.

7. With advertence to this, I am to point out that the Madras Committee did not say the strongest winds were from the north-east, but "the heaviest seas yet observed have invariably been from the north and the north-east." As matter of fact, the wind does not at Madras blow from the north and north-east for more than four months of the year, from October to February, the direction of the wind during the remaining eight months being more or less southerly. The direction of the wind, however, seems to have little effect on the swell, which rolls in with the crests of the waves parallel, or nearly so, to the coast line; with the result that seas enter the present mouth freely, and do not disperse before reaching the shore at the base of the harbour. Those seas would be deflected from a north-east entrance by the proposed protecting horn.

8. A further objection to the north-east entrance raised by Sir John Hawkshaw's Committee is (paragraph 14 of report) that "there would, for a considerable time, be two entrances;" but I am directed to state that this Government do not attach much weight thereto, inasmuch as the old entrance could probably be closed, and the new one opened, during the interval between two stormy seasons.

9. After most carefully considering all that has been urged against the proposed new entrance, His Excellency the Governor in Council adheres strongly to the opinion he has already recorded in favor of it. He considers that the retention of the eastern entrance will involve the loss of the greater part of the advantage which Madras might otherwise confidently expect to obtain from the harbour, and that it will also, in all probability, involve heavy and ever recurring outlay to repair storm damages. And I am directed to add that this opinion is in no way contingent upon the decision that may be arrived at with respect to the necessity for providing the south arm of the harbour with a wave-breaker. If such provision can be dispensed with, as recommended by the Madras Committee, the new entrance can probably be opened within the sum (£480,000) named by Sir John Hawkshaw's Committee; but if otherwise, this Government are of opinion that the additional outlay, estimated by the same body at £127,000, *must* be incurred in view to the efficiency of the harbour and the security of vessels lying therein.

10. The question of whether ships could safely ride out a cyclone in the harbour may, in the opinion of this Government, be left to be decided by the commanders of such vessels. In most cases sufficient warning is given of the approach of a cyclone to enable vessels to get to sea, if they desire to do so; but it is impossible to entertain doubt that a vessel in the harbour would have a much better chance during a cyclone if the eastern entrance were closed, than if it were open. It should, moreover, be remembered that the main object of the harbour is not to provide a refuge for vessels during the brief period of cyclonic storms, but to secure smooth water for landing and shipping operations in ordinary weather, and to protect the jetties and other appliances necessary thereto from the destructive effects of a cyclone to which they are



liable so long as they are exposed to the direct influence of the sea from the east. Every convenience of this sort was wrecked in 1881; and unless the proposal to close the eastern entrance is accepted, it will be useless to attempt their reconstruction.

11. Respecting the proposal to reduce the width of the present eastern entrance to 450 feet, which is renewed by Sir John Hawkshaw's Committee in paragraph 22 of their late report, I am directed to observe that this too is more a nautical than an engineering question, and that the weight of local nautical opinion has been recorded strongly against the proposal. Upon this point I am to refer to paragraphs 25 to 27 of the Madras Committee's first report. With that opinion on record, His Excellency the Governor in Council must continue to object to the proposal.

12. With respect to the second point dealt with in the papers under acknowledgment, namely, the section to be given to the sea-face of the harbour, I am directed to state that His Excellency the Governor in Council greatly prefers the third of the methods of reconstruction quoted by Sir John Hawkshaw's Committee in paragraph 18 of their last report, namely, the random block-work system. Its adoption was strongly recommended by the Madras Committee; and as Sir John Hawkshaw's Committee consider that it may be adopted with safety, it is hoped by this Government that all objection will now be removed.

13. With respect to the third point, namely, the chief executive authority under which the restoration of the harbour is to be carried out, I am directed to draw attention to paragraphs 10 and 11 of General Sankey's letter, under date 4th July 1883, No. 1856 W., where the opinion on this important matter of His Excellency the Governor in Council is stated clearly and unmistakably; and I am to say that His Excellency has seen no reason for modifying that opinion.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

OOTACAMUND,
9th June 1884.

Exd. E. Fernandez.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

# Govt. of {1884} Madras.

PUBLIC WORKS.

*Dated June, 9th.*

*Recd.* *Encl.*

**9th June 1884, No. 1437 W.**

**JUNE.**

**Madras Harbour**

Expressing opinion on certain points connected with proposed scheme for the restoration of the —

153
6



GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following papers :—

Despatch from the Right Honorable the Secretary of State for India, to His Excellency the Most Honorable the Governor-General of India in Council, dated India Office, London, 25th September 1884, No. 56, Public Works.

Your Excellency's Public Works letter, No. 32, dated 4th July 1884, on the subject of the Madras Harbour works, has received my consideration in Council.

2. Your Excellency forwards a communication addressed to you by the Government of Madras, together with a letter from the Chairman of the Madras Chamber of Commerce, reiterating objections to certain features in the plan of restoration of the harbour works as settled by the committee, to whom the matter had been specially referred in this country, and you state that you concur generally in the views held by the Madras Government.

3. It is recognized by every one that the chief objects which have to be kept in view in carrying out the works of restoration are (1) the structural stability of the pier walls, (2) the selection of the best position for the entrance, in view to providing a safe and easy ingress and egress for ships, and (3) the security and accommodation to be given to shipping, especially local craft, by obtaining stiller water within the harbour.

4. It is to the position of the entrance to the harbour advocated by the committee, and to its supposed unfavorable effect on the stillness of the water within, that the objections taken by local opinion appear to apply, and I have anxiously considered what course I should follow in consequence of this much to be regretted divergence of judgment.

5. The engineering questions discussed in the correspondence now forwarded to me have been so recently investigated a second time by Sir John Hawkshaw's committee, the engineer members of which are regarded as among the greatest living authorities on works of the description in question, and who were in possession of and carefully considered all the views before expressed by the authorities at Madras and of your own professional advisers, to which I cannot find that any argument or statement of fact have now been added, that, without underrating the value of local knowledge and opinions, I have felt that it would be useless again to ask the committee to reconsider their recommendations.

6. It appeared to me that, after consulting the best authorities available on the subject, no choice was left to me but to accept their decision on the questions raised, the whole of which are of an eminently technical nature, and trustworthy opinions on which can only be formed upon prolonged and extensive experience such as that possessed by Sir John Hawkshaw and Sir J. Coode, and in my despatch, No. 23, of 24th April last, I informed your Excellency that this was the conclusion at which I had arrived, and I am not now able to see any sufficient reason for changing it.

7. In the accompanying report * which Mr. Parkes, in communication with Mr. Thorowgood, has made on the subject of future operations, he expresses concurrence with the conclusions of the committee. He points out that the larger vessels should have no difficulty in getting out to sea when a severe storm is threatened, and

* Dated 21st August 1884.

that of the approach of such storms timely warning can be, and in fact always has been, given, while, as regards the smaller craft, he is of opinion that the provision of floating docks or basins, which he shows might be formed on the land reclaimed on the south side of the harbour, would protect them from danger. Nor is it anticipated that, in ordinary weather, the quietude of the water within the harbour would be better secured by a change in the entrance. These suggestions are in conformity with the views expressed in the report of Sir John Hawkshaw's committee, and, if acted upon judiciously, appear to offer a means by which to accomplish the object sought without changing the position of the entrance. Mr. Thorowgood, who is in full possession of Mr. Parkes' views, and of the reasons which have led him and the committee to adhere to the eastern entrance, has already started on his return to Madras, and will be able to furnish the authorities there with any additional particulars they may require, and it is to be hoped that conflicting views may be reconciled by further discussion. Meanwhile, the plan of operations which Mr. Parkes has proposed will not preclude the further consideration of the position of the entrance of the harbour for several months at least, and possibly for another working season, and his plans should be followed generally, on the understanding that if any additional facts or arguments are adduced bearing on the question of the entrance which appear of sufficient weight to justify the step, a further reference to engineering authority in this country may become desirable.

8. In the meantime the machinery, noted in the margin, has been ordered and will be despatched to Madras.

Two Titan cranes.
One crane travelling wave-breaker.

9. With regard to the estimates which form the appendices to Mr. Parkes' letter, I beg that they may be examined, and that I may be duly informed whether they are such as may be accepted.

---

Enclosures.

Madras Harbour.

P.W. 1612/84.

23, Abingdon Street,
21st August 1884.

In the concluding paragraph of my letter to you, dated 5th July last, I stated that I was preparing a report, in which I proposed to deal with the various questions which have accumulated in the last two years, and which would include a more detailed explanation and estimate of the proposed works of restoration, together with a classified statement of the operations carried on, and the expenditure incurred, during the period of the general suspension of work. I have now the honor to submit that report.

2. I will begin with the proposed works of restoration. The general character and extent of these works will be as laid down in the first joint report of the committee, consisting of Sir John Hawkshaw, Sir John Coode, and Professor Stokes, dated 23rd January 1883, which I accept as my implied instructions. But the proposals I am about to submit are the result of a careful reconsideration of the existing state of the works, based on records of later date than those laid before the committee above mentioned, and aided by personal conference with Mr. Thorowgood. The details of the new work have been independently designed, but where my conclusions differed from those of the committee I have carefully investigated the grounds of difference, and when I thought there was reason for doing so, I have not scrupled to increase the dimensions given by the committee, and to introduce some additional precautions.

3. There are on the other hand one or two features of the committee's plan, of which I think it only right to state that I am not myself satisfied of the necessity, but I have included these in my own design and estimate in deference to the opinion of the committee. They are works for the execution of which no immediate provision can be made, and if I feel it my duty at some future time to raise the question of their being carried into execution, it will be in consequence of some definite confirmation of my present doubts.

4. On the accompanying general plan of the harbour, to a scale of 200 feet to an inch, the new works are shown in red, and on the sheet of cross sections the character of the work at the different points is shown.

5. Commencing with the shore end of the north pier, and noting that the numbers represent the distance in feet from the point B, the first cross section from 200 to 250 shows the addition required to a special weak point. It is simply the continuation of a form of protection which was applied in 1877 as far as 200, and was so far very effective. There was at that time no occasion to carry it further, but the rubble foreshore has since been worn away by the action



of the sea, and requires feeding and protection. This is shown not only by the foreshore being rather bare in front of the wall, but also by the fact of the centre joint having latterly opened a little, which indicates a settlement. It will be seen by the section that the superstructure is only two blocks high at this part, so that it is founded at a depth at which the action of the sea is considerable, and a wide sloping foreshore is the only protection. Beyond the site of this special protection the superstructure is three blocks high, and founded at a lower level. The protective work consists of a rubble bank 50 feet long and 22 feet wide at the top, and tapered off at either end for a further length of 40 feet. On the top of this rubble 16 concrete blocks, each 9 feet × 9 feet × 6 feet and weighing 30 tons, will be built during the ensuing three months, when the wind and sea may be expected to be invariably from the southward. The northerly seas of the next north-east monsoon will wash down the rubble bank, and the concrete blocks will drop and form a facing for the submerged foreshore, as was the case with similar work in 1877. As this work can be done with appliances now on the ground, as it is of importance to carry it out during the present season, and as it may fairly be considered included in the sanction already given for the protection of existing works, Mr. Beardmore has been instructed to proceed with it; 2,500 tons of rubble and 288 cubic yards of concrete blocks will be required, and the cost will be about Rs. 7,500.

6. The above work will occupy the length from 160 to 290. In the remainder of the length, from 0 to 400, all that is required is to fill up the existing foreshore with a little additional rubble as may be required. This is in accordance with section I of the committee.

7. At 400 the line of continuous protection by random blocks will commence, but from 400 to 900 it will be of gradually increasing dimensions, from a single block laid against the foot of the wall at 400 to a mound 20 feet wide at the level of high water at 900. Within this length the depth of water is such that any waves of sufficient height to be formidable will have been broken outside, and a wave-breaker, as such, is not required. All that is required is a protection against the scour of the foreshore.

8. At 900, where the depth at high water is 25 feet, and from thence outwards, the dimensions of the wave-breaker are intended to be such as to prevent the blow of the wave from falling with its maximum force on the superstructure. What these dimensions should be are not determinable, so far as I am aware, by any recognised rule, whether based on theory or experience. It is a matter in which each engineer must use his own judgment, and mine, based on the best data I am acquainted with, would give rather greater dimensions than those shown by the committee. The difference so far as cost is concerned is not very great. If the additions were made by increasing the quantity of concrete blocks, the increase of cost would be about a lakh and a half, but if made (as I think may be done without any infringement of the essential principles laid down by the committee) by forming the interior of the mound of large rubble, the increase of cost would be only half a lakh. I think I am justified in asking the Government to sanction this modification of the design, so that it may cover my own conceptions of the required conditions of stability, but I shall, of course, be prepared to submit my conclusions to further consideration if it is considered desirable to do so.

9. It will be understood then that the following dimensions for the wave-breaker are rather in excess of those shown by the committee, but the excess is obtained by forming a nucleus of large rubble against the face of the wall and covering it with blocks. This large rubble will be deposited immediately before the blocks, so that it may not be exposed to the wash of the sea before being covered with blocks.

10. At 900 feet, then, as before said, the width of wave-breaker at high water (taken as one foot above De Haviland's mean sea level) will be 20 feet, and the width will gradually increase to 28 feet at 2,200 (see sections at these points). The blocks will be allowed to form their own slope to seaward, each block being simply carried out by the wave-breaker crane to the required distance and dropped into the sea, till the mound has reached the required height. If future storms should draw the mound down to a flatter slope more blocks will have to be added to maintain the designed width at high water level. The slope of 1½ to 1 shown on the sections is that at which it is anticipated the mound will be ultimately permanent in form, but this, of course, cannot be guaranteed.

11. The point 2,200 is the limit to which the existing work can be utilized as a built structure. Since the storm of November 1881 the upper blocks have been tied together with pieces of bent railway bars cemented into them, and the top has been levelled with concrete. Nothing more will be done till, as a final operation, after the whole length of the piers shall have been completed, the capping of concrete in mass about six feet high recommended by the committee is placed upon it.

12. From this point forwards the system of construction will be in a certain sense reversed. Instead of placing a new wave-breaker in front of the old work, the old work will be treated as part of the wave-breaker, and a new wall constructed inside it. By this arrangement the old work will be utilized to the fullest extent, while in the execution of the new work the elements of uncertainty will be reduced to a minimum. It will be a continuance of the system of work hitherto carried on with much success as an executive operation, and of which the cost is well

known. Some modifications and some special works, however, will have to be introduced, which to a small extent will involve new conditions.

13. The mode of passing from one system to the other is shown upon the plan. The old building is standing complete to 2,200, and from that point the new building will commence as a complete section, but in order to form a continuous line along which the setting machines and the blocks and other materials can pass without interruption, it is proposed to build a wall 12 feet wide for a length of 160 feet back, starting at 2,040. This wall will curve away from the old wall (the space between the two being filled in with rubble and concrete) till sufficient space is gained to build the section to the full width of 24 feet.

14. The new building will be of the same general character and dimensions as its predecessor, but there will be some modifications of detail. The original building consisted of two independent walls placed in contact, but not tied together. It is recommended that for the future the blocks should be bonded together, so as to form one wall, and in this recommendation I concur. The unbonded system has great advantages in comparatively shallow water, in which the waves have little effect on the blocks themselves, but much on the foundations, while in deeper water the action of the sea on the foundations is less, but that on the blocks themselves is greater, and this fact turns the scale in favor of bond for the outer portions of the piers. At the same time the bond rather increases in some respects the difficulties inseparable from a compressible foundation, and new difficulties are introduced by the special circumstances of the case.

15. It will be seen from the sections that the new rubble base will be deposited over the inner slope of the old, and upon that slope some of the overthrown blocks are lying. All the blocks which lie under the line of the new building will have to be removed, either bodily or by blasting, for if they are allowed to remain they will cause inequalities in the settlement, which will be highly injurious to the superstructure above. In order to avoid these blocks as much as possible I have increased the distance at which the committee proposed to place the new pier from the old one by 9 feet, and this will also place the line of new building more clear of the old rubble.

16. But even with these precautions of removing the old blocks, and increasing the distance from the old work, there will still be a greater liability than there was in the original work to unequal settlement. The sea side of the new building will still partially rest on the old rubble, which has been consolidated by four or five years' exposure to the sea. The new rubble will be in the same position as the old was when first built upon, that is, it will be liable to be compressed to the extent of a foot or 18 inches within a few hours after the weight of the blocks is placed upon it, and to a slower settlement subsequently extending over months, and perhaps years. This latter slow process of settlement, however, is not injurious to the work. But the first is so, it subjects the blocks to great and irregular strains, and is, I think, the most fruitful cause of many of the original blocks having been broken. The evils would be materially aggravated by the fact of one side being more liable to settlement than the other.

17. It is, however, possible materially to reduce these evils, if not to prevent them altogether, and it is proposed to do this by subjecting each length of bed after it is prepared by the divers, and before the blocks are set, to a compression rather greater than that of the blocks themselves. This will be accomplished by placing in front of the work a pile of iron (old rails, with the interstices filled up with cheap cast-iron bars), covering the same area as a row of blocks, and having a weight rather greater than that of the blocks. This "compressor" will be moved forward in advance of the building by the Titan. If, after its removal, it is found to have compressed a bed unequally, the hollow parts will be fitted up with suitable flat pieces of stone before the blocks are set.

18. I propose to introduce another departure from the original design, which will also diminish the evils of settlement. In the original work the foundation blocks were 6 feet high, and above this there were three courses of blocks, each 8 feet high, the whole being 4½ feet wide. It is intended now to use blocks 6 feet high and 6 feet wide, of which there will be five courses, including the foundation course. These blocks will be stronger than those 4½ feet wide, and less liable to break. There is also the incidental advantage that the iron compressors would have to be advanced in stages of 6 feet instead of 4½ feet, and this would accord better with a fair rate of progress of one row per day.

19. It will be seen by the cross sections that the foundation course consists of two blocks of equal length (each 14 feet), the upper courses of blocks of 14 and 10 feet alternately breaking joint. Thus the foundation course will not be bonded. The reason for this is that there would be a practical difficulty in manipulating both the 16 feet and the 12 feet blocks in that situation. I pointed out these difficulties to the committee, and obtained their concurrence to this small departure from their recommendation. The importance of bonding is greatest in the top course, and diminishes in descending. In the bottom course it is practically *nil*.

20. The blocks will be further locked together by means of a projection on the top of one block fitting into a corresponding recess in the bottom of the block above. This principle was adopted in the original work, and was certainly successful in preventing the blocks from sliding on one another, as they had been found to do at Kurrachee and elsewhere. In the present case a



connection of a similar kind will be made between the ends of the 14 feet blocks on one side with the ends of the 14 feet blocks in the courses above and below on the other side, which overlap them, and there will also be hollows and projections on a somewhat similar principle in the backs and faces of the two top courses, thus giving additional ties throughout the whole width. A further tie will be given by means of a bent rail cemented into the two blocks of the top course in every row, but the cramp which is shown in the committee's sections in the second course from the top may, I think, be dispensed with, in consideration of the additional ties provided by the projections and hollows in the blocks themselves. The cramp could be only very imperfectly fixed, as it would be constantly in the wash of the sea, and the necessity of fixing it before setting the top course would be a serious obstruction to the work.

21. There will be an interval of about 45 feet between the face of the new wall and the back of the old one, and in this space the great bulk of the overthrown blocks are lying. The remainder of the space will be filled up with random blocks to form the wave-breaker, of which the remains of the old work will form the sea slope. Any of the old blocks of the two upper courses that remain in place will be removed to the body of the wave-breaker so as to leave the sea face fairly uniform. The two lower courses, of the sea wall at any rate, are very nearly perfect and will form a continuous toe to the slope of the wave-breaker very much as shown in the average section from 2,600 to 3,800.

22. There are now in stock 800 blocks which will be available for use in the wave-breaker. They are not of the best form for the purpose, but they will be used in the under parts where this is not of consequence. About 6,000 additional blocks will be required to complete the wave-breakers, and there will be uniformly 9 feet × 9 feet × 6 feet, and weigh 30 tons each.

23. The same system of work will be continued to the pier head, but the new built work will be curved round as shown on the plan, so as to avoid a great mass of fallen blocks among which the "Titan" is lying embedded, and also to obtain an entirely new foundation for the additional 50 feet of length required to obtain the narrower entrance. The old pier head is standing with the lower courses almost perfect, the interval between the ends of the old and the new work will be built up with a solid wall of concrete blocks, and the enclosed space behind filled in with random blocks. The last 200 feet of the new pier, including the portion facing the entrance, will be made 38 feet wide, instead of 24 feet, and will be founded 12 feet lower than that within the harbour, or 34 feet below mean sea level. Its toe will be protected by an apron of concrete blocks laid on the foreshore.

24. The work at the south pier will be generally similar to that at the north, except that, in consequence of the advance of sand, the protection works need not be commenced so near the shore, and there is no place requiring special protection like that proposed for from 200 to 250 at the north pier. There has been some advance of the sand since the date of the latest survey (1882), and in execution rather less work will be required than is shown upon the accompanying plan and sections, but for the present I have thought it better to base my estimates on the latest complete survey.

25. According to this then the protection by concrete blocks will commence at 1,000, and will gradually increase up to a high-water width of 20 feet at 1,300, where the depth at high water is 25 feet. It then continues with the width gradually increasing to 28 feet at 2,550, up to which point the existing pier is perfect.

26. At 2,550 the new pier commences, being connected with the existing work in the same manner as at the north pier, and is carried on to the head with only such variations as the different circumstances require. The line shown on the plan passes between the overthrown blocks and the Titan. The Titan is not in this case encumbered with blocks, and can be removed by blasting if it should be necessary to do so. The new head will be connected with the old one in the same manner as at the north pier. The difference in the form of the two heads is rendered necessary by the different positions of the fallen Titans, but there is no objection to it, as it will be scarcely noticeable from any accessible point of view.

27. I estimate that the above works will require 3½ years from the recommencement of blocksetting in June next, or till about the end of 1888. The estimated cost is Rs. 45,90,051, including 7½ per cent. for establishment, and 2½ for contingencies, but this estimate does not give a basis for determining the total cost of the harbour as completely restored, without taking into account the expenditure since the storm of November 1881, and the relation of that expenditure to the previous outlay on the one hand, and to the future outlay on the other, I shall show (in paragraph 42 *post*) that a sum of Rs. 2,96,334 has been already expended on works and materials included in this estimate.

28. The total expenditure up to 31st October 1881 was Rs. 58,72,082 including Rs. 1,53,945 expended in the purchase and partial fixing of moorings which were the subject of a different sanction from that of the harbour works proper. It also included the value of certain materials which had been acquired for the completion of the work and are still available.

29. Between 31st October 1881 and 30th April 1884 Rs. 9,08,088 have been expended, and regular monthly statements purporting to account for the details of this expenditure have been

regularly submitted to Government, but as, in conformity with the inflexible rule of the Public Works Department system, all charges are referred to heads for which there is a corresponding sanctioned estimate, the accounts would show that expenditure has gone on increasing for works to which no addition has been made. It is obvious that the present form of the accounts can only be viewed as provisional, and that any real explanation of the expenditure must be based on an entire re-arrangement of the statement.

30. At my request Mr. Thorowgood has made such a re-arrangement, of which I append a copy (appendix A). From this it would appear that the total expenditure may be classed as follows:—

| | Rs. |
|---|---|
| 1. Actual work, and purchase of materials for work ... ... | 4,43,972 |
| 2. Purchase of land threatened with erosion, and compensation for land washed away ... ... ... ... ... ... | 2,58,075 |
| 3. Establishment, and salaries of foremen under agreement ... | 2,06,041 |
| Total ... | 9,08,088 |

But as the first and second of these items were incurred under the superintendence of the harbour works' staff, they should bear their fair charge for the cost of such, which I place at 10 per cent. for the first, and the sum of Rs. 6,650 (the actual salaries of the persons employed) for the second. With these corrections the items would stand thus:—

| | Rs. |
|---|---|
| 1. Actual work, &c. ... ... ... ... ... ... ... | 4,88,369 |
| 2. Purchase of land, &c. ... ... ... ... ... ... | 2,64,725 |
| 3. Establishment. Cost during suspension of work ... | 1,54,994 |
| Total ... | 9,08,088 |

31. Now I would submit that the last two of these items, although fairly debitable to the harbour *undertaking*, are not fairly chargeable to the *works*, and should be kept distinct in any statement of expenditure. I shall have occasion further on to explain the circumstances under which the outlay under the second head was incurred, and I will only now say that it ought to appear in a statement of gain and loss of land, in which there is a credit as well as a debit side. With regard to the third, I need only say that to add it to the item of "Establishment" in the accounts of either the old or the new works could only mislead. I submit that it should appear as an item by itself.

32. There remains to be accounted for the sum of Rs. 4,43,972, or, including cost of management, Rs. 4,88,369, little more than half the total of the official statement. This may be classed under four heads, as under:—

| | Rs. |
|---|---|
| A. Stone revetment for protection of shore north of harbour ... | 1,13,618 |
| B. Expenditure debitable to the original design .. ... | 1,17,769 |
| C. Expenditure consequent on the storm of November 1881 ... | 39,509 |
| D. Expenditure in anticipation of the restoration works ... ... | 1,73,076 |
| Total ... | 4,43,972 |

33. The first of these items is part of a total of Rs. 2,04,627 expended on this object and hitherto charged to "Contingencies." I think it might fairly be placed in the same category as the purchase of land, for which it is simply an alternative, but, at any rate, it should be kept apart as an exceptional item of expenditure.

34. Item B consists of Rs. 75,029 expended on levelling and clamping the injured portions of the piers, and this would have been done even if the remaining portions of the work had not been damaged by the storm; Rs. 15,328 is the expenditure on moorings in the month of November 1881 previous to the storm. The remainder of this item, Rs. 27,412, covers Rs. 16,013 expended on an extension of the town sewer at a spot more than half a mile from the harbour, and chargeable to the harbour funds on rather questionable grounds. This leaves Rs. 11,399 for various small contingent expenses.

35. Item C consists of Rs. 16,485 expended in clearing away the wrecks of the two hopper barges sunk in the storm, and this has to be reduced by more than half of a sum of Rs. 12,835 (the proceeds of a sale of the recovered materials of the barges and some other old materials not easily separable); Rs. 17,803 expended on the recovery, removal, painting, and tarring and stowing away for future use of mooring materials, and Rs. 5,221, repairs to private property damaged in the storm.



153
9

36. Item D consists of Rs. 87,230 for new concrete blocks, Rs. 58,079 for various repairs and renewals of plant and machinery, and Rs. 27,767, the net increase in the value of unissued stores and materials since November 1881. The expenditure under this item (D) are charges against the estimate for the restoration works.

37. I have appended (appendix B) a statement of the total expenditure from the commencement of the works to 30th April last, classified under five principal heads, which I would submit for adoption in future accounts. The following is a summary:—

| Sanctioned estimate. Rs. | Name of account. | Expenditure. Rs. |
|---|---|---|
| 56,50,000 ... ... | I. Original design ... ... | 56,57,840 |
| 2,00,000 ... ... | II. Moorings ... ... ... | 1,90,589 |
| | III. Cost of establishment during suspension of works ... ... | 1,54,994 |
| | IV. Gain and loss of land ... ... | 4,82,114 |
| | V. Restoration works .. ... | 2,96,334 |
| | Total as per official return ... | 67,81,871 |

38. The first of these, I would suggest, may be considered a *closed account*. The official statement of expenditure up to 31st October 1881 has been amended by the addition of such subsequent works as are fairly debitable to the design, and by the removal from it of charges which must still be kept open, some being transferred, as shown in the appendix to account IV and some to account V.

39. The second (moorings) must be kept open, but no further expenditure will be incurred till the restoration works are further advanced. An amended estimate, though not a very large one, will then have to be submitted.

40. The third (cost of establishment during suspension of works) I would suggest should be treated as a *closed account*. A liberal allowance has been made for the legitimate cost of superintendence of such works as have been going on during the general suspension, and the sum of Rs. 1,54,994 is the remainder.

41. The fourth (gain and loss of land) I shall explain more fully further on, and show that it should be treated from henceforth as one side of a Dr. and Cr. account.

42. The fifth will be absorbed in the regular accounts of expenditure on the restoration works, and will appear under the proper heads. Sanction is asked for an estimate of Rs. 45,90,051, against which this amount of Rs. 2,96,334 will be the first charge. The estimate itself, in the form which I submit for adoption, is given in appendix C.

43. I beg now to return to the subject above named, the gain and loss of land. This subject has been treated in former reports as the "sand difficulty" and the "changes of the coast line," but the two latter descriptions are now imperfectly applicable to it, while the first represents the result which is now most prominent.

44. It will be remembered that from the commencement of the works it became manifest that there were movements of sand up and down the coast in opposite directions in the two monsoons, of which the movement from south to north during the south-west monsoon was the greater. This movement being obstructed by the harbour piers the result was an annual advance of the shore line on the south of the harbour, and an annual retreat of the same on the north. The plans show the former in its successive steps for the last seven years. Each blue line shows the most shoreward position of high-water mark for the year. It advances every year from about March to about October, and then retreats from October to March. The rate of increment decreases with fair regularity from year to year, as the length of shore to be covered and the depth of water to be filled increase. It is clear on the one hand that there is no indication of a limit to the advance, and on the other that, considering the decreasing ratio in the rate of advance, the time when it will be injurious to the harbour is still very remote. The area of land gained from the sea up to the present time is 70 acres.

45. Within the harbour there has also been an advance of the shore line, but this took place almost entirely during the years 1876 and 1877, when the north pier formed the only barrier to the northerly movement, the south pier not having then advanced sufficiently to arrest it. Since the latter year there have been some variations in the positions of the high-water line, due to local causes, but no persistent annual advance. The area of land gained within the harbour is 18 acres.

46. To the north of the harbour the result is as might be anticipated, the reverse of that to the south. The preponderating northerly movement of sand causes an annual erosion instead of an accumulation. But the progress is much less regular. This is due to two causes, the one natural, the other artificial. The natural cause is this. The sand within the influence of the waves is subject to two distinct movements, the alongshore movement due to the oblique stroke

of the wave (and this is greatest in moderate weather), the other a transverse movement which is *on* or *off* shore according as the wind is *off* or *on* shore. Thus the *off* shore wind in itself accumulative all along the coast acts with an accumulative alongshore movement to the south, and an erosive movement to the north, and the *on* shore wind of the remainder of the year, erosive all along the coast, acts with the erosive alongshore movement to the south, and the accumulative to the north. Hence the forces are in both seasons acting in concert to the south, and in opposition to the north, and the result is much greater irregularity in the annual changes where they are in opposition.

47. The artificial cause of irregularity is that whenever erosion is manifested protective measures are naturally at once taken, and these counteract the local erosion, even if they drive it to some other locality. As a whole, however, the protective measures appear to have been efficient, for while the gain of land to the south of the harbour has been, as already stated, 70 acres, the loss to the north has been only 41 acres, and this, of course, entirely beyond the limit of the protective works.

48. For the above reasons the conclusions to be drawn from the records of erosion north of the harbour are much less definite than those drawn from the records of the accumulation to the south. We know that erosion is going on, but both the rate of it and the locality for the future are very uncertain. Nevertheless, I think a provisional settlement has now been made upon a tolerably satisfactory basis, and I would ask for a confirmation of it.

49. To explain the present state of the question I must go back to the early stages of the work. The part of the shore affected extends for about two miles northward from the north pier. For three quarters of a mile there was a made road along the shore, and on the landward side of this road stand in succession the Madras Railway Company's Ráyapuram terminus and offices, the Biden Seamen's Home (these are shown on the plan), some merchants' godowns, a first-class bungalow and compound belonging to the late Honorable J. G. Coleman (lately purchased by the Government), and a cluster of small brick-built native houses. Beyond this there was no regular road, but the shore was occupied by hut villages, with few permanent buildings, and timber yards. A little inland are five second-class bungalows standing in compounds having a depth of some 400 feet, beyond which is a good road parallel with the shore. To the northward of the last of these bungalows is a native village with a bazaar, but few permanent buildings, and beyond this agricultural land.

50. As the north pier advanced into the sea in 1876 the first effects of erosion were felt opposite the railway terminus. These were immediately met by the deposit of stone and bags of concrete, and little inconvenience resulted. As the pier advanced further seaward the locality of erosion was thrown further to the northward, and the protective works assumed the form of a continuous stone revetment between the road and the sea, and upon this had been expended up to 31st October 1881 the sum of Rs. 91,009. It extended to a point 3,450 feet from the north pier and a little beyond Mr. Coleman's property.

51. The storm of November 1881 showed, as had been anticipated, that this revetment required an addition of stone, as the first was worked into the sand by the action of the sea. Some of the buildings close to the road were damaged, and were repaired at the expense of the harbour works, but, on the whole, the results of the storm were not serious so far as the revetment extended.

52. But the question was now prominently presented: How far is this protective revetment to be carried? It was effective as far as it went, but costly, and it became evident that it would be possible to spend more in protecting the land than the land itself was worth. In the early part of 1882, therefore, while at Madras, I investigated this question, and satisfied myself that though the revetment was fully justifiable as far as it had gone, for up to that point the evil of erosion would be even greater than the loss of the value of the land, this would not be the case much further on. I therefore recommended that the existing revetment should be strengthened, and that it should be extended northwards sufficiently to make a fair junction with the new line of shore, but that beyond that no further protection should be attempted. All the land abutting on the shore for some two miles northward should be purchased by the Government, so that no further questions of compensation to private owners should arise.

53. These recommendations have since been carried out. The revetment has been completed and extended at a cost of Rs. 1,13,618 and 140 acres of land have been purchased, or its loss compensated for, at a cost of Rs. 2,59,475, and these sums, together with the Rs. 91,009 spent on the original revetment, and the cost of management, make up the sum of Rs. 4,82,114, which I put forward in paragraph 37 as the *debit* side of the "Gain and Loss of Land Account."

54. I have now to show on what the credit side of this account will be based, and while I allow that the great bulk of this is still in the future, yet I submit that the longer the opening of the account is delayed the greater will be the difficulty in establishing it.

55. I have mentioned that 140 acres of land were purchased; of these 41 have been washed away, so that 99 acres remain. The rents of these are collected, and under present orders are to be credited to the harbour works funds. These at any rate should be placed in the new account.





56. Then there have been gained within the harbour limits, as stated in paragraph 45, 18 acres of land. A great part of this has been utilized, and two large godowns have been erected upon it by the Marine Department for port revenue purposes. The value of the accommodation thus given should be credited to the same account, either by the land being transferred to the Marine Department at its fair value, or by an annual payment proportioned to the use made of the land. This payment would no doubt increase from year to year.

57. To the south of the harbour 70 acres have been gained. The Commissariat Department have appropriated an advantageous site, which, five years ago, was in the surf, on which a building, 200 feet by 120 feet, has been erected. Another site has been appropriated in a similar manner by the Marine Department, on which was erected a shed for horses landed from ships. Other buildings of the same kind will no doubt follow, for the situation is a valuable one, and though it is no doubt gratifying to see it utilized, it is somewhat inconsistent that the outlay by which it has been acquired should be debited to one department, and the returns credited to another.

58. The above are Government appropriations, but private individuals are also profiting by the new site. The dealers whose timber yards north of the harbour were purchased at a high price out of harbour works funds are occupying the new beach south of the harbour for the same purpose *rent free*, or if rent is paid it is not credited to the harbour works accounts.

59. I am well aware that if revenue were collected from the sources I have indicated it would make at present but a small show in comparison with the expenditure, but it is certain that it would increase, and it is also desirable that the new land should be recognized as a property which has been acquired by the Government, at a cost of nearly five lakhs of rupees, and that some control should be exercised over its occupation. I would add that I am about to point out a mode of utilization of a portion of a site which would ultimately add materially to the value of the whole.

60. I would now beg to submit some remarks on the future utilization of the harbour, which, although they can only be followed up by definite recommendations for immediate action to a small extent, are, I think, especially called for at the present time, because the subject has been lately under discussion from another point of view. A proposal had been made to alter the position of the entrance, with the view of obtaining stiller water in the harbour, but as this proposal was not approved by Sir John Hawkshaw, Sir John Coode, and Professor Stokes, on reference to them by the Secretary of State, it may now be considered at an end. It is only necessary for me to say that I concur in their conclusion, and I only refer to it now as giving a suitable occasion for pointing out what may be done for improving the accommodation of the harbour with the entrance in its present position.

61. The main points to be kept in view are—

I.—The safety of ships.

II.—The facility for loading and discharging cargo boats alongside the ships.

III.—The facility for loading and discharging cargo boats at the shore.

IV.—The safety of cargo boats and other local craft in bad weather.

62. With regard to the safety of ships, I think it is now generally understood, though it may be somewhat inconsistent with the popular ideas upon the subject, that a harbour may be very useful, even though it may not be a place of absolute safety in the heaviest storms. If Madras were a terminal port, such as London or Liverpool, or even Calcutta or Bombay, the want of absolute safety would be a serious drawback, but Madras is essentially a port of call, where ships only remain for a day or two, and are never dismantled. A steamer's fires are never let out during her stay in the port, and no sailing ship would ever be admitted, unless in very settled weather, without every facility being provided for her leaving at an hour's notice, and in any wind. To be caught in a cyclone at Madras, therefore, is no more than to be caught in a cyclone in mid ocean, provided always that the ship can get to sea. This then is the provision that is wanted, and not a safe mooring in the height of the storm.

Now, it must be remembered that the dangerous storms in the Bay of Bengal never come without notice, but occasionally, indeed frequently, the notice comes without the storm following. This is a source of inconvenience, because precautions have to be taken upon the *notice*, before the actual advent of the storm, when they would be too late. Hence it happens more often than not that when ships are sent to sea they return without having met with the expected storm.

63. But this is an inconvenience which may fairly be expected to be lessened as the indications of storms are better recorded, and the actual courses of existing storms are more perfectly traced. Even as it is, however, the inconvenience is not an intolerable one, and may be taken as an infinitesimally small deduction from the real value of the harbour. During the last two years there have not been more than four or five occasions on which ships have been warned to sea, and not one on which they would have been in actual danger if they had remained at their moorings in the harbour, mutilated though it be. Yet, during all this time, every single steamer has come into the harbour to load and discharge, and paid dues for doing so.

64. It must be admitted that, in one respect, a ship is worse off in the harbour than anchored in the roads outside. She must put to sea at an earlier stage of the warning for bad weather, as the confined space increases the difficulty of manœuvring the ship with a rising wind and sea, setting probably from different quarters. But this is an evil which will certainly diminish with more complete mooring and warping appliances, and more local experience on the part of the marine officers, and it does not touch the question of the ultimate safety of the ship. It has sometimes been asserted that the harbour is a trap from which escape would be impossible. It might perhaps be so once in 10 years if the commander of the ship, and the whole staff of the Marine Department and the Meteorological Observatory, were simultaneously to neglect the most ordinary and well known precautions, but, under existing conditions, such an idea is inconceivable.

65. I submit, then, that the demand for absolutely safe berthage for ships in the height of a cyclone is based rather on sentimental than on practical grounds. The harbour introduces no new element of danger. All that can be said is that, while it gives many new advantages and remedies many evils, it leaves one evil of very rare occurrence untouched. It is right to add that I do not think even this one evil is irremediable at some future time, but at present the circumstances of the port would not warrant the necessary outlay.

66. With regard to the second point, the facility for loading and discharging cargo boats alongside the ship, the advantages of the present over the old system are obvious. Under the old system the ship was anchored at a mile or upwards from the shore to a single anchor, so that she swung with her head to the wind or the current whichever might be the stronger, and rolled to the swell which generally comes from a third quarter. A more "uneasy" position for a ship, even in ordinary weather, it is difficult to imagine, and all around her, while subject to these conflicting disturbances, the cargo boats had to crowd. These boats again were subjected to yet another disturbance, the wind waves, which would scarcely affect the ship except indirectly by constantly driving the boats against her sides. Under these circumstances cargo had to be transferred to and from the boats. Then the boats had to be rowed out and back by manual labor (11 men to a boat carrying two tons) over this mile, and through the surf. The whole operation was one of little danger but of great cost, both in the labor employed, the damage done to goods, and the detention of the ships.

67. Now compare this with the present system. The ship is now brought to within a quarter of a mile of the shore; she is completely out of the current, and, being moored head and stern, is not affected by the wind; her head faces the swell. The wind waves which tossed the boats outside the harbour are much reduced, so that the latter are far more manageable. I mention these details to show that the advantages afforded by the harbour are by no means confined to a reduction of the on-shore swell. Even if this were disregarded altogether (and even those who are loudest in their disparagement admit *some* reduction), the advantages which remain are sufficient to explain the reason of the notorious fact that ships are eager to enter the harbour. Of course it is fully admitted that the more the swell can be reduced the better, but to make this one object paramount is altogether to misrepresent the case.

68. With regard to the loading and discharging cargo boats at the shore, the advantage gained so far is simply that due to the reduction of the waves, whatever that may be. In itself it is not much, but the stiller water enables improvements to be made which would have more effect. The existing screw-pile pier was made for open sea work, and it has inconveniences which are inseparable from such work. The principal one of these is its great height (about 18 feet) above water. With constant smooth water a height of 6 feet would be sufficient, and obviously much more convenient.

69. A few months before the storm of November 1881 two new low level jetties were actually commenced, with the intention that they should for a time supersede the screw-pile pier, which was itself to be altered and adapted to the new circumstances, and again brought into action when required as an auxiliary to the new jetties. The storm put an entire stop to this scheme, at any rate till the harbour is restored, and if it is then revived it must be with considerable modifications. But this scheme was after all only the best under circumstances then existing. New circumstances have since arisen, and another scheme must be adapted to them.

70. Such a scheme may be found in the modification in the system of working the existing pier. The complaint first made was of the great height cargoes had to be lifted, but, in reply to the obvious suggestion that the employment of steam cranes would remedy this evil, the further complaint was started that, even if the goods were lifted more quickly, they could not be removed from the pier on the existing line of railway. Now the pier is 40 feet wide. It contains four lines of railway of 5 feet 6 inches gauge. Upon the same width six lines of metre gauge could be placed. These two additional lines of railway would relieve any conceivable amount of block. All that is wanted, therefore, to *treble* (I think I may safely say) the present accommodation of the pier is to expend fifty thousand rupees on three or four steam cranes with a quick motion, a sufficient stock of narrow gauge trucks, and materials for two extra lines of railway. It is no part of the present duty of the harbour works staff to work out the details of such a scheme, but I have no hesitation in saying that some such would be a perfect solution of any existing or probable difficulty in the landing and shipping of goods at the shore.



71. The last point which I named in paragraph 61, the safety of cargo boats and other local craft in bad weather, is, in my opinion, the most important of all. As I have already shown ships have a refuge at sea, but this is not available for local craft. If they cannot safely ride at anchor they must be hauled up on the beach. This necessity obviously limits the size of the craft to be employed. Masula boats carrying two tons can be beached even when loaded. The cargo boats carrying 12 tons, which were introduced after the screw-pile pier was built, can be beached empty, and were formerly so placed in safety during the two bad weather seasons of the year; but for lighters of 60 to 100 tons, which are essential to an economical system of landing and shipping cargo, for a steam tug, for a floating derrick for lifting heavy articles, and for other craft for which a demand is sure to arise, beaching for purposes of safety is not practicable; safe floating berths must be provided.

72. I had certainly formerly anticipated that craft of this description might have safely lain at anchor within the harbour even in the worst weather, but I am not prepared to resist the impression to the contrary which was produced by the effects of the late storm. It may be that that impression will be removed or modified by further experience of future storms, when the breakwaters are more efficient and the opening for the entrance of the waves reduced; but for the present I will assume that, on the threatening of a cyclone, the present area of the harbour must be cleared by the sea-going ships going to sea, and the local craft in another direction. What is this direction to be?

73. The 70 acres of land gained to the south of the harbour and described in paragraph 44 of this report seem to suggest an answer to the question. It will be seen from the plan that, in March of this year, the high-water line outside the harbour was nearly continuous with the two-fathom contour inside. Two years hence it may be safely predicted that it will be something like 100 feet further out. Now, a dock or basin 1,000 feet long, 300 feet wide, and 10 feet deep at low water, with an opening through the pier into the harbour 60 feet wide, covered by a jetty of concrete blocks running northwards from the pier for 300 feet, would provide accommodation for the whole of the local craft, and would cost, including a stream dredger for the excavation, about 1½ lakh of rupees, and for an additional half lakh the area of the basin could be doubled.

74. I do not suggest this for immediate execution. Craft too large for hauling up on the beach should not be introduced till the harbour is somewhat more complete, but I point it out in general terms as the direction in which the harbour may be extended, and developed to a great extent. The basin would be, in the first instance, a mere place of shelter, but a boat wharf would soon be established on its landward side, and the frontage would become valuable. As the high-water mark advances seaward the basin would be widened, and in course of years its seaward margin would be so near the deep water in the harbour as to suggest the possibility of a ship entrance. With such capabilities in the site which has been added to the harbour property I submit that I am justified in anticipating advantages which will go far to compensate for some disappointment in the degree of stillness obtainable in the area of the harbour itself, and an equivalent for the five lakhs expended in protecting and purchasing land to the north.

75. It is right to state that the idea of the necessity of boat shelter is by no means new. It was urged years ago, and among others by the present Master Attendant, Captain Taylor, as the real want of Madras, and, in the visits I have paid to several other ports of India, I have found that the cost of landing and shipping cargoes is less dependent on the condition of the ship's anchorage, as to exposure or distance from shore, than upon the power of employing larger or smaller cargo boats, and this in its turn depends on the facilities for giving them shelter. But it must be remembered that at Madras a boat harbour would have been impracticable on account of the movement of sand along the shore until works had been carried out far enough into deep water to stop the sand and at the same time to form a ship harbour.

76. I may further suggest that this boat harbour would form the most convenient access to a line of water communication with the Buckingham Canal, and the extensive system of inland navigation in connection with it. The distance is about a mile, and the intermediate ground is almost entirely unoccupied.

77. As the foregoing report has dealt with a variety of subjects, it may be convenient if I conclude by a concise *resumé* of its contents.

Paragraphs 1 to 26 are devoted to a description of the proposed works of restoration.

Paragraphs 27 to 42 contain an analysis of the expenditure especially since the storm of November 1881, and paragraph 37 contains my recommendation as to the apportionment of the items of expenditure to five several heads.

Paragraphs 43 to 59 deal with the question of gain and loss of land by the accumulation and erosion of the sand on the coast.

Paragraphs 60 to 75 deal with the utilization of the harbour, 62 to 65 having reference to the means for ensuring the safety of ships, 66 and 67 to the transfer of cargo between the ships and the boats, 68 to 70 to the loading and discharging of boats at the shore, with a suggestion in paragraph 70 for an immediate improvement of the system of working on the screw-pile pier, 71 to 75 to the safety of cargo boats and other local craft in bad weather, with a suggestion in

73 and 74 for the future utilization of the land gained to the south of the harbour by the formation of a boat harbour.

Paragraph 76 suggests that a communication may ultimately be established between this harbour and the inland canals.

78. In the appendices will be found the following :—

A. Mr. Thorowgood's re-arrangement of the accounts of expenditure from October 1881 to April 1884.

B. Abstract of expenditure from commencement of works to 30th April 1884.

C. Estimate of restoration works as recommended, with statement of expenditure in respect thereof to 30th April 1884.

I have, &c.,

(Signed) W. PARKES.

---

## APPENDIX A.

### Madras Harbour.

Analysis of Expenditure between 31st October 1881 and 30th April 1884 by Mr. Thorowgood.

| | | Rs. |
|---|---|---|
| Total expenditure shown in accounts, 30th April 1884 ... ... | | 67,69,036 |
| Add recovery on sale of plant and materials ... ... ... | | 12,835 |
| | Total ... | 67,81,871 |
| Total expenditure, as shown 31st October 1881 ... | 58,72,083 | |
| Add for work done in November 1881, south pier rubble ... ... ... ... ... ... | 1,200 | |
| | 58,73,283 | |
| Add further for recoveries on "concrete blocks" in north and south piers (of which Rs. 296 is accounted for) ... ... ... ... ... ... | 300 | |
| | | 58,73,583 |
| Total difference to be accounted for ... | | 9,08,288 |

*Expenditure.*

| | | | |
|---|---|---|---|
| 1. Additions to existing pier works :— | | | |
| Concrete topping, clamping, and railways— | | | |
| North pier ... ... ... ... ... | 44,088 | | |
| South pier ... ... ... ... ... | 27,080 | | |
| Rubble foreshore and repairs to surf banks— | | | |
| North pier ... ... ... ... ... | 3,861 | | |
| South pier ... ... ... ... ... | ... | | |
| | | 75,029 | |
| 2. Recovery and destruction of hopper barges ... ... ... | | 16,485 | |
| 3. Recovery and painting mooring gear, exclusive of cost of four pontoon boats (Rs. 8,465) ... ... ... ... ... | | 18,003 | |
| 4. Rubble stone revetment, north beach ... ... ... ... | | 1,13,618 | |
| 5. Repairs to buildings, damages by sea ... ... ... ... | | 5,221 | |
| 6. New concrete blocks ... ... ... ... ... ... | | 87,230 | |
| 7. Repairs and renewals to machinery and plant, transferred from other heads as below :— | | | |
| Concrete blocks ... ... ... ... ... | 19,082 | | |
| Setting blocks ... ... ... ... ... | 8,819 | | |
| Revetment, north beach ... ... ... | 1,859 | | |
| Moorings ... ... ... ... ... | 2,000 | | |
| North pier, repairs ... ... ... ... | 2,459 | | |
| South pier, do. ... ... ... ... | 1,933 | | |
| North pier, foreshore ... ... ... ... | 1,766 | | |
| South pier, do. ... ... ... ... | 4,552 | | |
| Pontoons (item 3) ... ... ... ... | 8,465 | | |
| | | 50,935 | |



| | | | Rs. |
|---|---|---|---|
| 7a. Actual charges under "General Tools" between November 1881 and 30th April 1884, as shown in accounts ... ... | | | 7,144 |
| Total to this point ... | | | 3,73,665 |
| 8. Establishment taken at 7½ per cent. on the above total ... | | | 28,010 |
| 9. Contingencies (including intercepting drain) ... ... | | | 27,250 |
| 9a. Police, conservancy, and lighting ... ... ... ... | | | 3,307 |
| 10. Compensation paid for land washed away ... ... ... | | | 52,181 |
| 11. Purchase of land north of harbour ... ... ... ... | | | 2,05,894 |
| 12. Establishment on items 10 and 11, estimate at Rs. 350 a month for 19 months (nearly 2¾ per cent.) ... ... ... | | | 6,650 |
| 13. Taking total establishment charges, as shown in accounts, and adding charge for establishment during suspense, transferred as below, deduct from this total, items 8 and 12 and there remains establishment during suspense ... ... ... | | | 1,68,074 |
| Total charge to 30th April 1884 ... ... ... | | 5,10,809 | |
| 31st October 1881 ... ... ... | | 3,51,004 | |
| | | 1,59,805 | |
| Add from— | | | |
| North pier rubble ... ... ... ... | 1,766 | | |
| Setting blocks ... ... ... ... | 8,819 | | |
| North pier, sea damage ... ... ... | 4,918 | | |
| South pier, rubble ... ... ... ... | 4,552 | | |
| South pier, sea damage ... ... ... | 1,932 | | |
| Concrete blocks ... ... ... ... | 19,082 | | |
| Revetment ... ... ... ... | 1,860 | | |
| | | 42,929 | |
| | | 2,02,734 | |
| | Total ... | 8,64,831 | |
| Add to this— | | | |
| Stone lying at quarry ... ... ... ... ... | 4,659 | | |
| Stores on hand ... ... ... ... ... | 23,108 | | |
| Payments for moorings in accounts of November and December ... ... ... ... ... | 15,328 | | |
| Item No. 34 in account sheet ... ... ... ... | 162 | | |
| | | 43,257 | |
| | | 9,08,288 | |

*Note.*—The above is the basis of the statement forming appendix B, but the items have been further re-arranged to some extent, which accounts for some differences in the figures, though the total amounts will be found to agree.

W. PARKES.

---

## APPENDIX B.

### Madras Harbour Works.

Abstract of Expenditure from Commencement of Work to 30th April 1884.

| Estimates. | Description of Work. | | Expenditure. |
|---|---|---|---|
| | (I) *Original Design.* | | Rs. |
| | Expenditure to 31st October 1881 ... ... | 57,18,137 | |
| | Do. in November ,, ... ... | 1,500 | |
| | Supplementary protection works ... ... | 75,029 | |
| | Contingencies ... ... ... ... ... | 27,412 | |
| | Recovery of wrecks and repairs of storm damage ... ... ... ... ... | 21,706 | |
| | Establishment, 10 per cent. on Rs. 1,24,147 ... | 12,415 | |

Abstract of Expenditure from Commencement of Work to 30th April 1884—*cont.*

| Estimates. | Description of Work. | | | Expenditure. |
|---|---|---|---|---|
| | | | | RS. |
| | Deduct (transferred to IV and V)— | | | |
| | To IV, Revetment ... ... | 91,009 | | |
| | „ IV, Purchase of land ... ... | 1,400 | | |
| | „ V, Concrete blocks ... ... | 40,281 | | |
| | „ V, Stores ... ... ... | 65,669 | 1,98,359 | |
| Sanctioned, Rs. 56,50,000 | Net expenditure on original design ... ... ... | | | 56,57,840 |
| | (II) *Moorings.* | | | |
| | Expenditure to 31st October 1881 ... ... | | 1,53,945 | |
| | Do. in November 1881 ... ... | | 15,328 | |
| | Subsequent expenditure ... ... ... | | 18,003 | |
| | Establishment, 10 per cent. on Rs. 33,133 ... | | 3,313 | |
| Sanctioned, Rs. 2,00,000 | Expenditure to 30th April 1884 ... ... ... ... | | | 1,90,589 |
| | (III) *Cost of Establishment.* | | | |
| Submitted for sanction, Rs. 1,54,994 | During suspension of works ... ... ... ... ... | | | 1,54,994 |
| | (IV) *Gain and Loss of Land.* | | | |
| | Gained, 88 acres; lost, 41 acres. | | | |
| | Protection : Revetment previous to October 1881 ... ... ... ... ... | | 91,009 | |
| | Do. do. subsequent to do. | | 1,13,618 | |
| Submitted for immediate sanction, Rs. 5,00,000 to be subject to recovery by rents and value of land utilized. | Establishment, 10 per cent. on Rs. 1,13,618 ... | | 11,362 | |
| | Purchase of land and compensation ... ... | | 2,58,075 | |
| | Do., transferred from I .. ... ... | | 1,400 | |
| | Establishment expenses ... ... ... | | 6,650 | |
| | Total to be carried to debit of account ... ... ... | | | 4,82,114 |
| | (V) *Expenditure to be charged against Restoration Works.* | | | |
| | Concrete blocks, transferred from I ... ... | | 40,281 | |
| | New do. made since October 1881 ... | | 87,230 | |
| | Repairs and renewals of plant and machinery. | | 58,079 | |
| | Consumable stores on hand October 1881, transferred from I ... ... ... ... | | 65,669 | |
| | Do., balance of additions and issues since October 1881 ... ... ... ... | | 27,767 | |
| | Establishment, 10 per cent. on Rs. 1,73,076 ... | | 17,308 | |
| | Total to be carried to debit of account ... ... ... | | | 2,96,334 |
| | Total expenditure to 30th April 1884, as per official return. | | | 67,81,871 |

W. PARKES.

21st August 1884.



153/13

## APPENDIX C.

### MADRAS HARBOUR.

Estimate of Restoration Works.

| | Amount. | Amount. | Expenditure to 30th April 1884. |
|---|---|---|---|
| *Preliminaries.* | | | |
| | RS. | RS. | RS. |
| New machinery from England ... ... ... ... | 1,74,050 | | |
| Repairs and renewals of old machinery ... ... ... | 72,479 | | |
| Alteration and extension of block grounds ... ... ... | 10,000 | ... | 58,079 |
| Railway materials ... ... ... ... ... ... | 71,000 | | |
| Total preliminaries ... | ... | 3,27,529 | |
| *North Pier.* | | | |
| Rubble stone in foreshores and base— | | | |
| Ordinary deposited from breakwater, 5,532 tons at Rs. 1-8-0 ... ... ... ... ... ... ... | 8,297 | | |
| Do. from boats, 182,260 tons at Rs. 2 ... ... ... | 3,64,520 | | |
| Large do. under wave-breaker from breakwater, 14,757 tons at Rs. 1-12-0 ... ... ... ... ... | 25,812 | | |
| Concrete blocks for building— RS. A. P. | | | |
| Making 58,116 cubic yards at ... ... 9 0 0 | 5,23,044 | | |
| Setting 2,062 „ „ ... ... 2 0 0 | 4,124 | | |
| Do. 35,245 „ „ ... ... 2 8 0 | 88,112 | | |
| Do. 20,809 „ „ ... ... 3 0 0 | 62,427 | | |
| Concrete in mass for filling 500 cubic yards at Rs. 19 0 0 | 5,000 | | |
| Wave-breaker— | | | |
| Built blocks, 288 cubic yards at... ... 10 0 0 | 2,880 | | |
| Ordinary do. 70,849 cubic yards at ... 9 0 0 | 6,37,641 | | |
| Depositing do. 70,849 cubic yards at ... 1 0 0 | 70,849 | ... | 63,756 |
| Apron blocks, 1,667 do. ... 9 0 0 | 15,003 | | |
| Setting do 1,667 cubic yards at ... ... 4 0 0 | 6,668 | | |
| Concrete in bags, 742 cubic yards at ... 12 0 0 | 8,904 | | |
| Cramps, 330 each ... ... ... ... 10 0 0 | 3,300 | | |
| Concrete capping, 22,400 cubic yards at ... 10 0 0 | 2,24,000 | | |
| Total for north pier ... | ... | 20,50,581 | |
| *South Pier.* | | | |
| Rubble stone in foreshores and base— | | | |
| Ordinary deposited from breakwater, 675 tons at Rs. 1-8-0 ... ... ... ... ... ... ... | 1,013 | | |
| Do. deposited from boats, 169,517 tons at Rs. 2 ... | 3,39,034 | | |
| Large do. deposited from breakwater, 15,038 tons at Rs. 1-12-0 ... ... ... ... ... ... | 26,317 | | |
| Concrete blocks for building— RS. A. P. | | | |
| Making 52,113 cubic yards at ... ... 9 0 0 | 4,69,377 | | |
| Setting 2,062 „ ... ... 2 0 0 | 4,124 | | |
| Do. 29,282 „ ... ... 2 8 0 | 73,205 | | |
| Do. 20,809 „ ... ... 3 0 0 | 62,427 | | |
| Concrete in mass for filling, 500 cubic yards at Rs. 10 ... ... ... ... ... ... | 5,000 | | |
| Wave-breaker— | | | |
| Blocks, making 57,066 cubic yards at ... 9 0 0 | 5,13,594 | | |
| Depositing do. 57,066 do. at ... 1 0 0 | 57,066 | ... | 63,755 |
| Apron blocks, 1,667 do. at ... 9 0 0 | 15,003 | | |
| Setting do. 1,667 do. at ... 4 0 0 | 6,668 | | |
| Concrete in bags, 742 cubic yards at ... 12 0 0 | 8,904 | | |
| Cramps, 275 each ... ... ... 10 0 0 | 2,750 | | |
| Concrete capping, 19,200 cubic yards at ... 10 0 0 | 1,92,000 | | |
| Total for south pier ... | ... | 17,76,482 | |

Estimate of Restoration Works—*cont.*

| | Amount. | Amount. | Expenditure to 30th April 1884. |
|---|---|---|---|
| | RS. | RS. | RS. |
| Materials in store to be debited to works during progress. | ... | ... | 93,436 |
| Establishment, 7½ per cent. ... ... ... ... ... | ... | 3,11,594 | 17,308 |
| Contingencies, 2½ „ ... ... ... ... ... | ... | 1,03,865 | ... |
| Lighting entrance ... ... ... ... ... | ... | 20,000 | ... |
| Total ... | ... | 45,90,051 | 2,96,334 |

W. PARKES.

21st August 1884.

---

From the Officiating Under Secretary to the Government of India, dated Simla, 28th October 1884, No. 415 M.

Forwarded to the Government of Madras in the Public Works Department for report on the proposals and estimates.

(By Order.)

(Signed) R. B. BUCKLEY,
Offg. Under Secy. to the Govt. of India.

---

From JULAND DANVERS, Esq., Secretary, Public Works Department, to the Secretary to the Government of Madras, Public Works Department, dated India Office, S.W., 25th September 1884, No. 1433 P.W.

I am directed to transmit herewith, for the information of the Government of Madras, copies of a despatch, No. 56 (together with its enclosures), which the Secretary of State for India has this day addressed to the Government of India relative to the Madras Harbour Works.

---

From JULAND DANVERS, Esq., Secretary, Public Works Department, to the Secretary to the Government of Madras, Public Works Department, dated India Office, S.W., 10th October 1884, No. 1433/2 P.W.

With reference to my letter of 25th ultimo, No. 1433/1 P.W., I forward herewith the plans (2) referred to by Mr. Parkes in his report on the restoration of the Madras Harbour Works, dated 21st August last.

---

Office Note from the Examiner of Public Works Accounts, to the Secretary to Government, Public Works Department, dated Madras, 13th November 1884, No. 589.

Your office note No. 1999 D, dated 10th November 1884.

I do not see any objection to the proposed recasting of the heads of account under which the expenditure on the Madras Harbour Works has been recorded. If the re-arrangement be ordered the details can be settled by Mr. Thorowgood in communication with this office.

---

From J. H. TAYLOR, Esq., Lieut., R.N.R., Master Attendant, Administrative Department, Madras, to the Chief Secretary to Government, dated Madras, 17th November 1884, No. 10562.

With reference to your endorsement, No. 2532, dated 13th November 1884, I have the honor to state that, under the provisions of the Indian Ports Act XII of



1875, the beach is vested in the Marine Department and not the Harbour Works, and accordingly rent is being levied for the same, at the rate of Rs. 6 per ground per month for the storage of timber, the amount being credited to the harbour dues account in order to assist in meeting the interest on the construction of the harbour. The Railway Company alone pay Rs. 3 per ground per month for the ground held by them, as it is at a long distance from the landing place. Mr. Parkes is in error with regard to the value of the sand reclaimed. The principal portion of it is now a lake, and no building could be erected on it, even if other objections did not exist from a military point of view. The horse stockade has no sure existence. It is liable to be washed away in any storm, and the mule stables, which occupy a slightly higher ground, are erected by Government, and the Marine Department has not taken any rent or claimed any jurisdiction over it.

---

From A. T. ARUNDEL, Esq., President of the Municipal Commission Madras, to the Chief Secretary to Government, dated Madras, 27th November 1884, No. 1595.

In reply to endorsement, No. 2593, Financial, dated 20th November 1884, I have the honor to report that the municipality does not occupy any part of the new foreshore gained by the harbour, nor does it collect rents from any of the timber merchants or other occupants. The collection of such ground rents by the municipality ceased in 1881 and was left to the proper officers of Government (G.O., No. 234 W., dated 28th January 1881).

---

No. 2704, Financial.

Transferred to the Public Works Department.

(By Order.)

FORT ST. GEORGE,
5th December 1884.

(Signed) J. D. REES,
Ag. Under Secy. to Govt.

---

No. 2612, Marine.

Transferred to the Public Works Department.

(Signed) E. F. WEBSTER,
Chief Secretary.

22nd November 1884.

---

From R. B. BUCKLEY, Esq., Officiating Under Secretary to the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Secretary to the Government of Madras, Public Works Department, dated Fort William, 28th November 1884, No. 450 M.

In compliance with the request contained in your letter, No. 2815 W., dated 10th November 1884, I am directed to forward the accompanying copy of a despatch to the Secretary of State, No. 32 P.W., dated 4th July 1884, regarding the restoration of the Madras Harbour.

---

ENCLOSURE.

Despatch from the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Right Honorable Her Majesty's Secretary of State for India, dated Simla, 4th July 1884, No. 32 Public Works.

In continuation of our despatch, No. 59 P.W., dated 13th November 1883, and with reference to your Lordship's despatches, Nos. 23 and 28 P.W., dated 24th April and 15th May 1884, respectively, in connection with the Madras Harbour Works, we have the honor to forward,

for the information of Her Majesty's Government, copy of a further communication from the Government of Madras, and to state that we concur generally in the opinions therein expressed concerning the restoration of the harbour.

---

G.O., dated 6th December 1884, No. 6093, Military.

From the Controller of Military Accounts, to the Secretary to Government, Military Department, dated Fort St. George, 1st December 1884, A.

In forwarding the accompanying letter * from the Commissary-General, I have the honor to express my concurrence with the views held by him, and to attach a letter † from the Examiner of Public Works Accounts, to whose department the charge appertains.

* No. 2124 T.B., of 22nd November 1884, stating that the Harbour authorities have no claim to rent for mule lines if it is not within their limits.
† No. 57 C.M.A., of 28th November 1884.

---

ENCLOSURES.

From the Commissary-General, to the Secretary to Government, Military Department, dated Madras, 22nd November 1884, No. 2124 T.B.

I have the honor to acknowledge the receipt of Proceedings of Government in the Public Works Department, No. 2817 W., of the 10th instant, forwarded for report under your docket, No. 5627, of the 13th idem, and herewith returned as requested.

2. Mr. Parkes, Chief Engineer of the Madras Harbour Works, in paragraph 57 of his report claims rent for the site on which the commissariat mule stables now stand on the plea that five years ago this site was in the surf and that the beach on which the stables stand has been reclaimed in consequence of the construction of the harbour works.

3. It seems open to question whether the reclaiming of this beach was a portion of the original harbour scheme, or whether this steady encroachment of the sand is not a danger which gives the authorities considerable anxiety for the future of the harbour.

4. If this reclamation was not a portion of the original scheme, it appears doubtful whether the harbour authorities can claim rent for a site which they had no direct intention of forming.

5. A question of fact also arises, viz., whether the site of the commissariat mule lines was five years ago in the surf as stated by Mr. Parkes. That officer may not be aware that to prevent the encroachment of the sea a number of stone groynes were many years ago thrown out by the Engineer Department of Government, the first being constructed opposite the office of Messrs. Parry and Company as far back as 1853.

6. These groynes reclaimed a considerable beach, and in default of accurate measurements of the foreshore for many years past I think some further proof is needed of Mr. Parkes' statement that the site on which the mule stables stand has been reclaimed since the harbour works commenced.

7. Moreover if, as I suppose, the commissariat mule sheds are beyond harbour limits the harbour authorities can, I imagine, have no claim to rent.

---

From the Examiner, Public Works Accounts, to the Controller of Military Accounts, Fort St. George, dated Madras, 28th November 1884, No. 57 C.M.A.

In returning the papers received with your memorandum, No. 2644, dated 25th November 1884, I have the honor to state that this office has no remarks to offer on the question raised.

---

*Order*—dated 6th December 1884, No. 6093, Military.

The replies of the Commissary-General and Controller of Military Accounts communicated to the Public Works Department.

(True Extract.)

(Signed) A. KENNEY-HERBERT, Lt.-Col.,
Offg. Secy. to Govt., Mily. Dept.



From F. N. THOROWGOOD, Esq., M. INST. C.E., Superintendent, Madras Harbour Works, to the Secretary to Government, Public Works Department, dated Madras, 6th December 1884, No. 27 W.

I have the honor to acknowledge the receipt of your memorandum, No. 1996 C., of the 4th, asking my opinion as to the sufficiency of the estimates made by Mr. Parkes for the restoration of the Madras Harbour and forwarded with the Secretary of State's despatch, No. 56, of September 25, 1884.

2. I have carefully examined all the details of the estimates, and indeed was in consultation with Mr. Parkes at Westminster when they were made, and I believe that they are perfectly sufficient for the work to be done.

3. I beg to be permitted to add that I hope the arrangement suggested in paragraph 37 of Mr. Parkes' report may be carried out, substituting for the date April 30, 1884, the date at which the *bonâ fide* work of restoration on the new design shall commence, and correcting the figures accordingly. An infinite deal of trouble and numerous petty disputes will be avoided if we can start fair on a new estimate, the detailed arrangements of which can be made between the Examiner of Public Works Accounts and myself.

4. I return the papers marginally noted, as I imagine you intend that I should do.

1 Despatch.
2 Plans.

---

ORDER—dated 19th December 1884, No. 3127 W., Public Works.

In his despatch of the 25th September 1884, No. 56 P.W., the Secretary of State communicates to the Government of India the conclusions at which he has arrived in respect to the restoration of the Madras Harbour Works. It is intimated that the plan of future operations proposed by Mr. Parkes should be followed generally; the eastern entrance being maintained, in the absence of any additional facts or arguments of sufficient weight to justify a further reference to engineering authority in England. The revised estimates framed by Mr. Parkes should, it is stated, be examined and reported on.

2. His Excellency the Governor in Council observes that a decision having been come to in favor of the eastern entrance, there seems nothing to prevent the immediate prosecution of the work of restoration on the estimates framed by Mr. Parkes, the sufficiency of which for the object in view there seems no reason to doubt.

3. The Examiner, Public Works Accounts, reports that he sees no objection to the proposed recasting of the heads of account under which the expenditure on the works has been recorded. The details of the re-arrangement can now be undertaken on the lines suggested by the Superintendent in his letter, No. 27 W., dated 6th December 1884.

4. It is observed that the accretion to the south of the harbour is vested in the Marine Department under the provisions of the Indian Ports Act XII of 1875, and that the rents collected for occupation of the land are carried to the credit of the harbour dues account, to assist in meeting the interest on the capital cost of the harbour works.

5. A copy of these Proceedings will be forwarded to the Government of India in reply to their endorsement, No. 415 M., dated 28th October 1884.

(Here enter No. 3128 W., dated 19th December 1884.)

(True Extract.)

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Superintendent, Madras Harbour Works.
" Examiner, Public Works Accounts.
" Marine Department.
Exd. C. Howarth.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

# Govt. of {1884} Madras.

## PUBLIC WORKS.

*Dated December, 19th.*

*Recd.* *Encl.*

**G.O., 19th Dec. 1884, No. 3127 W.**

**DECEMBER.**

**Madras Harbour Works**

Orders on the subject of the reconstruction of the —.

153
12

20TH DECEMBER 1887, No. 3484 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following despatch from the Right Honorable Viscount CROSS, Her Majesty's Secretary of State for India, to His Excellency the Right Honorable the Governor in Council, Fort St. George, dated India Office, London, 24th November 1887, No. 10, Public Works:—

With reference to my Public Works despatch, No. 6, dated 19th May last, in which I informed your Excellency that I had determined to submit the question of the best position for the entrance to Madras Harbour for the consideration of a special committee, I have now to acquaint you that the results of the committee's deliberations have been communicated to me in the accompanying report.

2. While offering no remarks upon its contents, I forward the report for your information. I have thought it proper to request the Consulting Engineer for the Harbour to furnish me with any remarks he may wish to make on the recommendations of the committee, and on the receipt of his reply I will again address your Excellency as to the steps which should be taken in consequence of the recommendations contained in the committee's report.

ORDER—dated 20th December 1887, No. 3484 W., Public Works.

Communicated to the Chairman, Harbour Trust Board, and the Marine Department, in continuation of the undermentioned proceedings:—

G.O., No. 1590 W., dated 14th June 1887.
" " 1765 W., " 1st July "
" " 1898 W., " 14th " "
" " 2978 W., " 7th Nov. "

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Chairman, Harbour Trust Board, with copy of report.
" Marine Department, with copy of report.

Exd. J. Moses.
Spare Copies

6

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1887} Madras.

PUBLIC WORKS.

*Dated December, 20th.*

*Encl.*

*Read.*

**G.O., 20th Dec. 1887, No. 3484 W.**

**DECEMBER.**

**Madras Harbour**

Despatch from the Secretary of State communicating, with remarks, report of the special committee on the question of the entrance to the —, communicated to the officers concerned.

153/17

1st August 1888, No. 11/2335 W., Public Works.

PUBLIC WORKS DEPARTMENT.

Letter—to

The Right Honorable the SECRETARY of STATE for INDIA.

My Lord,

We have the honor to acknowledge receipt of Your Lordship's despatches, No. 6, Public Works, dated 6th May 1887; No. 10, Public Works, dated 24th November 1887; and No. 11, Public Works, dated 15th December 1887, respectively, with report of the committee appointed by Your Lordship to consider the best position for the entrance to the Madras Harbour and notes of evidence; and remarks by Mr. Parkes thereon.

2. We have communicated these papers to the Harbour Trust Board, and have now the honor to forward, for Your Lordship's perusal, copy of our Proceedings No. 2335 W., dated 1st August 1888, embodying a report by the Board and a Note by the Chief Engineer, Public Works Department.

3. We have carefully considered all that has been written on the subject, and are prepared to accept the plan proposed by the committee, which we consider will best meet all requirements. We would, however, call Your Lordship's attention to a plan* recently proposed by Sir G. Molesworth, which would also, we think, meet all requirements, and possesses some advantages which the committee's plan does not, but which would, we consider, prove more costly.

* *See* letter from Chairman, Harbour Trust Board, No. 1086, dated 21st June 1888.

4. We shall await intimation from Your Lordship that the plan proposed by the committee has been finally adopted, but we have the honor to request that this may be made by telegraph. Meanwhile, we have called on the Harbour Trust Board for an expression of their views as to the best means of carrying out the proposed plan and for a detailed estimate of the cost. We are fully impressed with the necessity for adopting an expeditious method of carrying out the works to completion, but we are not convinced that Mr. Parkes's proposal to nearly complete the work on the existing sanctioned plan before clearing the north-east entrance will prove economical or satisfactory.

5. We have the honor to solicit Your Lordship's favorable consideration of the Board's request that the rate of interest upon capital advances may be reduced from 4½ to 4 per cent. per annum, which appears to us reasonable. With reference to the

concluding paragraphs of the Chairman's letter No. 69, dated 6th April 1888, we have communicated to the Harbour Trust Board Your Lordship's despatch dated 7th June 1888, No. 4.

We have the honor to be,
My Lord,
Your Lordship's most obedient, humble servants,

(Signed) CONNEMARA.
( „ ) C. G. ARBUTHNOT.
( „ ) P. P. HUTCHINS.
( „ ) H. E. STOKES.

Ootacamund,
1st August 1888.

Exd. F. R. Bantleman.

153/18

# GOVT. OF MADRAS.

*PUBLIC WORKS DEPARTMENT.*

LETTER to the Right Honorable the Secretary of State for India.

No. $\frac{11}{2335\ W.}$, dated 1st Aug. 1888.

Forwarding copy of Proceedings on the report of the Home committee regarding the best position for an entrance to the Madras Harbour; and requesting early intimation of the final adoption of the committee's plan.

153
19

1st August 1888, No. 2335 W., Public Works.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following papers:—

G.O., dated 25th April 1888, No. 151, Marine.

*Read*—the following letter from R. W. BARLOW, Esq., C.S., Chairman, Harbour Trust Board, to the Chief Secretary to Government, dated Madras, 6th April 1888, No. 69:—

I have the honor to acknowledge the receipt of G.O. No. 153 W., dated 16th January 1888, forwarding a letter from Mr. Parkes addressed to the Under-Secretary of State for India, dated 25th November 1887, and to submit, for the information of Government, an extract of the Proceedings of the Harbour Trust Board at their meeting of 2nd March, confirmed at the meeting of the 8th idem.

2. The question of the position of the entrance has been most carefully considered and very fully discussed; and while the trustees "adhere to their former resolution as to the necessity of a north-east entrance, and (with one dissentient) prefer plan No. III, approved by the London committee, subject to any modifications that may be proved necessary hereafter," they are unanimously of opinion that *smooth* water is absolutely necessary to make the harbour a success, as without it very little practical progress can be made in the improvement of means for conducting landing and shipping operations, inasmuch as with an eastern entrance all improvements effected, in the way of providing large iron lighters, low level wharfage, &c., are liable to be wrecked by the free entrance of the heavy rollers accompanying each succeeding cyclone, or very heavy weather.

3. The Board do not think the harbour can be looked upon as a harbour of refuge from a cyclone, until experience has proved it such, and, at present, are of opinion that no ship would attempt to enter the harbour for shelter or, if inside, remain on the approach of or during a cyclone, if it should be at all practicable to put to sea beforehand; that, during the prevalence of such a storm, it may be taken for granted all shipping operations would be suspended; and that on its approach all vessels would put to sea and return when the weather had moderated.

4. It is absolutely essential, in the opinion of the trust, to the future prosperity of this port, that ships so returning should find lighters and machinery for loading or landing cargo, ready to go to work at once; and lighters and jetties, with cranes erected thereon, must depend for safety upon the smoothness of the water in the harbour. An eastern entrance will never give *smooth* water during at all heavy weather, and though a boat harbour, as proposed by Mr. Parkes, would secure the lighters, it would leave jetties and wharves in the harbour, with the cranes thereon, unprotected and exposed to certain destruction.

5. Referring to the three points dealt with by Mr. Parkes in his letter, the trustees would remark, with regard (*a*) to the question of the advance of the sand to the south of the harbour, that had the committee been in possession of the information referred to by Mr. Parkes in para. 22, they would probably never have alluded to the subject. The advance of sand to the south of the southern arm of the harbour is, the Board consider, a matter of no present practical importance, and has nothing whatever to do with the question, whether the best position for the entrance is east or north-east.

6. In reference (*b*) to the second point raised by Mr. Parkes, the Board unanimously approve the decision of Admirals Salmon and Nares and of Sir John Coode, and, as there are "two co-existing but conflicting judgments based upon the same evidence," would strongly urge their right to act upon the one which coincides with

their own unanimous views. It is in their opinion a most difficult task for gentlemen at a distance, who may never have seen this port in a cyclone, and are totally unacquainted with its business, routine, and requirements, to form a judgment. The Board would most emphatically urge that they are in every way best qualified to *know* what is wanted, altogether independent of a mass of conflicting testimony, which is all the gentlemen forming the various committees at a distance have to guide them.

7. Referring (*c*) to Mr. Parkes's third point, the Board agree with him in para. 29 that he had perhaps "rather enhanced than otherwise the difficulties of the situation;" they *prefer* plan No. III, but what they *want* is *smooth water*, ensuring safety to landing and shipping appliances in heavy weather. Any modification of plan III or IV or any plan which will give them *this*, within a reasonable time, at a cost which the port can afford to pay, is all they have contended for as being absolutely necessary, and upon the absolute necessity of *smooth water* they do most strongly insist.

8. The Board do not approve of Mr. Parkes's modification "A," which presents the objectionable re-entering curve to the full force of a cyclone swell, immediately to seaward of a proposed entrance, and they understand that this is an objection previously insisted upon by all engineers who have been consulted.

9. The question of an alternative scheme brings me to the financial position and revised estimates.

10. Mr. Parkes estimates the extra cost of his new proposal, above sanctioned estimate, with 600 feet overlap, at Rs. 18½ lakhs, and with 800 feet, Rs. 21¼ lakhs (para. 33).

On referring the question to their Engineer, Mr. Thorowgood, he estimates the probable extra cost *for Mr. Parkes's plan A*, at Rs. 24,75,976 and Rs. 27,14,236, respectively.

11. *For plan III* Mr. Thorowgood estimates the extra cost to be Rs. 27,70,103 and Rs. 30,08,363 for 600 and 800 feet overlap, respectively.

12. In estimating their financial position the trustees prefer to take their own engineer's estimate made on the spot, and, in round figures, the result would be as follows, upon the date when it is anticipated that the works will be complete:—

| | 600 *feet Overlap.* | Rs. |
|---|---|---|
| Sanctioned estimate | | 46,55,000 |
| Add extra for plan III | | 27,70,000 |
| | | 74,25,000 |
| *Deduct*— | | |
| Advances refunded— | | |
| 1886-87, 1887-88 | 2 | |
| 1889, 1894 | 6 | 8,00,000 |
| | | 66,25,000 |
| Capital advances outstanding, 1894-95 | | *2,98,125 |
| Interest thereon, at 4½ per cent. | | 1,00,000 |
| Annual refund of loan | | 3,98,125 |
| Amount payable to Government | | 3,00,000 |
| *Income*— | | |
| Revenue account | | 1,20,000 |
| Port dues levied under Acts XII of 1875 and IV of 1881 | | 12,000 |
| Surplus of pilotage fees | | 20,000 |
| Warehouse charges | | 4,52,000 |
| Deduct amount payable to Government as above | | 3,98,000 |
| Balance to credit of trust | | 54,000 |

* Decreasing annually by Rs. 4,500, the interest at 4½ per cent. upon one lakh of rupees.



| | 800 *feet Overlap.* | Rs. |
|---|---|---|
| Sanctioned estimate | | 46,55,000 |
| Add extra for plan III | | 30,08,000 |
| | | 76,63,000 |
| *Deduct*— | | |
| Advances refunded as above | | 8,00,000 |
| Capital advances outstanding, 1894-95 | | 68,63,000 |
| Interest thereon, at 4½ per cent. | | *3,08,800 |
| Sinking fund | | 1,00,000 |
| | | 4,08,800 |
| Income as above | | 4,52,000 |
| Balance to credit of the trust | | 43,200 |

13. In framing the above estimate the calculations have been based on actuals of previous years; the revenue from port dues is shown at Rs. 1,20,000 only, that being the amount shown in para. 11 of G.O. No. 15, dated 17th January 1888, after allowing for the reduction of Annas 1-6 per ton on liners, recommended by the Board in my letter No. 6974, dated 5th March 1888. The surplus of pilotage fees is taken from the actuals of 1886-87, Rs. 12,467. With regard to the item, Rs. 20,000 warehouse charges, the Board propose to supply, as soon as possible, a want very much felt in Madras by erecting warehouses and storing goods therein under warrant, in the same manner as is done in Bombay, where the Port Trust received in 1880-81, when the system was first introduced, *Rs. 30,716-6-1*, which in 1884-85 had risen to Rs. 97,280-15-3, or deducting cooly-hire, to about Rs. 85,000 net. The Board are of opinion that at least Rs. 20,000 might be raised from this source increasing annually.

14. Another source from which a large income might be derived is by saving in *boat-hire*, provided smooth water can be relied on in the harbour; this is now fully Re. 1 per ton all round, the total tonnage handled yearly being between 2½ and 3 lakhs of tons. Taking the lower figure to allow for timber floated on shore, and calculating a saving of 12 annas per ton in boat-hire charges as practicable with smooth water, an additional revenue of Rs. 1,87,000 could be levied, as enhanced harbour dues, without imposing any additional tax on the trade of the port; and this sum, with the surplus shown above, is more than sufficient to meet all current charges, including petty construction. The reason why boat-hire is so excessively high at Madras is the insecurity of the investment in lighters, which are liable to be smashed to pieces at any moment, and which, under ordinary circumstances, soon become unserviceable, through constantly beating up against each other, against ships' sides, and against the piles of the pier. Iron lighters carrying 100 tons each could, with smooth water, be safely maintained in the harbour, and loaded beforehand against the arrival of a steamer, thereby economising time. A charge for boat-hire of only 4 annas a ton, yielding Rs. 25 per trip, would be, if anything, too high, and more than would be needed to pay a handsome return upon a comparatively secure investment. But the Board do not wish, if it can be avoided, to enhance harbour dues, when smooth water renders a reduction in boat-hire practicable, one of the chief objects of the harbour being not only to facilitate but to cheapen landing and shipping operations, and they would prefer to allow the trade of the port to benefit, as much as circumstances will permit, by any reduction which may be found practicable hereafter. It would probably be sufficient at first to divide the saving effected between the Board and the merchants concerned.

15. I am further requested by the Board to ask that Government will suggest to the Right Honorable the Secretary of State that the rate of interest upon capital advances might be reduced from 4½ to 4 per cent. per annum, which would be of material assistance to the trade of the port.

* Decreasing annually by Rs. 4,500, the interest at 4½ per cent. upon one lakh of rupees.

16. In conclusion, I am desired by the Board to urge upon Government that the Board consider that Mr. Parkes is not sufficiently acquainted with this port to enable him to form a correct opinion of its requirements, and the result of carrying his theories into practice has already been far from satisfactory.

17. The Board have on the spot a staff of engineers who for many years have had the advantage of an intimate practical acquaintance with the harbour which, in its present condition, admits of completion within only very narrow-limits of design, and the Board would earnestly represent that all details in reference thereto should be settled on the spot by themselves, subject to the control of the Madras Government, who can instruct their engineers to inquire into and examine any deviation from the sanctioned plan which it might be considered, in the interests of the port, to adopt. This would obviate the delays which have occurred hitherto through constant references to England.

18. The Board are quite willing to subordinate their wishes to engineering control, but would most strongly urge that this control should be in the hands of the Madras Government, and if any proposals which might be made were approved by Government, the Board respectfully submit that the Right Honorable the Secretary of State might rest assured that the matter had been carefully inquired into by competent engineering authority.

---

Enclosures.

Extract of Proceedings of the Trustees of the Harbour of Madras, at a meeting held at the offices of the Board on Friday the 2nd day of March 1888.

* * * *

2. Read again all papers in connection with the question of the position of the entrance to the harbour, and minutes by the Chairman, Messrs. G. L. Chambers, J. R. Hunter, Captain W. L. C. Baddeley, R.E., Captain H. A. Street and Mr. J. McLintock, and examined plans in reference thereto. Mr. Thorowgood was asked to attend, and explained to the trustees various points upon which they desired information and then withdrew.

Resolved that the trust adhere to their former resolution as to the necessity of a north-east entrance and prefer the plan No. III approved of by the London committee subject to any modifications that may be proved necessary hereafter. The Chairman is invited to submit to Government the views of the Board in regard to the despatch from the Secretary of State, dated India Office, 15th December 1888, communicated under endorsement order No. 153 W., dated 16th January 1888.

* * * *

---

Extract of Proceedings of the Trustees of the Harbour of Madras, at a meeting held at the offices of the Board on Friday the 23rd day of March 1888.

* * * *

2. Read draft letter from the Chairman, Harbour Trust Board, addressed to the Chief Secretary to Government, Marine Department, in reply to G.O. No. 153 W., dated 16th January 1888, communicating a despatch from the Right Honorable the Secretary of State, No. 11, dated 15th December 1887, forwarding a letter from Mr. Parkes, dated 25th November 1887, in reference to the question of the position of the entrance to the harbour.

Read minutes by Captain Street, Indian Marine, Captain W. L. C. Baddeley, R.E., Mr. Hunter, Mr Chambers and the Chairman.

Resolved that this letter, as now amended, be redrafted and circulated for further consideration.

* * * *

---

Extract of Proceedings of the Trustees of the Harbour of Madras, at a meeting held at the offices of the Board on Thursday the 29th day of March 1888.

* * * *

2. Read again drafted letter addressed to the Chief Secretary to Government, Marine Department, in reply to G.O. No. 153 W., dated 16th January 1888, communicating a despatch from the Right Honorable the Secretary of State, No. 11, dated 15th December 1887, forwarding

153/21



a letter from Mr. Parkes, dated 25th November 1887, in reference to the question of the position of the entrance to the harbour.

Resolved that this letter, as now amended, be approved.

* * * *

---

*Order*—dated 25th April 1888, No. 151, Marine.

Transferred to the Public Works Department with the following remarks:—

(1) According to the budget of the current year, reviewed in G.O., dated 7th March 1888, No. 215, Financial, the Board's total revenue receipts amount to Rs. 3,03,000. But this sum includes Rs. 20,000, interest on investments, which will probably have disappeared before the completion of the harbour, as the current revenue expenditure is at present considerably in excess of the receipts.* Again, the establishment and contingency charges amount, in round numbers, to Rupees 1,14,000, and the normal charges for petty construction and repair cannot be taken as less than Rs. 40,000 annually. (The amount provided under this head in the present year's budget is Rs. 95,000). The Board's surplus under harbour revenue in years to come cannot therefore, on the present sources of income, be estimated at more than Rs. 1,29,000 (Rs. 2,83,000 — Rs. 1,54,000) per annum.

* *Revenue Account.*

| | Rs. |
|---|---|
| Budget-estimate for 1888-89— | |
| Receipts ... ... .. ... | 3,03,000 |
| Charges ... ... ... ... | 4,13,000 |

(2) The Board have now been appointed conservators of the port under Section 8, Act XII of 1875, and this will enable them to apply the surplus port revenues under that Act to the improvement of the harbour. But it must be remembered that the Government can at any time by an executive order remove them from this position.

(3) Even assuming, however, that their position as conservators will be a permanent one, they have largely over-estimated their surplus from port dues, which they put down at Rs. 1,20,000 per annum. The total receipts of the Madras Port in 1886-87, inclusive of pilotage fees, amounted, according to the Port Officer's administration report for that year, to Rs. 1,83,527, while the charges aggregated Rs. 1,45,601. The Board will doubtless be able to effect a considerable reduction in the port establishment, and the revision of port fund accounts ordered in G.O., 17th January 1888, No. 15, will probably be favorable to Madras. But, on the other hand, the port dues on sea-going ships other than coasting steamers have just been reduced from 6 to 4½ annas a ton, and the Board estimate that this will reduce the receipts under this head by some Rs. 25,000. Allowing for all these changes, the port surplus available for harbour purposes cannot be reckoned at more than Rs. 40,000 per annum in addition to the Rs. 12,000 which the Board have taken credit for under Pilotage fees.

(4) The total surplus upon which the Board can now reckon will therefore be—

| | Rs. |
|---|---|
| From Harbour revenue account ... ... ... ... ... | 1,29,000 |
| „ Port fund ... ... ... ... ... ... ... | 40,000 |
| „ Pilotage fees ... ... ... ... ... ... ... | 12,000 |
| „ Warehouse fees ... ... ... ... ... ... ... | 20,000 |
| Total ... | 2,01,000 |

or in all about 2 lakhs of rupees, to meet payments to Government which will amount to Rs. 3,98,000 if the 600 feet overlap is adopted, or Rs. 4,08,000 upon the 800 feet overlap, leaving a deficit of Rs. 1,97,000 or Rs. 2,07,000.

(5) The Board, however, consider that the saving in boat-hire will enable the trade to pay increased harbour dues without additional burthen, and hope to realise not less than Rs. 1,87,000 per annum under this head. That amount will more than cover the ordinary charges of the Harbour Trust Board, which have been omitted in the Board's calculations, but are included above, and will nearly meet the deficit above shown. The balance remaining may jointly be met by additional warehouse fees, of which the Board have adopted a minimum estimate; or must be provided for by increasing harbour or port dues beyond the amount of the estimated saving in boat-hire. The Government are at present unable to test the correctness of these estimates,

but they note that the anticipated saving in boat-hire depends on the certainty of smooth water, and this cannot be secured until the harbour approaches completion.

(6) It is evident then that, making full allowance for the fact that the interest on the accumulated sinking fund will, as time goes on, materially diminish the net charges, the Board will sooner or latter be obliged to raise the harbour dues, or port dues, or both, in order to meet the increased liabilities which they propose to incur. Such increase, and more especially under port dues which have just been reduced, is, however, perfectly feasible, and may possibly not entail more than a temporary increased burthen on the trade. There is also a considerable, though not as yet ascertained, surplus to the credit of the Madras Port Fund, which will now be at the disposal of the Board as Conservator. On the whole, from a financial point of view, the Board's ability to repay the further advance now in question seems sufficiently established.

(7) Of course, if the Board's prayer for a reduction of the interest on capital advances from 4½ to 4 per cent. is complied with, the necessity for imposing fresh rates will be *pro tanto* diminished. The Government, in this department, consider that the request is a reasonable one, and deserves the favorable consideration of the Secretary of State.

(True Extract.)
(Signed) W. L. C. BADDELY, Capt., R.E.,
Under-Secy. to Govt., P.W.D.,
*for* Chief Secretary.

---

G.O., dated 6th March 1888, No. 764 W., Public Works.

*Read*—the following paper:—

From R. B. BUCKLEY, Esq., Under-Secretary to the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Secretary to the Government of Madras, Public Works Department, dated Calcutta, 28th February 1888, No. 106 M.

With reference to the Secretary of State's despatches, noted in the margin, on the subject of the best position for the entrance to the Madras harbour, I am directed to forward, for His Excellency the Governor's information, copy of a Note on the subject, by Mr. Molesworth, the Consulting Engineer to the Government of India for State Railways.

Nos. 10 and 11 P.W., dated respectively the 24th November and 15th December 1887, to the address of His Excellency the Governor of Madras.

---

Enclosure.

*Note by* G. L. Molesworth, Esq., *Consulting Engineer to the Government of India for State Railways, on the subject of the Madras Harbour.*

The committee, composed of Admiral Salmon, Sir John Coode, and Sir George Nares, has now pronounced in favour of an entrance at the north-east corner of the Madras harbour, closing the present entrance to the east.

Of the four plans proposed and marked Nos. I, II, III and IV, respectively, the committee accords its preference to No. III on nautical grounds, but it does not state the nature of those grounds.

Plan No. I was originally proposed by the Madras committee in its report, dated June 20th, 1883; but when that report was referred to me by the Government of India for opinion, I pointed out in my Note of July 17th, 1883, the very serious objections to which this plan was exposed from its re-entering curve and from the action of confluent waves.

I also pointed out that plan No. II (which, in my opinion, was the necessary modification of No. I in order to remedy its defects) was open to the undoubted objection of throwing vessels, entering the harbour, further into shoal water than was desirable, and I suggested for consideration the alternative plan of extending one of the faces so as to cover the existing entrance as shown in No. IV.

In May 1887, Mr. Thorowgood submitted, for the consideration of the Madras Harbour Trust Board, plans Nos. I, II and IV, and in addition to these plans he also submitted the modification of No. IV, as shown in plan No. III.



In No. III the extension of the face is carried out with a slight change of direction, whereas in the plan I suggested, the extension was in a straight line, on the prolongation of the face.

Mr. Thorowgood, however, in putting forward plan No. III, accorded the preference to No. IV, which also found most favour with the Harbour Board for the following reasons:—

"(1*st*) That only a very small portion of the old ruined wall and rubble have to be cleared away.

"(2*nd*) That during the construction there will never be more openings than the proposed entrance through which the sea can come.

"(3*rd*) That it allows the work to be proceeded with at present at least for 4 months or more."

I may add that I prefer my original suggestion as it stands in plan No. IV to its modified form as plan No. III, because, in addition to the above-mentioned advantages, No. IV allows more sea room and involves less disturbance at the mouth of the harbour from the action of confluent waves. The relative estimates of plans Nos. III and IV are Rs. 61,00,000 and Rs. 62,45,000, respectively.

The ends of the covering arm should, in my opinion, be turned inwards instead of outwards as shown on the drawings.

If No. III is to be carried out, I would strongly recommend a slight modification of it, as shown by the blue lines which I have drawn on the plan No. III that accompanies the report of the committee.

---

*Order*—dated 6th March 1888, No. 764 W., Public Works.

Communicated to the Harbour Trust Board for consideration, in continuation of G.O. No. 404 W., dated 4th February 1888.

(True Extract.)
(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

---

G.O., dated 9th June 1888, No. 1715 W., Public Works.

*Read*—the following paper:—

From the Secretary to the Government of India, Public Works Department, dated 23rd May 1888, No. 261 M.

In continuation of Public Works Department No. 106 M., dated the 28th February 1888, I am directed to forward, for the information of His Excellency the Governor in Council, the accompanying copy of a further Note, dated the 5th May 1888, by Mr. Molesworth, the Consulting Engineer to the Government of India for State Railways, on the subject of the best position for the entrance to the Madras harbour.

---

Enclosure.

*Note by* G. L. Molesworth, Esq., *Consulting Engineer to the Government of India for State Railways, dated 5th May* 1888, *on the subject of the best position for the entrance to the Madras Harbour.*

When I wrote my last Note on the Madras harbour, I had not seen the minutes of evidence which induced the committee to prefer plan No. III on "nautical grounds." I have now had an opportunity of studying that evidence, and I would suggest, for consideration, a slight modification of the plan I originally suggested (marked No. IV). This modification consists simply in prolonging slightly further the eastern arm which I had suggested; and also slightly altering the tangent point from the north-eastern elbow so as to change its position instead of having it in the position in which it was originally built.

I have shown the prolongation of the eastern arm sufficiently long to cover the opening and protect it from seas coming in, even at an angle of 30° from the normal direction.

In my report on the Madras harbour, dated March 1st, 1882, para. 96, I advanced the opinion that "the *waves of a dangerous character must always come in broadside to the shore or nearly so* whatever the position of the storm;" and in paras. 75 and 76 of that report, I gave my reasons for the opinion I advanced. This opinion is confirmed by the experience of nautical men, as given in the evidence. The direction of the waves is stated to be quite

independent of the direction of the wind, and that the heavy swells come in nearly broadside to the shore, even when the wind is blowing off the shore. Others state that the direction of the waves never exceeds an angle of 30° from the normal, but I doubt very much whether any waves, except those of oscillation, which are comparatively harmless, can possibly come in at any angle approaching this.

In fact, it is opposed to the laws governing the motion of waves that a *wave of translation* should deviate to any considerable extent from the parallel of the general direction of the contour lines of the bottom of the sea to seaward of the harbour.

An arm covering an angle of 30° will, however, be on the safe side, as protecting the entrance to the harbour, even from waves of oscillation.

I annex a sketch showing the modifications I would propose in my original suggestion; the existing work being shown in black lines, my suggestion of July 1883 in red lines, and the slight modifications I now propose in blue lines.

These modifications will, in my opinion, meet any objections that may be raised on "nautical grounds" to my original suggestions, whilst they will be free from some of the objections to which project No. III is exposed.

---

*Order*—dated 9th June 1888, No. 1715 W., Public Works.

Communicated to the Chairman, Harbour Trust Board, for early remarks, in continuation of G.O. No. 764 W., dated 6th March 1888.

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

---

From R. W. BARLOW, Esq., C.S., Chairman, Harbour Trust Board, to the Chief Secretary to Government, Marine Department, dated Madras, 21st June 1888, No. 1086.

I have the honor to acknowledge G.O. No. 1715 W., dated the 9th instant, forwarding, for the remarks of the Board, a note with plan attached by Sir G. Molesworth regarding the best position for a north-east entrance to this harbour. These were, after circulation, very carefully considered at the meeting of the trustees on the 19th instant, and I submit copy of the resolution then passed, together with copy of a letter from the Board's engineer, No. 368, dated 18th idem, replying to a reference made to him on the subject.

2. Sir G. Molesworth's plan, if carried out, would give the harbour a slightly larger area, but this would be of no practical use for the anchorage of vessels; it would also afford additional protection against waves of translation coming in at a maximum angle of 30° from north of the normal direction; but the trustees note that Sir Guilford gives it also as his opinion that "waves of a dangerous character must always come in broadside to the shore, or nearly so," and in this the trust fully concur, while they also agree with him that "waves of oscillation" are "comparatively harmless," even should they come in at an angle approaching 30°.

3. The Board consider that they would not be justified in incurring the additional heavy expenditure and delay which the adoption of Sir G. Molesworth's design would involve. The junction of the new curves at the north and south arms with the old works, left undamaged by the cyclone of November 1881, proved a most difficult and costly undertaking, and the trust are not disposed to accept any modification that would involve a repetition of this at the north arm. The revised plan would further necessitate the removal of a considerable portion of the *new* work at the northern arm at a heavy outlay, protected, as it is, by a 40-feet wave-breaker screen. The proposed alteration would, besides, carry the south arm into deeper water, as pointed out by our engineer involving still further expenditure. Under a review of the above conditions, the Board are decidedly opposed to the modification suggested by Sir G. Molesworth, and adhere to plan III or IV, as already submitted to Government.



Enclosures.

From F. N. THOROWGOOD, Esq., M. Inst., C.E., Superintendent, Madras Harbour Works, to the Chairman, Harbour Trust Board, dated Madras, 18th June 1888, No. 368.

I have the honor to return, herewith, the papers which accompanied your letter No. 954, of June 13th, with Sir Guilford Molesworth's modified plan for an entrance to the Madras harbour.

It appears to me that nearly the whole of the outer portion of the north pier will have to be taken up to carry out the design proposed, and the greater depth of water into which the south arm is brought will undoubtedly add to the cost of the work and increase the time of construction.

---

Extract of Proceedings of the Trustees of the Harbour of Madras, at a meeting held at the offices of the Board, on Tuesday the 19th day of June 1888.

* * * *

9. Read letter from the Engineer, Harbour Trust Board, No. 368, dated 18th June 1888, submitting report upon the modified plan for an entrance to the Madras harbour, by Sir Guilford Molesworth, communicated with G.O. No. 1715 W., dated 9th June 1888.

Resolved that the additional protection afforded would not justify the increased expenditure and delay which would be incurred by the necessity for taking up a large portion of the new work recently constructed at the head of the north arm.

* * * *

(True Extract.)

(Signed) C. PINSENT,
Secretary, Harbour Trust Board.

---

Transferred to the Public Works Department.

Ootacamund,
23rd June 1888.

(Signed) H. E. STOKES,
Chief Secretary.

---

*Note by the Chief Engineer, Public Works Department.*

To a member of the committee appointed in 1883, which first suggested a north-east entrance to the harbour, a perusal of the report of the committee appointed by the Secretary of State to consider the subject, with the interesting notes of evidence, must be satisfactory. It seems now at last to be allowed generally that a north-east entrance is necessary, and it is the opinion of eminent nautical men that steamers can enter and leave the harbour by such an entrance without much difficulty.

2. This opinion was all that was needed by this Government.

3. There seems to be no reason why the Government should not accept, without hesitation, the position of entrance as approved by the Home committee, and generally by the Harbour Trust Board; the only apparent objection to it is that it necessitates the removal of a very considerable extent of old work which would have been avoided by the adoption of either plan No. 1 (originally proposed) or plan No. 2. It has, however, the advantage of opening in deeper water rather further from the shore and this may be worth the extra cost.

4. There is, however, another plan very recently submitted by Sir G. Molesworth, which was not before the Home committee, and which, coming from such an authority, deserves consideration. This plan is a considerable modification of one formerly submitted by Sir G. Molesworth, as it provides, by an altered form of the arms, for completely sheltering the entrance from waves approaching the coast from any possible direction north of the normal, which his former plan did not. It would, moreover, increase the accommodation within the harbour, and would bring the entrance further from shore than the plan approved by the Home committee. In all respects, therefore, the proposal is a good one; but we have no estimate of its cost, and it is evident from the length of the arms and the depth of water in which they are to be constructed that it must much exceed that of the proposal by the Home committee,

while it would seem that at least as much old work has to be removed in one case as in the other. The Harbour Trust Board are opposed to the scheme (*see* their letter, No. 1086, dated 21st June 1888).

It is right that Sir G. Molesworth's note and proposal should be laid before the Secretary of State, but it seems to be questionable whether the advantages which it secures are sufficient to warrant additional outlay and consequent delay in completion of the harbour.

5. In his remarks on the report of the Home committee, Mr. Parkes enters very fully into the subject of the advance of sand on the works which the evidence before the committee led them to suppose was a very serious matter, and which they adduced as one reason for their preference for a north-east entrance. The Harbour Trust Board briefly dispose of this subject, considering that it is a matter of no present practical importance, and that had the committee been in possession of information which Mr. Parkes states he received after the sittings of the committee, they would probably never have alluded to the subject. The committee apparently had before them surveys of the harbour up to 1887, and from the soundings in 1886 came to the conclusion that the sand was advancing south of the works faster than was anticipated. Mr. Parkes maintained that the apparent advance in 1886 was due to the heavy cyclone sea in May 1886, and would not be found to be a real advance; the information which he received after the committee ceased their sittings was from a survey made in September 1887, and which showed that the actual advance during the year near the works was considerably less than that anticipated by the committee. This certainly strengthens Mr. Parkes's position, and the result of examination, made at different times, of the soundings leads to the conclusion that the advance of sand need not be considered as such a serious matter as the committee think. The committee considers the sand will have advanced to the end of the south arm in twenty years, Mr. Parkes says 50 or 60 years, but he calls attention to another point; he says, "I contend that it is now well established how the sand comes, and in what quantities it comes, and therefore how it may be intercepted when it becomes necessary, and what the cost of intercepting it will be. It may be added that that cost, which will not be required for 50 years, will not therefore be a serious burden on the trade." It is submitted that Mr. Parkes's views on the question are sound, and that the advance of sand is not a matter for present consideration.

6. Mr. Parkes's views as to the question of a north-east entrance are not definitely stated in his remarks on the committee's report. He refers to the conflict of opinion between the two committees appointed by the Secretary of State, and apparently considers the question to be still unsettled. He doubts whether the present strong feeling in favor of the north-east entrance will be permanent at Madras, and suggests that Captain Taylor's successor may hold different views, that the Harbour Trust Board is a changing body, and that the financial view of the question may alter the present opinion. To this it may be replied that from June 1883, when the committee appointed in Madras proposed the north-east entrance, all authorities in Madras have persistently advocated the north-east entrance; the Harbour Trust Board, from the date of their constitution, were strongly in favor of it, and as at present constituted, with the successor of the late Captain Taylor as member, have expressed themselves more strongly than ever in favor of it, and the financial position has been carefully estimated by the Board and reviewed by Government in G.O. No. 151, Marine, dated 25th April 1888. The Government have always been in favor of the north-east entrance, while allowing that the question was one on which nautical opinion deserved the highest consideration, and, now that a committee of eminent naval and engineering authorities, selected by the Secretary of State, have reported in favor of it, it is considered that the question should be finally disposed of and the north-east entrance adopted.

7. Considering, therefore, the question settled and the form of entrance suggested by the Home committee adopted, it remains to be decided how the work is to be carried out, and on this point the Board has little to say. Mr. Parkes is evidently in favor of proceeding on the sanctioned plan till each pier is built to within about



300 feet of its termination; in fact, almost completing the harbour on the present sanctioned design, and then removing part of the work to form a north-east entrance. He suggests that the question of a change of entrance might then be reconsidered, but following what has been said above, the suggestion should be rejected. He says, "To carry out the work to that extent would take about eighteen months, during every month of which time the shelter would be improving. To proceed on the plan recommended by the committee, the first two or three years would be spent in opening the harbour still more to the sea, and that in the most dangerous possible form, while a further three years would be occupied before anything like efficient shelter would be obtained." This may be true, but it has to be remarked that the work to be removed to form a north-east entrance at present is much shattered and comparatively easy of removal, while if the harbour is nearly completed on the present design, the work to be removed will be the strongest part, most carefully fitted together, and the difficulty of removing it may then be considered too serious to be overcome. In either case special machinery will probably have to be procured for the removal of the old work, and we ought to have careful estimates of what the cost would be in both cases. It may possibly prove, as the best way of completing the harbour expeditiously, that the northern arm should be nearly completed on the line of the present design, so that one crane could be used in constructing the protecting arm of the committee's approved plan, while another is pushing on the southern arm, but it can hardly be the most economical plan, and it should be considered, if this method of working is be adopted, whether the section of the work, which would only have to stand for a year or two, should not be modified with a view to the easy removal of the blocks as soon as the protecting arm is completed. The most economical method of working would, it is believed, be to clear the north-east entrance as expeditiously as possible, and then close the existing entrance and run on the protecting arm, for which a very large amount of material would be in readiness. The harbour would be more exposed than it is at present for the time, but probably even then it would only be for a few days in the north-east monsoon that the sea inside would be too rough for work; during the south-west monsoon it would be quite sheltered.

8. If the question of a north-east entrance is now definitely settled, this question of how the revised plan is to be carried out will be of the first importance. The Board might, it is suggested, be asked to prepare detailed estimates of the cost of removing the old work, and to state their views on the subject of opening the north-east entrance at once, in order that there should be no delay in proceeding with the work on receipt of approval of the Secretary of State to a change in design.

Bangalore,
27th June 1888.

(Signed) J. O. HASTED, Colonel, R.E.,
Chief Engineer, P.W.D.

---

Order—dated 1st August 1888, No. 2335 W., Public Works.

In accordance with the earnest request of the Government, in their letter No. 1437 W., dated 9th June 1884, to the Secretary to the Government of India that the question of a north-east entrance to the harbour should be referred to more competent nautical authority, the Right Honorable the Secretary of State appointed a committee composed of Admirals Salmon and Nares and Sir J. Coode, to report on the subject.

2. The Governor in Council has read with much interest the committee's report and the voluminous notes of evidence taken by them, and is gratified to learn that the committee shares the views held by this Government as well as by all competent authorities in the Presidency, and is in favor of an entrance at the north-east corner of the harbour, with a covering arm. An entrance at this corner would possess the additional advantage of being fully protected against naval attack by the shore batteries, which it is proposed to construct to the north of the harbour; but an entrance in the centre of the eastern arm can receive but little protection from shore

batteries, and that arm would, within a certain distance, afford cover to boats attempting to force an entrance for the purpose of destroying the shipping in the harbour.

3. The plan proposed by the committee has been generally approved by the Harbour Trust Board and by the Chief Engineer, and is accepted by the Government.

4. The Harbour Trust Board will be requested to submit their views as to the best method of carrying out this plan with an estimate of the cost, and of any further machinery that may be required, and the Secretary of State will be asked to communicate by wire his sanction to the prosecution of the work on the committee's design.

Ordered that the Secretary of State be addressed.

(Here enter No. $\frac{11}{2335\ W.}$, dated 1st August 1888.)

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Chairman, Madras Harbour Trust Board.
" Marine Department.

Exd. F. R. Bantleman.
Spare Copies

1853/25

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1888} Madras.

PUBLIC WORKS.

*Dated August*, 1*st*.

*Recd.* *Encl.*

**G.O., 1st Aug. 1888, No. 2335 W.**

**AUGUST.**

**Madras Harbour**

Passing orders on report and plan of the Home committee as regards the best position for an entrance to the —.

153/28

To the Under Secretary of State for India.

Sir,

In compliance with the instructions contained in your letter of 8th April, we have examined thoroughly into the subject of the position of the entrance to Madras Harbour, in connection with the work of reconstruction now in progress.

We have taken evidence upon this highly complicated subject, and beg to report as follows :—

It is agreed on all hands that, owing to the frequently disturbed state of the water, the facilities for landing and embarking passengers, cargo, &c., offered by the harbour, are very much restricted, nor would it be feasible, for the same reason, to use without serious interruption, wharves and jetties along the shore line; or to keep in safety within it, such improved lighters, tugs, and other harbour craft as would greatly increase its value as a trading port. Much cargo is said to be lost overboard in the process of transhipment, and, for want of tugs, no sailing vessels use the harbour at all.

The confused sea within the harbour is attributed, by all who have given evidence, to the nearly constant swell from the eastward which runs in through the present entrance, and, being deflected from the side walls, causes what is variously described as a "nubbly sea" or "joggle of a sea," and in bad weather as being like "a boiling pot." In consequence of which it is the opinion of many of the most experienced captains that, excepting for the distance from the shore, loading and unloading could be as advantageously done outside as inside. During the cyclone of November 1881 the greater portion of the craft within the harbour were wrecked before the walls gave way.

The swell, which is the source of so much trouble at Madras, appears to be generated in the Bay of Bengal, and, as it approaches the harbour, advances ordinarily in a line parallel with the coast, but is occasionally deflected as much as 30° each way.

It is contended by the Madras Harbour Trust Board that the remedy for all the defects in the present harbour lies in closing the eastern entrance and opening one elsewhere. Captain Taylor, the Port Officer, who was charged to represent to us the views of that Board, goes so far as to say that the one thing needful is smooth water, that smooth water can only be got by closing the present or eastern entrance, and that no engineering difficulty nor expenditure, however great, should be allowed to stand in the way of such a change being made, and that without it "the harbour will never be worth "having."

We have carefully considered the different proposals for remedying the defects in the present harbour.

In order to render this Report as clear and comprehensive as possible we have caused the three accompanying drawings to be prepared.

Drawing No. 1 exhibits the projects (numbered I., II., III., and IV.) described in a report on the different proposals for a north-east entrance, dated 2nd May 1887, and addressed to the Chairman of the Madras Harbour Trust Board by the Superintendent of the Harbour Works. These proposals were referred to by different witnesses in the evidence taken in the course of our inquiry.

Drawing No. 2 contains a plan of the harbour in its present condition, and also three sections which we have had prepared in order to illustrate, as clearly as possible, the changes which have taken place in the depths immediately to the northward and southward of the harbour within the last few years.

Drawing No. 3 shows, by red colour, the position, aspect, and covering arm of the new north-east entrance, which we have to recommend for adoption.

The proposal to open the harbour at the south-east corner, whether alone or in conjunction with another opening at the north-east corner, we feel bound to dismiss. Our calculations, founded upon soundings taken and submitted to us by Mr. Parkes, more especially a comparison of those taken in 1886 with those taken in 1882, show that, so rapid and regular is the encroachment of the sand on the south side, that, if continued at the same rate, which we have strong reason to apprehend will be the case, within twenty years the depth of water at the south-east corner will be reduced to four fathoms.

The present, or east entrance, we believe to be the easiest and safest for ingress or egress, but not only does it admit the sea in the manner described, but we are of opinion that the time is not very far distant when the depth at this entrance will be so far reduced as to become too shallow for the larger class of vessels frequenting the port.

The designs on which the harbour is being reconstructed include reducing the width of the present entrance from 550 to 450 feet; the opinions of nautical men differ as to whether the reduction is advisable from the navigating point of view, but all concur in thinking that the alteration would not have a sufficiently quieting effect on the state of the water inside.

A proposal has been brought before us to protect the present entrance by constructing a detached breakwater to the eastward of it. This appears to us a difficult and costly operation; a breakwater outside would not, we believe, prevent the entrance of sand into the harbour.

The alternative is an opening in the north-east corner with a covering arm. This is the plan favoured by the Madras Board, and to this we have given our most careful consideration.

The opinions of the captains of steamers frequenting the port differ materially. Some see considerable difficulty and danger in taking an entrance so placed, others see none. We give it as our opinion that, although it may not be so easy of ingress, and ships may be detained outside more frequently than at present, the increased difficulty is not sufficient to condemn it.

Experience alone can prove whether the harbour reconstructed, with the east entrance closed, and an opening made in the north-east corner, with a covering arm, will prove a safe anchorage during a cyclone. One captain only says that he would rather risk staying in than go out under such circumstances, while others look upon such a harbour as "a trap" from which there would be no escape. The Port Officer expects to be able to move ships about as in a dock, and the pilot thinks that, with warps and the "assistance of a tug," ships could be taken out on the approach of a cyclone. Our view is, that we should be indisposed to risk remaining in the harbour until it has been proved that vessels can lie there in safety during cyclones, but while admitting the doubt, especially if the harbour is crowded, we see no reason why, with proper appliances, ships should not be got safely out on receiving warning.

Having carefully weighed all the evidence we have been able to collect, which comprises the views of all classes interested, or who have had opportunities of forming an opinion, we pronounce in favour of an entrance at the north-east corner, with a covering arm, and that the entrance on the east face be closed up.

Of the four plans submitted to us by the Madras Harbour Trust Board we give the preference on nautical grounds to Plan III., but with an addition to the length of the covering arm. What the precise length should be can be best determined by experience. We are of opinion, however, that the overlap should not be less than 600 feet, and need not be more than 800 feet.

According to an approximate estimate which we have obtained from Mr. Parkes, the cost of completing the harbour with a north-east entrance, if the overlap be 600 feet, will be Rs. 22,81,345, and, if the overlap be 800 feet, Rs. 25,56,611, in excess of the cost of completing the harbour on the design adopted in 1884, with an east entrance 450 feet wide, estimated



153
27

by Mr. Parkes in August 1884 to be Rs. 45,90,051, out of which about 21½ lakhs had been expended up to 31st March last.

It appears, therefore, according to the estimates put before us by Mr. Parkes, that the expenditure to be incurred as from 31st March last, in executing the work according to our recommendation (shown in red colour on Drawing No. III. annexed to this Report) will amount to about 47¼ lakhs of rupees with an overlap of 600 feet, and to about 50 lakhs of rupees if it should be found necessary to make the overlap 800 feet.

In this estimate it is assumed that the *débris* of the old work will be removed to a depth of 36 feet below low water of lowest tides throughout the new entrance, which depth we regard as a minimum, and we are distinctly of opinion that not less than this should be sanctioned.

We have the honour to be,

Sir,

Your obedient Servants,

(Signed) NOWELL SALMON.
JOHN COODE.
G. S. NARES.

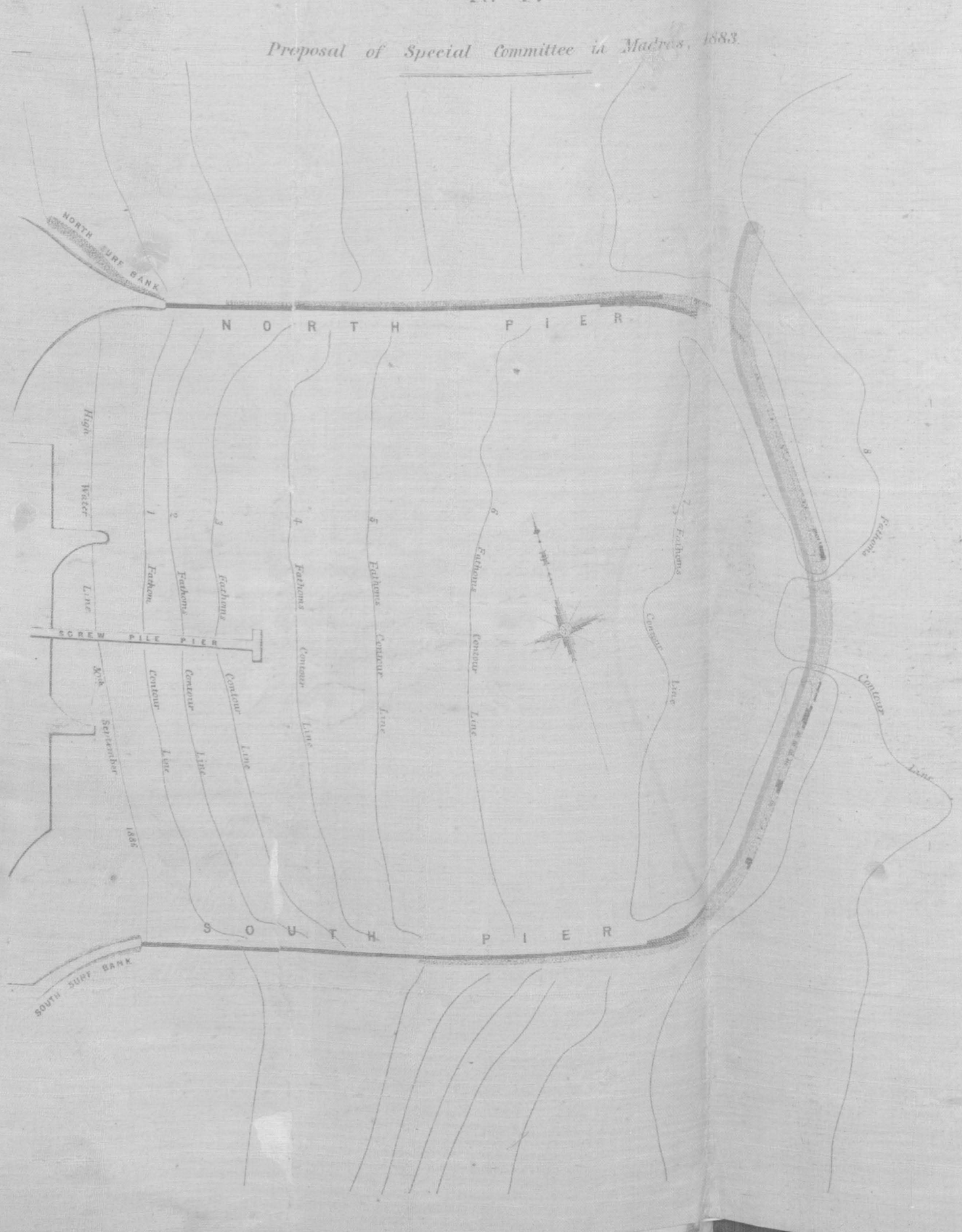
19th October 1887.

# MADRAS HARBOUR

153/28

## Nº 1.

*Proposal of Special Committee in Madras, 1883.*

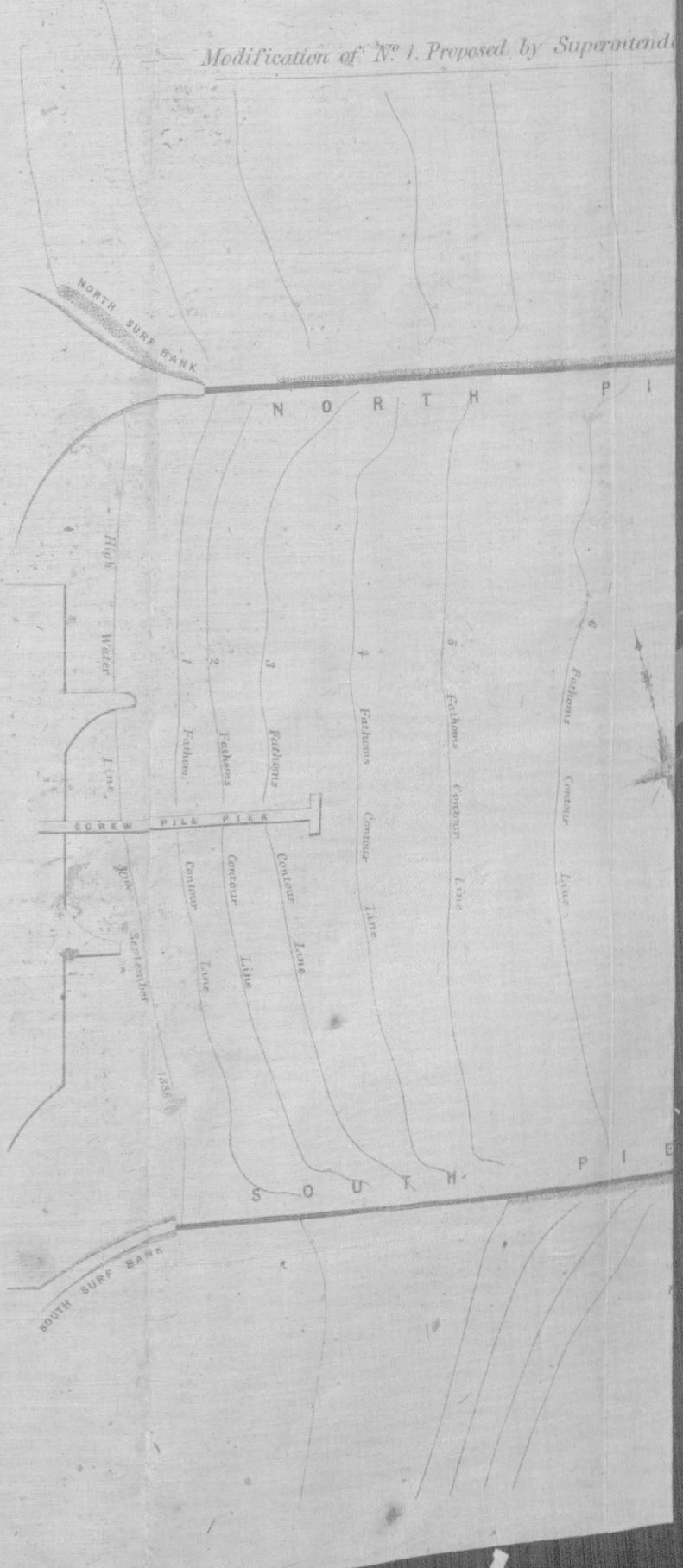



*To accompany Report of Committee*

*Proposals for Entrance referred to in*

## Nº 2.

*Modification of Nº 1. Proposed by Superintend*



…, appointed by Viscount Cross April 1887, to consider the question of the Entrance
… Letter from the Chairman of Madras Harbour Trust Board, dated May 4th 1887.

—Drawing No. 1.—

153/29

…nt of Harbour Works_ 1887.—

No. 3.

153/30

Alternative Proposal by Superintendent of Harbour Works_ 1887.—




NOTE. Contours in blue show depths in fathoms below De Havilland's Mean Sea Level, September 1886.

153/31

No. 4.

Alternative Proposal by Superintendent of Harbour Works_ 1887.—




ROBT. J. COOK & HAMMOND, LITH. BROADWAY, WESTMINSTER.

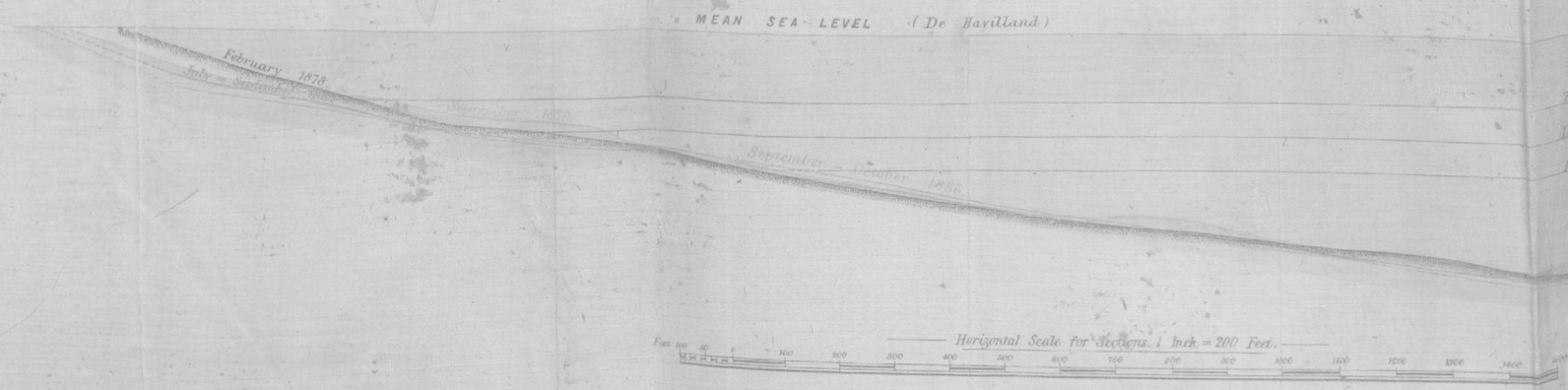
# MADRAS HARBOUR

*To. accompany Rep*



f Committee, appointed by Viscount Cross April 1887, to consider the question of the Entrance

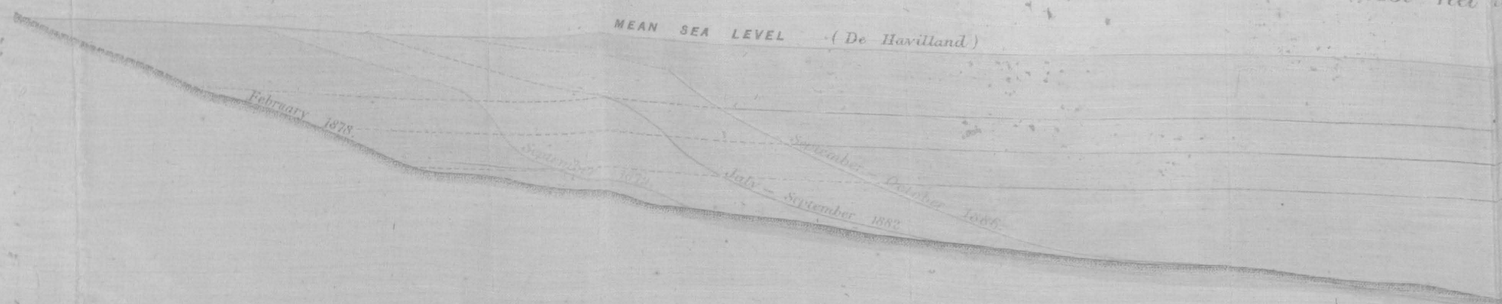
SECTION ON LINE A.B. (800 feet North of North Pier)

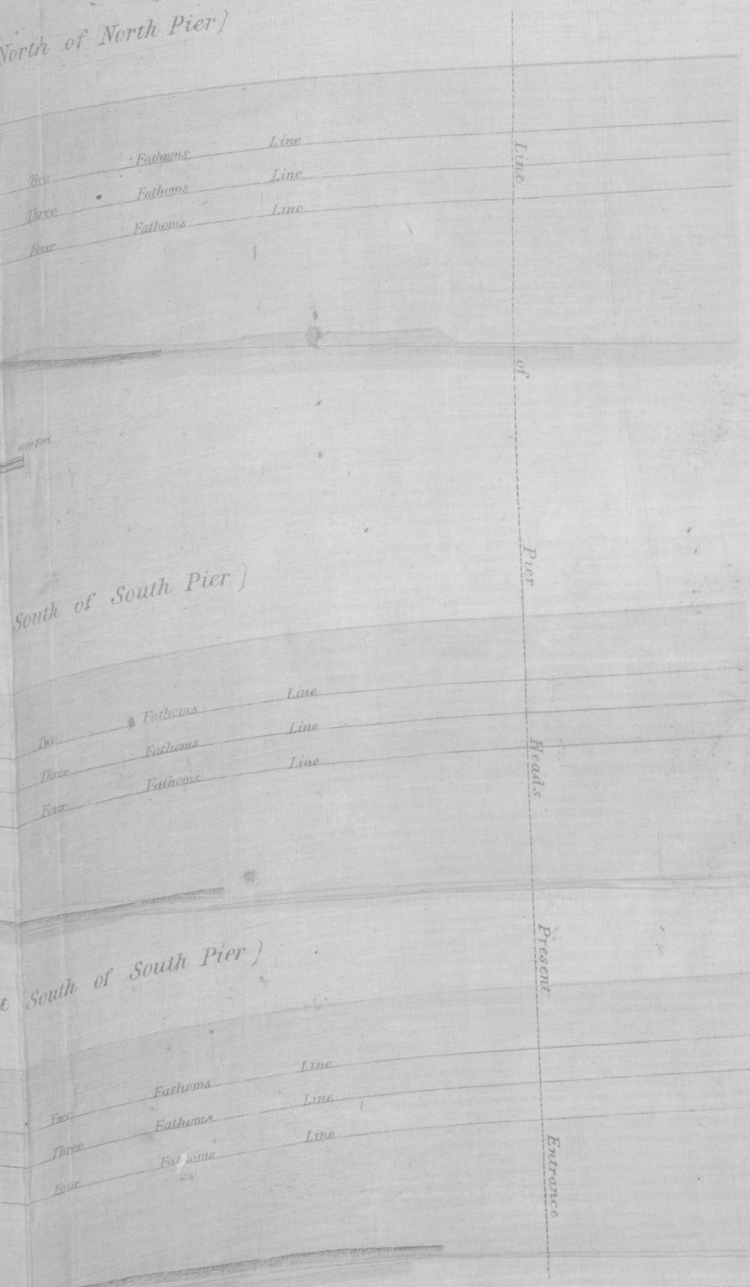



SECTION ON LINE C.D. (300 feet South of South Pier)




SECTION ON LINE E.F. (1350 feet South of South Pier)



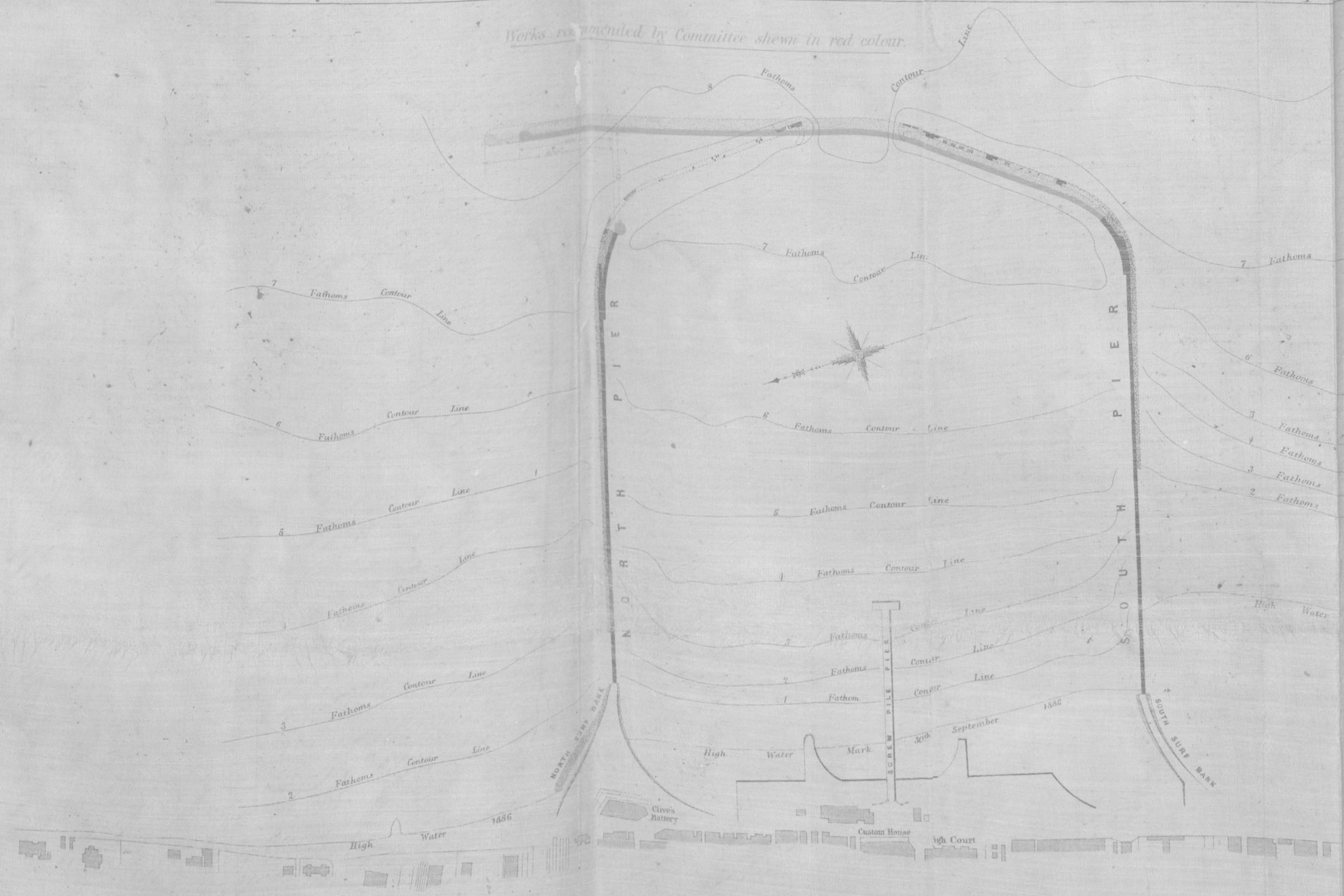

JOHN C. DUFF & HAMMOND, LITH. BROADWAY, WESTMINSTER.

Drawing No. 3.

# MADRAS HARBOUR

## To accompany Report of Committee, appointed by Viscount Cross April 1887, to consider the question of the Entrance.

Works recommended by Committee shewn in red colour.




NOTE. Contours in blue show depths in fathoms below De Havilland's Mean Sea Level, September 1886.

Robt J. Cook & Hammond Lith Broadway, Westminster.

2069

15 Jan 1888 No 15 Pol

Cuttack Mar 1888

53/37

Read the following despatch from the Right Honorable the Secy of State for India, to the Right Honorable the Governor in Council Fort St George

India Office,
London, 15th December 1887.

Public Works,
No. 11.

**To His Excellency The Right Honourable The Governor in Council, Fort St. George.**

MY LORD,

*Madras Harbour Works. Remarks by Mr. Parkes on Report of Harbour Committee.*

X 3484(W) 20-12-87

With reference to my Public Works Letter, No. 10, dated 24th ultimo, which forwarded, for your Excellency's information, copies of the report which has been presented by the Committee appointed to consider the best position for the entrance to Madras Harbour, I now transmit copy of a letter which has been received from Mr. Parkes, the Consulting Engineer for the harbour, containing his remarks on the conclusions of the Committee.

The Enclosure to p. 2 will be forwarded hereafter

2. Of the four designs which were laid before the Committee by the late Captain Taylor, as representative of the Harbour Trust Board, the Committee, for the reasons stated in their report, have recommended the adoption of No. III. Mr. Parkes, for engineering and other reasons, strongly urges the adoption of a design similar to No. I. The comparative merits of these designs are sufficiently discussed in Mr. Parkes' letter and in the minutes of evidence taken before the Committee, of which copies are now forwarded for your Excellency's information.

3. Before coming to a final decision on the course which should be adopted on the recommendations of the Committee, I desire to have the benefit of your Excellency's opinion in Council after obtaining the views of the Harbour Board on the whole subject.

I have the honour to be,
My Lord,
Your Lordship's most obedient humble Servant,

Cross.

16401. I. 2959. A

2069

153/37 Enc 2

From W. Parkes, Esqr, Consulting Engr for the Madras Harbour Works, to the Under Secy of State for India, dated

ENCLOSURE.

Madras Harbour Entrance.

Sir, 23, Abingdon Street,
25th November 1887.

In compliance with the request contained in your letter of the 22nd instant, No. P.W. 2070, I have the honour to submit the following remarks on the Report of the Committee appointed to consider the above question.

2. It is desirable that I should at the outset explain my position with regard to this question. I have never taken a prominent part in its discussion. When it was originally raised in 1882, shortly after the destructive storm of November 1881, I recommended that a decision upon it should be deferred till the works of restoration had made some progress. When, in 1883, Sir John Hawkshaw's Committee, in their first Report, expressed an opinion unfavourable to the change of entrance, I ventured to recommend that this decision should not be accepted as final (see my Report to the Government of Madras, dated 9th March 1882, paragraphs 44 and 45, and that to the India Office, dated 10th February 1883, paragraph 14).

3. The Committee appointed by the Government of Madras, however, on the 30th April 1883, were not satisfied to leave the question in this state, but in their Report, dated 20th June, forced an immediate decision by presenting an independent scheme of reconstruction, of which a north-east entrance was an essential feature. This scheme was referred to Sir John Hawkshaw's Committee, and by them emphatically condemned. This decision was accepted as final by the Secretary of State, and I felt that the discussion of the question ought then to be considered as exhausted, and that my duty was to show how the admitted evils of the sanctioned eastern entrance could be best met by other arrangements. To this I devoted a large portion of my Report of 21st August 1884 (from paragraph 60 to the end), and to the further development of this I have since devoted much time and consideration.

4. It is right I should mention that, while I disclaim any responsibility in this final decision in favour of the eastern entrance, I entirely acquiesced in it as the best under the circumstances, though had my opinion been officially asked I should have been disposed to say more about the views and arguments of the nautical men locally consulted than was said in the Report of Sir John Hawkshaw's Committee.

5. From the above it will be seen that there is nothing in my past attitude in regard to this question to prevent my acquiescence in the adoption of a north-east entrance, if such reason is shown for it as will place the decision on a logical basis, even though I might have to yield something of my own estimate of the balance of argument on a question on which there is admittedly much to be said on both sides; but I think it my duty, holding the position I do, to give what assistance I can to enable the Secretary of State to decide whether an order based on the recommendations of the present Committee can be considered as final and unassailable.

6. With this view I have given careful and critical examination to the evidence and to the Committee's Report, and I am bound to say that, in my opinion, the adoption of that Report as a basis for further action will

not relieve the undertaking of the difficulties under which it a present labouring, but will rather tend to introduce new ones.

7. I do not propose to criticise the Report in detail, but, in justification of the opinion above expressed, I would beg to direct attention to three points suggested by a study of the Report :—

1st. The introduction of a question of far greater importance than that of the entrance, which, if solved in the direction indicated by the Committee, would render the further discussion of the entrance question quite superfluous.

2nd. Its incompleteness as an authoritative basis for the action of Government.

3rd. A recommendation in a matter which, from the Committee's point of view, is one of secondary importance, but from my point of view of primary importance, and to which, in my capacity of responsible Engineer of the works, I think it is within the scope of of my authority to take exception.

8. The first question of importance above alluded to is set forth in the second paragraph in page 2 of the Report. It is that—

"So rapid and regular is the encroachment of the sand on the south "side, that, if continued at the same rate, which we have strong "reason to apprehend will be the case, within 20 years the depth of "water at the south-east corner will be reduced to four fathoms."

This apprehension is used as an argument against the formation of an entrance at the south-east corner, a proposal which has never been seriously entertained on account of the fact that the sand is advancing on that side of the harbour, but it is now for the first time introduced as it is in the Committee's next paragraph as an argument against the eastern opening, though no reference is made to its causing any difficulty at the site of the north-east opening.

9. Now I submit that if this apprehension of the Committee is to be taken as a ground for future action, it must be taken with all its necessary consequences. Those consequences are that within 20 years, that is, within the lifetime of the majority of the persons now employed in or about the harbour, the navigable depth of the south-east corner will be lost, that "at a time not very far distant" it will be lost at the middle of the sea face of the harbour, and by an inevitable continuance of the same process the site of the proposed north-east entrance will be subject to the same destructive action. Thus the present generation will witness the gradual absorption of the harbour in a mass of sand and the reduction of the advantages of Madras as a trading port to something far inferior to what they were before the harbour works were commenced.

10. It will be easily supposed that when such a prospect as this was suggested to me I lost no time in looking carefully to the grounds of my own very different conclusion. I am happy to say that the result has been the confirming and strengthening of that conclusion, and I think I may confidently add the detection of the fallacy on which the anticipation of the Committee is based.

11. I would beg to explain in as few words as I can what is the conclusion which has been thus questioned. When my original proposal for a harbour at Madras was first put forward, objections were made to it in several influential quarters on the ground of its interference with the movement, and the consequent accumulation, of sand. This question was specially referred to Mr. Bateman, who was consulted by the Secretary of State before the scheme was sanctioned in 1875. Mr. Bateman's opinion was that the injurious accumulation of sand would take so long that it might be disregarded.

No. 784 S W d/ 14.3.87
" 1001 W d/ 4.4.87
" 1179 W d/ 29.4.87
" 1283 W d/ 11.5.87
" 8/1283 W d/ 11.5.87
" 1316 W d/ 13.5.87
" 1383 W d/ 20.5.87
" 10/1383 W d/ 20.5.87
" 1517 W d/ 7.6.87
" 1590 W d/ 14.6.87
" 1765 W d/ 1.7.87
" 1787 W d/ 4.7.87
" 1898 W d/ 14.7.87
" 2358 W d/ 2.9.87
" 2978 W d/ 7.11.87
" 3484 W d/ 20.12.87

Hw/A

Special
13th P
ew Works

No 153 w a/16th January/88

PWC No 347

No 17

Public Works
15th December 1887

1.5

Communicated in
continuation of GO
3484 W of 20th December 1887
to the Chairman for
an expression of opinion
by the Harbour Trust
Board.

The
Letter to Fort St George
No 11 & Enclosure

Hall
13.1.88

R 12.1.88

E 3

(Plan
+ report
+ Inquiries
read in S.E. PP
with 23.1.88)

with e. a. w.

Chairman H.T.B.
with 1 plan & copy of report
Marine Dept
D 24/1

x To be returned after
c. marg Lockhart
made.

Mu. 13.1.88
R 16.1.88

W Saunders

16-1-88

C.N°347.

Govt. of India, Public Works.

PUBLIC WORKS.

Dated 27/11/1887

Rec'd. Encl.

G.O., Jan. 16 1888 No. 153S

Madras Harbour Entrance.

Coming to the Chairman for an expression of opinion by the M.I.B.C. despatch from the Secy. of State forty a letter from Mr. Parkes containing his remarks on the conclusions of the Lindow Committee on the question of the —

40/6

153/38 8/23



12. The first year's work caused what appeared to be a formidable accumulation, and the question was again raised and fully discussed, with the result that the Government was reassured. A calculation was made showing that the accumulation in one south-west monsoon occupied about one fiftieth of the space available for arresting the sand, thus giving 50 years as the minimum life of the harbour, without making any allowance for the opposite movement in the north-east monsoon, which was known to be considerable, but which could not then be definitely determined. Fifty years, therefore, with a considerable, but not at that time accurately determinable, addition was taken as approximately the time during which no measures need be taken to protect the harbour from sand.

13. Even after this the question was from time to time raised and discussed, but one objector after another dropped off, and since 1879 the question has been absolutely at rest.

14. In the meantime the movements of sand have been carefully watched, recorded, and reported on, so that if any one were disposed to object, the data were always at hand on which to base any adverse theory. But no one has come forward, and, on the contrary, the accumulation of facts has been such as to confirm in the most complete manner the correctness of our original anticipations. Each year shows a slight advance of beach, and the advance from year to year is so regular, though proceeding at a decreasing rate, as to show that the accretion is not the result of casual and variable storms, but of some regularly recurring seasonal action. The oblique stroke of the light but continuous surf on the beach is generally acknowledged as a sufficient cause for the results seen and recorded.

15. A position thus built up by the confirmatory experience of 10 years has a strong presumption in its favour. It may be based on a fallacy, but I submit it deserves to be attacked, if it is to be attacked at all, by some well-defined alternative theory. For such I have been looking anxiously since I first heard the Committee were not satisfied with my position, but all I have got as a result is the vague statement of their apprehensions quoted in paragraph 8.

16. This statement is based on certain figures from which the Committee and myself draw very different conclusions. In May 1886 there was a heavy cyclone sea which produced certain exceptional results, the shore line was considerably washed back, and there was a considerable accretion of sand at two, three, and four fathoms under water.

17. The Committee examining the latter alone came to the conclusion that it did not bear out my contention that the advance proceeds in a decreasing annual ratio, but the contrary, and they show that if it continues at the same rate in future as in the last four years, the four-fathom line will reach the south-east corner of the harbour in 15½ years. This period is increased in their Report to 20 years, though upon what grounds does not appear.

18. My deduction from the same data, but including with them the upper parts of the slope which were washed back, is that the rate of advance is decreasing, and that the measurements as a whole show that the disturbance of the storm of May did not result in any addition to the normal year's accumulation, but simply redistributed it by drawing down sand from the shore. Thus, my original calculation of 50 years as the *minimum* estimate of the life of the harbour is in no way affected, but the measurements show that the originally indeterminable addition to the 50 years may be taken to be at least 10 years, so that there is half a century to run from the present time. I think it unnecessary at present to cite further figures, but I may say that, if a further in-

vestigation were required, these would be forthcoming, and would confirm in a remarkable way my general conclusion.

19. I should add that the difference between the Committee and myself is not limited to the question of 20 or 50 years. There is another point of almost equal importance. I contend that it is now well established how the sand comes, and in what quantities it comes, and therefore how it may be intercepted when it becomes necessary, and what the cost of intercepting it will be. It may be added that that cost, which will not be required for 50 years, will not thenceforward be a serious burden on the trade. On the Committee's supposition there is no such knowledge. If the sand is conveyed by currents (which, though not suggested by the Committee, is the only other conceivable vehicle for its transport) it is impossible to say how or where it will be deposited, or whether it can be in any way controlled.

20. I have now shown how very different are the conclusions drawn by the Committee and myself from the same data. I hope I have also shown to the satisfaction of the Government that my conclusions are not of a character to be set aside in favour of such a vague suggestion as that put forward by the Committee. But if the case ended here I should hardly feel justified in asking that the Committee's suggestion should be set aside in favour of my conclusion. I could only ask that a decision should be postponed pending a reference to further experience. Meanwhile a continuance of the present heavy rate of expenditure on the works would be hardly justifiable.

21. But since the Committee ceased their sittings, after the members had left town, and while the Report was in circulation for signature, information has reached me which I think has brought the question to a practical test. A survey was made in September 1887 which shows the exact position of the four-fathom contour at that date. It will be remembered that the Committee's apprehension was that this would continue to advance at the same rate as in the four years previous to 1886. I contended that the advance in 1886 was exceptional and raised the average abnormally. I expressed my belief that future years would show, not a retreat, but a retarded rate of advance till the average normal annual rate was restored.

22. The following are the facts shown by the recent survey. On the line of section 300 feet south of the pier the average annual advance between 1882 and 1886, and which the Committee expected to continue, was 120 feet. From 1886 to 1887 the actual advance was, however, 10 feet.

On the line of section 550 feet south of the pier the anticipated advance was 96 feet, the actual 35 feet.

At 950 from the pier the anticipated advance was 78 feet, the actual 30 feet.

At 1,350 from the pier the anticipated advance was 65 feet, the actual 70 feet.

The fifth section was not repeated, but this as well as the fourth, and to some extent the third, had shown in 1886 much less exceptional disturbance than those nearer the pier.

23. Now, in view of these facts, I think I may go a step further than I should have ventured to do before the receipt of this information, and ask that this suggestion of the Committee should be dismissed as a groundless scare.

24. I now proceed to the second point named in paragraph 7, viz.:—"The incompleteness of the Committee's decision as an authoritative "basis for the action of Government." On this point I need hardly explain that I do not claim to have any voice except as contributing



information necessary to enable the Secretary of State to form a decision.

25. I would remark that there is this peculiarity in the subject referred to the Committee. An authoritative decision upon it, fully endorsed by the Secretary of State, is already in existence. Since that decision was given, 3½ years ago, there has not arisen any new evidence on matters of fact, nor has any new question been introduced except that of the advance of the sand, which has been introduced by the Committee themselves, and not by any of the witnesses on one side or the other. This question, as I have shown, is of far greater importance than the question of entrance. It must be dealt with independently of the latter, and in one of the three following ways, each of which will suggest its own consequences. If the Committee's view of the sand question is to be accepted as proved, I can see no other course than to at once abandon, and close the accounts of, a most unfortunate and ill advised undertaking. If the question is to be reserved for the test of further experience, further outlay should be suspended till time has solved it. If it be at once and finally rejected, as I think I have shown may be safely done, then the effects of its removal from the Committee's balance of argument must be considered.

26. Taking the last alternative, it is to be observed that the point is introduced by the Committee simply as an argument in favour of the north-east entrance. But there is nothing to show what weight they give to this argument, and whether its removal will transfer the balance to the other side. If it did so, of course, the decision as now pronounced would be null and void. If it did not, then we should have two co-extent but conflicting judgments, based upon the same evidence, one pronounced by Sir John Hawkshaw, Sir John Coode, and Professor Stokes, the other by Admiral Salmon, Sir John Coode, and Sir George Nares.

27. This somewhat peculiar position derives importance from a fact which has been brought to light by this inquiry. I have said that the evidence as to matters of *fact* was identical before the two Committees. In the evidence as to matters of *opinion* there is a marked contrast between the two. In the earlier case the nautical evidence was represented to be unanimous in favour of the north-east entrance. This alleged unanimity no doubt had great weight as an argument with the Harbour Trust Board, with the Government of Madras, and with the Government of India, but it is an argument which no longer exists. The unanimity has completely broken up, and it is now shown that nautical opinion is very much divided on the subject.

28. Under these circumstances, is it certain that the present strong feeling in favour of the north-east entrance will be permanent at Madras? The immediate or proximate successor of the late Captain Taylor may be an advocate of the eastern entrance. The Harbour Trust Board is a changing body. The financial view of the question, as yet hardly presented, will open a prospect of an addition of 40 or 50 per cent. to the harbour dues. May not these considerations, and I can imagine others to support them, give rise to an urgent demand for an appeal from Admiral Salmon's Committee, which would be supported by the precedent of the appeal granted from Sir John Hawkshaw's Committee?

29. I now pass to the third point named in paragraph 7, as to "a "recommendation in a matter which from the Committee's point of "view is one of secondary importance, but from my point of view may "be of primary importance, and to which, in my capacity of responsible "Engineer of the works, I think it is within the scope of my authority "to take exception." I fear it will be considered that what I have

already said has rather enhanced than otherwise the difficulties of the situation. I hope that what I have now to say may do something to suggest a solution, though unfortunately I have to begin by again joining issue with the Committee.

30. When I was before the Committee on the 29th June, several schemes for a north-east entrance were shewn to me, and my opinion upon them was asked. I was informed that the choice was virtually limited to two, which I will call A and B. Having previously seen and considered these I was able to speak definitely, and I gave the preference, for reasons adduced, very decidedly to Plan A. There was much general discussion of the matter, and I left the room with the strong impression that the members of the Committee were equally in favour of Plan A.

31. Several weeks afterwards I was requested to furnish estimates of these two schemes, and finding that my anticipation that the cost of Plan B would be considerably greater than that of Plan A was fully confirmed, the difference being nearly 5 lacs of rupees, and remembering the impression made upon me that the Committee were fully alive to the other objections to Plan B, which had been fully discussed, I did not think it necessary to repeat these in writing, and furnished simply the estimates in abstract.

32. It was therefore with considerable surprise that I afterwards found that the Committee had adopted Plan B, with all its objections, as their final recommendation, and make no allusion in their report to Plan A. My objections to Plan B are, of course, mainly on engineering grounds, and these might be outweighed by any considerable superiority on nautical grounds, but it is a case in which it is impossible that such considerable superiority can exist. I cannot admit that even the engineering member of the Committee can be so good a judge as myself of the relative difficulties of carrying out the two schemes, and I submit that it is a matter of detail in which the Committee's recommendation may be amended so as to make it conform to my views. I do not now trouble you with the details of my objections, but I shall be ready to furnish them if required.

33. What I have now to say is dependent upon the substitution of Plan A for Plan B. The estimated cost of Plan A (in addition to the sanctioned estimate) is Rs. 18,11,411, with an overlap of 600 feet, or of Rs. 20,86,677, with an overlap of 800 feet. This is supposing that its adoption is decided on before the work proceeds any further. I find that if the work were allowed to proceed upon the sanctioned plan till each pier is built to within about 300 feet of its termination, and the formation of a north-east entrance according to Plan A were then ordered, the ultimate extra cost would be something under a half a lac of rupees, say 18½ lacs or 21¼ lacs.

34. If this were done the harbour would be virtually restored to the state in which it was previous to the storm of November 1881, for the last 300 feet of each pier are standing in a state to give effectual shelter, and the question of a change of entrance might then be reconsidered in view of the actual effect of the piers as originally designed. The trade would then have the benefit, such as it is, of such a harbour in a virtually complete state pending the construction of the new entrance. To carry out the work to that extent would take about eighteen months, during every month of which time the shelter would be improving. To proceed on the plan recommended by the Committee, the first two or three years would be spent in opening the harbour still more to the sea, and that in the most dangerous possible form, while a further three years would be occupied before anything like efficient shelter would be obtained.

2069

153/ED

8/15-



35. In conclusion, I would beg to call attention to one point which has not been mentioned by the Committee. The Committee have stated very fairly how various admitted evils would be cured by the construction of the north-east entrance. For these evils Captain Taylor and others only allow the possibility of one remedy. It should be borne in mind, however, that many of them can be cured by other and less costly remedies, as I have previously shown. Credit should be taken for these on the side of the eastern entrance without necessarily assuming that they will place the whole balance of advantages in its favour.

I have, &c.,

(Signed) W. PARKES.

The Under Secretary of State
for India.